



# Environmental Referral Supporting Document

## Murchison Hydrogen Renewables Project

Murchison Hydrogen Renewables Pty Ltd as trustee for  
Murchison Hydrogen Renewables Project Trust

14 April 2022







**GHD Pty Ltd** | ABN 39 008 488 373

999 Hay Street, Level 10

Perth, Western Australia 6000, Australia

**T** +61 8 6222 8222 | **F** +61 8 6222 8555 | **E** permail@ghd.com | **ghd.com**

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		Name	Signature	Name	Signature	Date
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# Executive summary

Murchison Hydrogen Renewables Pty Ltd (Murchison Hydrogen Renewables) is seeking approval to develop the Murchison Hydrogen Renewables Project (the Proposal). The Proposal will use combined onshore wind and solar energy of approximately 5.2 gigawatt (GW) capacity to produce green hydrogen which will be converted to an estimated 2 Million tonnes per annum (Mtpa) of green ammonia for export to emerging green energy markets. The Proposal is located within the Shire of Northampton, Western Australia (WA), approximately 20 km north of Kalbarri.

The Proposal comprises the following major components:

- A wind and solar farm with a combined installed capacity of up to ~5.2 GW
- A Power-to-X (PtX) facility that will use the produced green energy to create ~2 Mtpa of green ammonia
- Ammonia export facility including pipeline and export vessel mooring and product transfer infrastructure.

The parent company of Murchison Hydrogen Renewables, Copenhagen Infrastructure Partners (CIP), is focussed on tackling rising carbon emissions through investment in renewable energy, green hydrogen and green ammonia. Green hydrogen is the product of splitting water into hydrogen and oxygen using renewable electricity. Green ammonia is the result of an additional step in this process, combining the hydrogen with atmospheric nitrogen through the Haber-Bosch process. This Proposal would contribute to a larger global portfolio of climate solutions currently in operation and under development by CIP.

Green hydrogen and ammonia will play a critical role in a transition to a carbon neutral economy. For areas where it is not feasible to produce renewable electricity, green hydrogen/ammonia will act as an energy dense intermediary between production and end user. Uses for these products are varied, hydrogen can replace polluting fuels currently used in the transport and heavy industry sectors and green ammonia can be used to reduce the amount of coal used in steel production. The future uses of green hydrogen and green ammonia will continually grow, with many uses for the products still under research and development.

Murchison Hydrogen Renewables is referring the Proposal to the Environmental Protection Authority (EPA) under Part IV of the *WA Environmental Protection Act 1986* (EP Act) and to the Australian Government Department of Agriculture, Water and Environment (DAWE) under the *Environment Protection Biodiversity Conservation Act 1999* (EPBC Act).

An assessment against the EPA's Statement of environmental principles, factors, objectives and aims of EIA (EPA 2021a), considers the Proposal may potentially impact the following Key Environmental Factors: Benthic communities and habitats, Coastal processes, Marine Environmental Quality, Marine fauna, Flora and vegetation, Terrestrial fauna, Inland waters, Air quality and Social surrounds. This document provides information on the Proposal characteristics and activities, key stakeholders and potential environmental impacts associated with the construction and operation of the Proposal. Additionally, it provides context for an environmental impact assessment which would investigate appropriate mitigations, significant residual impacts and environmental outcomes. Context for a holistic and cumulative impact assessment is also provided.

With this Proposal also being referred to DAWE, information is provided on Matters of National Environmental Significance. This Proposal may have an impact on EPBC Act listed threatened species (flora and fauna), listed migratory species and a World/National heritage place (Shark Bay). Initial mitigation measures to reduce the impact to MNES are provided.

This document outlines the work Murchison Hydrogen Renewables will undertake to inform the impact assessment. Work will include, but is not limited to, mapping of benthic habitat and communities, baseline studies of marine fauna, marine water quality modelling, coastal processes assessment, detailed flora and fauna surveys, surface water studies, air and noise modelling, heritage surveys and landscape and visual impact analysis. Murchison Hydrogen Renewables is committed to stakeholder engagement, allowing valued input from a range of stakeholders which is further detailed in this document.

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# Acronyms

Acronym	Definition
AHD	Australian Height Datum
BC Act	<i>Biodiversity Conservation Act 2016 (WA)</i>
BCH	Benthic Communities and Habitats
CIP	Copenhagen Infrastructure Partners
DAWE	Cth Department of Agriculture, Water and Environment
DBCA	WA Department of Biodiversity and Conservation Attractions
DE	Development Envelope
DJTSI	WA Department of Jobs, Tourism, Science and Innovation
DPIRD	WA Department of Primary Industries and Regional Development
DPLH	WA Department of Planning, Lands and Heritage
DWER	WA Department of Water and Environmental Regulation
EPA	WA Environmental Protection Authority.
EP Act	<i>Environmental Protection Act 1986 (WA)</i>
EPBC Act	<i>Environmental Protection and Biodiversity Conservation Act 1999 (Cth)</i>
GHG	Greenhouse Gas
GLpa	Gigalitres per annum
GW	Gigawatts
HRA	Hydrogen Renewables Australia
MNES	Matters of National Environmental Significance
MSL	Mean Sea Level
Murchison Hydrogen Renewables	Murchison Hydrogen Renewables Pty Ltd as trustee for Murchison Hydrogen Renewables Project Trust
Mtpa	Megatonnes per annum
PtX	Power-to-X
PV	Photovoltaic system
RL	Reduced Level
RO	Reverse Osmosis
SCF	Support Craft Facility
TLU	Tower Load Unit
WA	Western Australia
WIR	Water Information Reporting
WTG	Wind Turbine Generator



# 1. Introduction

## 1.1 Purpose and scope of referral

Murchison Hydrogen Renewables Pty Ltd (Murchison Hydrogen Renewables) is seeking approval to develop the Murchison Hydrogen Renewables Project (the Proposal). The Proposal will use combined onshore wind and solar energy of approximately 5.2 gigawatt (GW) capacity to produce green hydrogen which will be converted to an estimated 2 Million tonnes per annum (Mtpa) of green ammonia for export to emerging green energy markets. The Proposal is located within the Shire of Northampton, Western Australia (WA), approximately 20 km north of Kalbarri (Figure 1-1). The Proposal comprises the following major components:

- A wind and solar farm with a combined installed capacity of approximately 5.2 GW
- A Power-to-X (PtX) facility that will use the produced green energy to create an estimated 2 Mtpa of green ammonia
- Ammonia export facility including pipeline, export vessel mooring and product transfer infrastructure.

Murchison Hydrogen Renewables is referring the Proposal to the Environmental Protection Authority (EPA) under Part IV of the *WA Environmental Protection Act 1986* (EP Act) and to the Australian Government Department of Agriculture, Water and Environment (DAWE) under the *Environment Protection Biodiversity Conservation Act 1999* (EPBC Act).

This supporting document has been prepared to support the EP Act and EPBC Act referrals and provides an overview of the Proposal, the proposed approval framework, key environmental values, potential impacts, and management regime.

## 1.2 Proponent background

Initial development of the Proposal and stakeholder engagement was undertaken by Hydrogen Renewables Australia (HRA). Murchison Hydrogen Renewables is the superseding entity to HRA. Murchison Hydrogen Renewables will be the primary project development vehicle going forward and will own the project assets. The parent company of Murchison Hydrogen Renewables is Copenhagen Infrastructure Partners (CIP).

CIP has been delivering global infrastructure projects, including renewable projects, since 2014. CIP currently has a renewables portfolio consisting of:

- **Offshore wind:**
  - 12 operational, under construction and development projects in North America, Europe, Asia, and Australia
  - Total operational/under construction capacity of ~ 1 GW
  - Under development offshore wind capacity of up to 16 GW
- **Onshore wind:**
  - 12 operational, under construction and development projects in the UK and US
  - Total operational/under construction capacity of ~ 1.5 GW
  - Under development onshore wind capacity of up to 2 GW
- **Solar PV:**
  - Eight under construction and under development projects in the US
  - Total under construction capacity of ~ 0.5 GWac
  - Under development capacity of up to 1.3 GWac
- **Thermal and transmission:**
  - Eight operational, under construction and development projects in the UK and Germany
  - Total operational, under construction and under development capacity of ~ 1 GW
  - Total transmission capacity of ~ 1 GW

– **Power-to-X:**

- Developing a global PtX portfolio with projects located in Europe, North America, and Australia
- Total portfolio under development of ~ 6.5 GW electrolyser capacity
- Further ~ 3.6 GW capacity under evaluation.

## 1.3 Previous assessments and approvals

The Proposal is not subject to previous assessments or approvals.

## 1.4 Land Tenure

The majority of the onshore Development Envelope (DE) is within Pastoral Lease (registered number N050525), known as Murchison House Station, which is presently used primarily for grazing goats.

There is a narrow coastal strip of Unallocated Crown Land (UCL) along the onshore western edge of the DE, and a small reserve in the northeast of the DE. Current land tenure is shown on Figure 1-2.

Table 1-1 Existing land tenure in DE

Current status	Usage description	Purpose
Murchison House Station	Lease Type 3 L	Pastoral
Unallocated Crown Land	Type 3 V	Various
Transfer of Land Act	Type 1	Pastoral
Reserve	Type 3 R	Reserve
Road Isolation	Type 3 P	Road

A section 91 licence was granted on 24 June 2021 for a term of two years for the installation, repair, maintenance, operation, and use of met masts and temporary wind and solar monitoring equipment. Additional section 91 licence(s) will be sought for studies and other project planning purposes, including geotechnical analysis, in respect of parts of the DE.

Murchison Hydrogen Renewables has been engaging with the pastoral lessees and the State to progress appropriate tenure for the Proposal.

Murchison Hydrogen Renewables has discussed potential tenure options for the Proposal with the State, with the Department of Jobs, Tourism Science and Innovation (DJTSI) and the Department of Planning, Land and Heritage (DPLH), and the current proposal includes:

- in the first instance, an option to lease granted by the Minister for Lands pursuant to Section 88 of the *Land Administration Act 1997* (LAA) (Option to Lease).
- if Murchison Hydrogen Renewables exercises the Option to Lease, a Crown lease granted by the Minister for Lands under Section 79 of the LAA (Crown Lease)
- where tenure is required for any ancillary Project purposes (for example access roads to connect the Project to main roads nearby) – one or more easements granted by the Minister pursuant to Section 144 of the LAA (Easement), and (for the marine-based portion of the Proposal) tenure in respect of any port infrastructure and use from the relevant Port Authority once the area has been vested in that authority as a port.

The State has indicated in-principle support for the above tenure proposal.

## 1.5 WA Environmental Protection Act 1986

The EP Act is Western Australia's primary legislation governing environmental protection and impact assessment. This proposal is being referred under Part IV (Section 38) of the EP Act. Division 1 of Part IV of the EP Act

provides for the referral and assessment of significant proposals. The EPA defines a significant proposal as a proposal that, if implemented, is likely to cause a significant impact to the environment.

## **1.6 Environmental Protection and Biodiversity Conservation Act 1999**

The EPBC Act protects Matters of National Environmental Significance (MNES) within Australia. The EPBC Act provides that a 'controlled action' is one that is likely to cause a significant impact to a MNES and which must be approved under the EPBC Act. Parts 7 and 8 of the EPBC Act provides for the referral and assessment of controlled actions.

Should the Proposal be determined a controlled action, Murchison Hydrogen Renewables would request that the EPBC Act assessment approach be an 'accredited assessment' of MNES to be undertaken as part of the EPA assessment of the Proposal. The EPA assessment will then inform a decision by the Federal Minister for Environment and conditions for the Proposal under the EPBC Act.

## **1.7 Other approvals and regulation**

In addition to assessment under the primary environmental approvals (EP Act and the EPBC Act), the Proposal will require a range of other approvals. Consultation has commenced within government agencies and as the proposal continues to develop, and the consultation continues, these other approvals will be clarified.

## **1.8 Structure of document**

This supporting document provides information that is known and relevant, to inform the initial referral stage of the environmental impact assessment process. The contents of the document are as follows:

- **Section 1:** provides the necessary information to outline the history of the Proposal and the first steps in the impact assessment process. This section also highlights the Proponent's history and details.
- **Section 2:** provides the background for the Proposal and describes the components necessary to implementation. Decommissioning of the Proposal is also discussed.
- **Section 3:** provides details of the stakeholder engagement that has taken place to date in addition to an overview of the Murchison Hydrogen Renewables stakeholder engagement strategy.
- **Section 4 & 5:** identifies Key Environmental Factors that may be significantly impacted as a result of the Proposal implementation. Potential impacts are suggested, and studies are proposed which would form work to inform an impact assessment.
- **Section 6:** identifies the Matters of National Environmental Significance that may be impacted as a result of the Proposal and discusses mitigation measures to reduce significant environmental impacts.
- **Sections 7 to 10:** provide context for information that cannot yet be described with scientific detail but outlines the relevant processes during impact assessment that will be addressed.

## **1.9 Proponent details**

The proponent for this proposal is Murchison Hydrogen Renewables Pty Ltd as trustee for Murchison Hydrogen Renewables Project Trust.

ACN: 650922062

Office Address: Level 45, 108 St Georges Terrace, Perth, WA 6000

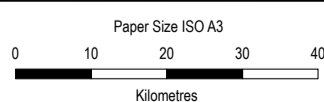
The contact for Murchison Hydrogen Renewables Pty Ltd in relation to this Proposal is:

**Amanda Le Moine**

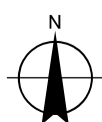
Email: amm@cisc.dk

Manager, Permitting & Approvals

Phone: +61 488 022 396



Map Projection: Transverse Mercator  
Horizontal Datum: GDA 1994  
Grid: GDA 1994 MGA Zone 50



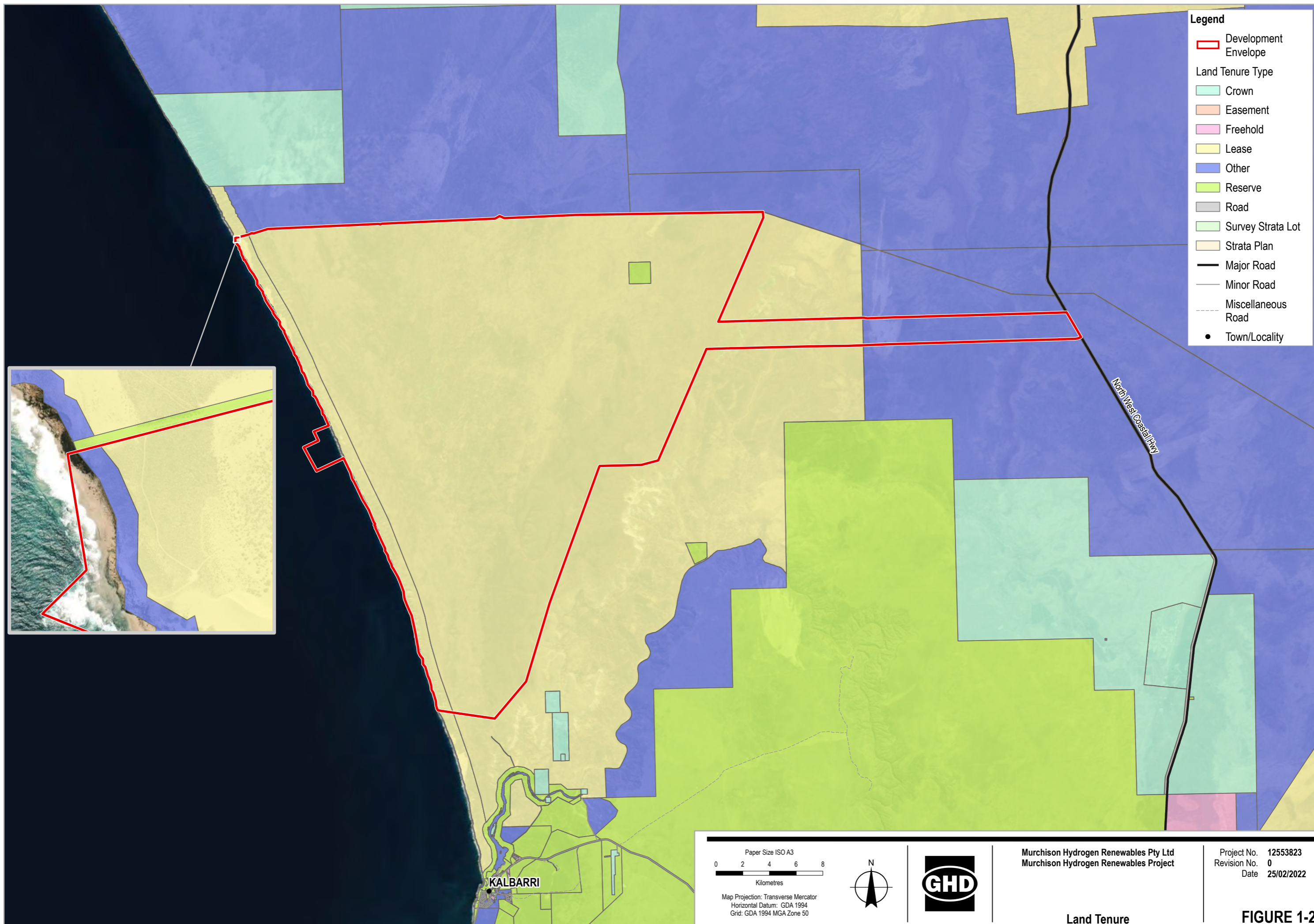
Murchison Hydrogen Renewables Pty Ltd  
Murchison Hydrogen Renewable Project

Project No. 12553823  
Revision No. 0  
Date 24/02/2022

**Locality Plan and  
Project Development Envelope**

**FIGURE 1-1**





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Print date: 25 Feb 2022 - 17:06

Data source: World Imagery: Earthstar Geographics  
World Topographic Map: Esri Community Maps Contributors, Esri, HERE, Garmin, METI/NASA, USGS  
World Imagery: Maxar



## **2. The Proposal**

### **2.1 Background**

Murchison Hydrogen Renewables is seeking approval to develop the Proposal. The Proposal will use combined onshore wind and solar energy of approximately 5.2 gigawatt (GW) capacity to produce green hydrogen which will be converted to an estimated 2 Million tonnes per annum (Mtpa) of green ammonia for export to emerging green energy markets, with the potential for local, domestic offtake as hydrogen or ammonia.

The Proposal site is located 20 km north of Kalbarri, with the majority of the DE located within the Murchison House Station (registered number N050525). The Proposal consists of several onshore and marine components.

### **2.2 Basis for referral**

Murchison Hydrogen Renewables is referring the Proposal to the EPA as a 'significant proposal'. Simultaneously, the Proposal will be referred to DAWE under the EPBC Act with the expectation that the Proposal will be a 'Controlled Action'.

This referral is the first stage of an environmental impact assessment that will inform stakeholders on long-term development, construction, operation, and decommissioning plans for the Proposal.

### **2.3 Proposal description**

#### **2.3.1 Local and regional context**

The Proposal is located within the Murchison Region of Western Australia, approximately 20 km north of Kalbarri (Figure 1-1) within the Shire of Northampton. The majority of the land-based portion of the Proposal lies within the Murchison House Station (registered number N050525) (Figure 1-2).

The majority of the marine-based portion of the Proposal lies directly to the west of the Murchison House Station area. The Support Craft Facility (SCF) will be located in one of two possible proposed locations. Option 1 is located within the DE. Alternatively, Option 2 is located adjacent to existing jetties within the town site of Kalbarri.

The surrounding land use for the project is pastoral and reserves, with the Kalbarri National Park approximately 10 km southeast of the DE. The DE is located 5 km to the north of the Murchison River at its closest point. The Shark Bay World Heritage Area is located 3 km north of the DE and approximately 16 km north of the PtX plant area. The northern boundary of the DE borders the State Barrier Fence Reserve.

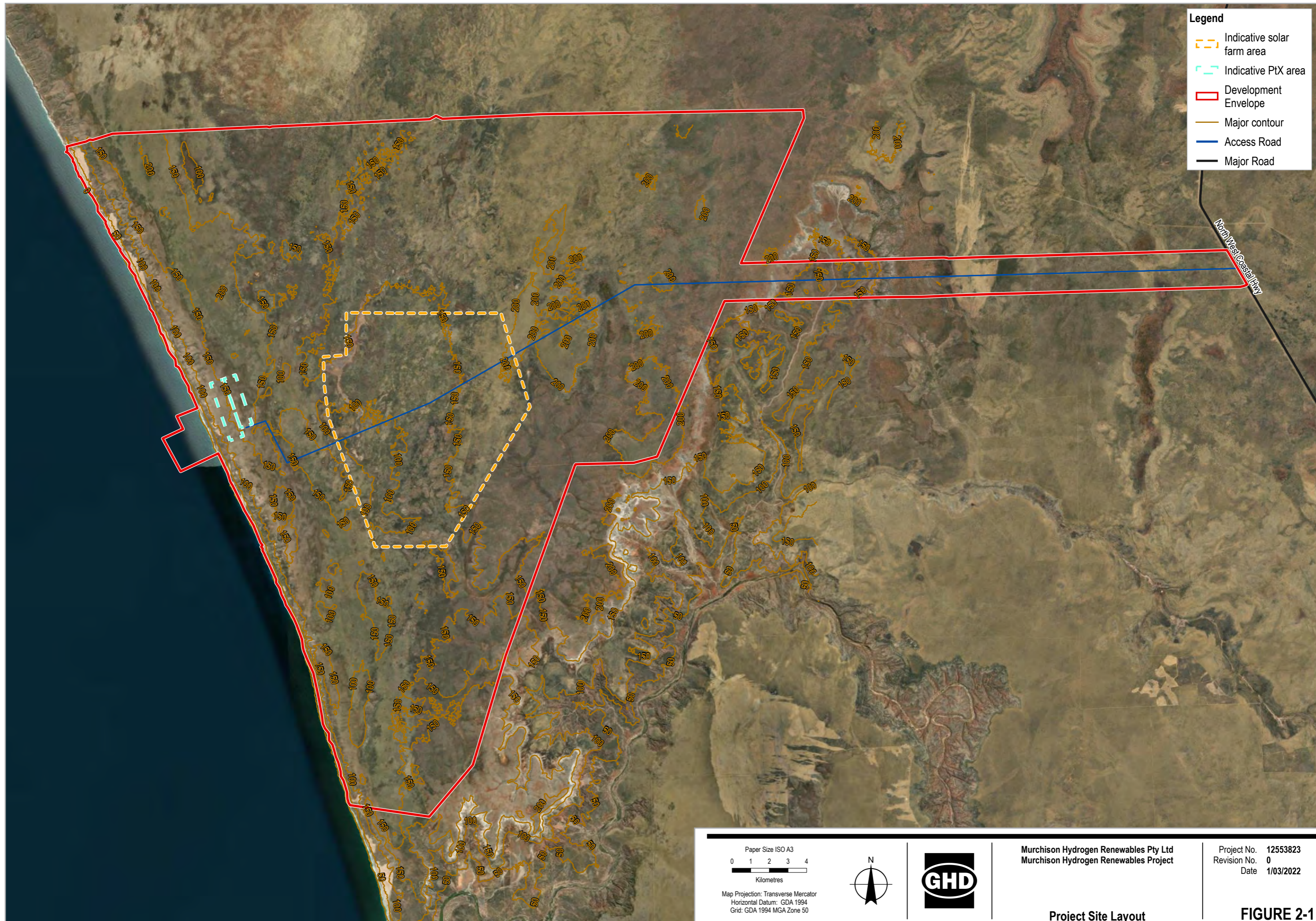
## 2.3.2 Key Characteristics

The Proposal, when constructed, will comprise the following infrastructure components:

- Approximately 700 wind turbines with an estimated 3.7 GW installed capacity
- Approximately 10,000 ha of solar panels with an estimated 1.5 GW installed capacity
- Battery storage and transformer station
- Substation
- Desalination plant with seawater intake and brine discharge pipes
- Electrolyser
- Hydrogen storage
- Ammonia production plant (including Air separation unit)
- Ammonia chiller and storage tanks
- Cooling units
- Transmission pipework
- Marine export terminal
- Support craft facility
- Interconnection power and piping infrastructure
- Communications systems
- Civil and associated roads infrastructure
- Maintenance and support services
- Admin, control rooms and security
- Backup power and safety systems
- Water supply and distribution.
- Plant utilities

These components can be described by the following key project areas and are shown in Figure 2-1 and a summary of technical detail can be found in the Proposal Content Document (contained in Appendix A).

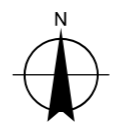




- Legend**
- - - Indicative solar farm area
  - - - Indicative PTX area
  - Development Envelope
  - Major contour
  - Access Road
  - Major Road



Map Projection: Transverse Mercator  
 Horizontal Datum: GDA 1994  
 Grid: GDA 1994 MGA Zone 50



Murchison Hydrogen Renewables Pty Ltd  
 Murchison Hydrogen Renewables Project

Project No. 12553823  
 Revision No. 0  
 Date 1/03/2022

**Project Site Layout**

**FIGURE 2-1**



## 2.3.3 Renewable energy

### 2.3.3.1 Solar PV Farm

The Solar PV Farm will be located within the central region of the DE (Figure 2-2). The Solar PV Farm will be developed within a footprint of up to approximately 10,000 ha, with a capacity of ~1.5 GW. Installation of PV modules will include their mounting structures and foundations, inverters, and other supporting infrastructure.

The final layout and disturbance footprint will depend on the arrangement and performance of the solar panels. The solar PV farm will consist primarily of parallel rows of solar panels with access tracks between panel rows to allow for ongoing maintenance. An optimised panel layout will be determined during the detailed design phase.

The solar farm will be accessed via unsealed tracks which connect to the road infrastructure being built to support the construction of the Proposal. A perimeter security fence will be installed around the solar PV farm infrastructure with enough distance reserved between the fence and the farm infrastructure to allow for maintenance and fire response.

Bushfire management requirements will require the vegetation under the solar panels to be cleared and a low fuel zone to be cleared around the Solar PV Farm.

### 2.3.3.2 Wind Farm

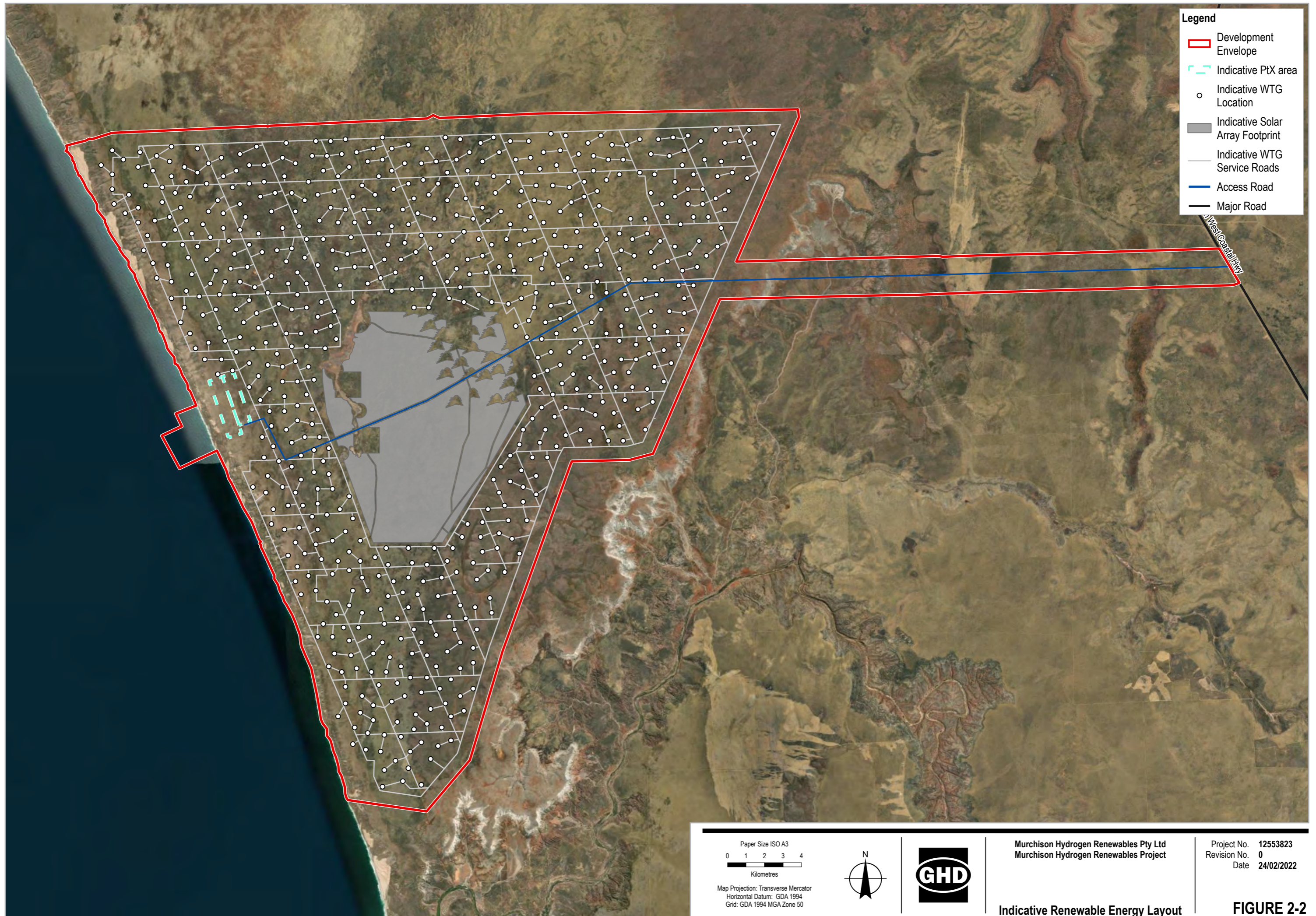
The Proposal will involve the installation of up to approximately 700 wind turbines with an installed capacity of ~3.7 GW. Each turbine will have a permanent footprint of up to approximately 0.2 ha, with a total final footprint of up to 140 ha for all turbines. An indicative layout of the wind farm is provided in Figure 2-2. The final wind farm design will be completed following studies of environmental constraints (e.g. flora and fauna). It is anticipated that there will be sufficient flexibility within the wind farm design to enable micro-siting to avoid environmental or heritage constraints.

Each turbine will have associated infrastructure to support the safe transmission of energy from the turbine to the PtX plant which contains the on-site energy storage and where the primary use of energy will be.

Each turbine will have an unsealed access road which will allow for construction and ongoing maintenance of equipment.

Construction for each turbine will require access for cranes in order to hoist the turbine blades. In order to safely lift the blades, additional temporary construction clearing will be required around the turbines. It is anticipated that up to approximately 2.3 ha would be required to facilitate construction of each turbine. Rehabilitation of areas temporarily cleared for construction would begin immediately after completion of construction.





- Legend**
- Development Envelope
  - Indicative PTX area
  - Indicative WTG Location
  - Indicative Solar Array Footprint
  - Indicative WTG Service Roads
  - Access Road
  - Major Road

<p>Paper Size ISO A3</p>  <p>Kilometres</p> <p>Map Projection: Transverse Mercator Horizontal Datum: GDA 1994 Grid: GDA 1994 MGA Zone 50</p>			<p><b>Murchison Hydrogen Renewables Pty Ltd</b> <b>Murchison Hydrogen Renewables Project</b></p>	<p>Project No. <b>12553823</b> Revision No. <b>0</b> Date <b>24/02/2022</b></p>
<p><b>Indicative Renewable Energy Layout</b></p>				<p><b>FIGURE 2-2</b></p>



## 2.3.4 Power to X plant

The Proposal will include the construction and operation of a PtX plant, which will convert renewable energy into green ammonia, as shown in the process flow diagram in Figure 2-3. The PtX plant will be located approximately 1 km from the coast in a central location to the project to minimise transmission requirements (Figure 2-4). The PtX Plant is intended to be hardstand with bunding in appropriate areas.

The PtX plant will contain the following components:

- Water Treatment and Desalination (RO) Plant
- Sub station
- Battery
- Electrolyser
- Hydrogen storage
- Ammonia production plant
- Cooling towers
- Ammonia chiller, storage and pump station
- Plant utilities
- Admin buildings and plant storage.

These components are described further in the section below.

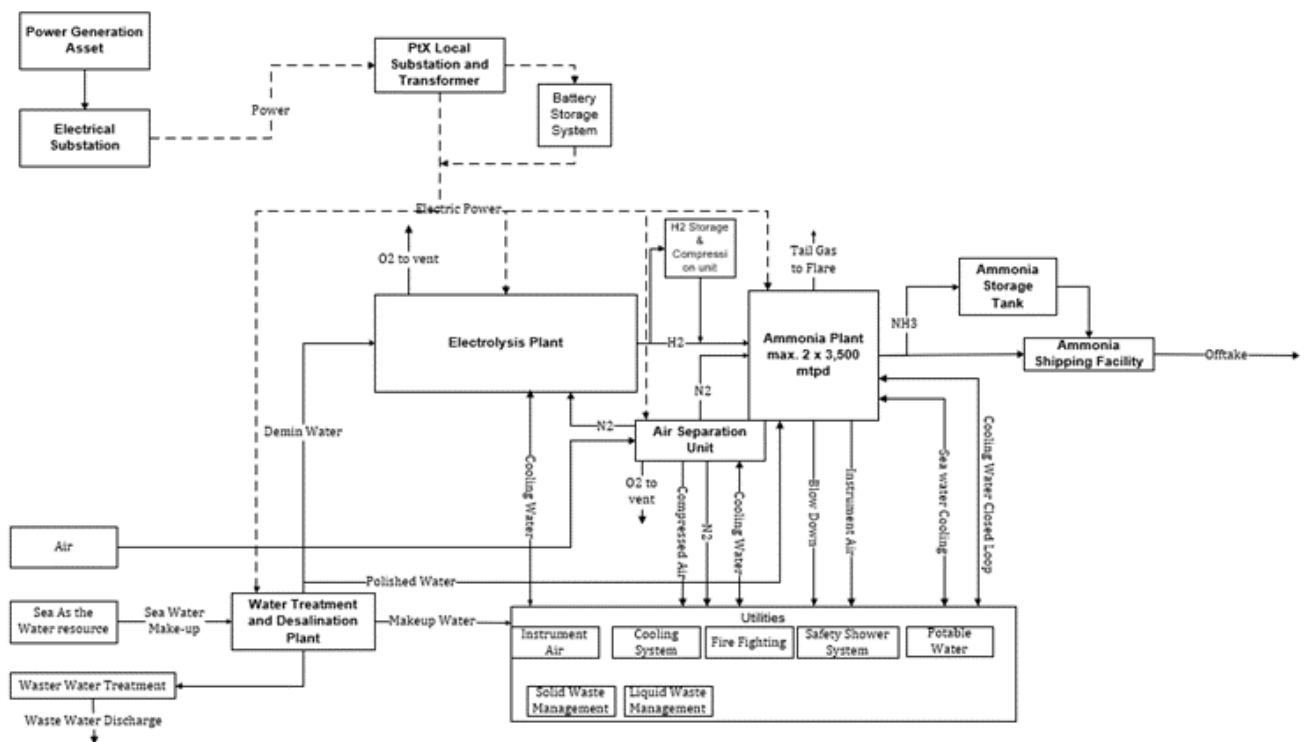


Figure 2-3 Process flow diagram

#### **2.3.4.1 Substation**

The substation will collect the renewable energy for the Solar PV Farm and Wind Farm.

#### **2.3.4.2 Battery**

The PtX plant is anticipated to have a 250 MW to 350 MW battery with a 2-hour duration. It is anticipated that the battery would operate to regulate incoming renewable energy sources prior to distribution to the hydrogen electrolyzers.

At present, the battery technology is yet to be confirmed; however, as engineering design progresses so will emergency response, fire suppression and environmental management requirements.

#### **2.3.4.3 Electrolyzers**

The Project is intended to have total electrolyser capacity of ~3 GW. The electrolyzers would use demineralised water to produce hydrogen. Oxygen is produced as a by-product of the electrolyzers, which will be discharged to the atmosphere at a safe distance from any ignition sources.

The electrolyser units are expected to use up to approximately 6 GLpa of demineralised water from the desalination plant to directly convert to hydrogen and oxygen.

In addition to the water requirements needed to operate of the electrolyzers, additional volumes of water are required for cooling. The amount of required water for the cooling system will be defined based on various parameters such as electrolyser cooling requirements (based on type and specification of the cooling system [open loop or closed loop]). The water demand and required cooling capacity will be defined in the detailed engineering phase.

#### **2.3.4.4 Hydrogen storage**

The project includes the storage of hydrogen. As an intermediary between electricity and ammonia, hydrogen storage will enable the efficient operation of the electrolyser (which can handle some fluctuation in input from the renewable energy sources) and the ammonia production process (which cannot readily adapt to varying fluctuation in input).

At this stage it is intended that the hydrogen will be compressed to 20 to 200 bar pressure but not liquified. The hydrogen storage will consist of up to 200 hydrogen storage vessels, each with a capacity of up to 680 tonnes.

#### **2.3.4.5 Ammonia Plant**

The ammonia plant uses Haber-Bosch technology to combine hydrogen with nitrogen (sourced from atmospheric nitrogen). The plant also includes an air separation unit and a nitrogen storage area.

#### **2.3.4.6 Ammonia chiller, storage and pump station**

The ammonia will be chilled and stored as a liquid (at or below -33°C).

The ammonia storage volume has been designed to hold between 90,000 to 180,000 tonnes.

In order to clear the cryogenic ammonia pipeline, a pressurised vapour return line will enable ammonia to be flushed from the export pipelines and returned to the ammonia storage and/or flared.

#### **2.3.4.7 Administration buildings, workshops and plant storage**

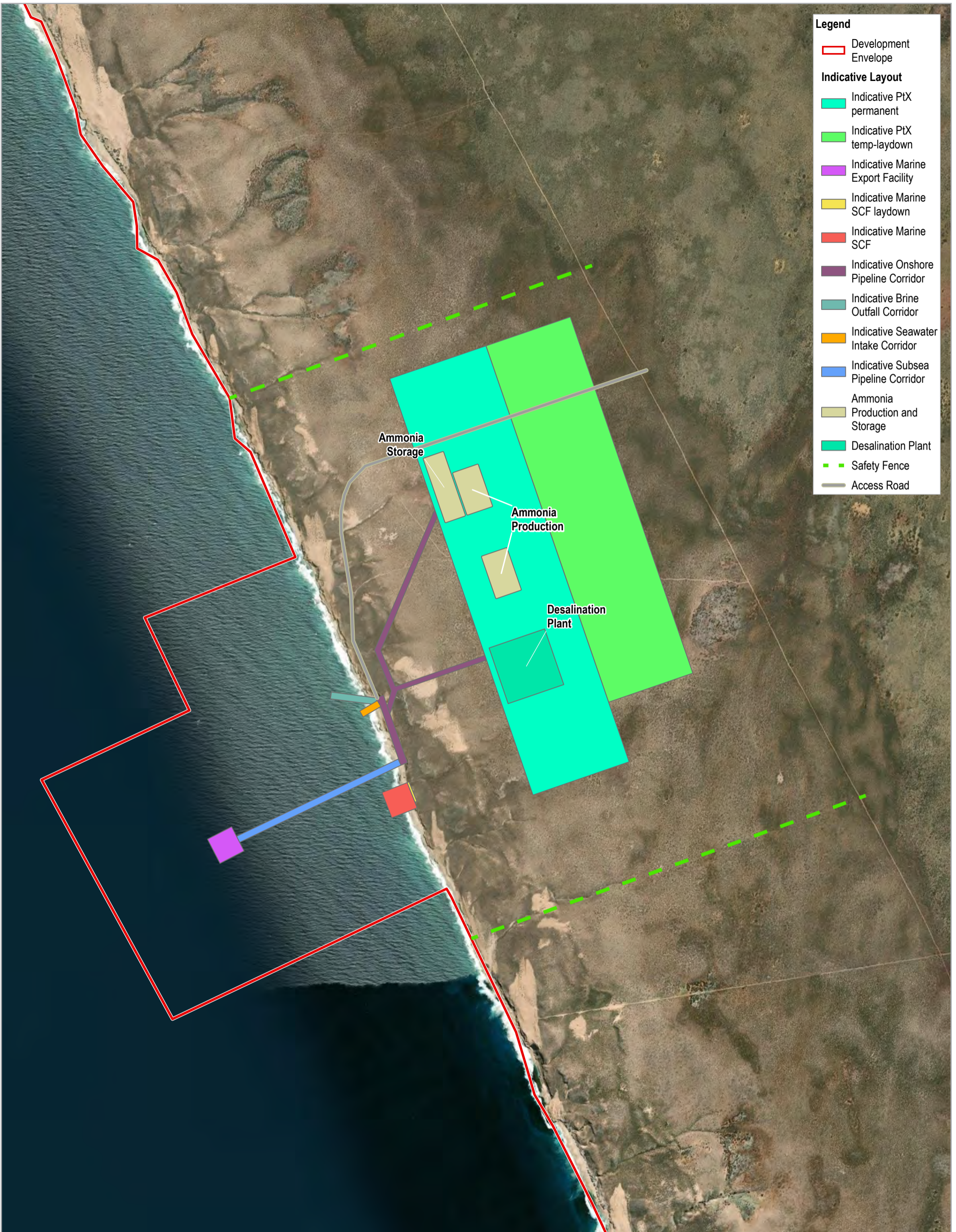
Administration buildings, workshops and plant storage will be required and it is anticipated that these will be co-located within the PtX area.

#### **2.3.4.8 Discharges**

To meet safety requirements, flaring infrastructure will be installed. The flaring infrastructure will be used to manage ammonia volumes and pressure and, if required, to depressurise the vapour return line.

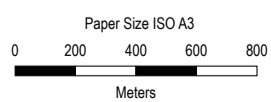
In connection with the ammonia plant, there is a need for a controlled burning of excess process gases. The flare would be located within the PtX plant area, with a safety zone of 50 m in radius.



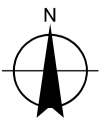


**Legend**

- Development Envelope
- Indicative Layout**
- Indicative PtX permanent
- Indicative PtX temp-laydown
- Indicative Marine Export Facility
- Indicative Marine SCF laydown
- Indicative Marine SCF
- Indicative Onshore Pipeline Corridor
- Indicative Brine Outfall Corridor
- Indicative Seawater Intake Corridor
- Indicative Subsea Pipeline Corridor
- Ammonia Production and Storage
- Desalination Plant
- Safety Fence
- Access Road



Map Projection: Transverse Mercator  
 Horizontal Datum: GDA 1994  
 Grid: GDA 1994 MGA Zone 50



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Indicative Plant Layout

FIGURE 2-4



## 2.3.5 Water supply and distribution infrastructure

### 2.3.5.1 Water demand

The Project is expected to have an overall water demand of approximately 6 GLpa of fresh water (from a desalination plant) and additional volumes of water for cooling. The required capacity for cooling is yet to be confirmed and will be defined in the detailed engineering phase.

#### 2.3.5.1.1 Seawater intake

The seawater intake will be located in water approximately 10 m deep. The design will be informed at a later stage.

#### 2.3.5.1.2 Discharge

The brine generated from the desalination plant would be diluted within the waste cooling water stream for discharge. The combined brine and waste cooling water stream would have an increase in salinity and temperature (compared to seawater). The waste cooling water stream is not expected to contain any contaminants as a result of the process.

The waste cooling water stream will be discharged via pipeline to the sea through a diffuser or diffuser array. The design of the diffuser infrastructure will consist of a protected subsea pipeline with risers terminating above the seabed at a suitable water depth and distance from coast. The diffuser exit velocity, port diameter and spacing will be designed to maximise mixing capacity.

#### 2.3.5.1.3 Shoreline infrastructure hub

Both the seawater intake and brine outfall pipelines will run subsea from the shoreline infrastructure facility. The pipelines will be subsea to a depth of at least -10 m MSL. Where the pipelines emerge from the seabed they will be protected. Clearing to accommodate this facility will be allocated within the 11.5 ha of clearing associated with onshore pipeline corridors.

The seawater intake and brine discharge pipelines will enter into a rock armoured platform on the shoreline. The shoreline infrastructure hub will include a sea water intake well that is connected to the sea water intake pipeline. This will be constructed to an approximate depth of -5 m MSL.

Specific construction methods of both intake and discharge pipelines will be reliant on geotechnical investigations.

#### 2.3.5.1.4 Pipelines

The onshore sections of both the seawater intake and brine discharge pipelines will be located within a trench between the shoreline infrastructure hub and the desalination plant (which would be located within the PtX plant).

Trenching to allow for onshore pipeline corridors would be within a 11.5 ha clearing footprint which would have exclusion fencing to allow for safe operation and inspection of the pipelines.

### 2.3.5.2 Heavy vehicle access track

An access track, suitable for heavy vehicles will be constructed from the PtX plant area to the shoreline infrastructure hub. This track shall have a gradient of no greater than 10% and will enable access for maintenance and emergency operations.

## 2.3.6 Marine Export Facility

### 2.3.6.1 Ammonia Export Pipeline

A cryogenic ammonia export pipeline will connect the PtX plant and storage facility to the marine export facility (Figure 2-5). The specific pipeline construction methods are yet to be finalised and will be reliant on geotechnical investigations. Construction methods will be determined during the detailed engineering phase.

The onshore section of cryogenic pipe-in-pipe pipeline will be approximately 1 km (from the PtX plant to the coast). The cryogenic pipeline will then run subsea to the marine export facility, reaching a depth of approximately -20 m



MSL, which is intended to be at distance of approximately 1400 m. Between the depth of -10 m MSL to the connection with the Marine Export Facility, the pipeline may either be protected or buried. The pipeline will be protected, with the type and method of protection yet to be determined. This will be confirmed during environmental impact assessment stage.

Adjacent to the cryogenic pipeline, a pressurised vapour return line will run along the same route, returning boil-off to the boil-off gas unit for re-liquification. The corridor for this pipeline has a maximum footprint of 6.6 ha.

A third pipe containing communications, services and utilities will also run within the same route.

### **2.3.6.2 Export facility**

Loading of export vessels will be conducted at the seaward end of the export ammonia pipeline using an export facility with a Single Point Mooring (SPM). At this stage, a Tower Load Unit (TLU) is expected to be used. The cryogenic ammonia export pipeline will connect to the fixed riser of the TLU. This removes the need for flexible joints below the sea surface area and relocates them to above the waterline, reducing the risk of leakage that might be possible via flexible risers. A fixed riser also has the benefit of above waterline valving, permitting the isolation of downstream flexible joints required for regular maintenance.

The export vessel will be either moored directly to the export facility or fixed anchor spread via anchor buoy systems.

The export facility will require a swing basin radius of approximately 330 m and a manoeuvring area of approximately 780 m. The anticipated vessel requirements are approximately three to four shipments per month.

The SPM will be secured to the seabed via piles. Specific design and installation details will be finalised on completion of marine geotechnical studies.

The export facility will have a maximum benthic disturbance footprint of 4 ha.

### **2.3.6.3 Navigational aids**

To support safe navigation within the vicinity of the Marine Export Facility, suitable marine navigational aids will be installed. Consultation with Department of Transport and Midwest Ports is ongoing regarding navigation requirements.

## **2.3.7 Support Craft Facility**

The Marine Export Facility requires tug and line boat support to position, moor, and support export vessel operations. It is estimated that four vessels would be required to support these operations. A Support Craft Facility (SCF) will be constructed to berth and service the required supporting vessels. Two options exist for the location of this facility, with the final determination to be made on completion of ongoing studies.

Stakeholder engagement will be undertaken to inform the support craft facility option study.

Each facility will provide:

- Appropriate moorings to service the vessels
- Refuelling infrastructure
- Office and workshop
- Road access to crew facilities and accommodation.

Specific details for each option area described below, which are shown on Figure 2-5 and Figure 2-6.

### **2.3.7.1 Option 1: Main project site (Coastal)**

This SCF would be proposed to be constructed to the west of the main project site. This option would require the construction of a breakwater and suitable berth and mooring infrastructure at the coast adjacent to the onshore project site. The maximum area of benthic habitat to be cleared for construction of SCF Option 1 would be 4 ha. Temporary terrestrial clearing to support SCF Option 1 will be no greater than 0.25 ha.

Dredging would be required on the land side of the breakwater post-construction, to ensure sufficient depth for support vessel navigation. Spoil would either be placed on existing beaches surrounding the facility or disposed of offshore.

The project is expected to require daily movements of support vessels to enable the planned ammonia export.

### **2.3.7.2 Option 2: Murchison River, Kalbarri**

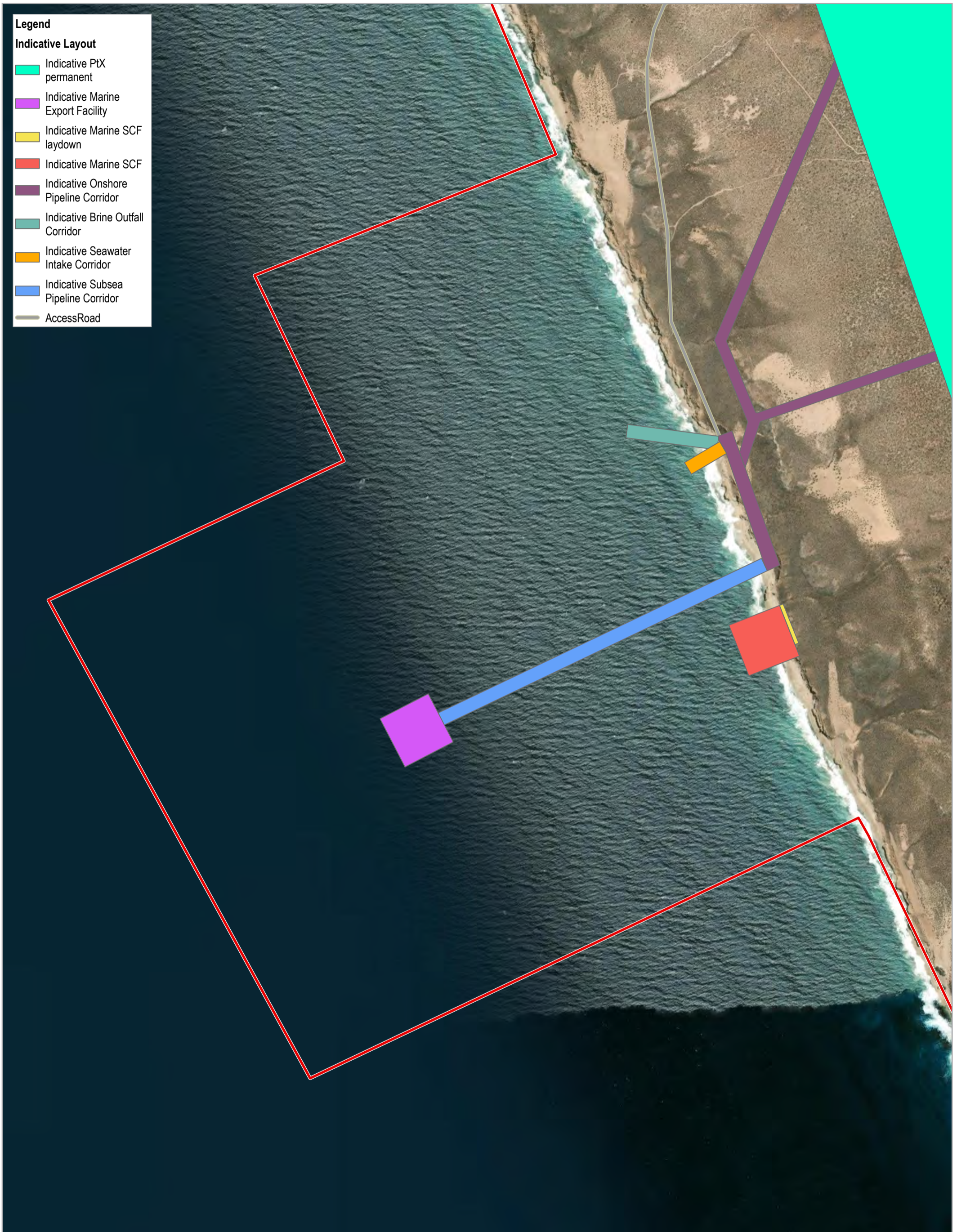
This facility would be proposed to be constructed within the Murchison River estuary. This option would require the construction of suitable berth infrastructure adjacent to existing infrastructure. This option would have a development footprint of 0.4 ha.

To enable tug and line boat navigation, dredging would be required to maintain a channel of suitable width within the river. River access and navigation study will also be undertaken as part of the option analysis.

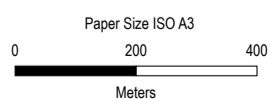
This option does not require the construction of breakwater structures, due to the location within the river and protection provided by natural structures located at the river mouth.

The project is expected to require daily movements of support vessels to enable the planned ammonia export.

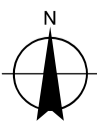




- Legend**
- Indicative Layout**
- Indicative PtX permanent
  - Indicative Marine Export Facility
  - Indicative Marine SCF laydown
  - Indicative Marine SCF
  - Indicative Onshore Pipeline Corridor
  - Indicative Brine Outfall Corridor
  - Indicative Seawater Intake Corridor
  - Indicative Subsea Pipeline Corridor
  - Access Road



Map Projection: Transverse Mercator  
 Horizontal Datum: GDA 1994  
 Grid: GDA 1994 MGA Zone 50



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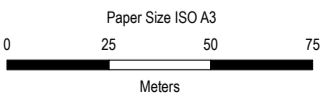
**Indicative location of  
 Support Craft Facility  
 Option 1 (Project Site)**

**FIGURE 2-5**

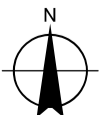




**Legend**  
 Indicative Support Craft Facility Development Area



Map Projection: Transverse Mercator  
 Horizontal Datum: GDA 1994  
 Grid: GDA 1994 MGA Zone 50



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**Indicative location of Support Craft Facility Option 2 (Kalbarri)**

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**FIGURE 2-6**



## 2.3.8 Supporting Infrastructure

### 2.3.8.1 Project access roads

The Proposal will require the construction of roads and tracks to facilitate safe site access and maintenance of permanent infrastructure. Up to approximately 1200 km of roads and tracks is currently intended to be constructed, this would have a maximum clearing footprint of up to 960 ha across all terrestrial areas of the DE.

Roads and tracks will be a combination of sealed and unsealed determined by frequency of use and operability. To support the construction and maintenance of roads onsite a small quarry will be developed to supply limestone.

The Proposal will include two access roads, one from Kalbarri, which will be the main access road during operation, and an access road from the Northwest Highway, which will be used to import large loads, such as wind turbine blades.

### 2.3.8.2 Accommodation

During operation it is anticipated that staff would either be based in Kalbarri, commute on a drive-in-drive-out basis or, if required on a fly-in-fly out basis.

### 2.3.8.3 Communication systems

Onsite communication systems are anticipated to include:

- Cell Towers
- Radio communication (two-way radio transceiver, Walkie-Talkie).

### 2.3.8.4 Maintenance and support services

The project will include a number of operational workshops with hardstand areas.

Office and security requirements, including fencing, will be in place to ensure safe operation of the plant and renewable energy infrastructure. Fencing requirements and access requirements are currently being determined and will be finalised during detailed design.

### 2.3.8.5 Other

A number of safety and fire control, including bushfire buffers, will be required during construction and operation. Clearing and fencing requirements will be included in all estimates of clearing requirements and assessed for environmental impact.

## 2.3.9 Construction facilities and temporary infrastructure

### 2.3.9.1 Laydown and construction areas

In addition to the final project footprint, the Proposal will require additional temporary clearing for both laydown areas and construction areas.

The wind turbines are expected to require a clearing area of up to 2.1 ha for construction in addition to the area of up to 0.2 ha of permanent footprint required (i.e. 2.3 ha total). The additional clearing will be required for construction activities, such as enabling crane access to safely manoeuvre turbine blades.

The Proposal will require substantial laydown requirements to enable the receipt of large items, such as wind turbine blades. It is intended that, where possible, laydown areas would be established in areas within the eventual final footprint (i.e. in areas such as the Solar PV Farm) before construction is complete.



The total temporary clearing for the Proposal, in addition to the final proposed footprint, will include the following:

- Construction:
  - 1470 ha for wind farm
- Laydown:
  - 50 ha additional laydown area for Wind and Solar
  - 181.5 ha for PtX plant (temporary laydown).

### **2.3.9.2 Marine dredging**

Construction of the marine infrastructure (i.e. ammonia export pipeline, seawater intake and brine outfall) may involve dredging of up to 80,000 m<sup>3</sup> of material from the seabed, to be disposed offshore at a location to be determined at a later design stage.

### **2.3.9.3 Construction facilities**

The construction of the project will require a large volume of concrete. To enable construction the project is intended to require at least one mobile batching and screening plant to produce concrete. Where possible, limestone and sand would be sourced for construction, such as roads, onsite in purpose-built quarries.

Rock may also be required for breakwater construction (if required for option 2 in the SCF).

As yet, marine construction techniques have not been determined; however, these will be defined through further engineering design.

### **2.3.9.4 Construction accommodation camp**

The Proposal will require the construction of a temporary accommodation facility to house the workforce during the period of project construction. The facility will have a capacity for up to 1,500 personnel and will contain all required supporting infrastructure within the footprint. The temporary accommodation facility is intended to be included in the 181.5 ha laydown area adjacent to the PtX plant construction area.

On completion of project construction, the temporary accommodation facility will be decommissioned, and all areas of disturbance revegetated with appropriate species.

The temporary construction accommodation facility will include a temporary waste-water treatment plant.

### **2.3.9.5 Temporary Bores and Portable Reverse Osmosis plant**

The Proposal will require the installation of bores and temporary reverse osmosis (RO) plant to support early construction. The bores and temporary RO plant will be operated until permanent water supply infrastructure is operational.

It is intended that the temporary bores and RO plant will be located within the proposed cleared area for the PtX.

On completion of project construction, the temporary bores and RO plant will be decommissioned, and all areas of disturbance revegetated with appropriate species.

Construction wastewater is to be discharged to sea (short term during construction).

### **2.3.9.6 Early power supply**

Prior to installation of sufficient renewable energy, a diesel generation set, and associated diesel storage will be required to provide power. The location of the temporary power supply is yet to be determined and will be confirmed during environmental impact assessment stage.

## 2.3.10 Total clearing for the Proposal

### Terrestrial

- Up to a total of 13,055 ha of vegetation clearing:
  - Approximately 1610 ha of total clearing for the wind farm
    - Up to 2.1 ha of temporary clearing per wind turbine generator (i.e. 1,470 ha in total)
    - Up to 0.2 ha of permanent clearing per wind turbine generator (i.e. 140 ha in total)
  - Approximately 10,000 ha of permanent clearing for the solar farm
  - Up to 50 ha of additional clearing for temporary laydown areas
  - Approximately 423.5 ha of total clearing for the PtX plant
    - Up to 242 ha of permanent clearing
    - Up to 181.5 ha of additional clearing for temporary laydown areas (inclusive of SCF Option 1 terrestrial laydown)
  - Approximately 960 ha of clearing for infrastructure to support this Proposal (i.e. roads, parking etc.)
  - Approximately 11.5 ha of clearing within pipeline corridors.

### Marine

- Up to a total of approximately 17.1 ha of clearing of benthic habitat:
  - Up to 4 ha of clearing for the marine export facility
  - Up to a total of 9.1 ha of clearing for marine pipeline corridors
    - Up to 2.5 ha of clearing for the seawater intake and discharge pipeline corridors
    - Up to 6.6 ha of clearing for the cryogenic ammonia export pipeline corridor
  - Up to 4 ha of clearing for the marine support craft facility (if SCF Option 1 is chosen)
  - Total marine dredging volume of approximately 80,000 m<sup>3</sup>.

### Estuarine (Optional):

- Up to 0.4 ha of clearing within Murchison River, to create permanent berthing infrastructure. Dredging to facilitate the berthing infrastructure may be required, however this may be undertaken by a third party and will be informed at a later design stage (if SCF Option 2 is chosen).

## 2.3.11 Key decommissioning activities

It is intended to restore the environmental values of the Proposal area following the lifespan of the Proposal. Requirements for decommissioning will be established through consultation with relevant stakeholders. The result will be a decommissioning management plan, which will be developed in the years leading up to decommissioning the Proposal. The decommissioning management plan is intended to include, but will not be limited to:

- Infrastructure agreements
- Rehabilitation strategies, planning and monitoring
- Land agreements.

# 3. Stakeholder Engagement

## 3.1 Overview

Murchison Hydrogen Renewables is committed to the development of ongoing relationships with the communities and stakeholders that may be affected by the Proposal. Stakeholder engagement began in March 2019. Initial engagement was conducted by HRA. Murchison Hydrogen Renewables is the superseding entity to HRA, and will be the primary project development vehicle going forward and will own the project assets.

Engagement with community members and other key stakeholders occurs via a range of channels. Local community engagement has included:

- Hon Minister Alannah MacTiernan, Minister for Hydrogen Industry, and forums run by her office to provide information on the project, discuss hydrogen land tenure and undertake early consultation prior to initiating the approvals processes, through meetings, telephone discussions, emails and letters.
- Government departments and decision making agencies including the EPA; Commonwealth Department of Agriculture, Water and the Environment (DAWE); Department of Water and Environmental Regulation (DWER); Department of Mines, Industry Regulation and Safety (DMIRS); the Department of Biodiversity, Conservation and Attractions (DBCA); Department of Transport – Marine (DoT); Department of Planning, Lands and Heritage (DPLH); Development WA, Department of Jobs, Tourism, Science and Innovation (DJTSI) to provide information on the project and undertake early consultation prior to initiating the approvals processes,
- The Shire of Northampton to provide information and explore planning approval requirements
- The Mid West Ports Authority to provide information and explore export facility options
- The pastoral leases of Murchison River Station to provide information on the project and seek access to land for ecological surveys as part of the environmental assessment
- Stakeholder briefings - with local, state and federal government representatives and other stakeholders occur on a regular basis. The meetings provide an opportunity for Murchison Hydrogen Renewables to update on business developments and for questions and concerns to be raised by stakeholders
- Community engagement – on-going community engagement, inviting a two-way discussion between the Proponent and local stakeholders (including Traditional Owners, local businesses)
- Dedicated working groups – run and organised by Murchison Hydrogen Renewables to inform stakeholders of project updates
- Regional stakeholders including the Mid West Chamber of Commerce and Industry; the Mid West Development Commission, Tourism WA – Geraldton; to provide information on the project and undertake early consultation prior to initiating the approvals processes
- Aboriginal corporations to develop an ongoing relationship, provide project information and progress the development of an ILUA
- Kalbarri Community public information sessions to provide early project information
- Recfishwest to provide project information prior to initiating the formal approvals process
- Department of Primary Industries and Regional Development (DPIRD) – request for fisheries information in order to undertake engagement.

## 3.2 Engagement related to the Proposal

Table 3-1 contains a summary of stakeholder engagement related to the Proposal. Engagement is ongoing.

## 3.3 Ongoing consultation

Murchison Hydrogen Renewables will continue to engage with relevant stakeholders throughout the environmental approval process to ensure that all concerns are addressed. This includes decision making authorities, other relevant government authorities, the local community, and environmental non-government organisations.

Murchison Hydrogen Renewables is committed to building effective relationships and working transparently with all stakeholders.



**Table 3-1 Summary of stakeholders engaged on the proposed action**

Stakeholder/s	Quarter (Calendar Year)	Purpose
Minister for Regional Development, Agriculture and Food; Hydrogen Industry	2019 Q1	Informed the Minister of the Project, Proponent credentials and proposed pathway to development.
Department of Jobs, Tourism, Science and Innovation	2019 Q2	Introduced Project and sought advice on potential issues and Government consultation
Aboriginal corporations		Introduced Project and commence ILUA and Section 91 discussions
Shire of Northampton		Introduced Project and sought advice on potential issues and local community consultation.
Mid West Development Commission		Introduced Project and sought advice on potential issues and local business opportunities
Aboriginal corporations	2019 Q3	Project update and continued ILUA and Section 91 discussions.
Aboriginal corporations	2019 Q4	Project update and continued ILUA and Section 91 discussions.
Department of Jobs, Tourism, Science and Innovation		Project update and sought advice on Government engagement.
Mid West Development Corporation		Project update and sought advice on potential issues and local business opportunities.
Shire of Northampton		Project update and sought advice on potential issues and local community consultation.
Kalbarri Community		Introduced Project, sought formal feedback via survey forms to understand potential areas of concern and opportunity. Outcomes published on HRA website.
Western Power	2021 Q1	Grid connection and power supply
Department of Jobs, Tourism, Science and Innovation		Project update and sought input on a variety of regulatory issues and requirements
Office of the Minister for Regional Development, Agriculture and Food; Hydrogen Industry	2021 Q2	Hydrogen land tenure options
Department of Jobs, Tourism, Science and Innovation; Department Planning, Lands and Heritage		Project update
Office of the Minister for Regional Development, Agriculture and Food; Hydrogen Industry		Project update
Office of the Minister for Mines and Petroleum; Energy; Corrective Services; Industrial Relations	2021 Q3	Land access and tenure

Stakeholder/s	Quarter (Calendar Year)	Purpose
Department of Jobs, Tourism, Science and Innovation		Land access and tenure
Department of Jobs, Tourism, Science and Innovation		Hydrogen land tenure
Aboriginal corporations		Introduced CIP, provided project update and continued ILUA discussions and negotiations.
Western Power		Grid connection options.
Department of Jobs, Tourism, Science and Innovation		Discussed port location options and constraints
Department of Jobs, Tourism, Science and Innovation		Project infrastructure (power)
Mid West Development Commission		Project update and discussed hydrogen hubs
Mid West Ports		Discussed port location options and constraints
Mid West Development Commission		Discussed port location options and constraints
Department of Jobs, Tourism, Science and Innovation		Discussed port location options and constraints
Minister for Regional Development, Agriculture and Food; Hydrogen Industry		Hydrogen land tenure
Mid West Development Commission		Project update
Aboriginal corporations)		Project update and continued ILUA discussions and negotiations
Office of the Minister for Regional Development, Agriculture and Food; Hydrogen Industry		Land tenure
Office of the Minister for Regional Development, Agriculture and Food; Hydrogen Industry		2021 Q4
Austrade	Austrade survey	
Department Planning, Lands and Heritage	Project update	
Department of the Premier and Cabinet	Renewable Hydrogen Council Meeting.	
Department Planning, Lands and Heritage	Murchison Hydrogen Project Discussion.	
Department of Jobs, Tourism, Science and Innovation	Project update	
Mid West Development Commission	Project update	
Department of Jobs, Tourism, Science and Innovation	Project update	
Recfishwest Shire of Northampton, Kalbarri Offshore and Angling Club	Temporary Notice to Mariners	

Stakeholder/s	Quarter (Calendar Year)	Purpose
Kalbarri Wilderness Cruises WA Fishing Industry Council Department of Transport (Marine)		
Department of Transport (Marine)		Follow up on Temporary Notice to Mariners
Department of Jobs, Tourism, Science and Innovation		Project update
Department of the Premier and Cabinet		Murchison Follow-up Meeting
Environmental Protection Authority (EPA Services)		Pre-Referral Briefing - Murchison Hydrogen Renewables Proposal
Shire of Northampton		Kalbarri Aerodrome Discussion
Department of Transport (Marine) Department of Planning, Lands and Heritage Development WA Department of Biodiversity, Conservation and Attractions Recfishwest Department of Mines, Industry Regulation and Safety Mid West Chamber of Commerce and Industry Mid West Development Commission Tourism WA (Geraldton Office) Shire of Northampton, Mid West Ports Department of Agriculture, Water and the Environment		2022 Q1
Department of Primary Industries and Regional Development - Fisheries		Request for Commercial Fisheries Information



# 4. Environmental factors

## 4.1 Identification of environmental factors

Environmental factors are those parts of the environment that may be impacted by an aspect of a proposal. The EPA has 14 environmental factors, organised into five themes: Sea, Land, Water, Air and People.

The following 11 preliminary key factors have been identified as relevant to the Proposal:

1. Benthic Communities and Habitats
2. Coastal Processes
3. Marine Environmental Quality
4. Marine Fauna
5. Flora and Vegetation
6. Terrestrial Fauna
7. Landforms
8. Inland Waters
9. Air Quality
10. Social Surroundings
11. Other environmental factors
  - Greenhouse Gas Emissions

The preliminary key environmental factors are presented in Sections 4.2 to 4.11. Matters of National Environmental Significance (MNES) are identified where relevant under each factor and summarised in Section 6.

## 4.2 Benthic Communities and Habitats

### 4.2.1 Policy and guidance

Table 4-1 Benthic Communities and Habitats policy and guidance

Source	Policy and guidance
EPA Policy and Guidelines	Environmental Factor Guideline: Benthic Communities and Habitats (EPA 2016a)
	Technical Guidance: Protection of Benthic Communities and Habitats (EPA 2016b)
	Technical Guidance: Environmental Impact Assessment of Marine Dredging Proposals (EPA 2016c)

### 4.2.2 Receiving environment

The Proposal is located in an area constrained by several sensitive receptors important to benthic communities and habitats (BCH). These include proximity to Key Ecological Features of the Western Rock Lobster (*Panulirus cygnus*), which is a dominant large benthic invertebrate. It is also an important part of the food web on the inner shelf, particularly as a juvenile, when it is preyed upon by varying organisms both vertebrate and invertebrate. The high biomass of western rock lobsters and their vulnerability to predation suggest that they are an important trophic pathway for a range of inshore species that prey upon juvenile lobsters.

Additional sensitive receptors are the nearshore portion of Abrolhos Australian Marine Park to the north and Blue Holes to the south which are both within relative proximity to the Proposal.

### 4.2.3 Potential impacts

The Proposal has the potential to result in following:

- Direct disturbance and loss of benthic communities and habitat as a result of dredging and permanent marine infrastructure.
- Temporary increase in water column turbidity due to nearshore construction activities and dredging
- Temporary release of contaminants from marine sediments during nearshore construction and dredging activities
- Temporary increase in suspended sediments, and associated settling of sediments as a result of dredging with the potential to impact BCH sensitive to smothering
- Increased vessel activity from operations may result in the introduction of invasive marine species
- Increased vessel activity and the potential for spills
- Discharges of brine effluent can potentially enhance the strength of stratification and in turn, promote reduced dissolved oxygen leading to loss of BCH
- Changes to marine salinity can induce osmotic stress
- Sediment trapped as a result of built infrastructure and dredging may create further loss of near shore benthic communities and habitat.

## 4.2.4 Proposed studies for impact assessment

The Proponent proposes to undertake:

- **Benthic Community and Habitats Baseline Program** - Baseline BCH mapping will be undertaken. The study will result in the preparation of BCH maps of substrate, benthic habitat and benthic communities in a manner suitable for environmental impact assessment.

## 4.3 Marine Fauna

### 4.3.1 Policy and guidance

Table 4-2 Marine Fauna policy and guidance

Source	Policy and guidance
EPA Policy and Guidelines	Environmental Factor Guideline: Marine Fauna (EPA 2016d)
Other Policy and Guidance	National Light Pollution Guidelines for Wildlife Including Marine Turtles, Seabirds and Migratory Shorebirds, Commonwealth of Australia (DEE 2020)
	Recovery Plan for Marine Turtles in Australia (Commonwealth of Australia 2017)

### 4.3.2 Receiving environment

#### 4.3.2.1 Coastal and seabirds

The *EPBC Act Protected Matters Report* listed 38 marine bird species – many of which are migratory – as potentially occurring within 40 km of the DE (Appendix C; Table 4-3). While all listed bird species may fly over or utilise habitats within or near the DE, the DE is not known to encompass waters or habitats that are critical for the survival of any of these species.

Table 4-3 Marine birds listed in the EPBC Act Protected Matters Report with potential to occur within 40 km of the DE

Scientific Name	Common Name	Presence Rank	Conservation Rank
<i>Actitis hypoleucos</i>	Common Sandpiper	Species or species habitat known to occur within area	Migratory; Marine
<i>Anous stolidus</i>	Common Noddy	Species or species habitat likely to occur within area	Migratory; Marine

Scientific Name	Common Name	Presence Rank	Conservation Rank
<i>Anous tenuirostris melanops</i>	Australian Lesser Noddy	Foraging, feeding or related behaviour likely to occur within area	Vulnerable; Marine
<i>Apus pacificus</i>	Fork-tailed Swift	Species or species habitat likely to occur within area	Migratory; Marine (overfly marine area)
<i>Ardenna carneipes</i>	Flesh-footed Shearwater, Fleishy-footed Shearwater	Species or species habitat likely to occur within area	Migratory; Marine
<i>Bubulcus ibis</i>	Cattle Egret	Species or species habitat may occur within area	Marine (overfly marine area)
<i>Calidris acuminata</i>	Sharp-tailed Sandpiper	Species or species habitat known to occur within area	Migratory; Marine
<i>Calidris canutus</i>	Red Knot, Knot	Species or species habitat may occur within area	Endangered; Migratory; Marine (overfly marine area)
<i>Calidris ferruginea</i>	Curlew Sandpiper	Species or species habitat known to occur within area	Critically Endangered; Migratory; Marine (overfly marine area)
<i>Calidris melanotos</i>	Pectoral Sandpiper	Species or species habitat may occur within area	Migratory; Marine (overfly marine area)
<i>Chalcites osculans</i>	Black-eared Cuckoo	Species or species habitat known to occur within area	Marine (overfly marine area)
<i>Charadrius leschenaultii</i>	Greater Sand Plover, Large Sand Plover	Species or species habitat may occur within area	Vulnerable; Migratory; Marine
<i>Diomedea amsterdamensis</i>	Amsterdam Albatross	Species or species habitat likely to occur within area	Endangered; Migratory; Marine
<i>Diomedea epomophora</i>	Southern Royal Albatross	Species or species habitat may occur within area	Vulnerable; Migratory; Marine
<i>Diomedea exulans</i>	Wandering Albatross	Species or species habitat may occur within area	Vulnerable; Migratory; Marine
<i>Fregata ariel</i>	Lesser Frigatebird, Least Frigatebird	Species or species habitat likely to occur within area	Migratory; Marine
<i>Haliaeetus leucogaster</i>	White-bellied Sea-Eagle	Species or species habitat known to occur within area	Marine
<i>Hydroprogne caspia</i>	Caspian Tern	Foraging, feeding or related behaviour known to occur within area	Migratory; Marine
<i>Larus pacificus</i>	Pacific Gull	Foraging, feeding or related behaviour known to occur within area	Marine
<i>Limosa lapponica</i>	Bar-tailed Godwit	Species or species habitat known to occur within area	Migratory; Marine
<i>Macronectes giganteus</i>	Southern Giant-Petrel, Southern Giant Petrel	Species or species habitat may occur within area	Endangered; Migratory; Marine
<i>Macronectes halli</i>	Northern Giant Petrel	Species or species habitat may occur within area	Vulnerable; Migratory; Marine
<i>Merops ornatus</i>	Rainbow Bee-eater	Species or species habitat may occur within area	Marine (overfly marine area)
<i>Motacilla cinerea</i>	Grey Wagtail	Species or species habitat may occur within area	Migratory; Marine (overfly marine area)
<i>Numenius madagascariensis</i>	Eastern Curlew, Far Eastern Curlew	Species or species habitat may occur within area	Critically Endangered; Migratory; Marine



Scientific Name	Common Name	Presence Rank	Conservation Rank
<i>Onychoprion anaethetus</i>	Bridled Tern	Foraging, feeding or related behaviour likely to occur within area	Migratory; Marine
<i>Pandion haliaetus</i>	Osprey	Breeding known to occur within area	Migratory; Marine
<i>Pterodroma mollis</i>	Soft-plumaged Petrel	Species or species habitat may occur within area	Vulnerable; Marine
<i>Puffinus assimilis</i>	Little Shearwater	Foraging, feeding or related behaviour known to occur within area	Marine
<i>Rostratula australis</i>	Australian Painted Snipe	Species or species habitat may occur within area	Endangered; Marine (overfly marine area)
<i>Stercorarius skua</i>	Great Skua	Species or species habitat may occur within area	Marine
<i>Sterna dougallii</i>	Roseate Tern	Foraging, feeding or related behaviour likely to occur within area	Migratory; Marine
<i>Sternula albifrons</i>	Little Tern	Species or species habitat may occur within area	Migratory; Marine
<i>Thalassarche carteri</i>	Indian Yellow-nosed Albatross	Species or species habitat may occur within area	Vulnerable; Migratory; Marine
<i>Thalassarche cauta</i>	Shy Albatross	Species or species habitat may occur within area	Endangered; Migratory; Marine
<i>Thalassarche impavida</i>	Campbell Albatross, Campbell Black-browed Albatross	Species or species habitat may occur within area	Vulnerable; Migratory; Marine
<i>Thalassarche melanophris</i>	Black-browed Albatross	Species or species habitat may occur within area	Vulnerable; Migratory; Marine
<i>Thalassarche steadi</i>	White-capped Albatross	Foraging, feeding or related behaviour likely to occur within area	Vulnerable; Migratory; Marine

#### 4.3.2.2 Marine Mammals

The *EPBC Act Protected Matters Report* listed nine marine mammal species as potentially occurring within 40 km of the DE (Appendix C; Table 4-4). Of these, five were considered as known or likely to occur within 40 km of the DE. Of these, all are mobile species and therefore capable of avoiding the areas during construction activities.

Table 4-4 Marine mammals listed in the *EPBC Act Protected Matters Report* with potential to occur within 40 km of the DE

Scientific Name	Common Name	Presence Rank	Conservation Rank
<i>Arctocephalus forsteri</i>	Long-nosed Fur-seal, New Zealand Fur-seal	Species or species habitat may occur within area	Marine
<i>Neophoca cinerea</i>	Australian Sea-Lion	Species or species habitat may occur within area	Endangered; Marine
<i>Eubalaena australis</i>	Southern Right Whale	Species or species habitat likely to occur within area	Endangered; Migratory Marine
<i>Balaenoptera musculus</i>	Blue Whale	Migration route known to occur within area	Endangered; Migratory Marine
<i>Megaptera novaeangliae</i>	Humpback Whale	Species or species habitat known to occur within area	Vulnerable; Migratory Marine
<i>Balaenoptera physalus</i>	Fin Whale	Foraging, feeding or related behaviour likely to occur within area	Vulnerable; Migratory Marine

Scientific Name	Common Name	Presence Rank	Conservation Rank
<i>Balaenoptera borealis</i>	Sei Whale	Foraging, feeding or related behaviour likely to occur within area	Vulnerable; Migratory Marine
<i>Orcinus orca</i>	Killer Whale, Orca	Species or species habitat may occur within area	Migratory Marine
<i>Balaenoptera edeni</i>	Bryde's Whale	Species or species habitat may occur within area	Migratory Marine

### 4.3.2.3 Marine Reptiles

The EPBC Act Protected Matters Report listed 12 marine reptiles as potentially occurring within 40 km of the DE (Appendix C; Table 4-5). Of these, five were considered as known or likely to occur within 40km of the DE. Of these, all are mobile species and therefore capable of avoiding the areas during construction activities.

Table 4-5 Marine reptiles listed in the EPBC Act Protected Matters Report with potential to occur within 40 km of the DE

Scientific Name	Common Name	Presence Rank	Conservation Rank
<i>Emydocephalus annulatus</i>	Turtle-headed Seasnake	Species or species habitat may occur within area	Marine
<i>Ephalophis greyi</i>	North-western Mangrove Seasnake	Species or species habitat may occur within area	Marine
<i>Disteira kingii</i>	Spectacled Seasnake	Species or species habitat may occur within area	Marine
<i>Disteira major</i>	Olive-headed Seasnake	Species or species habitat may occur within area	Marine
<i>Natator depressus</i>	Flatback Turtle	Species or species habitat known to occur within area	Vulnerable; Marine
<i>Aipysurus laevis</i>	Olive Seasnake	Species or species habitat may occur within area	Marine
<i>Pelamis platurus</i>	Yellow-bellied Seasnake	Species or species habitat may occur within area	Marine
<i>Aipysurus pooleorum</i>	Shark Bay Seasnake	Species or species habitat may occur within area	Marine
<i>Aipysurus foliosquama</i>	Leaf-scaled Seasnake	Species or species habitat likely to occur within area	Critically Endangered; Marine
<i>Dermochelys coriacea</i>	Leatherback Turtle, Leathery Turtle	Species or species habitat known to occur within area	Endangered; Marine
<i>Caretta caretta</i>	Loggerhead Turtle	Species or species habitat known to occur within area	Endangered; Marine
<i>Chelonia mydas</i>	Green Turtle	Foraging, feeding or related behaviour known to occur within area	Vulnerable; Marine

### 4.3.2.4 Finfish

The EPBC Act Protected Matters Report listed 10 finfish as potentially occurring within 40 km of the DE (Appendix C; Table 4-6). Of these, eight were considered as known or likely to occur within 40 km of the DE. Of these, all are mobile species and therefore capable of avoiding the areas during construction activities.

Table 4-6 Finfish listed in the EPBC Act Protected Matters Report with potential to occur within 40 km of the DE

Scientific Name	Common Name	Presence Rank	Conservation Rank
<i>Sphyrna lewini</i>	Scalloped Hammerhead	Species or species habitat likely to occur within area	Conservation Dependent
<i>Carcharias taurus</i> (west coast population)	Grey Nurse Shark (west coast population)	Species or species habitat known to occur within area	Vulnerable

Scientific Name	Common Name	Presence Rank	Conservation Rank
<i>Carcharodon carcharias</i>	White Shark, Great White Shark	Species or species habitat known to occur within area	Vulnerable; Marine Migratory
<i>Rhincodon typus</i>	Whale Shark	Species or species habitat may occur within area	Vulnerable; Marine Migratory
<i>Mobula alfredi</i>	Reef Manta Ray, Coastal Manta Ray	Species or species habitat known to occur within area	Migratory Marine Species
<i>Mobula birostris</i>	Giant Manta Ray	Species or species habitat likely to occur within area	Migratory Marine Species
<i>Isurus paucus</i>	Longfin Mako	Species or species habitat likely to occur within area	Migratory Marine Species
<i>Isurus oxyrinchus</i>	Shortfin Mako, Mako Shark	Species or species habitat likely to occur within area	Migratory Marine Species
<i>Carcharhinus longimanus</i>	Oceanic Whitetip Shark	Species or species habitat likely to occur within area	Migratory Marine Species
<i>Lamna nasus</i>	Porbeagle, Mackerel Shark	Species or species habitat may occur within area	Migratory Marine Species

### 4.3.3 Potential impacts

The Proposal has the potential to result in the following:

- Disturbance from increased vessel movements (collisions/noise) in the region, both in relation to international shipping for the Proposal during operations and marine infrastructure installation and maintenance vessels
- Direct impacts on marine fauna include vessel strike or entanglement in equipment such as dredges
- Behaviour modification from artificial lighting associated with offshore infrastructure, vessels and behind-dune infrastructure
- Underwater noise
- Construction, operation, decommissioning and maintenance works may result in the introduction of non-indigenous marine species to the area in vessel ballast water and on vessel hulls
- Impacts to benthic communities affecting marine fauna
- Changes in marine environmental quality (brine discharge, turbidity, release of contaminants during construction/operation) impacting marine fauna
- Introduced marine species from vessel biofouling or ballast water during construction or operations
- Unplanned spill of hazardous chemicals (e.g. hydrocarbons).

### 4.3.4 Proposed studies for impact assessment

The proponent proposes to undertake:

- **Marine fauna baseline and impact assessment** – a desktop assessment of marine mammals, marine reptiles, fish and fisheries, and shorebirds/seabirds that occur in the proposal area. A desktop assessment is proposed as the marine fauna information in existing public databases and studies/reports are sufficient to characterise distribution, abundance and seasonal occurrence of marine megafauna in and proximal to the proposal, it is expected that marine fauna monitoring is not necessary.
- **Introduced marine species (IMS) and baseline survey and risk assessment** – desktop review of introduced species, undertake an IMS survey approved of by DPIRD and establish an IMS baseline characterisation and risk assessment.
- **Underwater Noise Modelling (Construction) and Impact Assessment (Construction and Operational)** – desktop review of impact threshold, vessel noise and construction noise, carry out noise modelling of relevant construction activities while operational underwater noise modelling will be modelled on the basis of literature values.



## 4.4 Marine Environmental Quality

### 4.4.1 Policy and guidance

Table 4-7 Marine Environmental Quality policy and guidance

Source	Policy and guidance
EPA Policy and Guidelines	Environmental Factor Guideline: Marine Environmental Quality (EPA 2016e)
	Technical Guidance: Protecting the Quality of Western Australia’s Marine Environment (EPA 2016f)
	Technical Guidance: Environmental Impact Assessment of Marine Dredging Proposals (EPA 2016c)
Other Policy and Guidance	Australian and New Zealand Guidelines for Fresh and Marine Water Quality (Water Quality Australia, 2018)
	National Assessment Guidelines for Dredging (DAWE 2009)

### 4.4.2 Receiving environment

The DE is bounded by beaches and rocky ledges along the coast. Support Craft Facility option 1 is situated within the Murchison River estuary. Recreational and commercial fishing is undertaken in the area. Baseline water quality monitoring is being undertaken both within the estuary and in the vicinity of the proposed marine infrastructure to establish an understanding of the baseline conditions in the receiving environment.

### 4.4.3 Potential impacts

The Proposal has the potential to result in the following:

- Increased vessel activity in the region during construction, operation and maintenance causing increased turbidity
- Dredging requirements for construction as well as maintenance dredging causing increased suspended sediments
- Temporary release of contaminants from marine sediments during nearshore construction and dredging activities
- Discharge of brine from the desalination plant ocean outfall.

### 4.4.4 Proposed studies for impact assessment

The Proponent proposes to undertake the following surveys of marine environmental quality:

- **Baseline water quality monitoring** – obtain continuous data for a one-year study period allowing for the characterisation of baseline water quality.
- **Land-based contaminant fluxes to marine waters** – review of studies to be conducted characterising inland waters to inform a model that will demonstrate fluxes of water and contaminants from land-based surface and groundwaters to the marine environment.
- **Marine operational impacts modelling** – review of regional hydrodynamics and the creation of a model to understand the impacts to MEQ during operation.
- **Marine construction impacts modelling** – develop multiple construction scenarios, i.e. “worst”, “best” and “most-likely” scenarios, of impacts to MEQ and carry out preliminary impact assessment of turbidity and sediment threshold.
- **Water quality impacts modelling** – model impacts to water quality using industry standard and additional inputs, analyse the predicted relative impacts of the Proposal to water quality over a range of scenarios.
- **Marine environmental quality impact assessment** – collate and review the existing studies to determine the impacts to MEQ as a result of the Proposal.

The surveys will inform planning to avoid and minimise impacts to conservation values, enable quantification of impacts and inform management of the marine environment within and adjacent to the Proposal.

## 4.5 Coastal Processes

### 4.5.1 Policy and guidance

Table 4-8 Coastal processes policy and guidance

Source	Policy and guidance
EPA Policy and Guidelines	Environmental Factor Guideline: Coastal Processes (EPA 2016g)
Other Policy and Guidance	State Planning Policy No. 2.6: State Coastal Planning Policy (DPLH, 2021)
	Coastal hazard risk management and adaptation planning guidelines (DPLH 2019)

### 4.5.2 Receiving environment

The following coastal processes are applicable to the DE:

- Erosion of land by wave action, tidal movement and/ or winds, re-shaping and altering the coastal landforms
- Transportation of material in the sea and coast by wave action
- Deposition of eroded material along coastal region altering coastal morphology and landforms.

These processes are largely unaltered with no man-made infrastructure or developments located within the coastal or marine portion of the main DE.

The area associated with SCF Option 2 has been modified from its natural state. The Murchison River estuary has been the subject of dredging to maintain navigation channels for commercial fishing vessels. This maintenance dredging is undertaken on a regular basis.

### 4.5.3 Potential impacts

The Proposal has the potential to result in the following:

- Alteration of wave dynamics and interruption of longshore sediment transport
- Sediment trapped as a result of built infrastructure and dredging may create further loss of near shore benthic communities and habitat.

### 4.5.4 Proposed studies for impact assessment

The Proponent proposes to undertake the following surveys of coastal process adjacent to the DE:

- **Baseline: Local wave climate** – desktop review to characterise wave climate and create a local wave model, use of this baseline model to inform the following study.
- **Coastal processes impact assessment** – assess coastal processes using model simulations to determine the impacts of the Proposal to coastal processes.

The surveys will inform planning to avoid and minimise impacts to conservation values, enable quantification of impacts and inform management of the coast adjacent to the Proposal.

## 4.6 Flora and vegetation

### 4.6.1 Policy and guidance

Table 4-9 Flora and Vegetation policy and guidance

Source	Policy and guidance
EPA Policy and Guidelines	Statement of Environmental Principles, Factors and Objectives (EPA, 2021b)
	Environmental Factor Guideline: Flora and Vegetation (EPA, 2016h)
	Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment (EPA, 2016i)
Other Policy and guidance	WA Environmental Offsets Policy (Government of Western Australia, 2011)
	WA Environmental Offsets Guidelines (Government of Western Australia, 2014)

### 4.6.2 Receiving environment

#### 4.6.2.1 Regional biogeography

The DE predominantly lies within the Geraldton Sandplains IBRA bioregion and within the Geraldton Hills IBRA subregion. The Geraldton Sandplains bioregion comprises the central and northern Perth Basin, the Pinjarra Orogen, and the south end of the Carnarvon Basin. Outcrops of Jurassic siltstones and sandstones can be heavily lateralized. Extensive proteaceous heaths and scrub-heaths often with emergent mallees, *Banksia* and *Actinostrobos*, occur on an undulating, lateritic sandplain mantling Permian to Cretaceous strata. These heaths are rich in endemics. Sandplains are most extensive in the north and southeast where the region overlaps the edges of the Carnarvon Basin and Yilgarn Craton respectively. Extensive York gum and Acacia woodlands occur on alluvial outwash plains associated with drainage and with valleys in the hill country. Areas of coastal aeolian sands and limestone support proteaceous heath and Acacia scrubs (Desmond and Chant 2002).

#### 4.6.2.2 Regional vegetation mapping and extent

Broad scale (1:250,000) pre-European vegetation mapping of the area was completed by (Beard 1976) at an association level. Mapping indicates eight vegetation associations are present within the DE:

- Shrublands tree-heath between sandhills; *Banksia ashbyi*, *Grevillea gordoniana*, *Acacia* spp., *Melaleuca* and mallee (association 368)
- Shrublands; heath on coastal limestone (association 402)
- Shrublands; scrub-heath on sandplain (association 380)
- Shrublands; *Acacia rostellifera* thicket (association 17)
- Shrublands; *Melaleuca cardiophylla* thicket (association 387)
- Shrublands; scrub-heath on coastal association, yellow sandplain (association 408)
- Mosaic: Shrublands; scrub-heath on coastal association on yellow sandplain / Shrublands; acacia patchy scrub (association 401)
- Shrublands; *Acacia ligulata* scrub-heath (association 403)

The pre-European mapping has been adapted and digitised by (Shepherd, Beeston and Hopkins 2001). The extent of vegetation associations have been determined by the state-wide vegetation remaining extent calculations maintained by DBCA (GoWA 2019). As shown in Table 4-10, the proposed geotechnical investigation sites represent less than 0.001% of each vegetation association's calculated current extents at all scales (e.g. State, IBRA bioregion, IBRA subregion and LGA).



Table 4-10 Extent of pre-European vegetation associations within the DE (Beard 1975, (GoWA 2019))

Pre-European Vegetation Association	Scale	Pre-European extent (ha)	Current extent (ha)	Remaining (%)	%current extent in all DBCA managed land (proportion of current extent)	Area within the DE (ha)
368	State: Western Australia	330,110.25	330,110.25	100.00	73.46	1687
	IBRA bioregion: Geraldton Sandplains	416.19	416.19	100.00	94.18	1687
	IBRA subregion: Geraldton Hills	416.19	416.19	100.00	94.18	1687
	LGA: Shire of Northampton	10,731.21	10,731.21	100.00	64.15	1687
402	State: Western Australia	51,592.94	51,155.81	99.15	63.13	17273
	IBRA bioregion: Geraldton Sandplains	50,723.54	50,406.65	99.38	62.78	17273
	IBRA subregion: Geraldton Hills	50,723.54	50,406.65	99.38	62.78	17273
	LGA: Shire of Northampton	21,286.52	20,913.05	98.25	14.65	17273
380	State: Western Australia	580,374.88	351,916.09	60.64	40.01	20024
	IBRA bioregion: Geraldton Sandplains	507,696.88	319,288.64	62.89	39.60	20024
	IBRA subregion: Geraldton Hills	507,696.88	319,288.64	62.89	39.60	20024
	LGA: Shire of Northampton	323,476.98	249,037.61	76.99	31.88	20024
17	State: Western Australia	76,633.84	67,605.49	88.22	13.06	10311
	IBRA bioregion: Geraldton Sandplains	54,078.08	45,159.85	83.51	13.44	10311
	IBRA subregion: Geraldton Hills	49,605.04	42,016.28	84.70	13.26	10311
	LGA: Shire of Northampton	49,549.89	41,939.33	84.64	13.29	10311
387	State: Western Australia	14,898.42	13,571.67	91.09	4.35	16
	IBRA bioregion: Geraldton Sandplains	8,203.59	6,948.11	84.70	7.07	16
	IBRA subregion: Geraldton Hills	8,203.59	6,948.11	84.70	7.07	16
	LGA: Shire of Northampton	6,686.94	6,431.65	96.18	7.57	16
408	State: Western Australia	328,527.29	149,051.65	45.37	66.83	1023

Pre-European Vegetation Association	Scale	Pre-European extent (ha)	Current extent (ha)	Remaining (%)	%current extent in all DBCA managed land (proportion of current extent)	Area within the DE (ha)
	IBRA bioregion: Geraldton Sandplains	328,527.29	149,051.65	45.37	66.83	1023
	IBRA subregion: Geraldton Hills	328,527.29	149,051.65	45.37	66.83	1023
	LGA: Shire of Northampton	251,429.27	141,161.39	56.14	70.07	1023
401	State: Western Australia	32,726.65	32,726.65	100.00	24.91	24589
	IBRA bioregion: Geraldton Sandplains	32,603.86	32,603.86	100.00	24.63	24589
	IBRA subregion: Geraldton Hills	32,603.86	32,603.86	100.00	24.63	24589
	LGA: Shire of Northampton	32,401.50	32,401.50	100.00	24.16	24589
403	State: Western Australia	11,635.38	11,113.55	95.52	56.89	4472
	IBRA bioregion: Geraldton Sandplains	11,536.78	11,105.99	96.27	56.93	4472
	IBRA subregion: Geraldton Hills	11,536.78	11,105.99	96.27	56.93	4472
	LGA: Shire of Northampton	5,740.51	5,440.62	94.78	12.15	4472

#### 4.6.2.3 Conservation significant ecological communities

A search of DBCA's Threatened and Priority ecological community database was undertaken within 40 km buffer of the DE. No TEC/PECs were identified as occurring within the DE; however, four PECs were recorded outside the DE. These occurrences are described below and shown in Figure 4-1:

- Kalbarri Ironstone Community (Priority 1): three known locations, closest is approximately 15 km east of the southern region of the DE, other two known locations of this PEC are 25 km and 35 km southeast of the DE
- Highway Land System (Priority 3): three known locations, closest is approximately 15 km east of the northern region of the DE, other two known locations of this PEC are 22 km and 53 km east of the DE
- Cullawarra Land System (Priority 3): known location is 45 km northwest of the DE
- Tamala Land System (Priority 3): known location is 46 km northwest of the DE.

#### 4.6.2.4 Flora diversity

The *NatureMap* (DBCA 2007-) database identified 1084 taxa previously recorded within a 40 km radius from the centre of the DE (114° 10' 40" E, 27° 22' 43" S), forming a study area encompassing the DE and the surrounding area. This total comprised of 1020 native taxa and 64 naturalised (introduced) taxa. Dominant families recorded included Myrtaceae (179 taxa), Fabaceae (102 taxa) and Proteaceae (75 taxa).

The *NatureMap* database search is provided in Appendix D.

#### 4.6.2.5 Conservation significant flora

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) Protected Matters Search Tool (PMST) (DAWE 2021) and NatureMap (DBCA 2007) database identified the presence/potential presence of 105 conservation significant flora within a 40 km radius of the DE. This included:

- 10 Threatened taxa
- 10 Priority 1 taxa
- 38 Priority 2 taxa
- 37 Priority 3 taxa
- 16 Priority 4 taxa.

Within the DE, two Threatened flora listed under the EPBC Act and BC Act and 31 Priority flora as listed by DBCA have previously been recorded. A further three Threatened and 18 Priority flora have potential to occur in the DE based on the likelihood assessment as shown in Table 4-11.

Table 4-11 Conservation significant flora with potential to occur in the DE

Conservation significant species	EPBC	DBCA	Likelihood of occurrence
<i>Androcalva bivillosa</i>	CR	CR	Highly unlikely
<i>Beyeria lepidopetala</i>	EN	VU	Highly unlikely
<i>Caladenia barbarella</i>	EN	EN	Likely (Historical occurrence within DE)
<i>Caladenia bryceana</i> subsp. <i>cracens</i>	VU	EN	Likely (Historical occurrence within DE)
<i>Caladenia elegans</i>	EN	CR	Highly unlikely
<i>Caladenia wanosa</i>	VU	EN	Highly unlikely
<i>Drakaea concolor</i>	VU	EN	Possible
<i>Eucalyptus beardiana</i>	VU	EN	Possible
<i>Hypocalymma longifolium</i>	VU	VU	Possible
<i>Lechenaultia chlorantha</i>	VU	EN	Highly unlikely
<i>Chamelaucium</i> sp. Coolcalalaya (A.H. Burbidge 4233)	-	P1	Likely (Historical occurrence within DE)
<i>Corynotheca acanthoclada</i>	-	P1	Possible
<i>Desmocladius ferruginipes</i>	-	P1	Possible
<i>Macarthuria georgeana</i>	-	P1	Likely (Historical occurrence within DE)
<i>Malleostemon nerrenensis</i>	-	P1	Unlikely
<i>Mirbelia</i> sp. Zuytdorp (G.J. Keighery & N. Gibson 1688)	-	P1	Likely (Historical occurrence within DE)
<i>Pileanthus aurantiacus</i>	-	P1	Likely (Historical occurrence within DE)
<i>Scaevola</i> sp. Golden hairs (D. & B. Bellairs 1450 A)	-	P1	Possible
<i>Thryptomene</i> sp. Carrarang (M.E. Trudgen 7420)	-	P1	Likely (Historical occurrence within DE)
<i>Verticordia lepidophylla</i> var. <i>quantula</i>	-	P1	Likely (Historical occurrence within DE)
<i>Acacia gelasina</i>	-	P2	Unlikely
<i>Acacia leptospermoides</i> subsp. <i>obovata</i>	-	P2	Likely (Historical occurrence within DE)
<i>Acacia stereophylla</i> var. <i>cylindrata</i>	-	P2	Unlikely
<i>Adenanthos acanthophyllus</i>	-	P2	Unlikely



Conservation significant species	EPBC	DBCA	Likelihood of occurrence
<i>Angianthus microcephalus</i>	-	P2	Possible
<i>Baeckea subcuneata</i>	-	P2	Unlikely
<i>Bossiaea inundata</i>	-	P2	Unlikely
<i>Caladenia longicauda</i> subsp. <i>minima</i>	-	P2	Unlikely
<i>Calytrix harvestiana</i>	-	P2	Likely (Historical occurrence within DE)
<i>Calytrix paucicostata</i>	-	P2	Unlikely
<i>Calytrix purpurea</i>	-	P2	Unlikely
<i>Chthonocephalus tomentellus</i>	-	P2	Unlikely
<i>Cryptandra glabriflora</i>	-	P2	Unlikely
<i>Enekbatus cristatus</i>	-	P2	Unlikely
<i>Geleznovia amabilis</i>	-	P2	Unlikely
<i>Grevillea stenomera</i>	-	P2	Likely (Historical occurrence within DE)
<i>Malleostemon costatus</i>	-	P2	Unlikely
<i>Malleostemon microphyllus</i>	-	P2	Likely (Historical occurrence within DE)
<i>Melaleuca boeophylla</i>	-	P2	Unlikely
<i>Melaleuca oldfieldii</i>	-	P2	Unlikely
<i>Millotia jacksonii</i>	-	P2	Unlikely
<i>Persoonia brachystylis</i>	-	P2	Unlikely
<i>Platysace</i> sp. Kalbarri (D. & B. Bellairs 1383)	-	P2	Unlikely
<i>Scaevola chrysopogon</i>	-	P2	Possible
<i>Schoenus</i> sp. Kalbarri (K.R. Newbey 9352)	-	P2	Possible
<i>Scholtzia corrugata</i>	-	P2	Likely (Historical occurrence within DE)
<i>Scholtzia</i> sp. Folly Hill (M.E. Trudgen 12097)	-	P2	Likely (Historical occurrence within DE)
<i>Scholtzia tenuissima</i>	-	P2	Unlikely
<i>Scholtzia truncata</i>	-	P2	Possible
<i>Seringia saxatilis</i>	-	P2	Possible
<i>Styphelia cernua</i>	-	P2	Unlikely
<i>Thryptomene calcicola</i>	-	P2	Likely (Historical occurrence within DE)
<i>Thryptomene johnsonii</i>	-	P2	Possible
<i>Thryptomene</i> sp. Eagle Gorge (A.G. Guinness 2360)	-	P2	Possible
<i>Thysanotus fragrans</i>	-	P2	Unlikely
<i>Thysanotus kalbarriensis</i>	-	P2	Unlikely
<i>Verticordia dasystylis</i> subsp. <i>kalbarriensis</i>	-	P2	Unlikely
<i>Verticordia galeata</i>	-	P2	Possible
<i>Acacia plautella</i>	-	P3	Possible
<i>Acanthocarpus parviflorus</i>	-	P3	Likely (Historical occurrence within DE)
<i>Anthotroche myoporoides</i>	-	P3	Likely (Historical occurrence within DE)

Conservation significant species	EPBC	DBCA	Likelihood of occurrence
<i>Arnocrinum drummondii</i>	-	P3	Likely (Historical occurrence within DE)
<i>Austroparmelina macrospora</i>	-	P3	Unlikely
<i>Beyeria cinerea</i> subsp. <i>cinerea</i>	-	P3	Highly unlikely
<i>Beyeria gardneri</i>	-	P3	Unlikely
<i>Bossiaea calcicola</i>	-	P3	Possible
<i>Calytrix formosa</i>	-	P3	Possible
<i>Carpobrotus</i> sp. Thevenard Island (M. White 050)	-	P3	Likely (Historical occurrence within DE)
<i>Centrolepis cephaliformis</i> subsp. <i>murrayi</i>	-	P3	Unlikely
<i>Chamelaucium marchantii</i>	-	P3	Unlikely
<i>Chamelaucium</i> sp. Wongan Hills (B.H. Smith 1140)	-	P3	Unlikely
<i>Dasymalla glutinosa</i>	-	P3	Likely (Historical occurrence within DE)
<i>Drosera radicans</i>	-	P3	Unlikely
<i>Drosera rechingeri</i>	-	P3	Unlikely
<i>Grevillea costata</i>	-	P3	Unlikely
<i>Grevillea leucoclada</i>	-	P3	Unlikely
<i>Grevillea rogersoniana</i>	-	P3	Unlikely
<i>Guichenotia impudica</i>	-	P3	Highly unlikely
<i>Hemigenia saligna</i>	-	P3	Likely (Historical occurrence within DE)
<i>Lasiopetalum oldfieldii</i>	-	P3	Unlikely
<i>Lasiopetalum oppositifolium</i>	-	P3	Unlikely
<i>Lepidium biplicatum</i>	-	P3	Likely (Historical occurrence within DE)
<i>Macarthuria intricata</i>	-	P3	Possible
<i>Malleostemon pentagonus</i>	-	P3	Unlikely
<i>Mirbelia corallina</i>	-	P3	Unlikely
<i>Pileanthus bellus</i>	-	P3	Possible
<i>Scholtzia bellairsiorum</i>	-	P3	Unlikely
<i>Scholtzia oleosa</i>	-	P3	Likely (Historical occurrence within DE)
<i>Stenanthemum divaricatum</i>	-	P3	Unlikely
<i>Thryptomene caduca</i>	-	P3	Likely (Historical occurrence within DE)
<i>Triodia dielsii</i>	-	P3	Highly unlikely
<i>Verticordia cooloomia</i>	-	P3	Likely (Historical occurrence within DE)
<i>Verticordia densiflora</i> var. <i>roseostella</i>	-	P3	Unlikely
<i>Verticordia dichroma</i> var. <i>dichroma</i>	-	P3	Likely (Historical occurrence within DE)
<i>Verticordia dichroma</i> var. <i>syntoma</i>	-	P3	Likely (Historical occurrence within DE)
<i>Caladenia integra</i>	-	P4	Highly unlikely
<i>Eremophila microtheca</i>	-	P4	Likely (Historical occurrence within DE)
<i>Eucalyptus zopherophloia</i>	-	P4	Likely (Historical occurrence within DE)
<i>Frankenia confusa</i>	-	P4	Highly unlikely

Conservation significant species	EPBC	DBCA	Likelihood of occurrence
<i>Jacksonia velutina</i>	-	P4	Likely (Historical occurrence within DE)
<i>Lepidium puberulum</i>	-	P4	Likely (Historical occurrence within DE)
<i>Lepidobolus densus</i>	-	P4	Unlikely
<i>Lepidosperma rupestre</i>	-	P4	Highly unlikely
<i>Liparophyllum congestiflorum</i>	-	P4	Unlikely
<i>Pityrodia viscida</i>	-	P4	Highly unlikely
<i>Scaevola kallophylla</i>	-	P4	Unlikely
<i>Stachystemon nematophorus</i>	-	P4	Possible
<i>Triodia bromoides</i>	-	P4	Likely (Historical occurrence within DE)
<i>Verticordia capillaris</i>	-	P4	Possible
<i>Verticordia polytricha</i>	-	P4	Likely (Historical occurrence within DE)
<i>Wurmbea murchisoniana</i>	-	P4	Unlikely

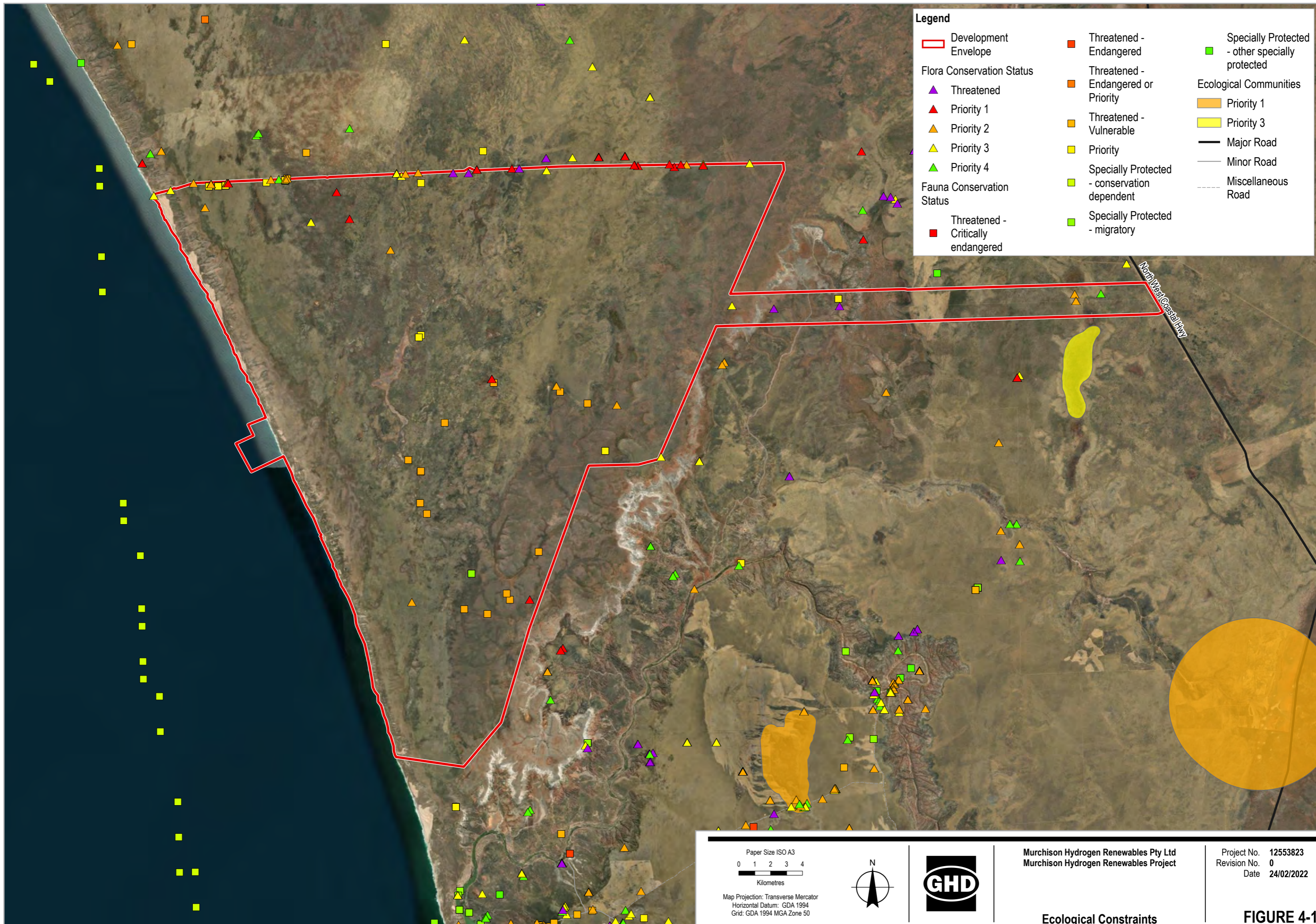
#### **Flora likelihood of occurrence assessment guidelines**

Likelihood of occurrence	Guideline
Likely	Species previously recorded within the study area and large areas of suitable habitat occur in the survey area.
Possible	Species previously recorded within the study area and areas of suitable habitat occur/may occur in the survey area.
Unlikely	Species previously recorded within the study area, but suitable habitat does not occur in the survey area.
Highly unlikely	Species not previously recorded within the study area, suitable habitat does not occur in the survey area and/or the survey area is outside the natural distribution of the species.

#### **4.6.2.6 Weeds**

The EPBC Act PMST (DAWE 2021) did not identify any Weeds of National Significance (WoNS) occurring within the DE or within a 5 km radius of the DE.





**Legend**

Development Envelope	Threatened - Endangered	Specially Protected - other specially protected
<b>Flora Conservation Status</b>	Threatened - Endangered or Priority	<b>Ecological Communities</b>
Threatened	Threatened - Vulnerable	Priority 1
Priority 1	Priority	Priority 3
Priority 2	Specially Protected - conservation dependent	Major Road
Priority 3	Specially Protected - migratory	Minor Road
Priority 4		Miscellaneous Road
<b>Fauna Conservation Status</b>		
Threatened - Critically endangered		

<p>Paper Size ISO A3</p> <p>Kilometres</p> <p>Map Projection: Transverse Mercator Horizontal Datum: GDA 1994 Grid: GDA 1994 MGA Zone 50</p>			<p>Murchison Hydrogen Renewables Pty Ltd Murchison Hydrogen Renewables Project</p>	<p>Project No. 12553823 Revision No. 0 Date 24/02/2022</p>
<p>Ecological Constraints</p>			<p><b>FIGURE 4-1</b></p>	



### 4.6.3 Potential impacts

The Proposal will result in the clearing of up to approximately 13,055 ha of native vegetation, of which approximately 1713 ha will be temporarily cleared during construction and rehabilitated. The Proposal is likely to result in direct impacts to threatened and priority flora as a result of clearing.

The Proposal also has the potential to result in the following:

- Introduction and/or spread of weeds
- Introduction and/or increased prevalence of feral herbivores
- Spills and/or leaks from storage and handling of hazardous materials and waste.

### 4.6.4 Proposed studies for impact assessment

A Detailed Flora and Vegetation Survey will be undertaken across the DE, with targeted flora surveys within areas of potential habitat for Threatened and Priority flora species.

## 4.7 Terrestrial fauna

### 4.7.1 Policy and guidance

Table 4-12 Terrestrial Fauna policy and guidance

Source	Policy and guidance
EPA Policy and Guidelines	Statement of Environmental Principles, Factors and Objectives (EPA, 2021b)
	Environmental Factor Guideline – Terrestrial Fauna (EPA, 2016j)
	Technical Guidance: Terrestrial vertebrate fauna surveys for environmental impact assessment (EPA 2020a)
	Technical Guidance: Sampling of short-range endemic invertebrate fauna (EPA, 2016k)
Other Policy and Guidance	Survey Guidelines for Australia's Threatened Bats (DEWHA, 2010a)
	Carnaby's Cockatoo ( <i>Calyptorhynchus latirostris</i> ) Recovery Plan: Western Australian Wildlife Management Program No. 52, (Department of Parks and Wildlife 2013).

### 4.7.2 Receiving environment

#### 4.7.2.1 Fauna diversity

The *NatureMap* (DBCA 2007) database identified 478 species previously recorded within a 40 km radius from the centre of the DE (114° 10' 40" E, 27° 22' 43" S), forming a study area encompassing the DE and the surrounding area (Appendix D). This total comprised nine amphibians, 153 bird, 91 fish, 133 invertebrate, 18 mammal and 74 reptile species. Of these species recorded, 472 are native and six are naturalised (introduced) species.

#### 4.7.2.2 Conservation significant fauna

The *NatureMap* (DBCA 2007) database and the EPBC Act PMST, considering the DE and a 40 km buffer (DAWE 2021), identified the presence/potential presence of 73 conservation significant fauna. The desktop assessment identified:

- 30 species listed as Threatened under the EPBC Act and/or BC Act
- Four species listed at Priority 3 under the BC Act
- Four species listed at Priority 4 under the BC Act
- 25 species protected under international agreement
- One species specially protected.

***Likelihood of occurrence***

A likelihood of occurrence assessment was conducted for the conservation significant fauna identified above in the desktop assessments. The likelihood of occurrence assessment concluded that 36 species are likely or known to occur, and the remaining species are highly unlikely to occur within the DE. This assessment is summarised in Table 4-13.

Table 4-13 Conservation significant fauna likely to occur in the DE

Taxa	Common Name	Status		Description and habitat requirements	Likelihood of occurrence within the project area	Source
		BC Act	EPBC Act			
<b>Birds</b>						
<i>Actitis hypoleucos</i>	Common Sandpiper	MI	MI	Habitat for the Common Sandpiper is varied: coastal and interior wetlands – narrow muddy edges of billabongs, river pools, mangroves, among rocks and snags, reefs or rocky beaches. Avoids wide open mudflats. This species is widespread and scattered, common on the north and west coasts and uncommon in the south-east and interior (Morcombe 2004).	<b>Likely.</b> The nearest record is 8 km south of the Survey Area.	DBCA
<i>Anous stolidus</i>	Common Noddy	MI	MI	The Common Noddy usually occurs on or near islands, on rocky islets and stacks with precipitous cliffs, or on shoals or cays of coral or sand. When not at the nest, individuals will remain close to the nest, foraging in the surrounding waters. Birds may nest in bushes, saltbush, or other low vegetation. They may also nest on the ground in Pigface ( <i>Carpobrotus</i> spp.) or grass, on bare rock, on top of rocks protruding above vegetation, on shingle beaches, among coral rubble or in sand close to grassy areas. The species has also been recorded nesting in the forks of tall trees, in holes in dead timber and on tree-stumps. It occurs off the north-west and central Western Australia coast and breeds on the Abrolhos Islands (DotEE 2019).	<b>Unlikely.</b> Coastal habitat is present however species is known to utilise offshore islands and atolls.	PMST
<i>Anous tenuirostris melanops</i>	Australian Lesser Noddy		VU	The Australian Lesser Noddy is usually found only around its breeding islands in the Houtman Abrolhos Islands. It usually occupies coral-limestone islands that are densely fringed with White Mangrove <i>Avicennia marina</i> . It occasionally occurs on shingle or sandy beaches. The bird roosts mainly in mangroves, especially at night, but may sometimes rest on a beach (DotEE 2019).	<b>Unlikely.</b> Coastal habitat is present however species is known to utilise offshore islands and atolls.	PMST
<i>Amytornis textilis subsp. textilis</i>	Western Grasswren	P4		The western subspecies of the Western Grasswren occurs in four types of semi-arid shrubland: (1) <i>Acacia</i> shrublands on coastal dunes, coastal plains and red sandplains, dominated by <i>Acacia ligulata</i> , <i>A. tetragonophylla</i> , <i>A. ramulosa</i> and <i>A. sclerosperma</i> , with chenopods such as <i>Rhagodia</i> spp. and <i>Threlkeldia diffusa</i> , other species of shrubs 1-3 m tall with a recumbent growth form that support twining species, and an extensive ground-cover of low shrubs, grasses and herbs. (2) Fire-affected shrublands dominated by <i>Ptilotus obovatus</i> and <i>Solanum orbiculatum</i> , which have replaced burnt-out Horse Mulga shrublands for at least 40 years following uncontrolled fires. (3) Low (< 1.5 m high) shrublands on calcareous sandplains, dominated by Umbrella Bush, <i>Exocarpus</i> spp., and other shrubs such as <i>Thryptomene</i> spp., and <i>Ptilotus</i> spp., mixed with hummocks of spinifex <i>Triodia</i> spp., and sometimes with <i>Atriplex</i> spp. (4) Dense thickets of	<b>Present.</b> The species was observed by GHD (2021) in the coastal dune shrublands habitat type of the Survey Area	Naturemap



Taxa	Common Name	Status		Description and habitat requirements	Likelihood of occurrence within the project area	Source
		BC Act	EPBC Act			
				<i>Muehlenbeckia cunninghamii</i> , <i>Atriplex</i> spp. and <i>Eremophila</i> spp. growing in drainage lines (DotE 2019). The species is currently known only from the Shark Bay region (TSSC 2006)		
<i>Apus pacificus</i>	Fork-tailed Swift	MI	MI	The fork-tailed Swift is a migratory species that follows large storm fronts and are almost exclusively areal species. In Western Australia, there are sparsely scattered records of the Fork-tailed Swift along the south coast, ranging from near the Eyre Bird Observatory and west to Denmark, in coastal and subcoastal areas between Augusta and Carnarvon, including some on nearshore and offshore islands. Scattered records are present in the Midwest region. Records are scattered throughout WA including the Pilbara, Kimberley, Wheatbelt, Gascoyne and deserts (Higgins 1999).	<b>Unlikely.</b> Although this species may periodically occur in the region, but the species is exclusively areal in nature and irregularly utilises terrestrial habitats.	DBCA
<i>Ardenna carneipes</i>	Flesh-footed Shearwater	MI	MI	The Flesh-footed Shearwater is a trans-equatorial migrant. The species is widely distributed across the southern Indian and south-western Pacific Oceans during the breeding season with colonies located on Saint Paul Island (France) in the southern Indian Ocean (Jouventin, 1994; Roux, 1985), on 41 islands off the coast of south-western Western Australia (Burbidge & Fuller, 1996), on Smith Island off the coast of Eyre Peninsula in South Australia (Robinson et al., 1986), on Lord Howe Island (Priddel et al., 2006) and on approximately 20 islands around the eastern and western coasts of the North Island of New Zealand to Cook Strait (Brooke, 2004; Marchant & Higgins, 1990; Taylor, 2000). The Flesh-footed Shearwater nests in colonies in burrows under trees or shrubs. On Lord Howe Island it favours the flatter areas in the central lowlands (Priddel et al., 2006). Most feeding is undertaken offshore over continental shelves where it feeds on fish and squid, mostly caught by pursuit-plunging (Marchant & Higgins, 1990). The Flesh-footed Shearwater readily takes baits from longlines (Baker & Wise, 2005).	<b>Unlikely.</b> There is coastal habitat present however species is known to utilise offshore islands.	PMST
<i>Ardenna pacifica</i>	Wedge-tailed Shearwater	MI	MI	The Wedge-tailed Shearwater nests in burrows on offshore islands during November-April. Research has indicated more than one million shearwaters migrate to the Pilbara islands each year to nest (DBCA, 2017).	<b>Unlikely.</b> The nearest closest record is 6 km east of the Survey Area. Coastal habitat is present however species is known to utilise offshore islands	DBCA
<i>Arenaria interpres</i>	Ruddy turnstone	MI	MI	The Ruddy Turnstone is found in most coastal regions with exposed rock coast lines or coral reefs, and also near platforms and shelves, often with shallow tidal pools and rocky, shingle or gravel beaches. It	<b>Likely.</b> There is suitable habitat within the Survey	DBCA

Taxa	Common Name	Status		Description and habitat requirements	Likelihood of occurrence within the project area	Source
		BC Act	EPBC Act			
				can be found on sand, coral or shell beaches, shoals, cays and dry ridges of sand or coral, and in occasionally near riverbeds, and on inland lakes and adjacent farmland. It strongly prefers rocky shores or beaches with large deposits of rotting seaweed. It has occasionally been sighted in estuaries, harbours, bays and coastal lagoons, among low saltmarsh or on exposed beds of seagrass, around sewage ponds and on mudflats. In south-west Australia, it may occur on pebble-strewn shores of salt lakes near the coast (DotE 2016). It is also common on all the larger islands south to Penguin Island (Nevill 2013).	Area and previous records 2 km east of the Survey Area	
<i>Calidris acuminata</i>	Sharp-tailed Sandpiper	MI	MI	In Australasia, the Sharp-tailed Sandpiper prefers muddy edges of shallow fresh or brackish wetlands, with inundated or emergent sedges, grass, saltmarsh or other low vegetation. This includes lagoons, swamps, lakes and pools near the coast, and dams, waterholes, soaks, bore drains and bore swamps, salt pans and hypersaline salt lakes inland. They also occur in saltworks and sewage farms. They use flooded paddocks, sedgeland and other ephemeral wetlands, but leave when they dry. They use intertidal mudflats in sheltered bays, inlets, estuaries or seashores, and also swamps and creeks lined with mangroves. Sometimes they occur on rocky shores. They are widespread from Cape Arid to Carnarvon, around coastal and subcoastal plains of Pilbara Region to south-west and east Kimberley Division. Inland records indicate the species is widespread and scattered from Newman, east to Lake Cohen, south to Boulder and west to Meekatharra (DotEE 2019).	<b>Likely.</b> There is some rocky shoreline habitat for this species within the Survey Area and the nearest record is 16 km east of the Survey Area. Typically this species occurs on inland water systems, therefore use may be opportunistic.	DBCA
<i>Calidris alba</i>	Sanderling	MI	MI	In Australia, the Sanderling is almost always found on the coast, mostly on open sandy beaches exposed to open sea-swell, and also on exposed sandbars and spits, and shingle banks, where they forage in the wave-wash zone and amongst rotting seaweed. Sanderlings also occur on beaches that may contain wave-washed rocky outcrops. Less often the species occurs on more sheltered sandy shorelines of estuaries, inlets and harbours. Rarely, they are recorded in near-coastal wetlands. There are rare inland records from sandy shores of ephemeral brackish lakes and brackish river-pools. They occur on most of the coast from Eyre to Derby, and also around Wyndham. They are more often recorded on the south and southwest coasts, north to around southern Shark Bay, with more sparsely scattered records further north in Gascoyne and Pilbara Regions and the Kimberley Division (DotEE 2019).	<b>Likely.</b> There is suitable habitat within the Survey Area and previous records 10 km south of the Survey Area	DBCA
<i>Calidris canutus</i>	Red Knot	MI	EN	In Australasia the Red Knot mainly inhabits intertidal mudflats, sandflats and sandy beaches of sheltered coasts, in estuaries, bays,	<b>Likely.</b> There is suitable habitat	PMST

Taxa	Common Name	Status		Description and habitat requirements	Likelihood of occurrence within the project area	Source
		BC Act	EPBC Act			
				inlets, lagoons and harbours; sometimes on sandy ocean beaches or shallow pools on exposed wave-cut rock platforms or coral reefs. They are occasionally seen on terrestrial saline wetlands near the coast, such as lakes, lagoons, pools and pans, and recorded on sewage ponds and saltworks, but rarely use freshwater swamps. They rarely use inland lakes or swamps. In WA there are scattered records in the south, and it is occasionally seen around Peron Peninsula and Carnarvon. It is widespread on the coast from Ningaloo and Barrow Island to the south-west Kimberley Division (DotE 2016).	within the Survey Area.	
<i>Calidris ferruginea</i>	Curlew Sandpiper	CR	CR	Curlew Sandpipers mainly occur in areas with soft mud conditions, including intertidal mudflats in sheltered coastal areas, such as estuaries, bays, inlets and lagoons, and also around non-tidal swamps, lakes and lagoons near the coast, and ponds in saltworks and sewage farms. They are found inland less often, including around ephemeral and permanent lakes, dams, waterholes and bore drains, usually with bare edges of mud or sand. They occur in both fresh and brackish waters. In WA, they are widespread around coastal and subcoastal plains from Cape Arid to south-west Kimberley Division, but are more sparsely distributed between Carnarvon and Dampier Archipelago ((DotEE 2019).	<b>Likely</b> The nearest record is at Chinaman's Rock Lookout 10 km south of the Survey Area.	DBCA, NatureMap & PMST
<i>Calidris ruficollis</i>	Red-necked stint	MI	MI	The Red-necked Stint can be found in fresh and saline water, but primarily in coastal regions (Nevill 2013). It is mostly found in areas including sheltered inlets, bays, lagoons and estuaries with intertidal mudflats, often near spits, islets and banks and, sometimes, on protected sandy or coralline shores. Occasionally they have been recorded on exposed or ocean beaches, and on stony or rocky shores, reefs or shoals. They also occur in saltworks and sewage farms; saltmarsh; ephemeral or permanent shallow wetlands near the coast or inland, including lagoons, lakes, swamps, riverbanks, waterholes, bore drains, dams, soaks and pools in salt flats. They have occasionally been recorded on dry gibber plains, with little or no perennial vegetation. It has been observed at the Nullarbor Plain, Reid, Stoke's Inlet, Grassmere Lake, Warden Lake, Dalyup and Yellilup Swamp, Swan River, Bengier Swamp, Guraga Lake, Wittecarra, Harding River, coastal Gascoyne, the Pilbara and the Kimberley (DotEE 2019).	<b>Likely.</b> There is suitable habitat within the Survey Area and the closest known record is 5 km south of the Survey Area	DBCA
<i>Calyptorhynchus latirostris</i>	Carnaby's cockatoo	EN	EN	Carnaby's Cockatoo occurs in uncleared or remnant native eucalypt woodlands, especially those that contain salmon gum, wandoo, marri, jarrah and karri, and in shrubland or kwongan heathland dominated by Hakea, Dryandra, Banksia and Grevillea species. Breeding activity is restricted to eucalypt woodlands mainly in the semiarid and subhumid	<b>Present</b> There is suitable habitat within the Survey Area and foraging evidence on the	DBCA, NatureMap & PMST

Taxa	Common Name	Status		Description and habitat requirements	Likelihood of occurrence within the project area	Source
		BC Act	EPBC Act			
				interior, from Kalbarri in the north, Three Springs District south to the Stirling Range, west to Cockleshell Gully and east to Manmanning. The species has expanded its breeding range westward and south into the jarrah-marri forests of the Darling Scarp and into the tuart forests of the Swan Coastal Plain, including the Yanchep area, Lake Clifton and near Bunbury. It nests in trees older than 120-150 years (DotEE 2019).	southern edge of the Survey Area. The closest known record is 6 km east of the Survey Area	
<i>Charadrius leschenaultii</i>	Greater sand plover	VU	MI	In Australasia the Greater Sand Plover is almost entirely coastal, inhabiting littoral and estuarine habitats. They mainly occur on sheltered sandy, shelly or muddy beaches with large intertidal mudflats or sandbanks, as well as sandy estuarine lagoons, and inshore reefs, rock platforms, small rocky islands or sand cays on coral reefs. They are occasionally recorded on near-coastal saltworks and salt lakes, including marginal saltmarsh, and on brackish swamps. They seldom occur at shallow freshwater wetlands (DotE 2016). Some come down the coast from Geraldton as far as Busselton, but numbers decrease from north to south (Nevill 2013).	<b>Likely.</b> There is suitable habitat within the Survey Area on the coastal strip and the closest known record is 10km south of the Survey Area.	DBCA, NatureMap & PMST
<i>Charadrius mongolus</i>	Lesser Sand Plover	EN	EN	In non-breeding grounds in Australia, the Lesser Sand Plover usually occurs in coastal littoral and estuarine environments. It inhabits large intertidal sandflats or mudflats in sheltered bays, harbours and estuaries, and occasionally sandy ocean beaches, coral reefs, wave-cut rock platforms and rocky outcrops. It also sometimes occurs in short saltmarsh or among mangroves, in saltworks and near-coastal salt pans, brackish swamps and sandy or silt islands in river beds. The species is seldom recorded away from the coast, at margins of lakes, soaks and swamps associated with artesian bores (DotE 2016). The Lesser Sand Plover mainly occurs in northern regions, and becomes more scarce in the south west (Nevill 2013).	<b>Likely</b> There are known records of the species at Chinaman's Rock Lookout approximately 10km south of the Survey Area.	DBCA, NatureMap
<i>Diomedea amsterdamensis</i>	Amsterdam Albatross		EN	Albatross and giant petrel species exhibit a broad range of diets and foraging behaviours, and hence their at-sea distributions are diverse. Combined with their ability to cover vast oceanic distances, all waters within Australian jurisdiction can be considered foraging habitat, however the most critical foraging habitat is considered to be those waters south of 25 degrees where most species spend the majority of their foraging time (DotEE 2019).	<b>Unlikely.</b> It is unlikely that the species occurs within the Survey Area but opportunistically it may occur within inland waters during extreme weather events	PMST
<i>Diomedea epomophora</i>	Southern Royal Albatross	MI	VU	Albatross and giant petrel species exhibit a broad range of diets and foraging behaviours, and hence their at-sea distributions are diverse. Combined with their ability to cover vast oceanic distances, all waters	<b>Unlikely.</b> It is unlikely that the species occurs	PMST



Taxa	Common Name	Status		Description and habitat requirements	Likelihood of occurrence within the project area	Source
		BC Act	EPBC Act			
				within Australian jurisdiction can be considered foraging habitat, however the most critical foraging habitat is considered to be those waters south of 25 degrees where most species spend the majority of their foraging time (DotEE 2019).	within the Survey Area but opportunistically it may occur within inland waters during extreme weather events.	
<i>Diomedea exulans</i>	Wandering Albatross	MI	VU	Albatross and giant petrel species exhibit a broad range of diets and foraging behaviours, and hence their at-sea distributions are diverse. Combined with their ability to cover vast oceanic distances, all waters within Australian jurisdiction can be considered foraging habitat, however the most critical foraging habitat is considered to be those waters south of 25 degrees where most species spend the majority of their foraging time.(DoTE, 2019).	<b>Unlikely.</b> It is unlikely that the species occurs within the Survey Area but opportunistically it may occur within inland waters during extreme weather events.	PMST
<i>Falco peregrinus</i>	Peregrine Falcon	OS		The Peregrine Falcon is found on and near cliffs, gorges, timbered watercourses, riverine environments, wetlands, plains, open woodlands, and pylons and spires of buildings, though less frequently in desert regions (Morcombe 2014; Pizzey & Knight 2012). They are not common but can be found almost anywhere throughout WA and in the southwest, including particularly at Fitzgerald River, Stirling Range, Porongurup National Parks, Kondinin, and Peak Charles, with many more locations north of Perth (Nevill 2013).	<b>Likely.</b> The species is known from the region (records within 4 km east of the Survey Area), however use would be opportunistic and utilised for foraging purposes only. No breeding habitat was present.	PMST, Naturemap and DBCA
<i>Falco hypoleucos</i>	Grey Falcon	VU	VU	The Grey Falcon inhabits lightly timbered country, especially stony, inland plains and Acacia scrub, gibber deserts, sand ridges, pastoral lands, and timbered watercourses, but seldom in driest deserts. Its distribution is centred on inland drainage systems. It also hunts in treeless areas and frequents tussock grassland and open woodland, especially in winter (Morcombe 2004; Pizzey & Knight 2012). It can mostly be seen on the northwest coast from Shark Bay to east Kimberley, and in the Pilbara and desert regions (Nevill 2013; Pizzey & Knight 2012).	<b>Unlikely.</b> There are no nearby records of the species. Its distribution is Shark Bay, Pilbara and desert regions.	PMST
<i>Fregata ariel</i>	Lesser Frigatebird	MI	MI	The Lesser Frigatebird breeds on small, remote tropical and sub-tropical islands, in mangroves or bushes, and even on bare ground. Major breeding populations of the Lesser Frigatebird are found in	<b>Unlikely.</b> It is unlikely that the species occurs	PMST

Taxa	Common Name	Status		Description and habitat requirements	Likelihood of occurrence within the project area	Source
		BC Act	EPBC Act			
				tropical waters of the Indian and Pacific Ocean (excluding the east Pacific), as well as one population in the South Atlantic. Outside the breeding season it is sedentary, with immature and non-breeding individuals dispersing throughout tropical seas, especially off the Indian and Pacific Ocean (IUCN Redlist 2016).	within the Survey Area but opportunistically it may occur within inland waters during extreme weather events.	
<i>Gelochelidon nilotica</i>	Gull-billed tern	MI	MI	The Gull-billed Tern is nomadic or migratory species in Australia. Gull-billed Terns are found in freshwater swamps, brackish and salt lakes, beaches and estuarine mudflats, floodwaters, sewage farms, irrigated croplands and grasslands, where resources are favourable. They are only rarely found over the ocean. The Gull-billed Tern. Although essentially an inland species, outside breeding season it shows a distinct preference for saltmarshes and lagoons near the coast. Movements are not fully understood but it is common and widespread in Australia (Morcombe 2014).	<b>Likely.</b> There are no nearby records of the species, the closest record is 17 km east of the Survey Area. There is numerous small claypans and dams that could potentially be habitat for the species within the Survey Area.	DBCA
<i>Hydroprogne caspia</i>	Caspian Tern	MI	MI	The Caspian Tern is mostly found in sheltered coastal embayments (harbours, lagoons, inlets, bays, estuaries and river deltas) and those with sandy or muddy margins are preferred. They also occur on near-coastal or inland terrestrial wetlands that are either fresh or saline, especially lakes (including ephemeral lakes), waterholes, reservoirs, rivers and creeks. They also use artificial wetlands, including reservoirs, sewage ponds and saltworks. In offshore areas the species prefers sheltered situations, particularly near islands, and is rarely seen beyond reefs. In WA, the Caspian Tern is widespread in coastal regions, from the Great Australian Bight to the Dampier Peninsula (DotEE 2019).	<b>Likely.</b> There is numerous small claypans and dams that could potentially be habitat for the species within the Survey Area.	DBCA
<i>Leipoa ocellata</i>	Malleefowl	VU	VU	The Bar-tailed Godwit is found mainly in coastal habitats such as large intertidal sandflats, banks, mudflats, estuaries, inlets, harbours, coastal lagoons and bays. It is found often around beds of seagrass and, sometimes, in nearby saltmarsh. It has been sighted in coastal sewage farms and saltworks, saltlakes and brackish wetlands near coasts, sandy ocean beaches, rock platforms, and coral reef-flats (DotE 2019). They are uncommon in the south west, but can be sighted from Geraldton to Bunbury, at Alfred Cove, and then at a few estuaries on the south coast including Kalgan River Mouth and Oyster Harbour (Nevill 2013).	<b>Present.</b> There is suitable habitat and numerous known previous records within the north western portion of the Survey Area. Evidence of the species (mounds and prints) were	PMST, Naturemap and DBCA

Taxa	Common Name	Status		Description and habitat requirements	Likelihood of occurrence within the project area	Source
		BC Act	EPBC Act			
					sighted within the Survey Area.	
<i>Limosa lapponica</i>	Bar-tailed godwit	MI	MI	The Bar-tailed Godwit is found mainly in coastal habitats such as large intertidal sandflats, banks, mudflats, estuaries, inlets, harbours, coastal lagoons and bays. It is found often around beds of seagrass and, sometimes, in nearby saltmarsh. It has been sighted in coastal sewage farms and saltworks, saltlakes and brackish wetlands near coasts, sandy ocean beaches, rock platforms, and coral reef-flats (DotE 2016). They are uncommon in the south west, but can be sighted from Geraldton to Bunbury, at Alfred Cove, and then at a few estuaries on the south coast including Kalgan River Mouth and Oyster Harbour (Nevill 2013).	<b>Likely.</b> There is suitable habitat within the Survey Area on the coastal strip and the closest known record is 10 km south of the Survey Area.	DBCA & PMST
<i>Macronectes giganteus</i>	Southern Giant-Petrel	MI	EN	Albatross and giant petrel species exhibit a broad range of diets and foraging behaviours, and hence their at-sea distributions are diverse. Combined with their ability to cover vast oceanic distances, all waters within Australian jurisdiction can be considered foraging habitat, however the most critical foraging habitat is considered to be those waters south of 25 degrees where most species spend the majority of their foraging time (DotEE 2019).	<b>Unlikely.</b> It is unlikely that the species occurs within the Survey Area but opportunistically it may occur within inland waters during extreme weather events.	PMST
<i>Macronectes halli</i>	Northern Giant Petrel	MI	VU	Albatross and giant petrel species exhibit a broad range of diets and foraging behaviours, and hence their at-sea distributions are diverse. Combined with their ability to cover vast oceanic distances, all waters within Australian jurisdiction can be considered foraging habitat, however the most critical foraging habitat is considered to be those waters south of 25 degrees where most species spend the majority of their foraging time (DotEE 2019).	<b>Unlikely.</b> It is unlikely that the species occurs within the Survey Area but opportunistically it may occur within inland waters during extreme weather events.	PMST
<i>Numenius madagascariensis</i>	Eastern curlew	CR	CR	The Eastern Curlew is most commonly associated with sheltered coasts, especially estuaries, bays, harbours, inlets and coastal lagoons, with large intertidal mudflats or sandflats, often with beds of seagrass. Occasionally, the species occurs on ocean beaches (often near estuaries), and coral reefs, rock platforms, or rocky islets. The birds are often recorded among saltmarsh and on mudflats fringed by mangroves, sometimes within the mangroves, and in coastal saltworks and sewage farms (Marchant & Higgins 1993). They are found commonly along the	<b>Likely.</b> There is suitable habitat within the Survey Area on the coastal strip and the closest known record is 17 km east of the Survey Area.	DBCA & Naturemap

Taxa	Common Name	Status		Description and habitat requirements	Likelihood of occurrence within the project area	Source
		BC Act	EPBC Act			
				north coast of WA, but rarely south of Shark Bay (Morcombe 2004). They are uncommon further south of Geraldton (Nevill 2013).		
<i>Numenius phaeopus</i>	Whimbrel	MI	MI	The Whimbrel is often found on the intertidal mudflats of sheltered coasts. It is also found in harbours, lagoons, estuaries and river deltas, often those with mangroves, but also open, unvegetated mudflats. It is occasionally found on sandy or rocky beaches, on coral or rocky islets, or on intertidal reefs and platforms. It has been infrequently recorded using saline or brackish lakes near coastal areas. It also used saltflats with saltmarsh, or saline grasslands with standing water left after high spring-tides, and in similar habitats in sewage farms and saltfields. There are a small number of inland records from saline lakes and canegrass swamps. The Whimbrel is common and widespread from Carnarvon to the north-east Kimberley Division. It is occasionally seen on the south coast of WA and has occasionally been recorded in the south-west and further north to Shark Bay (DotEE 2019).	<b>Likely.</b> There is suitable habitat within the Survey Area on the coastal strip and the closest known record is 17 km east of the Survey Area.	DBCA
<i>Oceanites oceanicus</i>	Wilson's storm-petrel	MI	MI	Albatross and giant petrel species exhibit a broad range of diets and foraging behaviours, and hence their at-sea distributions are diverse. Combined with their ability to cover vast oceanic distances, all waters within Australian jurisdiction can be considered foraging habitat, however the most critical foraging habitat is considered to be those waters south of 25 degrees where most species spend the majority of their foraging time (DotEE 2019).	<b>Unlikely.</b> It is unlikely that the species occurs within the Survey Area but opportunistically it may occur within inland waters during extreme weather events.	DBCA
<i>Onychoprion anaethetus</i>	Bridled Tern	MI	MI	Bridled Terns occupy tropical and subtropical seas, breeding on islands, including vegetated coral cays, rocky continental islands and rock stacks. They are only rarely found in inshore continental waters and along mainland coastlines, though the species is reported to breed on the mainland of far southern WA. In WA, breeding is widespread from islands off Cape Leeuwin (extending round the southern coast to Seal Rocks) north to Shark Bay and in Pilbara region and Kimberley Division. At sea, distribution extends from Cape Leeuwin north to Dirk Hartog Island, with isolated mainland coastal records at Point Maud and Ningaloo, and from Barrow Island to the Dampier Archipelago, and at sea off the Kimberley coast from waters west of the Dampier Peninsula to Ashmore Reef and Joseph Bonaparte Gulf (DotEE 2019).	<b>Unlikely.</b> Coastal habitat is present however species is known to utilise offshore islands and atolls.	PMST



Taxa	Common Name	Status		Description and habitat requirements	Likelihood of occurrence within the project area	Source
		BC Act	EPBC Act			
<i>Pandion cristatus</i>	Eastern Osprey	MI	MI	Ospreys occur in littoral and coastal habitats and terrestrial wetlands of tropical and temperate Australia and offshore islands. They are mostly found in coastal areas but occasionally travel inland along major rivers, particularly in northern Australia. They require extensive areas of open fresh, brackish or saline water for foraging. They frequent a variety of wetland habitats including inshore waters, reefs, bays, coastal cliffs, beaches, estuaries, mangrove swamps, broad rivers, reservoirs and large lakes and waterholes. They exhibit a preference for coastal cliffs and elevated islands in some parts of their range but may also occur on low sandy, muddy or rocky shores and over coral cays. The distribution of the species around the northern coast (south-western WA to south-eastern NSW) appears continuous except for a possible gap at Eighty Mile Beach (DotEE 2019).	<b>Likely.</b> There is suitable habitat and known previous records within the Survey Area.	DBCA
<i>Pluvialis fulva</i>	Pacific golden plover	MI	MI	In Australia the Pacific Golden Plover usually inhabits coastal habitats, on beaches, mudflats and sandflats (sometimes in vegetation such as mangroves, low saltmarsh such as <i>Sarcocornia</i> , or beds of seagrass) in sheltered areas including harbours, estuaries and lagoons, and also in saltworks. It is sometimes recorded on islands, sand and coral cays and exposed reefs and rocks. They are less often recorded in terrestrial habitats, but can be seen in habitats with short grass in paddocks, crops or airstrips, or ploughed or recently burnt areas. In WA, the species is seldom recorded along the southern or south-western coasts (DotEE 2019).	<b>Likely.</b> There is suitable habitat within the Survey Area on the coastal strip and the closest known record is 17 km east of the Survey Area.	DBCA
<i>Pluvialis squatarola</i>	Grey plover	MI	MI	Grey Plovers occur almost entirely in coastal areas, where they usually inhabit sheltered embayments, estuaries and lagoons with mudflats and sandflats, and occasionally on rocky coasts with wave-cut platforms or reef-flats, or on reefs within muddy lagoons. They also occur around terrestrial wetlands such as near-coastal lakes and swamps, or salt-lakes. The species is also very occasionally recorded further inland, where they occur around wetlands or salt-lakes (DotEE 2019).	<b>Likely.</b> There is suitable habitat within the Survey Area on the coastal strip and the closest known record is 10 km east of the Survey Area.	DBCA
<i>Pterodroma mollis</i>	Soft-plumaged Petrel	MI	VU	Albatross and giant petrel species exhibit a broad range of diets and foraging behaviours, and hence their at-sea distributions are diverse. Combined with their ability to cover vast oceanic distances, all waters within Australian jurisdiction can be considered foraging habitat, however the most critical foraging habitat is considered to be those waters south of 25 degrees where most species spend the majority of their foraging time (DotEE 2019).	<b>Unlikely.</b> It is unlikely that the species occurs within the Survey Area but opportunistically it may occur within inland waters during extreme weather events.	PMST

Taxa	Common Name	Status		Description and habitat requirements	Likelihood of occurrence within the project area	Source
		BC Act	EPBC Act			
<i>Rostratula australis</i>	Australian Painted Snipe	EN	EN	The Australian Painted Snipe generally inhabits shallow terrestrial freshwater (occasionally brackish) wetlands, including temporary and permanent lakes, swamps and claypans. They also use inundated or waterlogged grassland or saltmarsh, dams, rice crops, sewage farms and bore drains. Typical sites include those with rank emergent tussocks of grass, sedges, rushes or reeds, or samphire; often with scattered clumps of lignum Muehlenbeckia, canegrass, or sometimes tea-tree. It sometimes uses areas that are lined with trees, or that have some scattered fallen or washed-up timber (DotE 2019). In the south west it can be found around Carnarvon and wetlands north of Perth, particularly those west of Moora and Gingin (Nevill 2013).	<b>Unlikely</b> There are no known records within or nearby the Survey Area. Claypan and dam habitat is present however these areas are impacted by goat grazing and lack fringing vegetation	PMST
<i>Sterna dougallii</i>	Roseate tern	MI	MI	The Roseate Tern occurs in coastal and marine areas in subtropical and tropical seas. The species inhabits rocky and sandy beaches, coral reefs, sand cays and offshore islands. Birds rarely occur in inshore waters or near the mainland, usually venturing into these areas only accidentally, when nesting islands are nearby. In WA, the subspecies is regularly recorded north from Mandurah to around Eighty Mile Beach. Around the Kimberley coastline, the subspecies occurs at scattered sites, north to the Bonaparte Archipelago and possibly further. The subspecies used to be a sporadic visitor to the southwest, but occurs regularly at present. In addition, breeding colonies have been established on Lancelin Island and Second Rock (DotEE 2019).	<b>Likely.</b> There is suitable habitat within the Survey Area on the coastal strip and the closest record is 16 km east of the Survey Area	DBCA
<i>Sternula nereis nereis</i>	Australian Fairy Tern		VU	The Fairy Tern occurs along the coast of WA as far north as the Dampier Archipelago near Karratha, but mostly in the southern part of Australia including most of the coastline in the south west. It nests on sheltered sandy beaches, coastal inlets, spits and banks above the high tide line and below vegetation. It has been found in embayments of a variety of habitats including offshore, estuarine or lacustrine (lake) islands, wetlands, and mainland coastline (DotE 2016; Nevill 2013). They can also be seen in saltfields, saline or brackish lakes, and sewage ponds near the coast (Pizzey & Knight 2012).	<b>Likely.</b> There is suitable habitat within the Survey Area on the coastal strip and the species has been identified from database searches as being in the Survey Area.	PMST
<i>Thalassarche carteri</i>	Indian Yellow-nosed Albatross	MI	VU	Albatross and giant petrel species exhibit a broad range of diets and foraging behaviours, and hence their at-sea distributions are diverse. Combined with their ability to cover vast oceanic distances, all waters within Australian jurisdiction can be considered foraging habitat, however the most critical foraging habitat is considered to be those waters south of 25 degrees where most species spend the majority of their foraging time (DotEE 2019).	<b>Unlikely.</b> It is unlikely that the species occurs within the Survey Area but opportunistically it may occur within inland waters	PMST

Taxa	Common Name	Status		Description and habitat requirements	Likelihood of occurrence within the project area	Source
		BC Act	EPBC Act			
					during extreme weather events	
<i>Thalassarche cauta</i>	Shy Albatross	MI	EN	Albatross and giant petrel species exhibit a broad range of diets and foraging behaviours, and hence their at-sea distributions are diverse. Combined with their ability to cover vast oceanic distances, all waters within Australian jurisdiction can be considered foraging habitat, however the most critical foraging habitat is considered to be those waters south of 25 degrees where most species spend the majority of their foraging time (DotEE 2019).	<b>Unlikely.</b> It is unlikely that the species occurs within the Survey Area but opportunistically it may occur within inland waters during extreme weather events	PMST
<i>Thalassarche chlororhynchos</i>	Atlantic yellow-nosed albatross	VU	MI	Albatross and giant petrel species exhibit a broad range of diets and foraging behaviours, and hence their at-sea distributions are diverse. Combined with their ability to cover vast oceanic distances, all waters within Australian jurisdiction can be considered foraging habitat, however the most critical foraging habitat is considered to be those waters south of 25 degrees where most species spend the majority of their foraging time (DotEE 2019).	<b>Unlikely.</b> It is unlikely that the species occurs within the Survey Area but opportunistically it may occur within inland waters during extreme weather events	DBCA & Naturemap
<i>Thalassarche impavida</i>	Campbell Albatross	MI	VU	Albatross and giant petrel species exhibit a broad range of diets and foraging behaviours, and hence their at-sea distributions are diverse. Combined with their ability to cover vast oceanic distances, all waters within Australian jurisdiction can be considered foraging habitat, however the most critical foraging habitat is considered to be those waters south of 25 degrees where most species spend the majority of their foraging time (DotEE 2019).	<b>Unlikely.</b> It is unlikely that the species occurs within the Survey Area but opportunistically it may occur within inland waters during extreme weather events	PMST
<i>Thalassarche melanophris</i>	Black-browed Albatross	MI	VU	Albatross and giant petrel species exhibit a broad range of diets and foraging behaviours, and hence their at-sea distributions are diverse. Combined with their ability to cover vast oceanic distances, all waters within Australian jurisdiction can be considered foraging habitat, however the most critical foraging habitat is considered to be those waters south of 25 degrees where most species spend the majority of their foraging time (DotEE 2019).	<b>Unlikely.</b> It is unlikely that the species occurs within the Survey Area but opportunistically it may occur within inland waters	PMST

Taxa	Common Name	Status		Description and habitat requirements	Likelihood of occurrence within the project area	Source
		BC Act	EPBC Act			
					during extreme weather events	
<i>Thalassarche steadi</i>	White-capped Albatross	MI	VU	Albatross and giant petrel species exhibit a broad range of diets and foraging behaviours, and hence their at-sea distributions are diverse. Combined with their ability to cover vast oceanic distances, all waters within Australian jurisdiction can be considered foraging habitat, however the most critical foraging habitat is considered to be those waters south of 25 degrees where most species spend the majority of their foraging time (DotEE 2019).	<b>Unlikely.</b> It is unlikely that the species occurs within the Survey Area but opportunistically it may occur within inland waters during extreme weather events	PMST
<i>Thalasseus bergii</i>	Crested tern	MI	MI	There are few stretches off the Australian coastline where the Crested Tern cannot be seen — it has been known as both the Bass Straits Tern and the Torres Straits Tern. They breed in colonies on small offshore islands where their nests are so densely packed together that adjacent owners can touch each other's bills. Though the Crested Tern is usually a strictly coastal species, there are occasional records in the arid interior of Australia, where birds were possibly blown by passing tropical cyclones (Birdlife Australia, 2021).	<b>Present.</b> There are known records within the southern portion of the Survey Area as observed by GHD in 2021.	DBCA & GHD (2021)
<i>Tringa brevipes</i>	Grey-tailed tattler	P4	MI	The Grey-tailed Tattler is often found on sheltered coasts with reefs and rock platforms or with intertidal mudflats. It can also be found at intertidal rocky, coral or stony reefs as well as platforms and islets that are exposed at low tide. It has been found around shores of rock, shingle, gravel or shells and also on intertidal mudflats in embayments, estuaries and coastal lagoons, especially fringed with mangroves. It is less often on open flat sandy beaches or sandbanks, especially around accumulated seaweed or isolated clumps of dead coral. It is occasionally found around near-coastal wetlands, such as lagoons and lakes and ponds in sewage farms and saltworks. Inland records for the species are rare with sightings on river banks and the edges of rock pools. There are a few scattered records for the species along the south coast near the Eyre Bird Observatory, Point Malcolm, Rossiter Bay, Shark Lake Nature Reserve and surrounding swampland. It is found in the south-west between Augusta and Cervantes (DotEE 2019).	<b>Likely.</b> There is suitable habitat within the Survey Area on the coastal strip and known records of the species 10 km south of the Survey Area.	DBCA & Naturemap
<i>Tringa nebularia</i>	Common greenshank, greenshank	MI	MI	The Common Greenshank is found in a wide variety of inland wetlands and sheltered coastal habitats of varying salinity. It occurs in sheltered coastal habitats, typically with large mudflats and saltmarsh, mangroves or seagrass. Habitats include embayments, harbours, river estuaries, deltas and lagoons and are recorded less often in round	<b>Likely.</b> There is suitable habitat within the Survey Area on the coastal strip and known	DBCA



Taxa	Common Name	Status		Description and habitat requirements	Likelihood of occurrence within the project area	Source
		BC Act	EPBC Act			
				tidal pools, rock-flats and rock platforms. The species uses both permanent and ephemeral terrestrial wetlands, including swamps, lakes, dams, rivers, creeks, billabongs, waterholes and inundated floodplains, claypans and saltflats. It will also use artificial wetlands, including sewage farms and saltworks dams, inundated rice crops and bores. The edges of the wetlands used are generally of mud or clay, occasionally of sand, and may be bare or with emergent or fringing vegetation, including short sedges and saltmarsh, mangroves, thickets of rushes, and dead or live trees (Higgins & Davies 1996).	records of the species is 2 km east of the Survey Area.	
<b>Mammal</b>						
<i>Bettongia penicillata ogilbyi</i>	Woylie		EN	<p>Woylies originally inhabited a wide range of landscapes. In the western deserts, Indigenous people reported that they occupied sand plains and dunes with <i>Triodia</i> spp. (spinifex) hummock grassland. The remnant subpopulations in south-western Australia inhabit woodlands and adjacent heaths with a dense understorey of shrubs, particularly <i>Gastrolobium</i> spp. (poison pea), which contain monofluoroacetic acid (from which the compound present as sodium monofluoroacetate in the vertebrate pesticide '1080' is derived (DotEE 2019).</p> <p>From 2001 to 2010 the total population size of woylies declined significantly, by about 89 percent. However, since 2010 the population size has substantially increased, driven mainly by increases in the largest population at Upper Warren, with a variety of trends (increase, decrease, stable or decreased to functionally extinct) recorded at other subpopulations. From 2001 to 2016 there has been an overall decline in the total population by about 50 percent. Taking into account the uncertainty in the data and the upper and lower population estimates, this decline may range from 5 percent to 74 percent. The species has likely undergone a severe reduction in numbers over three generation lengths (9–15 years), equivalent to at least 50 percent, and the causes of the reduction have not ceased (DotEE 2019).</p>	<b>Highly unlikely.</b> The species is extinct in this region.	PMST
<i>Dasyurus geoffroii</i>	Chuditch, Western Quoll	VU	VU	The Chuditch inhabits eucalypt forest (especially Jarrah, <i>E. marginata</i> ), dry woodland, mallee shrublands, heaths, and desert, particularly in the south coast of WA. They also occur at lower densities in drier woodland and mallee shrubland in the goldfields and wheatbelt, as well as in Kalbarri National Park (translocated). Chuditch require adequate numbers of suitable den and refuge sites (horizontal hollow logs or earth burrows) to survive (DEC 2012). In Jarrah forest, Chuditch populations occur in both moist, densely vegetated, steeply sloping forest and drier, open, gently sloping forest (Van Dyck and Strahan 2008). The species can travel large distances, and for this	<b>Likely.</b> There are known records of approximately 9 km south of the Survey Area within the Kalbarri gorge system. The species has also been recorded from Eurady Station to	Naturemap, DBCA and PMST

Taxa	Common Name	Status		Description and habitat requirements	Likelihood of occurrence within the project area	Source
		BC Act	EPBC Act			
				reason requires habitats that are of a suitable size and not excessively fragmented (DEC 2012).	the east and Hamelin Station to the north.	
<i>Notamacropus eugenii derbianus</i>	Tammar wallaby	P4		The Tammar Wallaby inhabits dense, low vegetation for daytime shelter and open grassy areas for feeding. It inhabits coastal scrub, heath, dry sclerophyll (leafy) forest and thickets in mallee and woodland. The tammar wallaby is currently known to inhabit three islands in the Houtman Abrolhos group, Garden Island near Perth, Middle and North Twin Peak Islands in the Archipelago of the Recherche, and at least nine sites on the mainland including Dryandra, Boyagin, Tutanning Batalling (reintroduced) Perup, private property near Pingelly, Jaloran Road timber reserve near Wagin, Hopetown, Stirling Range National Park, and Fitzgerald River National Park (DEC 2012; Van Dyck and Strahan 2008).	<b>Likely.</b> There are known records of approximately 9 km south of the Survey Area near the Kalbarri gorge system.	Naturemap & DBCA
<i>Petrogale lateralis subsp. Lateralis</i>	Black-flanked Rock-wallaby	VU	EN	Known Black-flanked Rock-wallaby populations remain restricted to suitable habitat in the Little Sandy Desert, Cape and Calvert Ranges, with seven populations in the Wheatbelt region, Barrow and Salisbury Islands, and Ningaloo Station. Populations have been re-established via translocation to a number of sites in the Avon Valley and Cape le Grand National Parks and Paruna Sanctuary. The habitat varies between colonies but always involves grassland feeding habitat for feeding in close proximity to cliff, rock-pile, talus or escarpment refuge habitat. Rock cliffs or other steep substrates with adequate shelter and refuge are essential for breeding (Van Dyck & Strahan 2008).	<b>Unlikely.</b> There is no suitable habitat within the Survey Area. Species is only known from the Murchison River gorge system.	PMST
<b>Reptile</b>						
<i>Egernia stokesii subsp. badia</i>	Western Spiny-tailed Skink	VU	EN	The Western Spiny-tailed Skink is known to occur in a broad semi-arid area in south-west WA, between Shark Bay and Minnivale and east to Cue. Most records of the brown form Western Spiny-tailed Skink are in York Gum ( <i>Eucalyptus loxophleba</i> ) woodland with some records in Gimlet ( <i>E. salubris</i> ) and Salmon Gum ( <i>E. salmonophloia</i> ) woodland. Populations persist in woodland patches as small as one hectare and completely surrounded by wheatfields. Sites with the greatest number of individuals contain numerous fallen logs and were subjected to low-intensity grazing by domestic stock. Hollow logs are used as refuge sites in woodland habitat. Preferred refuges consist of piles of several, overlapping, hollow logs providing a combination of basking and shelter sites. An increasing number of skinks are being located in altered habitat under piles of wood, scrap metal or under buildings on private property (DotEE 2019).	<b>Likely.</b> The species is known to be from the region, with the closest record nearby approximately 35 km northeast at the Billabong Roadhouse.	PMST & Gaikhorst pers.comm

Taxa	Common Name	Status		Description and habitat requirements	Likelihood of occurrence within the project area	Source
		BC Act	EPBC Act			
<i>Cyclodomorphus branchialis</i>	Gilled Slender Blue-tongue	VU	VU	The Gilled Slender Bluetongue is found in the lower west coastal regions on WA, between the Murchison and Irwin Rivers. It is a ground-dwelling lizard of largely crepuscular and nocturnal habits. The species has little information available but is thought to sheltering by day in porcupine grass, leaf-litter, and under fallen timber (Cogger 2017). However the author has recorded the species under rocks and in loamy spoil heaps.	<b>Likely.</b> The species is known to be from the region, with the closest record approximately 30km southeast of the Survey Area in the Galena and Warribano areas.	DBCA & Gaikhorst pers.comm.
<i>Lerista humphriesi</i>	Taper-tailed West Coast slider (Murchison River)	P3		The Taper-Tailed West-Coast Slider is known only from the Murchison River district. It occurs in Acacia-dominated sandplains and other habitats where the <i>Lerista</i> genus is found (Cogger 2014).	<b>Known</b> There are known records from Kalbarri area from 1995 and along the State Barrier Fence Zuytdorp section (Maryan & Gaikhorst, 2019)	Naturemap, Maryan & Gaikhorst, (2019)
<i>Pletholax gracilis edelensis</i>	Keeled legless lizard (Shark Bay)	P3		The Keeled Legless Lizard is mostly found in the Shark Bay region of WA, although there has been records of the reptile approximately 10 km east of Kalbarri, and two just north of Rockingham (DPaW 2007-).	<b>Likely.</b> The species has previously been trapped approximately 13km east of Kalbarri.	Naturemap
<b>Invertebrates</b>						
<i>Idiosoma nigrum</i>	Shield-backed Trapdoor Spider	EN	VU	The Shield-backed Trapdoor Spider is endemic to semi-arid south-west Western Australia. It occurs in a number of severely fragmented populations in the central and northern Wheatbelt (e.g. Minnivale and East Yorkrakine). Further north, the species occurs in more arid areas in the Midwest (e.g. large isolated ranges at Jack Hills, Weld Range and Blue Hills) and coastal areas of the Midwest (e.g. Zuytdorp Station north of the Murchison River and Nanga Station south of Shark Bay). The arid Midwest populations are naturally fragmented or isolated because they persist only on ranges, but the Wheatbelt and coastal Midwest populations are all severely fragmented as a result of land clearing (DotEE 2019).	<b>Likely.</b> The species has been trapped previously in the area approximately 5km away from the Survey Area. Its distribution is restricted to the central and central-western Wheatbelt bioregion of south-western Australia (Rix <i>et al</i> 2018).	Naturemap, (Rix <i>et al</i> 2018).

Taxa	Common Name	Status		Description and habitat requirements	Likelihood of occurrence within the project area	Source
		BC Act	EPBC Act			
<i>Idiosoma incomptum</i>	Carnarvon shield-backed trapdoor spider	P3		<i>Idiosoma incomptum</i> a member of the intermedium-clade has a relatively widespread, near-coastal distribution in Western Australia's southern Carnarvon Basin, from Zuytdorp north to at least Boolathana Station. Little is known of the biology of <i>I. incomptum</i> , other than that of males that have been collected wandering in search of females in winter and possibly late autumn (Rix <i>et al</i> 2018).	<b>Likely.</b> The species has been trapped previously in the area approximately 5km away from the Survey Area. The species has a relatively widespread, near-coastal distribution in Western Australia's southern Carnarvon Basin, from Zuytdorp north to at least Boolathana Station (Rix <i>et al</i> 2018).	Naturemap, Rix <i>et al</i> (2018).
<i>Idiosoma arenaceum</i>	Geraldton Sandplain shield-backed trapdoor spider	P3		<i>Idiosoma arenaceum</i> has a moderately widespread distribution in the Geraldton Sandplains and far northern Wheatbelt bioregions of south-western Western Australia, from near Yandanooka, Canna, and Geraldton north to Zuytdorp. Burrows are adorned with a 'moustache-like' arrangement of twig-lines, sometimes under Casuarina, and male specimens have been collected wandering in search of females in late autumn and winter, with an outlying record from January (Rix <i>et al</i> 2018).	<b>Likely.</b> The species has been trapped previously in the area approximately 5km away from the Survey Area. The species has a moderately widespread distribution in Geraldton north to Zuytdorp (Rix <i>et al</i> 2018)	Naturemap, Rix <i>et al</i> (2018).
<i>Synemon gratiosa</i>	Graceful sunmoth	P4		The Graceful Sun Moth occurs within the Swan, South West and Midwest WA DPaW regions, and the South-west, Swan and Northern Agricultural Natural Resource Management regions. The range of the Graceful Sun Moth is from Namburg National Park (near Dandaragan) in the north to Mandurah in the south. The Graceful Sun Moth is associated with two habitat types: (1) Coastal heathland on Quindalup dunes where it is restricted to secondary sand dunes due to the abundance of the preferred host plant <i>Lomandra maritima</i> . (2) Banksia woodland on Spearwood and Bassendean dunes, where the second known host plant <i>L. hermaphrodita</i> is widespread (DotEE 2019).	<b>Likely.</b> There are known records of the species at the Murchison Station	Naturemap



Taxa	Common Name	Status		Description and habitat requirements	Likelihood of occurrence within the project area	Source
		BC Act	EPBC Act			
<i>Ogyris subterrestris petrina</i>	Arid bronze azure butterfly	CR	CR	The ABAB is listed due to its severely fragmented distribution with only two extant subpopulations being recorded in Western Australia. These subpopulations are at Barbalin Nature Reserve (BNR), and at a second site ~100km from Barbalin. This second site is small, and its precise location is withheld for conservation reasons. A third subpopulation (the first discovered, in the 1980s) occurred near Lake Douglas, 12km SW of Kalgoorlie, but is now locally extinct and no ABAB have been recorded there since 1993. At the two known extant sites where the ABAB occurs, the vegetation is mature mixed gimlet <i>E. salubris</i> / salmon gum <i>E. salmonophloia</i> woodlands on red-brown loam soils, with an open understorey. In addition to gimlet and salmon gum, other smooth-barked eucalyptus at these sites which have basal ant colonies include wandoo <i>E. capilosa subsp. wandoo</i> , smooth-barked york gum <i>E. loxophleba subsp. lissophloia</i> and ribbonbarked mallee <i>E. sheathiana</i> .(DBCA, 2020)	<b>Unlikely.</b> The species falls within the modelled mallee woodland habitat for the species however the species currently known range is from the Merredin region in the eastern Wheatbelt (Gaikhorst pers.comm)	DBCA & Gaikhorst pers.comm)

### **Fauna likelihood of occurrence assessment guidelines**

<b>Assessment outcome</b>	<b>Description</b>
Present	Species recorded during the field survey or from recent, reliable records from within or close proximity to the Survey Area.
Likely	Species are likely to occur in the Survey Area where there is suitable habitat within the Survey Area and there are recent records of occurrence of the species in close proximity to the Survey Area. OR Species known distribution overlaps with the survey area and there is suitable habitat within the Survey Area.
Unlikely	Species assessed as unlikely include those species previously recorded within 10 km of the Survey Area however: There is limited (i.e. the type, quality and quantity of the habitat is generally poor or restricted) habitat in the Survey Area. The suitable habitat within the Survey Area is isolated from other areas of suitable habitat and the species has no capacity to migrate into the Survey Area. OR Those species that have a known distribution overlapping with the Survey Area however: There is limited habitat in the survey area (i.e. the type, quality and quantity of the habitat is generally poor or restricted). The suitable habitat within the survey area is isolated from other areas of suitable habitat and the species has no capacity to migrate into the survey area.
Highly unlikely	Species that are considered highly unlikely to occur in the Survey Area include: Those species that have no suitable habitat within the Survey Area. Those species that have become locally extinct or are not known to have ever been present in the region of the Survey Area.

<b>Term</b>	<b>Description</b>
Study Area	a 40 km buffer around the Survey Area
Survey Area	the area subject to the current Survey Area
locality	the area within an approximate 40 km radius of the Survey Area
Cr	Critically endangered
En	Endangered
Vu	Vulnerable
IA	International agreement
Mi, Ma	Migratory, Marine
CD	Conservation dependent
OS	Other specially protected fauna
P1 – P4	Priority 1 – Priority 4. Threatened and Priority fauna rankings
EPBC Act	<i>Environmental Protection and Biodiversity Conservation Act 1999</i>
DBCA	Department of Biodiversity and Conservation Attractions
BC Act	<i>Biodiversity Conservation Act 2016</i>

### 4.7.3 Potential impacts

The Proposal will result in the clearing of up to approximately 13,055 ha of native vegetation, of which 1713 ha will be temporarily cleared during construction and rehabilitated. The Proposal is likely to result in direct impacts to threatened and priority fauna as a result of clearing.

The Proposal may also result in the following:

- Direct loss or displacement of individuals as a result of operational vehicle movements
- Weed introduction and spread during construction activities, modifying fauna habitats with potential indirect impacts to fauna community structure
- Direct loss or displacement of migratory shorebirds or other avifauna individuals as a result of operation of Wind Farm
- Indirect loss or displacement of individuals as a result of construction and operation activities.

### 4.7.4 Proposed studies for impact assessment

A Detailed Terrestrial Fauna Survey will be undertaken across the DE, with targeted fauna surveys within areas of potential habitat for Threatened and Priority fauna species.

## 4.8 Landforms

### 4.8.1 Policy and guidance

Table 4-14 Landforms policy and guidance

Source	Policy and guidance
EPA Policy and Guidelines	Statement of Environmental Principles, Factors and Objectives (EPA, 2021b)
	Environmental Factor Guideline – Inland Waters (EPA, 2018a)

### 4.8.2 Receiving environment

#### 4.8.2.1 Topography and geology

The geological units observable at ground surface across the landside portion of the Project area are indicated on the 1:250,000 Ajana map sheet published by the Geological Survey of Western Australia (Sheet SG 50-13).

The coastline is represented by the Zuytdorp Cliffs, which comprise Quaternary “Lithified Tamala Limestone” (QtI), with some areas along the coastal cliff area mapped as “Beaches and mobile coastal dunes – quartzose calcarenite” (Qs). Ground levels rise relatively steeply to the east, from sea level to in excess of RL (Reduced Level)+120 m AHD (Australian Height Datum) within about 500 m from the shore. However, it generally comprises a steep slope that can be traversed by foot. The section of cliffs and slopes within the DE is backed by hundreds of small regularly spaced creeks incised into the narrow belt of Tamala Limestone that extends behind the scarp (Playford et al 2013). These creeks only flow after heavy rain. The Zuytdorp Cliffs are considered a landform by the EPA, landforms are defined as:

*“The distinctive, recognisable physical features of the earth’s surface having a characteristic shape produced by natural processes. A landform is defined by the combination of its geology (composition) and morphology (form).” (EPA 2018a).*

## **4.8.2.2 Zuytdorp Cliffs**

### **4.8.2.2.1 Overview**

The Zuytdorp Cliffs stretch along Western Australia's northwest coast for approximately 210 km (Wakelin-King and Webb 2020). The spatial extent of these cliffs extends from just south of the Murchison River mouth in Kalbarri to the northerly point of Dirk Hartog Island (Tourism Western Australia 2022). In some areas, the cliffs reach heights of 280 m AHD (Wakelin-King and Webb 2020). Playford et al (2013) describes the Zuytdorp Cliffs as one of the most remarkable geomorphological features of the Australian coast.

These cliffs are interpreted to be a fault-line scarp, formed through early Holocene or late Pleistocene movement along the Zuytdorp Fault. This fault is not seen at the surface and is instead several meters west of cliff base within the coastal waters (Playford et al 2013). The presence of the fault is indicated by the sharp, linear nature of the cliffs which abruptly truncates dune limestones of the Pleistocene Tamala Limestone and overlying Holocene dunes. The scarp is only mildly eroded (Playford et al 2013).

### **4.8.2.2.2 Within the Development Envelope**

While ~40 km of the shoreline within the DE falls within the spatial extent of the Zuytdorp Cliffs, for much of the DE the coastline consists of a vegetated slope which meet the sandy and rocky shore. The landform is in good condition, due to the current pastoral use of the land. Approximately seven informal 4WD tracks leading west, from a coastal track on top of the cliffs. These tracks are found in areas where the slopes are traversable in a 4WD vehicle, to allow access to the shore. Due to the extent and remoteness of the Zuytdorp cliffs, the landform is well represented in good condition both locally and regionally. The majority of the extent of the cliffs is found within the Shark Bay World Heritage Area, protecting the landform from existing and reasonably foreseeable activities.

A recent study by Wakelin-King and Webb (2020) into the geomorphology of the Zuytdorp cliffs, explains that the cliffs run unbroken for 120 km, from False Point in the north to 50 km north of Kalbarri, and are then discontinuous closer to Kalbarri. This discontinuous area has cliffs generally less than 100 m in height with areas hollowed out by the coastal processes to form small bays. The difference in cliff topography between what is found in the DE and further north within the Shark Bay World Heritage Area is illustrated below in Plate 1 to Plate 4. Plate 1 to Plate 4 show cross sections of the elevation along a 1 km transect that covers the nearshore environment, the cliffs and the adjacent terrestrial environment. As shown in Plate 1 and Plate 2, the cliffs within the DE have a maximum slope of 24.8% and 28.7% and reach a maximum elevation of 94 m and 102 m, respectively. Plate 3 and Plate 4 show cliffs expressing the notable characteristics of this landform, with maximum slope of 61.8% and 71.3% and maximum elevation of 147 m and 193 m, respectively.



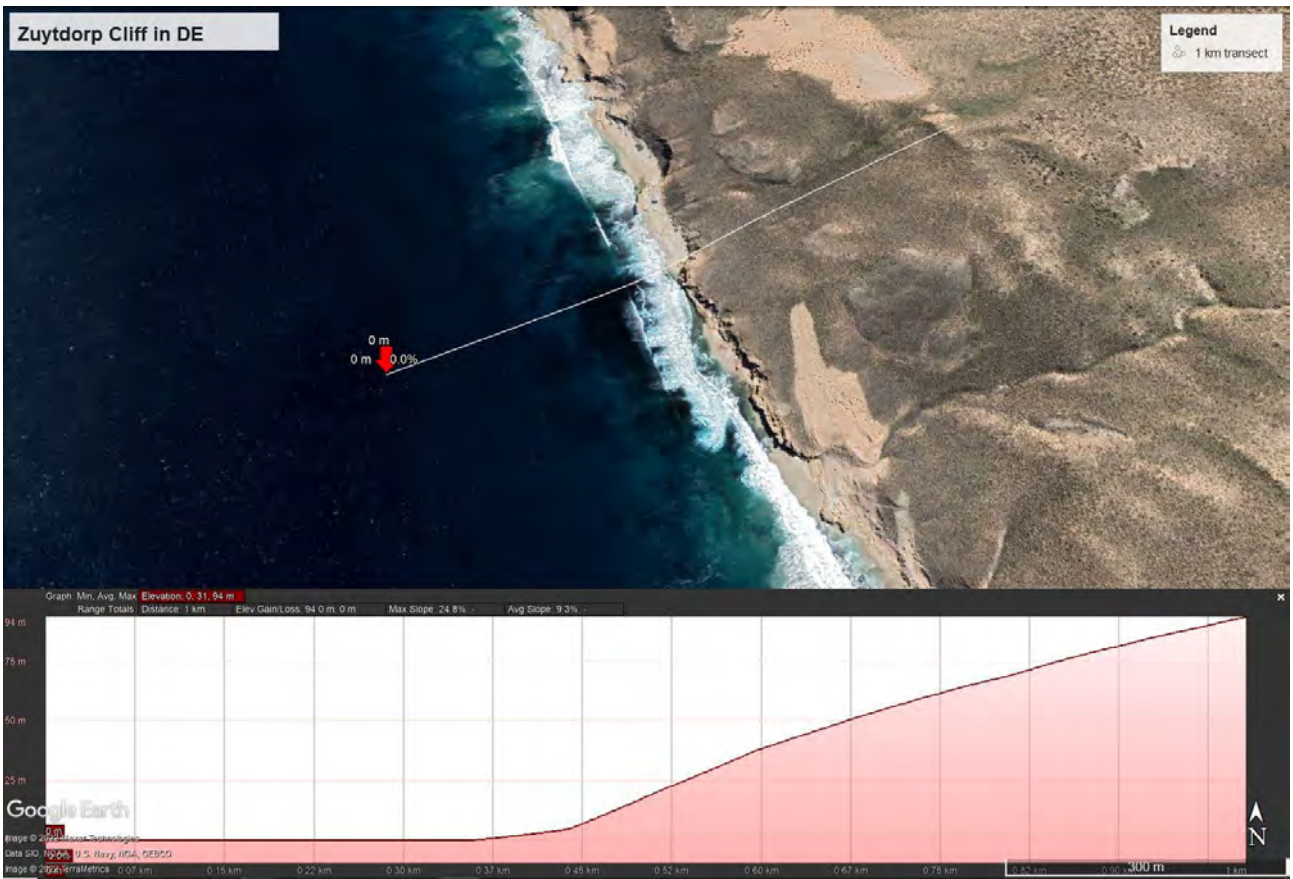


Plate 1 Elevation cross section along a 1 km transect within the DE

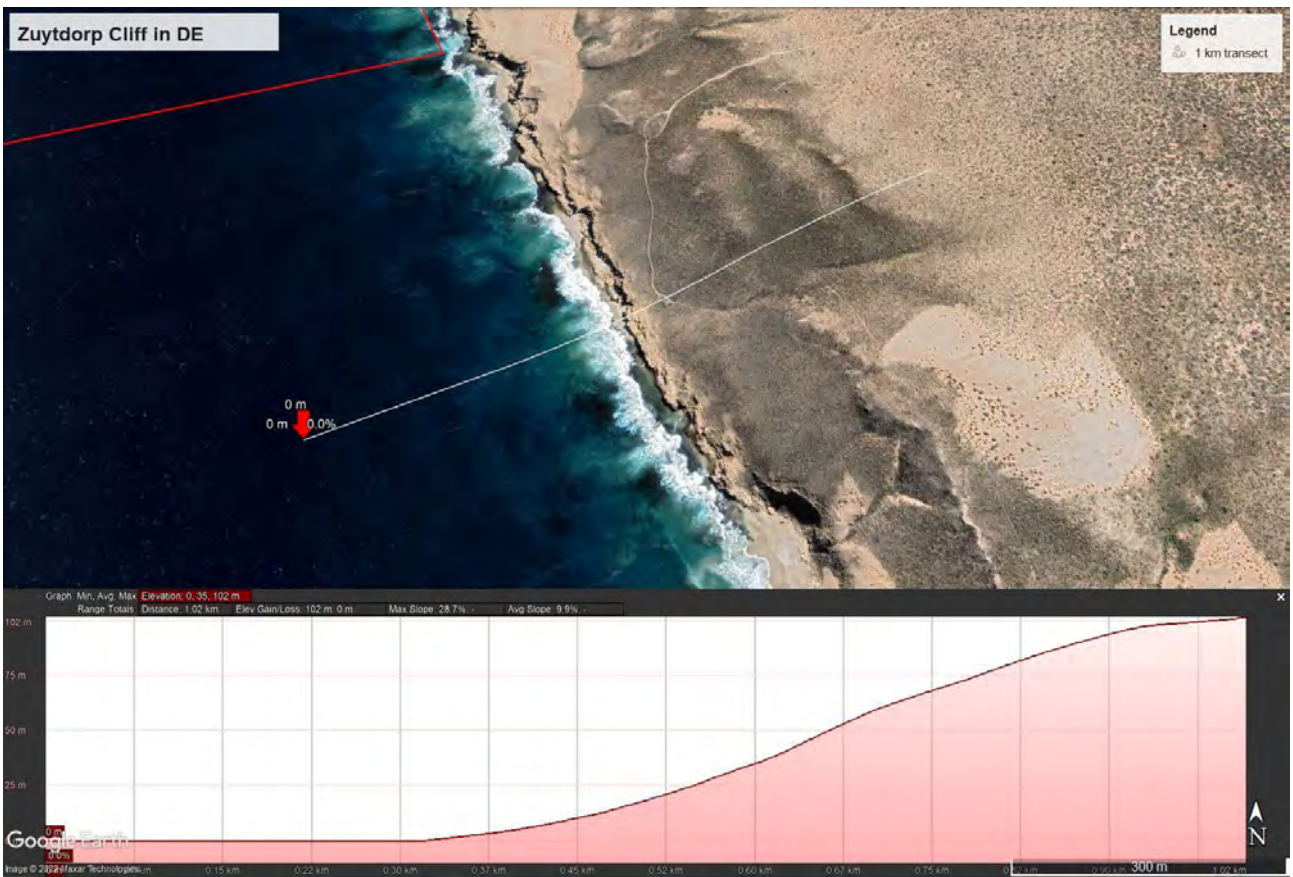
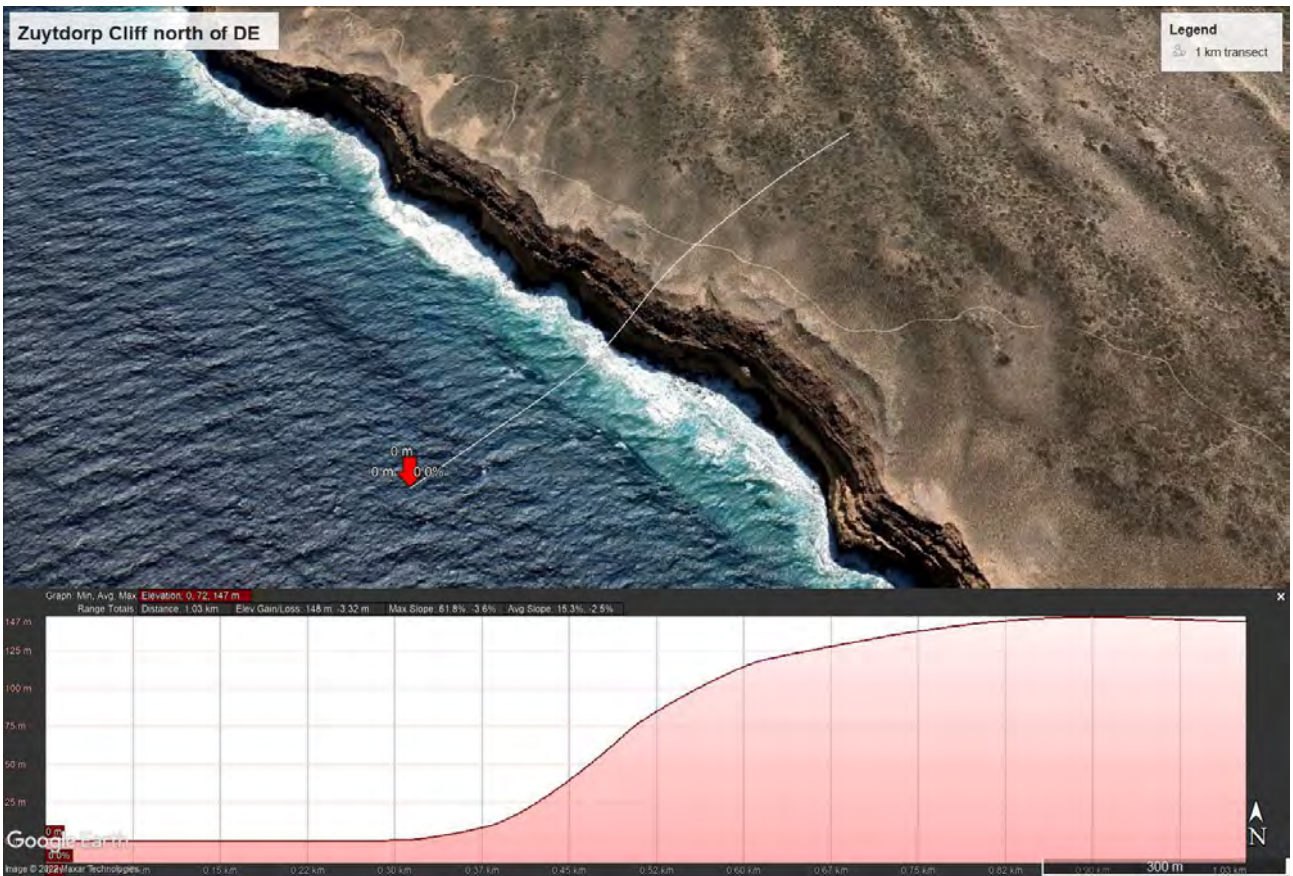
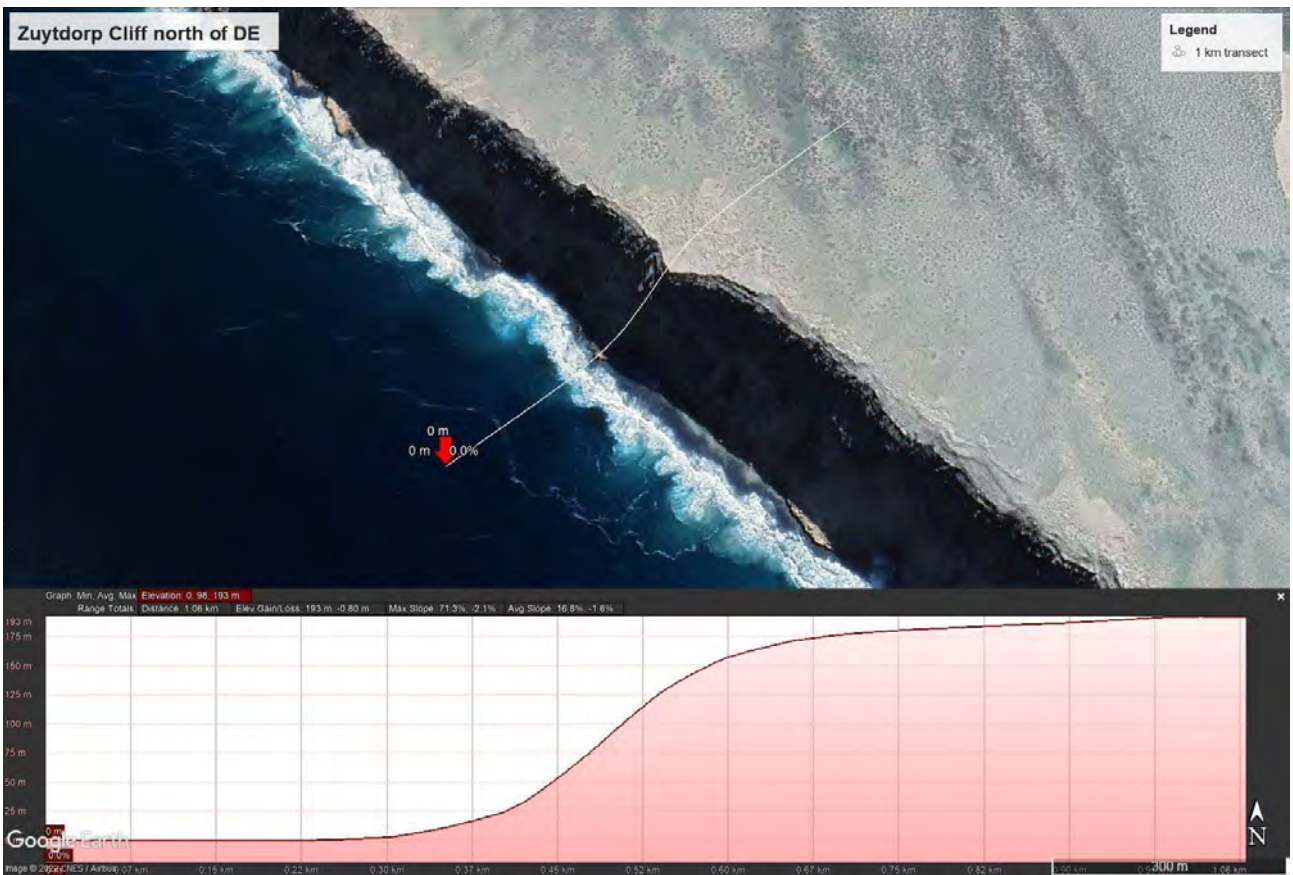


Plate 2 Elevation cross section along a 1 km transect within the DE





**Plate 3** Elevation cross section along a 1 km transect north of the DE, in Shark Bay World Heritage Area.



**Plate 4** Elevation cross section along a 1 km transect north of the DE, in Shark Bay World Heritage Area.

The desktop review of threatened and priority flora (seen in Section 4.6.2.5) showed the presence of three Priority species within the Lithified Tamala Limestone geology. These species are:

- *Thryptomene* sp. Carrarang (M.E. Trudgen 7420) - Priority 1
- *Lepidium biplicatum* - Priority 3
- *Eucalyptus zopherophloia* – Priority 4

Of these, only one taxa, *Thryptomene* sp. Carrarang (M.E. Trudgen 7420), was found solely within this Zuytdorp Cliff associated geology. More ecological survey effort is required in the area to determine if this species is restricted to this landform.

The Zuytdorp Cliffs within the DE do not hold any significant social importance and are not associated with any known heritage or cultural values. The cliffs may be considered of significant amenity value as they are a sightseeing destination, however, the recreational sightseeing activities such as boat or plane tours are focussed within the Shark Bay World Heritage Area. These tours depart from towns such as Denham and Carnarvon, which are 150 km and 260 km north of the DE respectively. Two noteworthy sites associated with the Zuytdorp Cliff landform are Steep Point, the most westerly point of Australia, 150 km north of the DE and the Zuytdorp shipwreck, which lies out of visible range, within the turbid waters at the base of the cliffs 10 km north of the DE. Cultural and heritage values within the DE are discussed in Section 4.11.

### 4.8.3 Potential impacts

The Proposal will involve tunnelling from the shoreline infrastructure hub out to the marine environment for the construction of the seawater intake and outfall pipelines, as well as the cryogenic ammonia pipeline. Onshore trenching between the shoreline infrastructure hub and the PtX plant will be used to install pipelines associated with the export of ammonia, the intake of seawater to the desalination plant and the return of water through the brine outfall (Figure 2-4). Adjacent to the pipelines an access road will also be constructed from the PtX plant to the shoreline infrastructure hub. The access road is expected to follow the existing 4WD access

The onshore pipeline corridor and shoreline infrastructure hub will be associated with a maximum clearing area of 11.5 ha. Clearing of the 11.5 ha to facilitate construction will be within a 1.5 km section of the cliffs, this will represent <0.01% of the length of the landform. Within this, the clearing corridors will be up to 45 m wide further minimising the impacts to the landform.

As result of this, the potential impact to the landform is not considered to be significant as to warrant assessment as a Potential Key Environmental Factor.

### 4.8.4 Proposed studies for impact assessment

No further studies on landforms are proposed.

## 4.9 Inland Waters

### 4.9.1 Policy and guidance

Table 4-15 Inland Waters policy and guidance

Source	Policy and guidance
EPA Policy and Guidelines	Statement of Environmental Principles, Factors and Objectives (EPA, 2021b)
	Environmental Factor Guideline – Inland Waters (EPA, 2018b)
Other Policy and Guidance	Australian and New Zealand Guidelines for Fresh and Marine Water Quality (Water Quality Australia, 2018)

## 4.9.2 Receiving environment

### 4.9.2.1 Geology and Soils

The Proposal site is in the Gascoyne Sub-basin of the Carnarvon Basin, which comprises a substantial thickness of sedimentary rocks, potentially about 4 km thick, overlying Precambrian basement rocks. The sedimentary rocks comprise Silurian Tumblagooda Sandstone over which there is a westwards-thickening Cretaceous veneer of marine sediments, including Birdrong Sandstone, Windalia Radiolarite (siltstone), Alinga Formation (clayey siltstone to greensand) and Toolonga Calcilutite (chalky calcilutite to calcisiltite). These are in turn overlain by Tertiary sediments (Pindilya Formation – sandstone and conglomerate) and Quaternary sediments (calcrete, Tamala Limestone, colluvium and eolian and residual sands). There is considerable calcareous coastal-dune build-up along the coastal strip that is indurated, forming the Tamala Limestone (GHD 2021).

The soil landscape changes from calcrete plateaux, mesas, hills and footslopes supporting annual grasslands, herbfields and degraded chenopod shrublands in the east through to elevated undulating limestone plains within thin sand cover, sea cliffs and low hills supporting low heath, mallee shrublands and paper bark thickets in the western coastal section. Throughout the mid-section, undulating sand plains and occasional dunes supporting shrub heath and tree heath vegetation is common (GoWA 2019; CSIRO 2020).

### 4.9.2.2 Topography

The western boundary of the landside portion of the site is defined by the shoreline, with the Indian Ocean to the west, and ground levels rise relatively steeply to the east from sea level to in excess of RL+120 m AHD within about 500 m from the shore. This area is named Zuytdorp Cliffs; however, it generally comprises a steep slope that can be traversed by foot.

To the east of the Zuytdorp Cliffs the remainder of the landside portion of the site is undulating with ground levels generally varying in the range +90 m AHD to +220 m AHD.

Immediately east of the shoreline “cliffs” is a strip of land about 5 km wide with elevations generally in the range +120 m AHD to +220 m AHD, but lower in some areas to the south. This strip coincides with the Tamala Limestone area, comprising partially lithified dunes. Moving further east ground levels generally fall, then rise again further east. There is a relatively low-lying area in the middle of the Project area named Lake Culcurdoo, which borders the western side of the planned Solar Farm area.

### 4.9.2.3 Surface hydrology

No rivers, as recognised under the RIWI Act, intercept or are within the vicinity of the DE (GoWA 2021X). Additionally, no RIWI Act protected surface waters or management areas are found within 20 km of the DE.

There may also be perched water at or near surface at isolated locations in interdunal depressions or low-lying areas where surficial colluvium or sheetwash materials include relatively low permeability fine grained soils (e.g. surficial clayey sand layer) (GHD 2021).

### 4.9.2.4 Groundwater

The Water Information Reporting (WIR) system is an online database published by the Western Australian Department of Water and Environmental Regulation (DWER). The database has records for nine historical water bores drilled within the Project site area. There are also records for one bore drilled relatively nearby, to the north of the Project area. Each of the bores is reported with a date that varies during the period 1935 to 1938.

The reported ground levels at the ten bore locations were in the range RL+85.3 m AHD to RL+182.9 m AHD, and the drilled bore depths were in the range 93.3 m to 163.1 m below ground level. Drilling notes are provided in the database, which in some cases provide general indications regarding depth to water, or zones in the profile where water was encountered. For some bores there are also records of water pumping tests and groundwater salinity.

Depths to water are indicated for seven of the ten bores as occurring at the time of drilling below depths in the range 79 m to 139 m. There are indications in the drilling notes that water was only recovered from isolated zones in the ground profile at some of the bore locations. Two of the other three boreholes for which water depths are not

provided do have indications that water was encountered at an unreported depth. The drilling notes explicitly state that water was not encountered within one of the bores, which was drilled to 102 m depth.

For those bores for which water quality observations were recorded, the water was generally reported to be “too salty” for human consumption or for other uses such as irrigation.

### 4.9.3 Potential impacts

The Proposal has the potential to result in the following:

- Potential impacts to surface water flows as a result of terrain compaction
- Potential impacts to surface water infiltration as a result of native vegetation clearing

### 4.9.4 Proposed studies for impact assessment

A baseline surface water study will be undertaken to assess hydrology and flooding within the DE. This study will assess environmental flows, flood risk, extent and depth and inform the planning and infrastructure of the Proposal.

## 4.10 Air quality

### 4.10.1 Policy and guidance

Table 4-16 Air Quality policy and guidance

Source	Policy and guidance
EPA Policy and Guidelines	Environmental Factor Guideline – Air Quality (EPA 2020b)
Other Policy and Guidance	Air Quality Modelling Guidance Notes (Department of Environment 2006)
	National Environment Protection (Ambient Air Quality) Measure (Air NEPM) (National Environment Protection Council 2003)
	Draft Guideline: Air Emissions (DWER 2019)
	Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales. (NSW EPA 2016)

### 4.10.2 Receiving environment

The Northampton Local Government Area only has two polluters in the area surrounding the Proposal site, according to the National Pollutant Inventory (DEE 2020). These two polluters are the Hose Mine and Wet Processing Plant belonging to GMA Garnet Pty Ltd and Compressor Station 6 of the Dampier Bunbury Natural Gas Pipeline, each found at approximately 50 km and 80 km from the DE respectively. Each of these pollutant sources emit CO, Cumene, NO<sub>x</sub>, PM10, PM2.5, PAH, SO<sub>2</sub> and VOCs.

Winds along the coast of the Murchison region result from both large-scale (synoptic) winds associated with low- and high-pressure systems and local-scale winds induced by thermal influences (e.g. sea breeze).

### 4.10.3 Potential impacts

The Proposal has the potential to result in the following:

- Dust dispersal during construction
- Odorous compounds from ammonia production
- Increase in CO<sub>2</sub>, CO, NO<sub>x</sub> and diesel exhaust of emergency power generation
- Noise emissions from operations within the PtX plant
- Noise emissions from the operation of vessels from SCF Option 1



- Noise emissions from construction activities related to the Proposal
- Noise emissions from WTG operations

#### 4.10.4 Proposed studies for impact assessment

The Proponent proposes to undertake the following surveys of Air Quality:

- **Construction and Operational Air Quality Modelling Assessment** – Initial desktop study to identify existing environment and sensitive receptors and following this, modelling of emissions and dust dispersion during a construction and operational scenario.
- **Construction and Operational Noise Modelling Assessment** – Baseline noise survey at sensitive receptors to identify existing environment and conduct noise modelling for a construction and operational scenario.
- **Operational Odour Assessment** – follow procedures in *Guideline: Odour emissions* (DWER 2019) to undertake screen level analysis.

### 4.11 Social Surroundings

#### 4.11.1 Policy and guidance

Table 4-17 Social surrounds policy and guidance

Source	Policy and guidance
EPA Policy and Guidelines	Environmental Factor Guideline – Social Surroundings (EPA 2016e)
	Guidance for the Assessment of Environmental Factors – Assessment of Aboriginal Heritage (EPA 2004)
Other Policy and Guidance	Aboriginal Heritage Act 1972 (GoWA 2021)
	Aboriginal Cultural Heritage Act 2021 (GoWA 2021)
	Heritage Act 2018 (GoWA 2021)
	Engage early – guidance for proponents on best practice Indigenous engagement for environmental assessments under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) (Department of the Environment 2016)
	Aboriginal Heritage – Due Diligence Guidelines (Version 3.0) (Department of Aboriginal Affairs and Department of the Premier and Cabinet 2013)
	The Burra Charter (Australia ICOMOS Charter for Places of Cultural Significance) (ICOMOS 2013)

#### 4.11.2 Receiving environment

##### 4.11.2.1 Native title and Aboriginal cultural heritage

The Traditional Owners and determined native title holders for the area, have provided their in-principle support for the Proposal. Murchison Hydrogen Renewables and the Traditional Owners have a well-established relationship and have been engaging now for more than two years in respect of the Proposal. Murchison Hydrogen Renewables and the Traditional Owners are well progressed in their engagement with the support of the Traditional Owners’ legal and other advisors, including negotiating for an Indigenous Land Use Agreement (ILUA) expected to be finalised and registered by mid-2022. The ILUA will include business, employment and training opportunities for the aboriginal groups relevant to the project area.

There are a total of 43 registered Aboriginal heritage sites listed in the Murchison House Station Pastoral Lease. Of these 43, 11 registered sites are within the Development Envelope. An Aboriginal Heritage Agreement was signed with the Traditional Owners in November 2019. This Agreement sets out the management of Aboriginal heritage surveys, sites, objects and other matters for the early access and studied undertaken pursuant to the section 91 licence tenure.

While there is potential for development areas and heritage places to overlap, the majority of the Proposal infrastructure will allow for micro-siting to avoid heritage sites. Prior to any preliminary or investigative works, a desk-based assessment of existing aboriginal heritage will be undertaken, to identify any archaeological and ethnographic heritage.

Detailed archaeological and ethnographic Aboriginal heritage surveys will be undertaken across the DE prior to ground disturbance works, in consultation with and together with the Traditional Owners and determined native title owners. If impacts to Aboriginal heritage cannot be avoided (noting it is anticipated that any identified sites should be able to be avoided), heritage impact approvals under heritage legislation will only be pursued with the agreement will be sought according to Section 18 of the Aboriginal and Torres Strait Islander Heritage Protection Act 1984.

#### 4.11.2.2 European heritage

The Shark Bay World and National Heritage Area is located 3 km north of the DE and approximately 16 km north of the PtX plant area. Shark Bay's waters, islands and peninsulas cover a large area of approximately 2.2 million ha, 70% of which are marine waters. At its closest point, the northern boundary of the DE lies approximately 3 km south of the southern boundary of the Shark Bay World Heritage area.

Desktop research indicates that there are no known sites within the DE that have State or local heritage status.

No registered European heritage sites are located within the DE.

#### 4.11.2.3 Amenity

The EPA Social Surroundings Factor Guideline (2016) identifies that:

“For the purpose of EIA, amenity values include both visual amenity, and the ability for people to live and recreate within their surroundings without any unreasonable interference with their health, welfare, convenience and comfort.

Noise, odour and dust all have the potential to unreasonably interfere with the health, welfare, convenience and comfort of people.

Natural landscapes and views often contribute to visual amenity, such as areas of high heritage, cultural or social significance due to their natural features or scenic quality.

Amenity values can be highly subjective. What may have amenity value for one person, may not be valued by another. Similarly, people have different levels of perception or tolerance for things that may impact amenity, such as noise, odour and dust.”

### 4.11.3 Potential impacts

The Proposal has the potential to result in the following:

- Disturbance of Aboriginal heritage sites
- Disturbance of European Heritage sites
- Reduction in visual amenity for any sensitive receptors in the locality
- Project-induced noise increases for sensitive receivers
- Restricted traditional and recreational use in the locality, including temporarily during construction
- Disturbance to the seabed during construction of offshore infrastructure, and risk of marine pest introduction, and any potential consequent impacts on existing wild fishery or aquaculture operations
- Additional human-use pressure on the coastal strip.

### 4.11.4 Proposed studies for impact assessment

The Proponent proposes to undertake the following further studies in respect of Social Surroundings:

- **European Heritage Survey** – desktop assessment of likely European heritage sites within the Proposal area.

- **Aboriginal Heritage Surveys** – surveys to be undertaken prior to construction to identify both registered and non-registered aboriginal heritage places of archaeological and ethnographic importance.
- **Landscape and Visual Impact Assessment** – assessment of the potential impacts of the Proposal to sensitive receptors, considering visual landscape character, define sense of place and outline mitigation and management measures.
- **Noise Assessment** – noise modelling to determine predicted Proposal-related noise change from baseline noise conditions at sensitive receptors.
- **Traffic Impact Assessment (Construction and Operations)** – preparation of a traffic assessment to investigate potential impacts of the project and provide mitigation measures.

## 5. Other factors

Another factor that may be relevant to the Proposal is Greenhouse Gas Emissions. The Proponent's current assessment is that GHG emissions are not likely to be considered a key environmental factor but will still be assessed as an "Other" factor.

### 5.1 Greenhouse Gas Emissions

Table 5-1 Overview of GHG emission in relation to the Proposal

<b>Receiving environment</b>	Australia has committed to reduce GHG emissions by 26 to 28 per cent below 2005 levels by 2030 under The Paris Agreement. In 2017, Western Australia (WA) contributed 88.5 million tonnes CO <sub>2</sub> -e, which is a 23 per cent increase from 2005 levels. The State Greenhouse Gas Inventory show a steady increase in GHG emissions in WA from the early 1990s. Generally, emissions growth in WA is expected to continue in the short to medium term (EPA 2020c).
<b>Potential impacts</b>	GHG emissions in the construction phase may contribute to an increase in GHG levels in Western Australia.
<b>Proposed studies for impact assessment</b>	N/A

# 6. Matters of National Environmental Significance (MNES)

## 6.1 Policy and guidance

Table 6-1 MNES policy and guidance

Policy and guidance
EPBC Act
Department of the Environment, Water, Heritage and the Arts, 2013, Significant Impact Guidelines 1.1 – Matters of National Environmental Significance
Guidelines for EPBC Act listed species, and associated Species Profile and Threats (SPRATS)

## 6.2 Summary of MNES

Table 6-2 presents a summary of the relevant MNES for the Proposal. The Proposal has the potential to cause significant impacts to listed threatened species (flora and fauna) and may have significant impacts to other MNES. As presented, the DE has the potential to support the following MNES:

- Listed threatened species (flora and fauna)
- Listed migratory species, and
- A National Heritage place, north of the DE.

Table 6-2 Summary of MNES relevance to the proposed action

MNES	Relevance to the Proposal
Listed threatened species and ecological communities	<b>Relevant.</b> There are no listed threatened communities known or likely to occur within the DE. Ten (10) threatened flora species are known or likely to occur within the DE. Forty-one (41) threatened fauna species are known or likely to occur within the DE. Numerous (26) listed marine species are known or likely to occur within the DE.
Listed migratory species	<b>Relevant.</b> Listed migratory species are known to or likely to occur within the DE.
Wetlands of international importance	Not relevant. Proposed action is not located within or adjacent to a Wetland of international importance.
Commonwealth marine areas	Not relevant. Proposed action is not located within Commonwealth marine areas.
World heritage properties	<b>Relevant.</b> One World Heritage place (Shark Bay, Western [105020]) located north of the proposed action.
National Heritage places	<b>Relevant.</b> One World Heritage place (Shark Bay, Western [105020]) located north of the proposed action.
Nuclear actions	Not relevant. Proposed action is not a nuclear action.
Great Barrier Reef Marine Park	Not relevant. Proposed action is on the west coast of Australia.
Protection of water resources from coal seam gas development and large coal mining development	Not relevant. Proposed action does not involve coal seam gas or coal mine development.



## 6.3 Mitigation

The mitigation hierarchy of avoid, minimise and rehabilitate will be followed to reduce the significant residual impact on the environment (GoWA 2014). As identified through the PMST (DAWE 2022, Appendix C), this proposal has the potential to impact on several protected matters. The below measures are preliminary mitigation measures that will be implemented during construction of the Proposal to reduce the significant residual impact. Knowledge gained through the proposed studies will be used as a basis for development and implementation of further, more detailed, mitigation measures. These will be included in the impact assessment stage.

### Threatened flora:

- Avoid:
  - Pre-clearance surveys and avoidance of identified populations as far as practicable
  - Service roads and turbine placement re-aligned to avoid mapped conservation significant species.
- Minimise:
  - Weed hygiene during construction and operations
  - Construction and operational vehicle and equipment movements limited to designated roads, access tracks and cleared areas, as far as practicable.
- Rehabilitate:
  - Measures for revegetation and planting for native vegetation disturbed during construction.

### Threatened fauna:

- Avoid:
  - Pre-clearance surveys and avoidance of identified nesting areas.
  - Construction to generally occur during daytime hours, avoiding peak nocturnal animal activity and reducing the likelihood of fauna strikes during construction. Construction during night-time hours will be avoided as far as practicable but may be required subject to the construction program.
- Minimise:
  - Construction and operational vehicle and equipment movements limited to designated roads, access tracks and cleared areas, as far as practicable.
  - Permanent and temporary lighting positioned so as to minimise the artificial light directed to adjacent native vegetation, while maintaining a safe working environment for employees.
- Rehabilitate:
  - Measures for revegetation and planting for native vegetation disturbed during construction.

### Migratory birds:

- Avoid:
  - Pre-clearance surveys and avoidance of identified nesting areas.
- Minimise:
  - Permanent and temporary lighting positioned so as to minimise the artificial light directed to adjacent native vegetation, while maintaining a safe working environment for employees.
- Rehabilitate:
  - Measures for revegetation and planting for native vegetation disturbed during construction.

### Listed marine species:

- Minimise:
  - Maximise buried infrastructure to minimise changes to sediment transport and erosion/ accretion
  - Staging and scheduling construction activities likely to generate underwater noise from piling outside of peak migratory periods.
  - Permanent and temporary lighting positioned so as to minimise the artificial light directed to adjacent native vegetation, while maintaining a safe working environment for employees.

**World/National Heritage Place:**

Avoid:

- All activity relevant to the Proposal will not go north of the State Barrier Fence Reserve, maintaining a distance from the Heritage Place, therefore not having a direct impact.

## 7. Mitigation of Impacts to Key Environmental Factors

Direct impacts of the Proposal to identified Key Environment Factors will follow the mitigation hierarchy as outlined by the State Government (GoWA 2014). This follows a process of avoid, minimise and rehabilitate and if a significant residual impact persists, Murchison Hydrogen Renewables will seek to produce an offsets package to reduce the impact to an acceptable level. Figure 7-1 is used to illustrate the mitigation process.

Initial mitigation measures were outlined above for MNES (Section 6.3). Many of these mitigation measures are applicable to identified Key Environmental Factors, such as Flora and Vegetation, Terrestrial Fauna, Coastal Processes and Marine Environmental Quality. Further mitigation measures will be developed during the environmental impact assessment process to address the detailed understanding of the environment that is gained from the proposed studies.

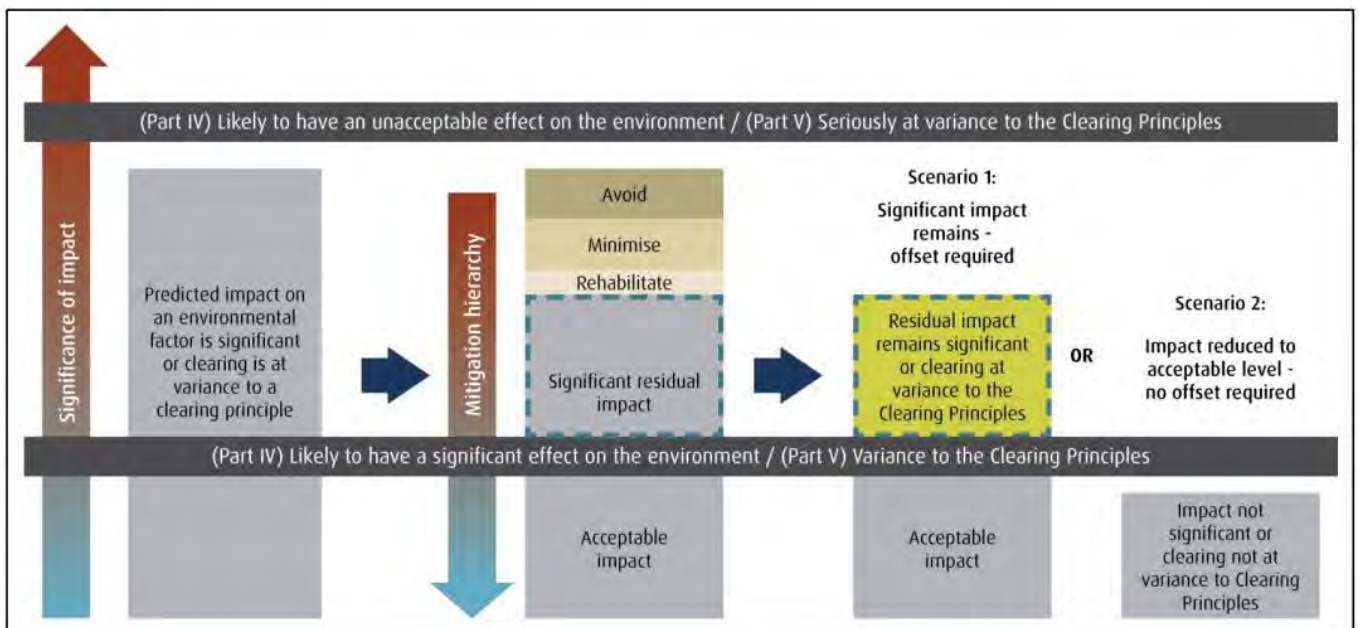


Figure 7-1 Mitigation hierarchy (GoWA 2014)

## 8. Likely Environmental Outcomes

The current knowledge of significant residual impacts to key environmental factors has been informed by limited preliminary environmental data, primarily from desktop sources. A comprehensive understanding of the environment and the significant residual impacts that will come as a result this Proposal being implemented will only be achieved following the proposed studies. Following the completion of these studies, residual impacts will be better understood. This will allow the development of well-informed, proposed environmental outcomes for each key environmental factor as well as MNES protected by the EPBC Act. These proposed outcomes will be written in accordance with the EPA's interim guidance on environmental outcomes (EPA 2021), this will ensure environmental outcomes:

- Aim to achieve one or more of the EPA's objectives for environmental factors
- Are specific in extent of impact, and
- Are measurable targets of the environmental state.

Environmental outcomes will be consistent with the EP Act principles and the EPA objectives for environmental factors. Where proposed outcomes are not consistent with these principles and objectives, Murchison Hydrogen Renewables will consider the design alternatives and additional mitigation measures as outlined in Section 7.

## 9. Holistic impact assessment

Until now, each key environmental factor has been considered independently from another. However, potential impacts are not isolated and it is known that ecosystems are comprised of complex interactions. Following the completion of the proposed studies, the Proposal's holistic impacts will be able to be appropriately measured. A preliminary assessment of holistic impacts has identified the following potential impacts as having effects and interactions with multiple key environmental factors:

- Dredging, increase vessel activity and increase salinity may impact marine flora and fauna via changes to the water column, increase vessel strikes, increase in noise, introduction of marine pests and unplanned hydrocarbon spills.
- Clearing of native vegetation may impact local vegetation communities, Threatened and Priority flora, Threatened and Priority fauna, fauna habitat, surface water flows, visual amenity and heritage values.
- Construction and operation may increase dust dispersal and alter air quality potentially impacting native flora and fauna, amenity and heritage values.

Figure 8-1 shows an indicative representation of the interaction between identified key environmental factors.

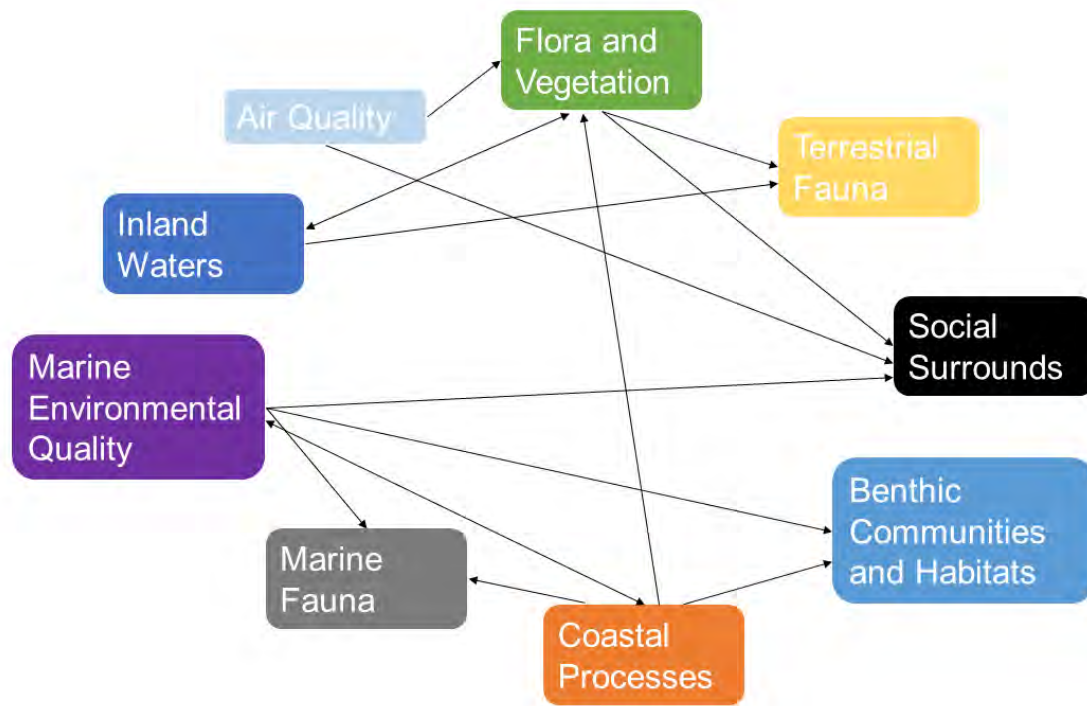


Figure 8-1 Relationship between key environmental factors

## 10. Cumulative impact assessment

The site where the Proposal is located is uniquely situated on a large area of undeveloped pastoral land. With Kalbarri National Park to the south and Zuytdorp Nature Reserve to the north, current environmental impacts to the region are relatively minimal. Potential impacts from past, present and reasonably foreseeable future activities will be assessed further following the completion of the proposed environmental studies in 2022. Other proposals, projects and activities within proximity to the DE include:

- Present:
  - Kalbarri township – 12 km south.
  - Dampier to Bunbury Natural Gas Pipeline – 80 km east.
  - GMA Garnet - Port Gregory Garnet Mine – 60 km south.
- Reasonably Foreseeable:
  - Australian Garnet – Lucky Bay Garnet Mine – 55 km south
  - Multiple developments in Oakajee – 120 km south

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# Appendices

# **Appendix A**

**Proposal Content Document**

# Murchison Hydrogen Renewables Project

## Proposal Content Document

**Table 1:** General proposal content description

<b>Proposal title</b>	Murchison Hydrogen Renewables Project
<b>Proponent name</b>	Murchison Hydrogen Renewables Pty Ltd as trustee for the Murchison Hydrogen Renewables Project Trust
<b>Short description</b>	<p>The Proposal will use combined onshore wind and solar energy of approximately 5.2 gigawatt (GW) capacity to produce green hydrogen which will be converted to an estimated 2 Million tonnes per annum (Mtpa) of green ammonia for export to emerging green energy markets. The Proposal is located within the Shire of Northampton, Western Australia (WA), approximately 20 km north of Kalbarri.</p> <p>The Proposal comprises the following major components:</p> <ul style="list-style-type: none"> <li>– A wind and solar farm with a combined installed capacity of approximately 5.2 GW</li> <li>– A Power-to-X (PtX) facility that will use the produced green energy to create approximately 2 Mtpa of green ammonia</li> <li>– Ammonia export facility including pipeline and export vessel mooring and product transfer infrastructure</li> </ul>

**Table 2:** Proposal content elements

<b>Proposal element</b>	<b>Location / description</b>	<b>Maximum extent, capacity or range</b>
<b>Physical elements</b>		
Development envelope	<p>Development Envelope (Figure 2)</p> <p>Indicative support craft facility development area (Figure 5)</p>	<p>Maximum extent of 85,883.4 ha, inclusive of:</p> <p>Access Road Area – 5,455 ha</p> <p>Marine Area – 566.7 ha</p> <p>PtX Area – 953.1 ha</p> <p>Solar Farm Area – 10,448.2 ha</p> <p>Wind Farm Area – 68,460.1 ha</p> <p>Estuarine Area – 0.4 ha</p>
Wind turbines	<p>Indicative Wind Turbine Generator (WTG) Locations</p> <p>Figure 1</p>	<p>Permanent footprint of 0.2 ha per turbine. Total 140 ha permanent footprint.</p> <p>Temporary construction footprint of up to 2.1 ha per turbine. Total temporary clearing up to 1,470 ha.</p>



Proposal element	Location / description	Maximum extent, capacity or range
		Maximum total clearing of 1,610 ha within the Wind Farm Area of 68,460.1 ha.
Solar farm	Indicative solar farm area Figure 2	Maximum total clearing of 10,000 ha within the Solar Farm Area of 10,448.2 ha.
Temporary laydown	Located adjacent to the access road within Wind Farm Area Figure 2	50 ha temporary clearing within the Wind Farm Area of 68,460.1 ha.
PtX plant Includes: - Desalination plant - Electrolyser - Ammonia plant - Battery storage system - Substation - Ammonia chiller and storage tanks - Onshore support facilities - Temporary footprint includes construction worker accommodation	Located near the western boundary of the Development Envelope Figure 2, Figure 3	242 ha permanent footprint. 181.5 ha temporary construction and laydown area Maximum total clearing of 423.5 ha within the PtX Area of 953.1 ha.
Access roads and other supporting infrastructure	Access road, WTG service roads and other project support roads Figure 1	Approximately 1,200 km of roads, including a main access road from the highway to the PtX plant. Total clearing of approximately 960 ha within the Development Envelope.
Onshore pipeline corridors including shoreline infrastructure hub	Between shoreline infrastructure hub and PtX plant. Figure 3	A total of approximately 2,500 m of onshore pipeline corridors Total clearing of approximately 11.5 ha within the 953.1 ha PtX Area.
Seawater intake and discharge pipeline	Seawater Intake and Brine Outfall Figure 3	Disturbance of up to 2.5 ha of benthic habitat within the 566.7 ha Marine Area. Intake pipeline approximately 150 m from shoreline

Proposal element	Location / description	Maximum extent, capacity or range
		Brine outfall pipeline approximately 350 m from shoreline.
Cryogenic ammonia export pipeline and pressurised vapour return line	From onshore support facilities along the length of the subsea pipeline Figure 3	Approximately 1,400 m subsea length to a water depth of approximately -20 m. Disturbance of up to 6.6 ha of benthic habitat within the 566.7 ha Marine Area.
Marine export facility	Seaward end of the subsea pipeline Figure 3	Located in water depth of approximately -20 to -25 m, approximately 1,400 m from shore. Swing basin radius of approximately 330 m Vessel manoeuvring area of approximately 780 m Disturbance of up to 4 ha of benthic habitat within the 566.7 ha Marine Area.
Support Craft Facility Option 1 - Coastal Includes: Breakwater structures, Berth infrastructure for support vessels and Dredging where required	Indicative marine support craft facility (SCF) Figure 3	Disturbance of up to 4 ha of benthic habitat within the 566.7 ha Marine Area. Dredging within the maximum combined pipeline dredge extent of 80,000 m <sup>3</sup> .
Support Craft Facility Option 2 – Kalbarri Berth infrastructure for support vessels Dredging will be undertaken where required to maintain channel at 50 m width and suitable depth for vessels.	Indicative support craft facility development area Figure 4	Footprint of approximately 0.4 ha within the 0.4 ha Estuarine Area.
<b>Construction elements</b>		
Tunnelling/HDD/trenching - marine	Ammonia export pipeline, pressurized vapour return line, marine communications, seawater intake and discharge pipelines. Figure 3	Up to approximately 1400 m subsea length to a water depth of approximately 20 m for pipelines to marine export facility

Proposal element	Location / description	Maximum extent, capacity or range
Tunnelling/HDD/trenching - terrestrial	From PtX plant to shoreline infrastructure hub Figure 3	Open trenching up to 2 m wide and 2 m deep, will require stockpiling of fill.  Pipes/transmission lines to be surrounded by engineered material and backfilled.  A total of approximately 2,500 m of onshore pipeline corridors between shoreline infrastructure hub and PtX plant.  Open trenching will require stockpiling of fill.
Seawater intake	Approximately 150 m offshore Figure 3	Vertical risers drilled into seabed  Ground anchors and seabed preparation
Brine discharge	Approximately 350 m offshore Figure 3	Vertical risers drilled into seabed  Ground anchors and seabed preparation
Dredging / Blasting	To support relevant SCF option.	Dredging / blasting, if required, dependent on support craft facility option taken forward and extent of seabed obstacles.
<b>Operational elements</b>		
Wind energy production	Figure 1	Approximately 700 turbines  Total approximately 3.7 GW
Solar farm energy production	Figure 1 Figure 2	Approximately 1.5 GW
PtX plant operation (electrolysis and ammonia production) <ul style="list-style-type: none"> <li>- Water treatment and desalination (RO) plant</li> <li>- Electrolyser</li> <li>- Ammonia production plant</li> </ul>	Located near the western boundary of the Development Envelope Figure 2, Figure 3	<ul style="list-style-type: none"> <li>- Electrolyser <ul style="list-style-type: none"> <li>o capacity of 3.0 GW</li> <li>o 6 GLpa of desalinated water demand</li> </ul> </li> <li>- Ammonia production plant <ul style="list-style-type: none"> <li>o 2 Mtpa</li> </ul> </li> </ul>
Ammonia export	From onshore support facilities along the length of the subsea pipeline Figure 3	Approximately 2 Mtpa  Maximum of 52 shipments per annum

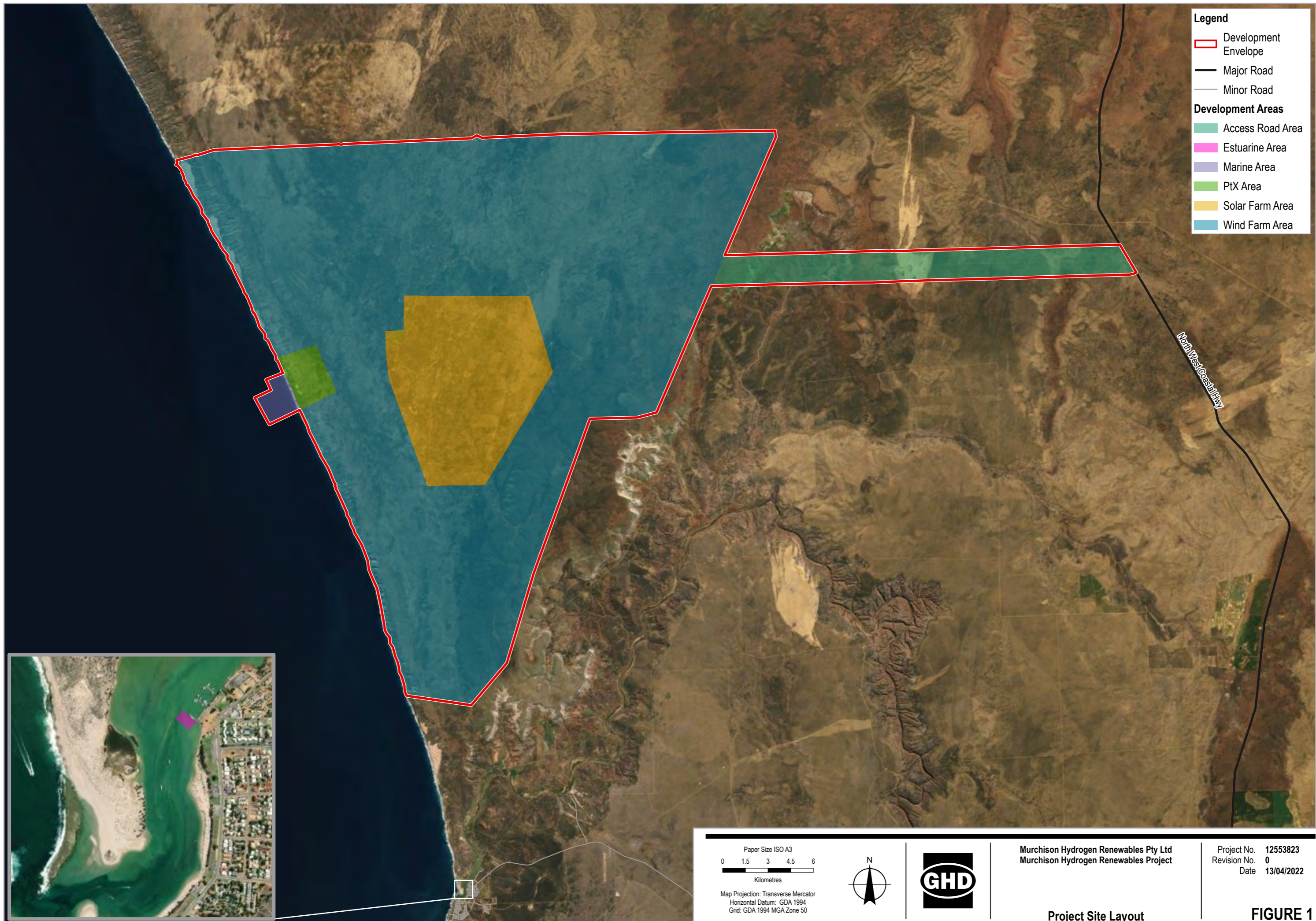
<b>Proposal elements with greenhouse gas emissions</b>	
Construction elements:	
Scope 1	Scope 1 GHG emissions associated with construction are not expected to be greater than 86,315 tCO <sub>2</sub> -e per annum (assuming 5.5 year construction period), which places the Proposal below the 100,000 tonnes CO <sub>2</sub> -e per annum threshold, as defined under the Australian Government's Safeguard Mechanism.
Scope 2	N/A
Scope 3	Emissions during manufacturing and construction of facility and equipment will be calculated during assessment stage but are expected to be less than 1,000,000 tCO <sub>2</sub> -e per annum
Operation elements:	
Scope 1	Scope 1 GHG emissions associated with operation are not expected to be greater than 40,000 tCO <sub>2</sub> -e per annum (taking a conservative approach with respect to cleared vegetation and no rehabilitation following construction considered), which places the Proposal below the 100,000 tonnes CO <sub>2</sub> -e per annum threshold, as defined under the Australian Government's Safeguard Mechanism.
Scope 2	Not expected to be greater than 1,000 tCO <sub>2</sub> -e per annum
Scope 3	Scope 3 GHG emissions associated with the transport of ammonia by sea tanker are estimated at no greater than 288,489 tCO <sub>2</sub> -e/yr. Offset of 5,300,000 tCO <sub>2</sub> emissions annually
<b>Rehabilitation</b>	
Areas temporarily cleared for laydown will be rehabilitated following construction. Final closure and rehabilitation following cessation of operations.	
<b>Commissioning</b>	
Desalination plant: Water sourced from ocean and discharged via diffuser. During construction, water will either be sourced from the ocean and a temporary desalination plant used, or potable water will be obtained. Integration pipeline: Pressure testing and disinfection of construction works. Reuse of water where practical, sourced from potable supply. Water neutralised and discharged to marine environment using direct discharge.	
<b>Decommissioning</b>	
In consultation with government, community and indigenous stakeholders: <ul style="list-style-type: none"> <li>• Removal of all above-surface infrastructure following cessation of operations.</li> <li>• Buried pipelines to be decommissioned and left in situ.</li> <li>• Removal of power infrastructure.</li> </ul>	

- Seawater intake and brine outfall will be cut to below seabed surface, removed and disposed of.

**Other elements which affect extent of effects on the environment**

Proposal time*	Maximum project life	35.5 years (construction + operations)
	Construction phase	Approximately 5.5 years including pre-construction phase
	Operations phase	30 years
	Decommissioning phase	Estimated 5 years post operations





- Legend**
- Development Envelope
  - Major Road
  - Minor Road
- Development Areas**
- Access Road Area
  - Estuarine Area
  - Marine Area
  - PtX Area
  - Solar Farm Area
  - Wind Farm Area

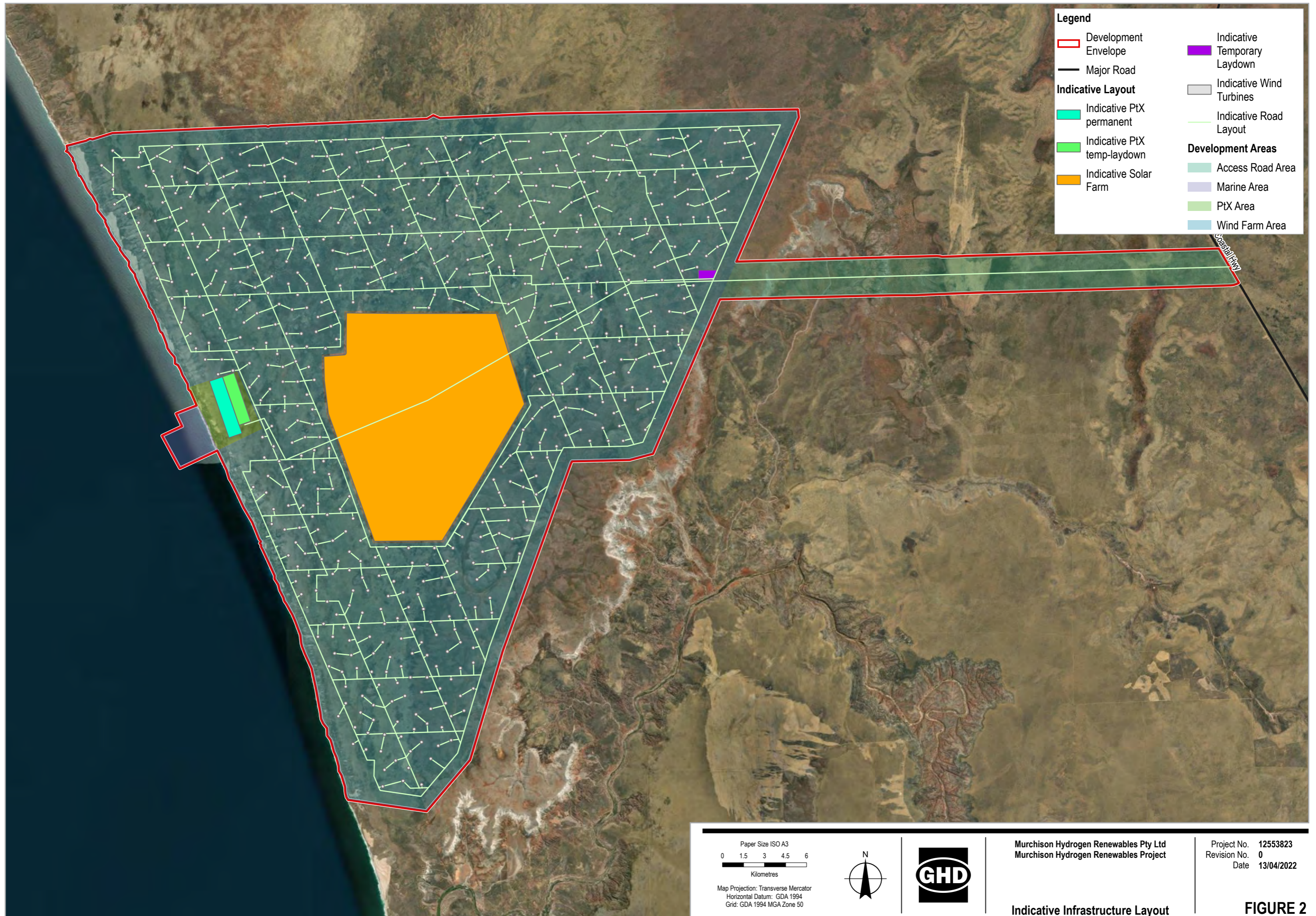


<p>Paper Size ISO A3</p> <p>0 1.5 3 4.5 6</p> <p>Kilometres</p> <p>Map Projection: Transverse Mercator Horizontal Datum: GDA 1994 Grid: GDA 1994 MGA Zone 50</p>			<p><b>Murchison Hydrogen Renewables Pty Ltd</b> <b>Murchison Hydrogen Renewables Project</b></p>	<p>Project No. 12553823 Revision No. 0 Date 13/04/2022</p>
<p><b>Project Site Layout</b></p>			<p><b>FIGURE 1</b></p>	

\\ghdnet\ghd\AU\Perth\Projects\6112553823\GIS\Map\Working\12553823\_Referral\12553823\_Referral.aprx\12553823\_01\_ProjectLayout\_RevA  
Print date: 13 Apr 2022 - 15:37

Data source: World Imagery: Earthstar Geographics  
World Imagery: Maxar. Created by: rbrown3





**Legend**

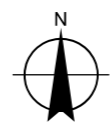
- Development Envelope
- Major Road
- Indicative PtX permanent
- Indicative PtX temp-laydown
- Indicative Solar Farm
- Indicative Temporary Laydown
- Indicative Wind Turbines
- Indicative Road Layout

**Development Areas**

- Access Road Area
- Marine Area
- PtX Area
- Wind Farm Area

Paper Size ISO A3  
 0 1.5 3 4.5 6  
 Kilometres

Map Projection: Transverse Mercator  
 Horizontal Datum: GDA 1994  
 Grid: GDA 1994 MGA Zone 50



Murchison Hydrogen Renewables Pty Ltd  
 Murchison Hydrogen Renewables Project

Project No. 12553823  
 Revision No. 0  
 Date 13/04/2022

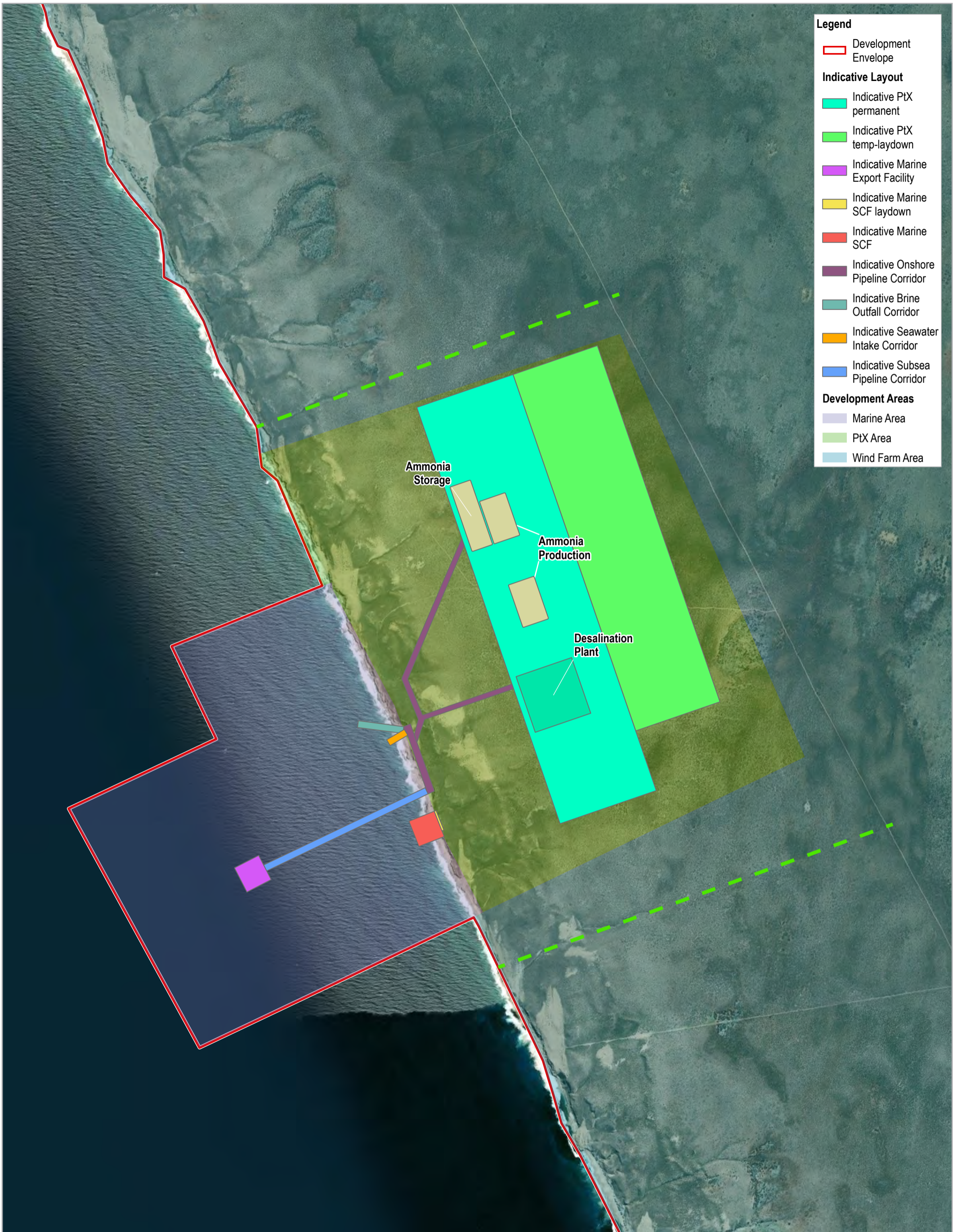
**Indicative Infrastructure Layout**

**FIGURE 2**

\\ghdnet\ghd\AU\Perth\Projects\6112553823\GIS\Maps\Working\12553823\_Referral\12553823\_Referral.aprx\12553823\_02\_IndicativeInfra\_RevA  
 Print date: 13 Apr 2022 - 13:48

Data source: World Imagery; Earthstar Geographics. Created by: rbrown3

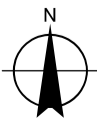




- Legend**
- Development Envelope
  - Indicative Layout**
  - Indicative PtX permanent
  - Indicative PtX temp-laydown
  - Indicative Marine Export Facility
  - Indicative Marine SCF laydown
  - Indicative Marine SCF
  - Indicative Onshore Pipeline Corridor
  - Indicative Brine Outfall Corridor
  - Indicative Seawater Intake Corridor
  - Indicative Subsea Pipeline Corridor
  - Development Areas**
  - Marine Area
  - PtX Area
  - Wind Farm Area

Paper Size ISO A3  
 0 200 400 600 800  
 Meters

Map Projection: Transverse Mercator  
 Horizontal Datum: GDA 1994  
 Grid: GDA 1994 MGA Zone 50



Murchison Hydrogen Renewables Pty Ltd  
 Murchison Hydrogen Renewables Project

**Indicative plant layout and  
 Indicative location of Support  
 Craft Facility Option 1**

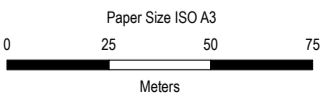
Project No. 12553823  
 Revision No. 0  
 Date 13/04/2022

**FIGURE 3**

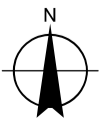




**Legend**  
 Indicative Support Craft Facility Development Area



Map Projection: Transverse Mercator  
 Horizontal Datum: GDA 1994  
 Grid: GDA 1994 MGA Zone 50



Murchison Hydrogen Renewables Pty Ltd  
 Murchison Hydrogen Renewables Project

**Indicative location of Support Craft Facility Option 2 (Kalbarri)**

Project No. 12553823  
 Revision No. 0  
 Date 25/02/2022

**FIGURE 4**



# **Appendix B**

**GHD scope and limitation**



This report: has been prepared by GHD for Murchison Hydrogen Renewables Pty Ltd as trustee for Murchison Hydrogen Renewables Project Trust and may only be used and relied on by Murchison Hydrogen Renewables Pty Ltd as trustee for Murchison Hydrogen Renewables Project Trust for the purpose agreed between GHD and Murchison Hydrogen Renewables Pty Ltd as trustee for Murchison Hydrogen Renewables Project Trust.

GHD otherwise disclaims responsibility to any person other than Murchison Hydrogen Renewables Pty Ltd as trustee for Murchison Hydrogen Renewables Project Trust arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report. GHD disclaims liability arising from any of the assumptions being incorrect.

GHD has prepared this report on the basis of information provided by Murchison Hydrogen Renewables Pty Ltd as trustee for Murchison Hydrogen Renewables Project Trust and others who provided information to GHD (including Government authorities), which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

# **Appendix C**

**Protected Matters Search Tool results**



# EPBC Act Protected Matters Report

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

Report created: 24-Jan-2022

[Summary](#)

[Details](#)

[Matters of NES](#)

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

[Extra Information](#)

[Caveat](#)

[Acknowledgements](#)

# Summary

## Matters of National Environment Significance

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

<a href="#">World Heritage Properties:</a>	1
<a href="#">National Heritage Places:</a>	1
<a href="#">Wetlands of International Importance (Ramsar)</a>	None
<a href="#">Great Barrier Reef Marine Park:</a>	None
<a href="#">Commonwealth Marine Area:</a>	1
<a href="#">Listed Threatened Ecological Communities:</a>	None
<a href="#">Listed Threatened Species:</a>	58
<a href="#">Listed Migratory Species:</a>	47

## Other Matters Protected by the EPBC Act

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

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

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

<a href="#">Commonwealth Lands:</a>	None
<a href="#">Commonwealth Heritage Places:</a>	None
<a href="#">Listed Marine Species:</a>	80
<a href="#">Whales and Other Cetaceans:</a>	14
<a href="#">Critical Habitats:</a>	None
<a href="#">Commonwealth Reserves Terrestrial:</a>	None
<a href="#">Australian Marine Parks:</a>	2
<a href="#">Habitat Critical to the Survival of Marine Turtles:</a>	None

## Extra Information

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

<a href="#">State and Territory Reserves:</a>	9
<a href="#">Regional Forest Agreements:</a>	None
<a href="#">Nationally Important Wetlands:</a>	1
<a href="#">EPBC Act Referrals:</a>	6
<a href="#">Key Ecological Features (Marine):</a>	2
<a href="#">Biologically Important Areas:</a>	16
<a href="#">Bioregional Assessments:</a>	None
<a href="#">Geological and Bioregional Assessments:</a>	None



# Details

## Matters of National Environmental Significance

### World Heritage Properties [\[ Resource Information \]](#)

Name	State	Legal Status	Buffer Status
<a href="#">Shark Bay, Western Australia</a>	WA	Declared property	In feature area

### National Heritage Places [\[ Resource Information \]](#)

Name	State	Legal Status	Buffer Status
Natural			
<a href="#">Shark Bay, Western Australia</a>	WA	Listed place	In feature area

### Commonwealth Marine Area [\[ Resource Information \]](#)

Approval is required for a proposed activity that is located within the Commonwealth Marine Area which has, will have, or is likely to have a significant impact on the environment. Approval may be required for a proposed action taken outside a Commonwealth Marine Area but which has, may have or is likely to have a significant impact on the environment in the Commonwealth Marine Area.

Feature Name	Buffer Status
EEZ and Territorial Sea	In feature area

### Listed Threatened Species [\[ Resource Information \]](#)

Status of Conservation Dependent and Extinct are not MNES under the EPBC Act.  
Number is the current name ID.

Scientific Name	Threatened Category	Presence Text	Buffer Status
<b>BIRD</b>			
<a href="#">Anous tenuirostris melanops</a> Australian Lesser Noddy [26000]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In feature area
<a href="#">Calidris canutus</a> Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area	In feature area
<a href="#">Calidris ferruginea</a> Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area	In feature area
<a href="#">Charadrius leschenaultii</a> Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat may occur within area	In buffer area only

Scientific Name	Threatened Category	Presence Text	Buffer Status
<a href="#">Diomedea amsterdamensis</a> Amsterdam Albatross [64405]	Endangered	Species or species habitat likely to occur within area	In feature area
<a href="#">Diomedea epomophora</a> Southern Royal Albatross [89221]	Vulnerable	Species or species habitat may occur within area	In buffer area only
<a href="#">Diomedea exulans</a> Wandering Albatross [89223]	Vulnerable	Species or species habitat may occur within area	In feature area
<a href="#">Falco hypoleucos</a> Grey Falcon [929]	Vulnerable	Species or species habitat likely to occur within area	In feature area
<a href="#">Leipoa ocellata</a> Malleefowl [934]	Vulnerable	Species or species habitat known to occur within area	In feature area
<a href="#">Limosa lapponica menzbieri</a> Northern Siberian Bar-tailed Godwit, Russkoye Bar-tailed Godwit [86432]	Critically Endangered	Species or species habitat known to occur within area	In feature area
<a href="#">Macronectes giganteus</a> Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area	In feature area
<a href="#">Macronectes halli</a> Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area	In feature area
<a href="#">Numenius madagascariensis</a> Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area	In feature area
<a href="#">Pterodroma mollis</a> Soft-plumaged Petrel [1036]	Vulnerable	Species or species habitat may occur within area	In feature area
<a href="#">Rostratula australis</a> Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
<a href="#">Sternula nereis nereis</a> Australian Fairy Tern [82950]	Vulnerable	Foraging, feeding or related behaviour known to occur within area	In feature area
<a href="#">Thalassarche carteri</a> Indian Yellow-nosed Albatross [64464]	Vulnerable	Species or species habitat may occur within area	In feature area
<a href="#">Thalassarche cauta</a> Shy Albatross [89224]	Endangered	Species or species habitat may occur within area	In feature area
<a href="#">Thalassarche impavida</a> Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area	In feature area
<a href="#">Thalassarche melanophris</a> Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area	In feature area
<a href="#">Thalassarche steadi</a> White-capped Albatross [64462]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In feature area
<a href="#">Zanda latirostris listed as Calyptorhynchus latirostris</a> Carnaby's Black Cockatoo, Short-billed Black-cockatoo [87737]	Endangered	Species or species habitat known to occur within area	In feature area
<b>FISH</b>			
<a href="#">Thunnus maccoyii</a> Southern Bluefin Tuna [69402]	Conservation Dependent	Species or species habitat likely to occur within area	In feature area
<b>MAMMAL</b>			
<a href="#">Balaenoptera borealis</a> Sei Whale [34]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In feature area
<a href="#">Balaenoptera musculus</a> Blue Whale [36]	Endangered	Migration route known to occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
<a href="#">Balaenoptera physalus</a> Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In feature area
<a href="#">Bettongia penicillata ogilbyi</a> Woylie [66844]	Endangered	Species or species habitat known to occur within area	In buffer area only
<a href="#">Dasyurus geoffroii</a> Chuditch, Western Quoll [330]	Vulnerable	Species or species habitat known to occur within area	In feature area
<a href="#">Eubalaena australis</a> Southern Right Whale [40]	Endangered	Species or species habitat likely to occur within area	In feature area
<a href="#">Megaptera novaeangliae</a> Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area	In feature area
<a href="#">Neophoca cinerea</a> Australian Sea-lion, Australian Sea Lion [22]	Endangered	Species or species habitat may occur within area	In feature area
<a href="#">Petrogale lateralis lateralis</a> Black-flanked Rock-wallaby, Moororong, Black-footed Rock Wallaby [66647]	Endangered	Species or species habitat known to occur within area	In buffer area only
<b>PLANT</b>			
<a href="#">Androcalva bivillosa</a> Stragglng Androcalva [87807]	Critically Endangered	Species or species habitat known to occur within area	In feature area
<a href="#">Beyeria lepidopetala</a> Small-petalled Beyeria, Short-petalled Beyeria [18362]	Endangered	Species or species habitat known to occur within area	In buffer area only
<a href="#">Caladenia barbarella</a> Small Dragon Orchid, Common Dragon Orchid [68686]	Endangered	Species or species habitat known to occur within area	In feature area
<a href="#">Caladenia bryceana subsp. cracens</a> Northern Dwarf Spider-orchid [64556]	Vulnerable	Species or species habitat known to occur within area	In feature area



Scientific Name	Threatened Category	Presence Text	Buffer Status
<a href="#">Caladenia elegans</a> Elegant Spider-orchid [56775]	Endangered	Species or species habitat known to occur within area	In feature area
<a href="#">Caladenia hoffmanii</a> Hoffman's Spider-orchid [56719]	Endangered	Species or species habitat known to occur within area	In feature area
<a href="#">Caladenia wanosa</a> Kalbarri Spider-orchid [5878]	Vulnerable	Species or species habitat known to occur within area	In buffer area only
<a href="#">Drakaea concolor</a> Kneeling Hammer-orchid [56777]	Vulnerable	Species or species habitat known to occur within area	In feature area
<a href="#">Eucalyptus beardiana</a> Beard's Mallee [18933]	Vulnerable	Species or species habitat known to occur within area	In feature area
<a href="#">Eucalyptus cuprea</a> Mallee Box [56773]	Endangered	Species or species habitat likely to occur within area	In buffer area only
<a href="#">Glyceria drummondii</a> Nangetty Grass [14008]	Endangered	Species or species habitat known to occur within area	In buffer area only
<a href="#">Hypocalymma longifolium</a> Long-leaved Myrtle [8081]	Vulnerable	Species or species habitat known to occur within area	In feature area
<a href="#">Lechenaultia chlorantha</a> Kalbarri Leschenaultia [16763]	Vulnerable	Species or species habitat likely to occur within area	In feature area
<a href="#">Stachystemon nematophorus</a> Three-flowered Stachystemon [81447]	Vulnerable	Species or species habitat known to occur within area	In feature area
<a href="#">Wurmbea tubulosa</a> Long-flowered Nancy [12739]	Endangered	Species or species habitat may occur within area	In feature area

## REPTILE

Scientific Name	Threatened Category	Presence Text	Buffer Status
<a href="#">Aipysurus foliosquama</a> Leaf-scaled Seasnake [1118]	Critically Endangered	Species or species habitat likely to occur within area	In feature area
<a href="#">Caretta caretta</a> Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area	In feature area
<a href="#">Chelonia mydas</a> Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area	In feature area
<a href="#">Dermochelys coriacea</a> Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known to occur within area	In feature area
<a href="#">Egernia stokesii badia</a> Western Spiny-tailed Skink, Baudin Island Spiny-tailed Skink [64483]	Endangered	Species or species habitat likely to occur within area	In feature area
<a href="#">Natator depressus</a> Flatback Turtle [59257]	Vulnerable	Species or species habitat known to occur within area	In feature area
<b>SHARK</b>			
<a href="#">Carcharias taurus (west coast population)</a> Grey Nurse Shark (west coast population) [68752]	Vulnerable	Species or species habitat known to occur within area	In feature area
<a href="#">Carcharodon carcharias</a> White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat known to occur within area	In feature area
<a href="#">Rhincodon typus</a> Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area	In feature area
<a href="#">Sphyrna lewini</a> Scalloped Hammerhead [85267]	Conservation Dependent	Species or species habitat likely to occur within area	In feature area
<b>SPIDER</b>			
<a href="#">Idiosoma nigrum</a> Shield-backed Trapdoor Spider, Black Rugose Trapdoor Spider [66798]	Vulnerable	Species or species habitat known to occur within area	In feature area

Listed Migratory Species			[ Resource Information ]	
Scientific Name	Threatened Category	Presence Text	Buffer Status	
<b>Migratory Marine Birds</b>				
<a href="#">Anous stolidus</a> Common Noddy [825]		Species or species habitat likely to occur within area	In feature area	
<a href="#">Apus pacificus</a> Fork-tailed Swift [678]		Species or species habitat likely to occur within area	In feature area	
<a href="#">Ardenna carneipes</a> Flesh-footed Shearwater, Fleshy-footed Shearwater [82404]		Species or species habitat likely to occur within area	In feature area	
<a href="#">Diomedea amsterdamensis</a> Amsterdam Albatross [64405]	Endangered	Species or species habitat likely to occur within area	In feature area	
<a href="#">Diomedea epomophora</a> Southern Royal Albatross [89221]	Vulnerable	Species or species habitat may occur within area	In buffer area only	
<a href="#">Diomedea exulans</a> Wandering Albatross [89223]	Vulnerable	Species or species habitat may occur within area	In feature area	
<a href="#">Fregata ariel</a> Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat likely to occur within area	In feature area	
<a href="#">Hydroprogne caspia</a> Caspian Tern [808]		Foraging, feeding or related behaviour known to occur within area	In feature area	
<a href="#">Macronectes giganteus</a> Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area	In feature area	
<a href="#">Macronectes halli</a> Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area	In feature area	

Scientific Name	Threatened Category	Presence Text	Buffer Status
<a href="#">Onychoprion anaethetus</a> Bridled Tern [82845]		Foraging, feeding or related behaviour likely to occur within area	In feature area
<a href="#">Sterna dougallii</a> Roseate Tern [817]		Foraging, feeding or related behaviour likely to occur within area	In buffer area only
<a href="#">Sternula albifrons</a> Little Tern [82849]		Species or species habitat may occur within area	In feature area
<a href="#">Thalassarche carteri</a> Indian Yellow-nosed Albatross [64464]	Vulnerable	Species or species habitat may occur within area	In feature area
<a href="#">Thalassarche cauta</a> Shy Albatross [89224]	Endangered	Species or species habitat may occur within area	In feature area
<a href="#">Thalassarche impavida</a> Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area	In feature area
<a href="#">Thalassarche melanophris</a> Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area	In feature area
<a href="#">Thalassarche steadi</a> White-capped Albatross [64462]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In feature area
<b>Migratory Marine Species</b>			
<a href="#">Balaenoptera borealis</a> Sei Whale [34]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In feature area
<a href="#">Balaenoptera edeni</a> Bryde's Whale [35]		Species or species habitat may occur within area	In feature area



Scientific Name	Threatened Category	Presence Text	Buffer Status
<a href="#">Balaenoptera musculus</a> Blue Whale [36]	Endangered	Migration route known	In feature area to occur within area
<a href="#">Balaenoptera physalus</a> Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In feature area
<a href="#">Carcharhinus longimanus</a> Oceanic Whitetip Shark [84108]		Species or species habitat likely to occur within area	In feature area
<a href="#">Carcharodon carcharias</a> White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat known to occur within area	In feature area
<a href="#">Caretta caretta</a> Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area	In feature area
<a href="#">Chelonia mydas</a> Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area	In feature area
<a href="#">Dermochelys coriacea</a> Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known to occur within area	In feature area
<a href="#">Eubalaena australis as Balaena glacialis australis</a> Southern Right Whale [40]	Endangered	Species or species habitat likely to occur within area	In feature area
<a href="#">Isurus oxyrinchus</a> Shortfin Mako, Mako Shark [79073]		Species or species habitat likely to occur within area	In buffer area only
<a href="#">Isurus paucus</a> Longfin Mako [82947]		Species or species habitat likely to occur within area	In buffer area only
<a href="#">Lamna nasus</a> Porbeagle, Mackerel Shark [83288]		Species or species habitat may occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
<a href="#">Megaptera novaeangliae</a> Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area	In feature area
<a href="#">Mobula alfredi as Manta alfredi</a> Reef Manta Ray, Coastal Manta Ray [90033]		Species or species habitat known to occur within area	In feature area
<a href="#">Mobula birostris as Manta birostris</a> Giant Manta Ray [90034]		Species or species habitat likely to occur within area	In feature area
<a href="#">Natator depressus</a> Flatback Turtle [59257]	Vulnerable	Species or species habitat known to occur within area	In feature area
<a href="#">Orcinus orca</a> Killer Whale, Orca [46]		Species or species habitat may occur within area	In feature area
<a href="#">Rhincodon typus</a> Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area	In feature area
<b>Migratory Terrestrial Species</b>			
<a href="#">Motacilla cinerea</a> Grey Wagtail [642]		Species or species habitat may occur within area	In feature area
<b>Migratory Wetlands Species</b>			
<a href="#">Actitis hypoleucos</a> Common Sandpiper [59309]		Species or species habitat known to occur within area	In feature area
<a href="#">Calidris acuminata</a> Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area	In feature area
<a href="#">Calidris canutus</a> Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area	In feature area
<a href="#">Calidris ferruginea</a> Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
<a href="#">Calidris melanotos</a> Pectoral Sandpiper [858]		Species or species habitat may occur within area	In feature area
<a href="#">Charadrius leschenaultii</a> Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat may occur within area	In buffer area only
<a href="#">Limosa lapponica</a> Bar-tailed Godwit [844]		Species or species habitat known to occur within area	In feature area
<a href="#">Numenius madagascariensis</a> Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area	In feature area
<a href="#">Pandion haliaetus</a> Osprey [952]		Breeding known to occur within area	In feature area

## Other Matters Protected by the EPBC Act

Listed Marine Species			[ Resource Information ]
Scientific Name	Threatened Category	Presence Text	Buffer Status
Bird			
<a href="#">Actitis hypoleucos</a> Common Sandpiper [59309]		Species or species habitat known to occur within area	In feature area
<a href="#">Anous stolidus</a> Common Noddy [825]		Species or species habitat likely to occur within area	In feature area
<a href="#">Anous tenuirostris melanops</a> Australian Lesser Noddy [26000]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In feature area
<a href="#">Apus pacificus</a> Fork-tailed Swift [678]		Species or species habitat likely to occur within area overfly marine area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
<a href="#">Ardenna carneipes as Puffinus carneipes</a> Flesh-footed Shearwater, Fleshy-footed Shearwater [82404]		Species or species habitat likely to occur within area	In feature area
<a href="#">Bubulcus ibis as Ardea ibis</a> Cattle Egret [66521]		Species or species habitat may occur within area overfly marine area	In feature area
<a href="#">Calidris acuminata</a> Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area	In feature area
<a href="#">Calidris canutus</a> Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area overfly marine area	In feature area
<a href="#">Calidris ferruginea</a> Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area overfly marine area	In feature area
<a href="#">Calidris melanotos</a> Pectoral Sandpiper [858]		Species or species habitat may occur within area overfly marine area	In feature area
<a href="#">Chalcites osculans as Chrysococcyx osculans</a> Black-eared Cuckoo [83425]		Species or species habitat known to occur within area overfly marine area	In feature area
<a href="#">Charadrius leschenaultii</a> Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat may occur within area	In buffer area only
<a href="#">Diomedea amsterdamensis</a> Amsterdam Albatross [64405]	Endangered	Species or species habitat likely to occur within area	In feature area
<a href="#">Diomedea epomophora</a> Southern Royal Albatross [89221]	Vulnerable	Species or species habitat may occur within area	In buffer area only



Scientific Name	Threatened Category	Presence Text	Buffer Status
<a href="#">Diomedea exulans</a> Wandering Albatross [89223]	Vulnerable	Species or species habitat may occur within area	In feature area
<a href="#">Fregata ariel</a> Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat likely to occur within area	In feature area
<a href="#">Haliaeetus leucogaster</a> White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area	In feature area
<a href="#">Hydroprogne caspia as Sterna caspia</a> Caspian Tern [808]		Foraging, feeding or related behaviour known to occur within area	In feature area
<a href="#">Larus pacificus</a> Pacific Gull [811]		Foraging, feeding or related behaviour known to occur within area	In feature area
<a href="#">Limosa lapponica</a> Bar-tailed Godwit [844]		Species or species habitat known to occur within area	In feature area
<a href="#">Macronectes giganteus</a> Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area	In feature area
<a href="#">Macronectes halli</a> Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area	In feature area
<a href="#">Merops ornatus</a> Rainbow Bee-eater [670]		Species or species habitat may occur within area overfly marine area	In feature area
<a href="#">Motacilla cinerea</a> Grey Wagtail [642]		Species or species habitat may occur within area overfly marine area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
<a href="#">Numenius madagascariensis</a> Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area	In feature area
<a href="#">Onychoprion anaethetus as Sterna anaethetus</a> Bridled Tern [82845]		Foraging, feeding or related behaviour likely to occur within area	In feature area
<a href="#">Pandion haliaetus</a> Osprey [952]		Breeding known to occur within area	In feature area
<a href="#">Pterodroma mollis</a> Soft-plumaged Petrel [1036]	Vulnerable	Species or species habitat may occur within area	In feature area
<a href="#">Puffinus assimilis</a> Little Shearwater [59363]		Foraging, feeding or related behaviour known to occur within area	In feature area
<a href="#">Rostratula australis as Rostratula benghalensis (sensu lato)</a> Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area overfly marine area	In feature area
<a href="#">Stercorarius skua as Catharacta skua</a> Great Skua [823]		Species or species habitat may occur within area	In feature area
<a href="#">Sterna dougallii</a> Roseate Tern [817]		Foraging, feeding or related behaviour likely to occur within area	In buffer area only
<a href="#">Sternula albifrons as Sterna albifrons</a> Little Tern [82849]		Species or species habitat may occur within area	In feature area
<a href="#">Thalassarche carteri</a> Indian Yellow-nosed Albatross [64464]	Vulnerable	Species or species habitat may occur within area	In feature area
<a href="#">Thalassarche cauta</a> Shy Albatross [89224]	Endangered	Species or species habitat may occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
<a href="#">Thalassarche impavida</a> Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area	In feature area
<a href="#">Thalassarche melanophris</a> Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area	In feature area
<a href="#">Thalassarche steadi</a> White-capped Albatross [64462]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In feature area
<b>Fish</b>			
<a href="#">Acentronura australe</a> Southern Pygmy Pipehorse [66185]		Species or species habitat may occur within area	In buffer area only
<a href="#">Campichthys galei</a> Gale's Pipefish [66191]		Species or species habitat may occur within area	In feature area
<a href="#">Choeroichthys suillus</a> Pig-snouted Pipefish [66198]		Species or species habitat may occur within area	In feature area
<a href="#">Festucalex scalaris</a> Ladder Pipefish [66216]		Species or species habitat may occur within area	In feature area
<a href="#">Filicampus tigris</a> Tiger Pipefish [66217]		Species or species habitat may occur within area	In feature area
<a href="#">Halicampus brocki</a> Brock's Pipefish [66219]		Species or species habitat may occur within area	In feature area
<a href="#">Haliichthys taeniophorus</a> Ribbioned Pipehorse, Ribbioned Seadragon [66226]		Species or species habitat may occur within area	In feature area
<a href="#">Hippocampus angustus</a> Western Spiny Seahorse, Narrow-bellied Seahorse [66234]		Species or species habitat may occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
<a href="#">Hippocampus breviceps</a> Short-head Seahorse, Short-snouted Seahorse [66235]		Species or species habitat may occur within area	In buffer area only
<a href="#">Hippocampus histrix</a> Spiny Seahorse, Thorny Seahorse [66236]		Species or species habitat may occur within area	In feature area
<a href="#">Hippocampus planifrons</a> Flat-face Seahorse [66238]		Species or species habitat may occur within area	In feature area
<a href="#">Hippocampus subelongatus</a> West Australian Seahorse [66722]		Species or species habitat may occur within area	In buffer area only
<a href="#">Hippocampus trimaculatus</a> Three-spot Seahorse, Low-crowned Seahorse, Flat-faced Seahorse [66720]		Species or species habitat may occur within area	In feature area
<a href="#">Lissocampus fatiloquus</a> Prophet's Pipefish [66250]		Species or species habitat may occur within area	In feature area
<a href="#">Maroubra perserrata</a> Sawtooth Pipefish [66252]		Species or species habitat may occur within area	In buffer area only
<a href="#">Mitotichthys meraculus</a> Western Crested Pipefish [66259]		Species or species habitat may occur within area	In buffer area only
<a href="#">Nannocampus subosseus</a> Bonyhead Pipefish, Bony-headed Pipefish [66264]		Species or species habitat may occur within area	In feature area
<a href="#">Phycodurus eques</a> Leafy Seadragon [66267]		Species or species habitat may occur within area	In buffer area only
<a href="#">Phyllopteryx taeniolatus</a> Common Seadragon, Weedy Seadragon [66268]		Species or species habitat may occur within area	In buffer area only



Scientific Name	Threatened Category	Presence Text	Buffer Status
<a href="#">Pugnaso curtirostris</a> Pugnose Pipefish, Pug-nosed Pipefish [66269]		Species or species habitat may occur within area	In buffer area only
<a href="#">Solegnathus lettiensis</a> Gunther's Pipehorse, Indonesian Pipefish [66273]		Species or species habitat may occur within area	In feature area
<a href="#">Solenostomus cyanopterus</a> Robust Ghostpipefish, Blue-finned Ghost Pipefish, [66183]		Species or species habitat may occur within area	In feature area
<a href="#">Stigmatopora argus</a> Spotted Pipefish, Gulf Pipefish, Peacock Pipefish [66276]		Species or species habitat may occur within area	In feature area
<a href="#">Stigmatopora nigra</a> Widebody Pipefish, Wide-bodied Pipefish, Black Pipefish [66277]		Species or species habitat may occur within area	In buffer area only
<a href="#">Syngnathoides biaculeatus</a> Double-end Pipehorse, Double-ended Pipehorse, Alligator Pipefish [66279]		Species or species habitat may occur within area	In feature area
<a href="#">Trachyrhamphus bicoarctatus</a> Bentstick Pipefish, Bend Stick Pipefish, Short-tailed Pipefish [66280]		Species or species habitat may occur within area	In feature area
<a href="#">Urocampus carinirostris</a> Hairy Pipefish [66282]		Species or species habitat may occur within area	In buffer area only
<a href="#">Vanacampus margaritifer</a> Mother-of-pearl Pipefish [66283]		Species or species habitat may occur within area	In buffer area only
<b>Mammal</b>			
<a href="#">Arctocephalus forsteri</a> Long-nosed Fur-seal, New Zealand Fur-seal [20]		Species or species habitat may occur within area	In buffer area only
<a href="#">Neophoca cinerea</a> Australian Sea-lion, Australian Sea Lion [22]	Endangered	Species or species habitat may occur within area	In feature area

**Reptile**

Scientific Name	Threatened Category	Presence Text	Buffer Status
<a href="#">Aipysurus foliosquama</a> Leaf-scaled Seasnake [1118]	Critically Endangered	Species or species habitat likely to occur within area	In feature area
<a href="#">Aipysurus laevis</a> Olive Seasnake [1120]		Species or species habitat may occur within area	In buffer area only
<a href="#">Aipysurus pooleorum</a> Shark Bay Seasnake [66061]		Species or species habitat may occur within area	In feature area
<a href="#">Caretta caretta</a> Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area	In feature area
<a href="#">Chelonia mydas</a> Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area	In feature area
<a href="#">Dermochelys coriacea</a> Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known to occur within area	In feature area
<a href="#">Disteira kingii</a> Spectacled Seasnake [1123]		Species or species habitat may occur within area	In feature area
<a href="#">Disteira major</a> Olive-headed Seasnake [1124]		Species or species habitat may occur within area	In feature area
<a href="#">Emydocephalus annulatus</a> Turtle-headed Seasnake [1125]		Species or species habitat may occur within area	In buffer area only
<a href="#">Ephalophis greyi</a> North-western Mangrove Seasnake [1127]		Species or species habitat may occur within area	In buffer area only
<a href="#">Natator depressus</a> Flatback Turtle [59257]	Vulnerable	Species or species habitat known to occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
<a href="#">Pelamis platurus</a> Yellow-bellied Seasnake [1091]		Species or species habitat may occur within area	In feature area
<b>Whales and Other Cetaceans</b>			<a href="#">[ Resource Information ]</a>
Current Scientific Name	Status	Type of Presence	Buffer Status
<b>Mammal</b>			
<a href="#">Balaenoptera acutorostrata</a> Minke Whale [33]		Species or species habitat may occur within area	In feature area
<a href="#">Balaenoptera borealis</a> Sei Whale [34]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In feature area
<a href="#">Balaenoptera edeni</a> Bryde's Whale [35]		Species or species habitat may occur within area	In feature area
<a href="#">Balaenoptera musculus</a> Blue Whale [36]	Endangered	Migration route known to occur within area	In feature area
<a href="#">Balaenoptera physalus</a> Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In feature area
<a href="#">Delphinus delphis</a> Common Dolphin, Short-beaked Common Dolphin [60]		Species or species habitat may occur within area	In feature area
<a href="#">Eubalaena australis</a> Southern Right Whale [40]	Endangered	Species or species habitat likely to occur within area	In feature area
<a href="#">Grampus griseus</a> Risso's Dolphin, Grampus [64]		Species or species habitat may occur within area	In feature area
<a href="#">Megaptera novaeangliae</a> Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area	In feature area

Current Scientific Name	Status	Type of Presence	Buffer Status
<a href="#">Orcinus orca</a> Killer Whale, Orca [46]		Species or species habitat may occur within area	In feature area
<a href="#">Pseudorca crassidens</a> False Killer Whale [48]		Species or species habitat likely to occur within area	In buffer area only
<a href="#">Stenella attenuata</a> Spotted Dolphin, Pantropical Spotted Dolphin [51]		Species or species habitat may occur within area	In feature area
<a href="#">Tursiops aduncus</a> Indian Ocean Bottlenose Dolphin, Spotted Bottlenose Dolphin [68418]		Species or species habitat likely to occur within area	In feature area
<a href="#">Tursiops truncatus s. str.</a> Bottlenose Dolphin [68417]		Species or species habitat may occur within area	In feature area

Australian Marine Parks		<a href="#">[ Resource Information ]</a>	
Park Name		Zone & IUCN Categories	Buffer Status
Abrolhos		Multiple Use Zone (IUCN VI)	In feature area
Abrolhos		Special Purpose Zone (IUCN VI)	In buffer area only

## Extra Information

State and Territory Reserves			<a href="#">[ Resource Information ]</a>
Protected Area Name	Reserve Type	State	Buffer Status
Eurardy	Conservation Reserve	WA	In buffer area only
Kalbarri	National Park	WA	In buffer area only
Kalbarri Blue Holes	Fish Habitat Protection Area	WA	In buffer area only
Nanga Station	NRS Addition - Gazettal in Progress	WA	In buffer area only
Nerren Nerren	NRS Addition - Gazettal in Progress	WA	In feature area
Part Murchison house	NRS Addition - Gazettal in Progress	WA	In feature area
Tamala Pastoral Lease (Part)	NRS Addition - Gazettal in Progress	WA	In buffer area only



Protected Area Name	Reserve Type	State	Buffer Status
Toolonga	Nature Reserve	WA	In buffer area only
Zuytdorp	Nature Reserve	WA	In feature area

### Nationally Important Wetlands [\[ Resource Information \]](#)

Wetland Name	State	Buffer Status
<a href="#">Murchison River (Lower Reaches)</a>	WA	In buffer area only

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

Title of referral	Reference	Referral Outcome	Assessment Status	Buffer Status
<b>Controlled action</b>				
<a href="#">Coburn Mineral Sand Project</a>	2003/1221	Controlled Action	Post-Approval	In buffer area only

### Not controlled action

<a href="#">Hadda 1, Flying Foam 1, Magnat 1 exploration drill</a>	2004/1697	Not Controlled Action	Completed	In buffer area only
<a href="#">Improving rabbit biocontrol: releasing another strain of RHDV, sthrn two thirds of Australia</a>	2015/7522	Not Controlled Action	Completed	In feature area
<a href="#">INDIGO West Submarine Telecommunications Cable, WA</a>	2017/8126	Not Controlled Action	Completed	In buffer area only

### Not controlled action (particular manner)

<a href="#">INDIGO Marine Cable Route Survey (INDIGO)</a>	2017/7996	Not Controlled Action (Particular Manner)	Post-Approval	In buffer area only
<a href="#">Westralia SPAN Marine Seismic Survey, WA &amp; NT</a>	2012/6463	Not Controlled Action (Particular Manner)	Post-Approval	In buffer area only

### Key Ecological Features [\[ Resource Information \]](#)

Key Ecological Features are the parts of the marine ecosystem that are considered to be important for the biodiversity or ecosystem functioning and integrity of the Commonwealth Marine Area.

Name	Region	Buffer Status
<a href="#">Commonwealth marine environment surrounding the Houtman Abrolhos Islands</a>	South-west	In buffer area only
<a href="#">Western rock lobster</a>	South-west	In buffer area only

### Biologically Important Areas

Scientific Name	Behaviour	Presence	Buffer Status
Seabirds			

Scientific Name	Behaviour	Presence	Buffer Status
<a href="#">Anous stolidus</a> Common Noddy [825]	Foraging (provisioning young)	Known to occur	In buffer area only
<a href="#">Ardena pacifica</a> Wedge-tailed Shearwater [84292]	Breeding	Known to occur	In feature area
<a href="#">Ardena pacifica</a> Wedge-tailed Shearwater [84292]	Foraging (in high numbers)	Known to occur	In buffer area only
<a href="#">Hydroprogne caspia</a> Caspian Tern [808]	Foraging (provisioning young)	Known to occur	In buffer area only
<a href="#">Larus pacificus</a> Pacific Gull [811]	Foraging (in high numbers)	Known to occur	In buffer area only
<a href="#">Onychoprion anaethetus</a> Bridled Tern [82845]	Foraging (in high numbers)	Known to occur	In buffer area only
<a href="#">Pelagodroma marina</a> White-faced Storm petrel [1016]	Foraging (in high numbers)	Known to occur	In buffer area only
<a href="#">Puffinus assimilis tunneyi</a> Little Shearwater [59363]	Foraging (in high numbers)	Known to occur	In feature area
<a href="#">Sterna dougallii</a> Roseate Tern [817]	Foraging (provisioning young)	Known to occur	In buffer area only
<a href="#">Sternula nereis</a> Fairy Tern [82949]	Foraging (in high numbers)	Known to occur	In buffer area only
<b>Whales</b>			
<a href="#">Balaenoptera musculus brevicauda</a> Pygmy Blue Whale [81317]	Distribution	Known to occur	In feature area
<a href="#">Balaenoptera musculus brevicauda</a> Pygmy Blue Whale [81317]	Known Foraging Area	Known to occur	In buffer area only

Scientific Name	Behaviour	Presence	Buffer Status
<a href="#">Balaenoptera musculus brevicauda</a> Pygmy Blue Whale [81317]	Migration	Known to occur	In buffer area only
<a href="#">Megaptera novaeangliae</a> Humpback Whale [38]	Migration	Known to occur	In buffer area only
<a href="#">Megaptera novaeangliae</a> Humpback Whale [38]	Migration (north)	Known to occur	In buffer area only
<a href="#">Megaptera novaeangliae</a> Humpback Whale [38]	Migration (north and south)	Known to occur	In feature area

# Caveat

## 1 PURPOSE

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

The report contains the mapped locations of:

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

## 2 DISCLAIMER

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

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

## 3 DATA SOURCES

Threatened ecological communities

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

Threatened, migratory and marine species

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

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

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

## 4 LIMITATIONS

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

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

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

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

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

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

# Acknowledgements

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

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

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



Please feel free to provide feedback via the [Contact Us](#) page.

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Department of Agriculture Water and the Environment

GPO Box 858

Canberra City ACT 2601 Australia

+61 2 6274 1111

# **Appendix D**

**NatureMap results**

# NatureMap Species Report

Created By Guest user on 01/12/2021

**Kingdom** Animalia  
**Current Names Only** Yes  
**Core Datasets Only** Yes  
**Species Group** All Animals  
**Method** 'By Circle'  
**Centre** 114° 11' 32" E, 27° 26' 32" S  
**Buffer** 40km

Name ID	Species Name	Naturalised	Conservation Code	Endemic To Query Area
1.	<i>Abudefduf sordidus</i>			
2.	24559 <i>Acanthagenys rufogularis</i> (Spiny-cheeked Honeyeater)			
3.	<i>Acanthistius pardalotus</i>			
4.	<i>Acanthistius serratus</i>			
5.	24260 <i>Acanthiza apicalis</i> (Broad-tailed Thornbill, Inland Thornbill)			
6.	24261 <i>Acanthiza chrysorrhoa</i> (Yellow-rumped Thornbill)			
7.	24265 <i>Acanthiza uropygialis</i> (Chestnut-rumped Thornbill)			
8.	<i>Acanthopagrus butcheri</i>			
9.	25535 <i>Accipiter cirrocephalus</i> (Collared Sparrowhawk)			
10.	24281 <i>Accipiter cirrocephalus</i> subsp. <i>cirrocephalus</i> (Collared Sparrowhawk)			
11.	25536 <i>Accipiter fasciatus</i> (Brown Goshawk)			
12.	41323 <i>Actitis hypoleucos</i> (Common Sandpiper)		IA	
13.	<i>Alboa worooa</i>			
14.	<i>Aldrichetta forsteri</i>			
15.	<i>Allenichthys glauerti</i>			
16.	<i>Amblyomma triguttatum</i>			
17.	<i>Amniataba caudavittata</i>			
18.	30833 <i>Amphibolurus longirostris</i> (Long-nosed Dragon)			
19.	<i>Aname mainae</i>			
20.	24312 <i>Anas gracilis</i> (Grey Teal)			
21.	24315 <i>Anas rhynchotis</i> (Australasian Shoveler)			
22.	24316 <i>Anas superciliosa</i> (Pacific Black Duck)			
23.	47414 <i>Anhinga novaehollandiae</i> (Australasian Darter)			
24.	25241 <i>Antaresia stimsoni</i> subsp. <i>stimsoni</i> (Stimson's Python)			
25.	24561 <i>Anthochaera carunculata</i> (Red Wattlebird)			
26.	<i>Apogon rueppellii</i>			
27.	24993 <i>Aprasia smithi</i> (Black-tipped Worm-lizard)			
28.	<i>Aprasia</i> sp.			
29.	24285 <i>Aquila audax</i> (Wedge-tailed Eagle)			
30.	<i>Aracana aurita</i>			
31.	<i>Araneus eburneiventris</i>			
32.	<i>Araneus senicaudatus</i>			
33.	41324 <i>Ardea modesta</i> (great egret, white egret)			
34.	24340 <i>Ardea novaehollandiae</i> (White-faced Heron)			
35.	24341 <i>Ardea pacifica</i> (White-necked Heron)			
36.	48573 <i>Ardenna pacifica</i> (Wedge-tailed Shearwater)		IA	
37.	24610 <i>Ardeotis australis</i> (Australian Bustard)			
38.	25736 <i>Arenaria interpres</i> (Ruddy Turnstone)		IA	
39.	41375 <i>Arenophryne xiphorhyncha</i> (Southern Sandhill Frog)			
40.	<i>Argiope protensa</i>			
41.	<i>Argiope trifasciata</i>			
42.	25566 <i>Artamus cinereus</i> (Black-faced Woodswallow)			
43.	24355 <i>Artamus minor</i> (Little Woodswallow)			
44.	24356 <i>Artamus personatus</i> (Masked Woodswallow)			
45.	24357 <i>Artamus superciliosus</i> (White-browed Woodswallow)			
46.	<i>Arthritica semen</i>			
47.	<i>Asadipus phaleratus</i>			
48.	<i>Aulonogyryus strigosus</i>			
49.	<i>Austracantha minax</i>			
50.	<i>Austroepigomphus (Xerogomphus) gordonii</i>			
51.	<i>Austrolabrus maculatus</i>			

Name ID	Species Name	Naturalised	Conservation Code	<sup>1</sup> Endemic To Query Area
52.	24318 <i>Aythya australis</i> (Hardhead)			
53.	<i>Backobourkia collina</i>			
54.	<i>Backobourkia heroine</i>			
55.	<i>Baetidae</i> sp.			
56.	<i>Barbuligobius boehlkei</i>			
57.	<i>Barnardius zonarius</i>			
58.	<i>Batrachomatus wingi</i>			
59.	<i>Bezzia</i> sp. 2 (SAP)			
60.	<i>Bigenditia zuytdorp</i>			
61.	24319 <i>Biziura lobata</i> (Musk Duck)			
62.	<i>Brachionus</i> cf. <i>nilsoni</i> (SAP)			
63.	<i>Brachionus quadridentatus cluniorbicularis</i>			
64.	42381 <i>Brachyurophis semifasciatus</i> (Southern Shovel-nosed Snake)			
65.	24359 <i>Burhinus grallarius</i> (Bush Stone-curlew)			
66.	24725 <i>Cacatua roseicapilla</i> subsp. <i>assimilis</i> (Galah)			
67.	25716 <i>Cacatua sanguinea</i> (Little Corella)			
68.	25598 <i>Cacomantis flabelliformis</i> (Fan-tailed Cuckoo)			
69.	24427 <i>Cacomantis flabelliformis</i> subsp. <i>flabelliformis</i> (Fan-tailed Cuckoo)			
70.	42307 <i>Cacomantis pallidus</i> (Pallid Cuckoo)			
71.	<i>Caenidae</i> sp.			
72.	24269 <i>Calamanthus campestris</i> (Rufous Fieldwren)			
73.	24780 <i>Calidris alba</i> (Sanderling)		IA	
74.	24784 <i>Calidris ferruginea</i> (Curlew Sandpiper)		T	
75.	24788 <i>Calidris ruficollis</i> (Red-necked Stint)		IA	
76.	<i>Callogobius mucosus</i> ?			Y
77.	25717 <i>Calyptorhynchus banksii</i> (Red-tailed Black-Cockatoo)			
78.	24734 <i>Calyptorhynchus latirostris</i> (Carnaby's Cockatoo, White-tailed Short-billed Black Cockatoo)		T	
79.	<i>Candonocypris novaezelandiae</i>			
80.	24253 <i>Capra hircus</i> (Goat)	Y		
81.	<i>Centropogon australis</i>			
82.	<i>Ceratopogonidae</i> sp.			
83.	<i>Cercophonius granulatus</i>			
84.	24564 <i>Certhionyx variegatus</i> (Pied Honeyeater)			
85.	25575 <i>Charadrius leschenaultii</i> (Greater Sand Plover)		T	
86.	25576 <i>Charadrius mongolus</i> (Lesser Sand Plover)		T	
87.	24377 <i>Charadrius ruficapillus</i> (Red-capped Plover)			
88.	<i>Chelmonops curiosus</i>			
89.	24321 <i>Chenonetta jubata</i> (Australian Wood Duck, Wood Duck)			
90.	47909 <i>Cheramoeca leucosterna</i> (White-backed Swallow)			
91.	<i>Chironominae</i> sp.			
92.	<i>Chironomus</i> aff. <i>alternans</i> (V24) (CB)			
93.	<i>Chroicocephalus novaehollandiae</i>			
94.	24431 <i>Chrysococcyx basalis</i> (Horsfield's Bronze Cuckoo)			
95.	24288 <i>Circus approximans</i> (Swamp Harrier)			
96.	24289 <i>Circus assimilis</i> (Spotted Harrier)			
97.	<i>Cladotanytarsus</i> sp. A (SAP)			
98.	<i>Cleidopus gloriamaris</i>			
99.	<i>Cloeon</i> sp.			
100.	<i>Cocotropus</i> ? sp.			Y
101.	<i>Coelopynia pruinosa</i>			
102.	<i>Coenagrionidae</i> sp.			
103.	25675 <i>Colluricincla harmonica</i> (Grey Shrike-thrush)			
104.	24613 <i>Colluricincla harmonica</i> subsp. <i>rufiventris</i> (Grey Shrike-thrush)			
105.	24399 <i>Columba livia</i> (Domestic Pigeon)	Y		
106.	25568 <i>Coracina novaehollandiae</i> (Black-faced Cuckoo-shrike)			
107.	<i>Corbiculidae</i> sp.			
108.	<i>Corduliidae</i> sp.			
109.	<i>Coris auricularis</i>			
110.	<i>Corixidae</i> sp.			
111.	<i>Cormocephalus aurantiipes</i>			
112.	<i>Cormocephalus turneri</i>			
113.	24416 <i>Corvus bennetti</i> (Little Crow)			
114.	25592 <i>Corvus coronoides</i> (Australian Raven)			
115.	24671 <i>Coturnix pectoralis</i> (Stubble Quail)			
116.	24420 <i>Cracticus nigrogularis</i> (Pied Butcherbird)			
117.	25595 <i>Cracticus tibicen</i> (Australian Magpie)			
118.	25596 <i>Cracticus torquatus</i> (Grey Butcherbird)			
119.	<i>Craterocephalus cuneiceps</i>			
120.	25456 <i>Crenadactylus ocellatus</i> (Clawless Gecko)			

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121.	24919 <i>Crenadactylus ocellatus</i> subsp. <i>horni</i> (Clawless Gecko)			
122.	24918 <i>Crenadactylus ocellatus</i> subsp. <i>ocellatus</i> (Clawless Gecko)			
123.	30893 <i>Cryptoblepharus buchananii</i>			
124.	25020 <i>Cryptoblepharus plagiocephalus</i>			
125.	<i>Cryptochironomus griseidorsum</i>			
126.	<i>Cryptoerithus halli</i>			
127.	<i>Cryptoerithus quobba</i>			
128.	30899 <i>Ctenophorus adelaidensis</i> (Southern Heath Dragon, Western Heath Dragon)			
129.	25460 <i>Ctenophorus maculatus</i> (Spotted Military Dragon)			
130.	24881 <i>Ctenophorus maculatus</i> subsp. <i>maculatus</i> (Spotted Military Dragon)			
131.	24882 <i>Ctenophorus nuchalis</i> (Central Netted Dragon)			
132.	24886 <i>Ctenophorus reticulatus</i> (Western Netted Dragon)			
133.	24889 <i>Ctenophorus scutulatus</i> (Lozenge-marked Dragon)			
134.	25027 <i>Ctenotus australis</i>			
135.	25039 <i>Ctenotus fallens</i>			
136.	25065 <i>Ctenotus pantherinus</i> subsp. <i>pantherinus</i> (Leopard Ctenotus)			
137.	25074 <i>Ctenotus schomburgkii</i>			
138.	<i>Culicidae</i> sp.			
139.	<i>Culicoides</i> sp.			
140.	25087 <i>Cyclodomorphus celatus</i> (Western Slender Blue-tongue)			
141.	24322 <i>Cygnus atratus</i> (Black Swan)			
142.	<i>Cypretta baylyi</i>			
143.	<i>Cypricerus</i> sp. 415 'humped' (CB)			
144.	24092 <i>Dasyurus geoffroii</i> (Chuditch, Western Quoll)		T	
145.	24995 <i>Delma australis</i>			
146.	25766 <i>Delma fraseri</i> (Fraser's Legless Lizard)			
147.	24999 <i>Delma grayii</i>			
148.	25004 <i>Delma tincta</i>			
149.	25296 <i>Demansia psammophis</i> subsp. <i>reticulata</i> (Yellow-faced Whipsnake)			
150.	25607 <i>Dicaeum hirundinaceum</i> (Mistletoebird)			
151.	<i>Dicrotendipes jobetus</i>			
152.	<i>Dingosa murata</i>			
153.	<i>Dingosa serrata</i>			
154.	24938 <i>Diplodactylus ornatus</i>			
155.	24940 <i>Diplodactylus pulcher</i>			
156.	<i>Dipulus caecus</i>			
157.	24470 <i>Dromaius novaehollandiae</i> (Emu)			
158.	24650 <i>Drymodes brunneopygia</i> (Southern Scrub-robin)			
159.	<i>Dytiscidae</i> sp.			
160.	<i>Egretta garzetta</i>			
161.	<i>Egretta novaehollandiae</i>			
162.	<i>Elanus axillaris</i>			
163.	<i>Eleotris aurea</i>			Y
164.	47937 <i>Elseiyornis melanops</i> (Black-fronted Dotterel)			
165.	<i>Enigmaepercis reducta</i>			
166.	<i>Enoplosus armatus</i>			
167.	<i>Eolophus roseicapillus</i>			
168.	24651 <i>Eopsaltria australis</i> subsp. <i>griseocularis</i> (Western Yellow Robin)			
169.	<i>Epinephelides armatus</i>			
170.	<i>Epinephelus coioides</i>			
171.	<i>Epinephelus rivulatus</i>			
172.	<i>Epinephelus tauvina</i>			
173.	24567 <i>Epthianura albifrons</i> (White-fronted Chat)			
174.	24570 <i>Epthianura tricolor</i> (Crimson Chat)			
175.	25109 <i>Eremiascincus richardsonii</i> (Broad-banded Sand Swimmer)			
176.	<i>Eriophora biapicata</i>			
177.	<i>Ethmostigmus rubripes</i>			
178.	<i>Euasteron carmarvon</i>			
179.	24368 <i>Eurostopodus argus</i> (Spotted Nightjar)			
180.	<i>Eviota bimaculata</i>			
181.	25621 <i>Falco berigora</i> (Brown Falcon)			
182.	25622 <i>Falco cenchroides</i> (Australian Kestrel, Nankeen Kestrel)			
183.	25623 <i>Falco longipennis</i> (Australian Hobby)			
184.	25624 <i>Falco peregrinus</i> (Peregrine Falcon)		S	
185.	<i>Ferrissia petterdi</i>			
186.	25727 <i>Fulica atra</i> (Eurasian Coot)			
187.	25730 <i>Gallirallus philippensis</i> (Buff-banded Rail)			
188.	24959 <i>Gehyra variegata</i>			
189.	24401 <i>Geopelia cuneata</i> (Diamond Dove)			
190.	25585 <i>Geopelia striata</i> (Zebra Dove)			



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191.	24403 <i>Geopelia striata</i> subsp. <i>placida</i> (Peaceful Dove)			
192.	<i>Gerres subfasciatus</i>			
193.	<i>Gerridae</i> sp.			
194.	25530 <i>Gerygone fusca</i> (Western Gerygone)			
195.	47962 <i>Glyciphila melanops</i> (Tawny-crowned Honeyeater)			
196.	24443 <i>Grallina cyanoleuca</i> (Magpie-lark)			
197.	<i>Gymnothorax woodwardi</i>			
198.	25627 <i>Haematopus fuliginosus</i> (Sooty Oystercatcher)			
199.	24487 <i>Haematopus longirostris</i> (Pied Oystercatcher)			
200.	24293 <i>Haliaeetus leucogaster</i> (White-bellied Sea-Eagle)			
201.	24295 <i>Haliastur sphenurus</i> (Whistling Kite)			
202.	<i>Halicampus brocki</i>			
203.	<i>Halichoeres brownfieldi</i>			
204.	<i>Halophryne ocellatus</i>			
205.	<i>Helcogramma decurrens</i>			
206.	25408 <i>Heleioporus albopunctatus</i> (Western Spotted Frog)			
207.	25412 <i>Heleioporus psammophilus</i> (Sand Frog)			
208.	<i>Hemicordulia tau</i>			
209.	<i>Hemigaleus australiensis</i>			
210.	<i>Heteroclinus</i> sp.			
211.	<i>Heteroclinus whitleyi</i> (ms)			
212.	24961 <i>Heteronotia binoei</i> (Bynoe's Gecko)			
213.	47965 <i>Hieraaetus morphnoides</i> (Little Eagle)			
214.	25734 <i>Himantopus himantopus</i> (Black-winged Stilt)			
215.	24491 <i>Hirundo neoxena</i> (Welcome Swallow)			
216.	<i>Histrio histrio</i>			
217.	<i>Hoggicosa affi</i>			
218.	<i>Hoggicosa castanea</i>			
219.	<i>Hogna crispipes</i>			
220.	<i>Holoplatys fusca</i>			
221.	<i>Hydraenidae</i> sp.			
222.	<i>Hydrochilus lateviridus</i>			
223.	<i>Hydrophilidae</i> sp.			
224.	25366 <i>Hydrophis elegans</i> (Elegant Seasnake, Bar-bellied Seasnake)			
225.	44656 <i>Hydrophis major</i> (Olive-headed seasnake, greater seasnake)			
226.	48587 <i>Hydroprogne caspia</i> (Caspian Tern)		IA	
227.	<i>Hyperlophus vittatus</i>			
228.	<i>Hyphydrus elegans</i>			
229.	<i>Hyporhamphus regularis</i>			
230.	34022 <i>Hypseleotris aurea</i> (Golden Gudgeon)		P2	
231.	<i>Hypseleotris compressa</i>			
232.	<i>Hypseleotris</i> sp.			
233.	<i>Idiommata blackwalli</i>			
234.	33917 <i>Idiosoma nigrum</i> (Shield-backed Trapdoor Spider)		T	
235.	<i>Ilyocypris australiensis</i>			
236.	<i>Indolpium</i> sp.			
237.	<i>Ischnura heterosticta heterosticta</i>			
238.	<i>Isometroides vescu</i>			
239.	<i>Isopedella saundersi</i>			
240.	<i>Istiblennius meleagris</i>			
241.	<i>Kyphosus cornelii</i>			
242.	<i>Laccophilus sharpi</i>			
243.	<i>Lampona cylindrata</i>			
244.	<i>Lamponina scutata</i>			
245.	<i>Larsia albiceps</i>			
246.	24511 <i>Larus novaehollandiae</i> subsp. <i>novaehollandiae</i> (Silver Gull)			
247.	25638 <i>Larus pacificus</i> (Pacific Gull)			
248.	<i>Latrodectus hasseltii</i>			
249.	<i>Leiopotherapon unicolor</i>			
250.	24557 <i>Leipoa ocellata</i> (Malleefowl)		T	
251.	<i>Leptoceridae</i> sp.			
252.	25129 <i>Lerista connivens</i>			
253.	25133 <i>Lerista elegans</i>			
254.	25141 <i>Lerista humphriesi</i> (taper-tailed West Coast slider (Murchison River), skink)		P3	
255.	25144 <i>Lerista kendricki</i>			
256.	25148 <i>Lerista lineopunctulata</i>			
257.	25151 <i>Lerista macropisthopus</i> subsp. <i>fusciceps</i>			
258.	30922 <i>Lerista micra</i>			
259.	25160 <i>Lerista planiventralis</i> subsp. <i>decora</i>			
260.	25165 <i>Lerista praepedita</i>			

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261.	<i>Lethrinus nebulosus</i>			
262.	<i>Lethrinus punctulatus</i>			
263.	<i>Lethrinus</i> sp.			
264.	25005 <i>Lialis burtonis</i>			
265.	<i>Libellulidae</i> sp.			
266.	25661 <i>Lichmera indistincta</i> (Brown Honeyeater)			
267.	24582 <i>Lichmera indistincta</i> subsp. <i>indistincta</i> (Brown Honeyeater)			
268.	25415 <i>Limnodynastes dorsalis</i> (Western Banjo Frog)			
269.	<i>Limnogonus</i> sp.			
270.	30932 <i>Limosa lapponica</i> (Bar-tailed Godwit)		IA	
271.	<i>Liza subviridis</i>			
272.	<i>Longrita zuytdorp</i>			
273.	<i>Lophoicthia isura</i>			
274.	<i>Lotella rhacinus</i>			
275.	42414 <i>Lucasium alboguttatum</i>			
276.	<i>Lycosa australicola</i>			
277.	<i>Lycosa godeffroyi</i>			
278.	<i>Macrogyrus angustatus</i>			
279.	24132 <i>Macropus fuliginosus</i> (Western Grey Kangaroo)			
280.	<i>Mainosa longipes</i>			
281.	25651 <i>Malurus lamberti</i> (Variegated Fairy-wren)			
282.	24544 <i>Malurus lamberti</i> subsp. <i>assimilis</i> (Variegated Fairy-wren)			
283.	25652 <i>Malurus leucopterus</i> (White-winged Fairy-wren)			
284.	24549 <i>Malurus leucopterus</i> subsp. <i>leuconotus</i> (White-winged Fairy-wren)			
285.	24551 <i>Malurus pulcherrimus</i> (Blue-breasted Fairy-wren)			
286.	25654 <i>Malurus splendens</i> (Splendid Fairy-wren)			
287.	24583 <i>Manorina flavigula</i> (Yellow-throated Miner)			
288.	<i>Masasteron sampeyae</i>			
289.	<i>Meedo harveyi</i>			
290.	25758 <i>Megalurus gramineus</i> (Little Grassbird)			
291.	24051 <i>Megaptera novaeangliae</i> (Humpback Whale)		S	
292.	47997 <i>Melanodryas cucullata</i> (Hooded Robin)			
293.	25663 <i>Melithreptus brevirostris</i> (Brown-headed Honeyeater)			
294.	24736 <i>Melopsittacus undulatus</i> (Budgerigar)			
295.	<i>Menemerus bivittatus</i>			
296.	25184 <i>Menetia greyii</i>			
297.	25491 <i>Menetia surda</i>			
298.	25186 <i>Menetia surda</i> subsp. <i>crewellii</i>			
299.	24598 <i>Merops ornatus</i> (Rainbow Bee-eater)			
300.	<i>Mesoveliidae</i> sp.			
301.	<i>Microcanthus strigatus</i>			
302.	<i>Microcarbo melanoleucos</i>			
303.	25693 <i>Microeca fascians</i> (Jacky Winter)			
304.	<i>Microvelia</i> ( <i>Austromicrovelia</i> ) <i>peramoena</i>			
305.	<i>Missulena granulosa</i>			
306.	<i>Mituliodon tarantulinus</i>			
307.	24904 <i>Moloch horridus</i> (Thorny Devil)			
308.	<i>Molycrta vokes</i>			
309.	<i>Monacanthus chinensis</i>			
310.	25191 <i>Morethia lineocellata</i>			
311.	25192 <i>Morethia obscura</i>			
312.	48008 <i>Morus serrator</i> (Australasian Gannet)			
313.	<i>Mugil cephalus</i>			
314.	<i>Muraenichthys</i> sp.			
315.	24223 <i>Mus musculus</i> (House Mouse)	Y		
316.	<i>Myandra bicincta</i>			
317.	25420 <i>Myobatrachus gouldii</i> (Turtle Frog)			
318.	<i>Naididae</i> (ex <i>Tubificidae</i> )			
319.	<i>Neatypus obliquus</i>			
320.	<i>Necterosoma regulare</i>			
321.	25248 <i>Neelaps bimaculatus</i> (Black-naped Snake)			
322.	<i>Nematalosa come</i>			
323.	<i>Nematalosa vlaminghi</i>			
324.	<i>Nematoda</i> sp.			
325.	25425 <i>Neobatrachus kunapalari</i> (Kunapalari Frog)			
326.	25426 <i>Neobatrachus pelobatoides</i> (Humming Frog)			
327.	25428 <i>Neobatrachus wilmorei</i> (Plonking Frog)			
328.	<i>Nephila edulis</i>			
329.	25497 <i>Nephurus levis</i>			
330.	24967 <i>Nephurus levis</i> subsp. <i>levis</i>			

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331.	24968 <i>Nephurus levis</i> subsp. <i>occidentalis</i>			
332.	<i>Nicodamus mainae</i>			
333.	<i>Nitocra near</i> sp. 4 (SAP)			
334.	<i>Notalina spira</i>			
335.	48024 <i>Notamacropus eugenii</i> subsp. <i>derbianus</i> (Tammar Wallaby, Tammar)		P4	
336.	<i>Notolabrus parilus</i>			
337.	24224 <i>Notomys alexis</i> ( <i>Spinifex Hopping-mouse</i> )			
338.	<i>Notonectidae</i> sp.			
339.	25564 <i>Nycticorax caledonicus</i> (Rufous Night Heron)			
340.	24194 <i>Nyctophilus geoffroyi</i> (Lesser Long-eared Bat)			
341.	24742 <i>Nymphicus hollandicus</i> (Cockatiel)			
342.	24497 <i>Oceanites oceanicus</i> (Wilson's Storm-petrel)		IA	
343.	24407 <i>Ocyphaps lophotes</i> (Crested Pigeon)			
344.	<i>Odax acroptilus</i>			
345.	<i>Oecetis</i> sp.			
346.	<i>Oecobius navus</i>			
347.	<i>Orectolobus</i> sp.			
348.	24618 <i>Oreoica gutturalis</i> (Crested Bellbird)			
349.	<i>Orthetrum caledonicum</i>			
350.	<i>Orthoclaadiinae</i> sp.			
351.	25680 <i>Pachycephala rufiventris</i> (Rufous Whistler)			
352.	24624 <i>Pachycephala rufiventris</i> subsp. <i>rufiventris</i> (Rufous Whistler)			
353.	24692 <i>Pachyptila belcheri</i> (Slender-billed Prion)			
354.	48591 <i>Pandion cristatus</i> (Osprey, Eastern Osprey)		IA	
355.	<i>Parablennius postocolomaculatus</i>			
356.	<i>Paracladopelma</i> sp. A (nr M2) (SAP)			
357.	<i>Parapercis haackei</i>			
358.	<i>Paraplotosus albilabris</i>			
359.	<i>Parastenocarididae</i> sp.			
360.	25254 <i>Parasuta monachus</i>			
361.	25682 <i>Pardalotus striatus</i> (Striated Pardalote)			
362.	<i>Parma occidentalis</i>			
363.	<i>Parupeneus spilurus</i>			
364.	<i>Pediana occidentalis</i>			
365.	24648 <i>Pelecanus conspicillatus</i> (Australian Pelican)			
366.	<i>Pemppheris klunzingeri</i>			
367.	48060 <i>Petrochelidon ariel</i> (Fairy Martin)			
368.	48061 <i>Petrochelidon nigricans</i> (Tree Martin)			
369.	24142 <i>Petrogale lateralis</i> subsp. <i>lateralis</i> (Black-flanked Rock-wallaby, Black-footed Rock-wallaby)		T	
370.	24659 <i>Petroica goodenovii</i> (Red-capped Robin)			
371.	<i>Petroscirtes breviceps</i>			
372.	25697 <i>Phalacrocorax carbo</i> (Great Cormorant)			
373.	24667 <i>Phalacrocorax sulcirostris</i> (Little Black Cormorant)			
374.	25699 <i>Phalacrocorax varius</i> (Pied Cormorant)			
375.	24409 <i>Phaps chalcoptera</i> (Common Bronzewing)			
376.	<i>Phryganoporus candidus</i>			
377.	48071 <i>Phylidonyris niger</i> (White-cheeked Honeyeater)			
378.	24841 <i>Platalea flavipes</i> (Yellow-billed Spoonbill)			
379.	<i>Plectorhinchus pictus</i>			
380.	25006 <i>Pletholax gracilis</i> subsp. <i>edelenensis</i> (Keeled Legless Lizard (Shark Bay))		P3	
381.	25007 <i>Pletholax gracilis</i> subsp. <i>gracilis</i> (Keeled Legless Lizard)			
382.	24383 <i>Pluvialis squatarola</i> (Grey Plover)		IA	
383.	25703 <i>Podargus strigoides</i> (Tawny Frogmouth)			
384.	25704 <i>Podiceps cristatus</i> (Great Crested Grebe)			
385.	25510 <i>Pogona minor</i> (Dwarf Bearded Dragon)			
386.	24907 <i>Pogona minor</i> subsp. <i>minor</i> (Dwarf Bearded Dragon)			
387.	24681 <i>Poliocephalus poliocephalus</i> (Hoary-headed Grebe)			
388.	<i>Polypedilum leei</i>			
389.	<i>Polypedilum watsoni</i>			
390.	<i>Pomatomus saltatrix</i>			
391.	24683 <i>Pomatostomus superciliosus</i> (White-browed Babbler)			
392.	<i>Priolepis nuchifasciata</i>			
393.	<i>Procladius paludicola</i>			
394.	<i>Prodidomus woodleigh</i>			
395.	<i>Protonibea</i> sp.			Y
396.	25261 <i>Pseudechis australis</i> (Mulga Snake)			
397.	<i>Pseudochromis wilsoni</i>			
398.	<i>Pseudogobius olorum</i>			
399.	<i>Pseudolampona boree</i>			

Name ID	Species Name	Naturalised	Conservation Code	<sup>1</sup> Endemic To Query Area
400.	24230 <i>Pseudomys albocinereus</i> (Ash-grey Mouse)			
401.	24237 <i>Pseudomys hermannsburgensis</i> (Sandy Inland Mouse)			
402.	42416 <i>Pseudonaja mengdeni</i> (Western Brown Snake)			
403.	25263 <i>Pseudonaja modesta</i> (Ringed Brown Snake)			
404.	25433 <i>Pseudophryne guentheri</i> (Crawling Toadlet)			
405.	<i>Pseudophryne</i> sp.			
406.	<i>Pseudorhombus jenynsii</i>			
407.	24390 <i>Psophodes occidentalis</i> (Western Wedgebill, Chiming Wedgebill)			
408.	<i>Pteragogus enneacanthus</i>			
409.	24173 <i>Pteropus scapulatus</i> (Little Red Flying-fox)			
410.	42344 <i>Purnella albifrons</i> (White-fronted Honeyeater)			
411.	25008 <i>Pygopus lepidopodus</i> (Common Scaly Foot)			
412.	25009 <i>Pygopus nigriceps</i>			
413.	24278 <i>Pyrrholaemus brunneus</i> (Redthroat)			
414.	<i>Rachycentron canadum</i>			
415.	<i>Radfordia notomys</i>			
416.	24245 <i>Rattus rattus</i> (Black Rat)	Y		
417.	24776 <i>Recurvirostra novaehollandiae</i> (Red-necked Avocet)			
418.	<i>Rhabdosargus sarba</i>			
419.	48096 <i>Rhipidura albiscapa</i> (Grey Fantail)			
420.	25614 <i>Rhipidura leucophrys</i> (Willie Wagtail)			
421.	<i>Scirtidae</i> sp.			
422.	<i>Scobinichthys granulatus</i>			
423.	<i>Scolopendra laeta</i>			
424.	<i>Scolopendra morsitans</i>			
425.	<i>Scorpaena gasta</i>			
426.	<i>Scorpaenodes steenei</i>			
427.	25534 <i>Sericornis frontalis</i> (White-browed Scrubwren)			
428.	24280 <i>Sericornis frontalis</i> subsp. <i>balstoni</i> (White-browed Scrubwren)			
429.	24279 <i>Sericornis frontalis</i> subsp. <i>maculatus</i> (White-browed Scrubwren)			
430.	<i>Serpulidae</i> sp.			Y
431.	<i>Siganus</i> sp.			
432.	<i>Sillago schomburgkii</i>			
433.	<i>Sillago</i> sp.			
434.	25266 <i>Simoselaps bertholdi</i> (Jan's Banded Snake)			
435.	25267 <i>Simoselaps littoralis</i> (West Coast Banded Snake)			
436.	<i>Simuliidae</i> sp.			
437.	30948 <i>Smicornis brevirostris</i> (Weebill)			
438.	24108 <i>Sminthopsis crassicaudata</i> (Fat-tailed Dunnart)			
439.	24109 <i>Sminthopsis dolichura</i> (Little long-tailed Dunnart)			
440.	24112 <i>Sminthopsis granulipes</i> (White-tailed Dunnart)			
441.	24114 <i>Sminthopsis hirtipes</i> (Hairy-footed Dunnart)			
442.	<i>Solegnathus lettiensis</i>			
443.	<i>Spinasteron westi</i>			
444.	<i>Staphylinidae</i> sp.			
445.	<i>Stenochironomus</i> sp.			
446.	48594 <i>Sternula nereis</i> (Fairy Tern)			
447.	<i>Storena formosa</i>			
448.	25590 <i>Streptopelia senegalensis</i> (Laughing Turtle-Dove)	Y		
449.	25518 <i>Strophurus spinigerus</i>			
450.	24942 <i>Strophurus spinigerus</i> subsp. <i>spinigerus</i>			
451.	24946 <i>Strophurus strophurus</i>			
452.	24259 <i>Sus scrofa</i> (Pig)	Y		
453.	<i>Synchiropus</i> sp.			
454.	33992 <i>Synemon gratiosa</i> (Graceful Sunmoth)		P4	
455.	<i>Tabanidae</i> sp.			
456.	25705 <i>Tachybaptus novaehollandiae</i> (Australasian Grebe, Black-throated Grebe)			
457.	24331 <i>Tadorna tadornoides</i> (Australian Shelduck, Mountain Duck)			
458.	30870 <i>Taeniopygia guttata</i> (Zebra Finch)			
459.	<i>Tanypodinae</i> sp.			
460.	<i>Tanytarsus fuscithorax/semibarbitarsus</i>			
461.	24167 <i>Tarsipes rostratus</i> (Honey Possum, Noolbenger)			
462.	<i>Tasmanicosa leuckartii</i>			
463.	<i>Tasmanocoenis tillyardi</i>			
464.	<i>Tetragnatha nitens</i>			
465.	48597 <i>Thalasseus bergii</i> (Crested Tern)		IA	
466.	<i>Thalassoma septemfasciata</i>			
467.	<i>Thereuopoda lesueurii</i>			
468.	<i>Thiaridae</i> sp.			
469.	24845 <i>Threskiornis spinicollis</i> (Straw-necked Ibis)			

Name ID	Species Name	Naturalised	Conservation Code	<sup>1</sup> Endemic To Query Area
470.	25203 <i>Tiliqua occipitalis</i> (Western Bluetongue)			
471.	25207 <i>Tiliqua rugosa subsp. rugosa</i>			
472.	<i>Tipulidae sp.</i>			
473.	25549 <i>Todiramphus sanctus</i> (Sacred Kingfisher)			
474.	<i>Trachichthys australis</i>			
475.	<i>Triaenodes sp. P1=P2</i> (PSW)			
476.	<i>Trichocyclus nigropunctatus</i>			
477.	<i>Trichonotus sp.</i>			
478.	24803 <i>Tringa brevipes</i> (Grey-tailed Tattler)		P4	
479.	24808 <i>Tringa nebularia</i> (Common Greenshank, greenshank)		IA	
480.	<i>Triplectides australis</i>			
481.	24983 <i>Underwoodisaurus milii</i> (Barking Gecko)			
482.	<i>Upeneichthys stotti</i>			
483.	<i>Urodacus hartmeyerii</i>			
484.	<i>Urodacus mckenziei</i>			
485.	<i>Urolophus sp.</i>			
486.	24386 <i>Vanellus tricolor</i> (Banded Lapwing)			
487.	25212 <i>Varanus eremius</i> (Pygmy Desert Monitor)			
488.	25218 <i>Varanus gouldii</i> (Bungarra or Sand Monitor)			
489.	25526 <i>Varanus tristis</i> (Racehorse Monitor)			
490.	<i>Venator immansueta</i>			
491.	<i>Venator koyuga</i>			
492.	<i>Venatrix arenaris</i>			
493.	24205 <i>Vespadelus finlaysoni</i> (Finlayson's Cave Bat)			
494.	<i>Xanthagrimon erythroneurum</i>			
495.	<i>Zephyrichthys barryi</i>			
496.	25765 <i>Zosterops lateralis</i> (Grey-breasted White-eye, Silvereye)			

**Conservation Codes**

T - Rare or likely to become extinct  
X - Presumed extinct  
IA - Protected under international agreement  
S - Other specially protected fauna  
1 - Priority 1  
2 - Priority 2  
3 - Priority 3  
4 - Priority 4  
5 - Priority 5

<sup>1</sup> For NatureMap's purposes, species flagged as endemic are those whose records are wholly contained within the search area. Note that only those records complying with the search criterion are included in the calculation. For example, if you limit records to those from a specific datasource, only records from that datasource are used to determine if a species is restricted to the query area.



