Yara Pilbara Fertilisers Pty Ltd

Ammonia Plant, Murujuga (Burrup Peninsula), Renewable Hydrogen Project

Section 38 Referral Supporting Report

July 2020

This report has been prepared by GHD Pty Ltd (GHD) for Yara Pilbara Fertilisers Pty Ltd and may only be used and relied on by Yara Pilbara Fertilisers Pty Ltd for the purpose agreed between GHD and Yara as set out in Section 1 of this report.

GHD otherwise disclaims responsibility to any person other than Yara Pilbara Fertilisers Pty Ltd 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 from any of the assumptions being incorrect.

Executive summary

Yara Pilbara Fertilisers Pty Ltd (YPF) and ENGIE are proposing to develop a Renewable Hydrogen Plant (the Proposal). The Proposal will be located adjacent to the existing YPF Plant within the Burrup Strategic Industrial Area (SIA), in the Pilbara region of Western Australia (WA).

The Proposal involves the construction and operation of a Renewable Hydrogen Plant and associated infrastructure, including a dedicated solar photovoltaic (PV) farm, electrolyser and its balance of plant, and supporting infrastructure, including site tracks. The Renewable Hydrogen Plant will provide a feed source for the existing YPF Ammonia Plant for the production of 'green ammonia'. This Proposal forms the commercial demonstration (Phase 0) of a longer term, larger scale renewable hydrogen project. The PV farm will have the production capacity of approximately 18 megawatt (MW) peak to facilitate the production of approximately 640 tonnes of renewable hydrogen per annum, and will incorporate a 10 MW electrolyser.

The Proposal will involve modification to Ministerial Statement (Statement 586) granted under the *Environmental Protection Act 1986* (EP Act).

The Proposal will be located within the existing Development Envelope established under Statement 586; however, the Proposal will have a discrete Proposal Footprint. The Renewable Hydrogen Plant footprint will be approximately 24.78 hectares (ha) which includes the solar PV panels, hydrogen electrolyser, and associated infrastructure.

The Proposal will support decarbonisation on Murujuga (Burrup Peninsula) and support the developing 'green hydrogen' market whilst maintaining the production of ammonia at the YPF Plant. It is expected to promote economic growth in the region and result in employment opportunities for the local population in both the construction and operational phase, including the opportunity to work together with the local Aboriginal traditional owner groups to develop commercial, employment and training opportunities.

Table ES1 presents a summary of the Proposal details and key characteristics.

YPF is referring the Proposal to the WA Environmental Protection Authority (EPA) under section 38 of the EP Act. An assessment of the Proposal against the EPA's Statement of Environmental Principles, Factors and Objectives (EPA 2020b), considers the Proposal may potentially impact the following key factors: Flora and Vegetation, Terrestrial Fauna, and Social Surroundings. This document provides information on the Proposal characteristics and activities, key stakeholders, potential environmental impacts, and proposed mitigation measures associated with the construction and operation of the Proposal.

This Proposal is also being referred to the Department of Agriculture, Water and the Environment (DAWE) due to the presence of protected fauna species (e.g. Pilbara Olive Python) listed fauna under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

A summary of potential environmental impacts, impact assessment, proposed management strategies and predicted environmental outcomes for each of the preliminary key environmental factors addressed in this Document is provided in Table ES2.

The impact assessment for the Renewable Hydrogen Plant indicates the impact of the Proposal could be managed under Part V of the EP Act.

Table ES1 Key proposal characteristics of the Proposal

Summary of the Proposal				
Proposal title	Ammonia Plant, Murujuga (Burrup Peninsula)			
Proponent name	Yara Pilbara Fertilisers Pty Ltd			
Short description	The proposal is to produce liquid ammonia from natural gas using advanced production technology on a site located within the King Bay-Hearson Cove Industrial Area on Murujuga (Burrup Peninsula), approximately 11 km north-west of Karratha in the Pilbara region. **The Proposal includes the construction and operation of a Renewable Hydrogen Plant, dedicated solar PV plant and associated infrastructure, to partially substitute the use of natural gas to feed the existing YPF Ammonia Plant,** located within the King Bay-Hearson Cove Industrial Area on Murujuga (Burrup Peninsula), approximately 11 km north-west of Karratha in the Pilbara region**.**				
Element	**Location**	**Approved extent (existing project under Statement 586)**	**Proposed change (this Proposal)**	**Proposed extent (revised Proposal)**
Physical Elements				
• Ammonia plant • Laydown area • Desalination plant • Access road and product pipeline to plant • **PV solar plant, hydrogen production plant, site tracks, and associated infrastructure**	Figure 1-2	Clearing of no more than 29 ha within 73 ha Development Envelope	**Increase in disturbance of 24.78 ha for a Renewable Hydrogen Plant**	Clearing of no more than **53.78** within 73 ha Development Envelope
Operational Elements				
Ammonia Plant capacity		Up to 2,600 t/day of ammonia		No change
Oxygen emissions			**Approximately 14,400 kg/day**	**Approximately 14,400 kg/day**

Table ES2 Summary of environmental impact assessment of preliminary key environmental factors

Flora and vegetation	
EPA objective	*To protect flora and vegetation so that biological diversity and ecological integrity are maintained.*
Policy and guidance	• Environmental Factor Guideline: Flora and Vegetation (EPA 2016a) • Technical Guidance: Flora and Vegetation Surveys for Environmental Impact Assessment (EPA 2016b)
Potential impacts	• Loss of vegetation and flora through clearing, including significant flora • Introduction and spread of environmental weeds • Fragmentation of native vegetation • Reduction in vegetation health as a result of dust generation during construction • Changes to vegetation structure and floristic composition in surrounding/adjacent areas through altered surface water drainage patterns and flows • Alteration of fire regimes
Mitigation	**Avoid** • Proposal Footprint designed to avoid impacts to significant vegetation and reduce disturbance to Priority flora • Ensure personnel and contractors are aware of the location of significant flora and vegetation on site and their responsibility to ensure they are protected **Minimise** • Minimise vegetation clearing through site selection and layout • Develop and implement ground disturbance procedures for clearing within the Development Envelope • Vehicles and equipment access limited to designated roads/access tracks and cleared areas • Undertake a weed monitoring program to minimise existing weed populations and reduce the potential spread into adjacent land • Proposal site induction to include information on prevention and management of fires • All machinery and vehicles undertaking clearing activities will be fitted with firefighting equipment • Proposal clearing activities will have integrated communications with YPF Pilbara Security, and have immediate access to their firefighting assets
Outcomes	**Predicted outcome** Implementation of the Proposal will result in the loss of 23.04 ha native vegetation and two individuals of *Terminalia supranitifolia* (Priority 3). Given the extent of locally and regionally located high quality vegetation, and the implementation of flora and vegetation mitigation measures, it is considered that the construction and operation of the Proposal are unlikely to have a significant effect or long term impact on flora and vegetation. As the implementation of the Proposal is not assessed to have any significant residual impacts to Flora and Vegetation, it is considered that the Proposal meets the EPA objective for this factor such that the biological diversity and ecological integrity of flora and vegetation are maintained.

Terrestrial Fauna	
EPA objective	*To protect terrestrial fauna so that biological diversity and ecological integrity are maintained.*
Policy and guidance	• Statement of Environmental Principles, Factors and Objectives (EPA 2018b) • Environmental Factor Guideline: Terrestrial Fauna (EPA 2016c) • EPA Technical Guidance –Terrestrial Fauna Surveys, Perth, Environmental Protection Authority (EPA 2016d) • EPA Technical Guidance – Sampling methods for terrestrial vertebrate fauna, Perth, Environmental Protection Authority (EPA 2016e) • Survey Guidelines for Australia's Threatened Bats (Department of the Environment, Water, Heritage and the Arts 2010a) • Survey Guidelines for Australia's Threatened Mammals (Department of the Environment, Water, Heritage and the Arts 2010b) • Survey Guidelines for Australia's Threatened Reptiles (Department of the Environment, Water, Heritage and the Arts 2010c)
Potential impacts	• Loss of fauna habitat including habitat for conservation significant fauna through vegetation clearing • Injury and/or death of fauna as a result of vehicle strike • Habitat fragmentation • Temporary increase in noise and vibration during construction and operations
Mitigation	**Avoid** • Proposal Footprint designed to reduce disturbance to fauna habitats and conservation significant fauna **Minimise** • Personnel and contractors to be provided with appropriate training to ensure conservation significant fauna and associated habitat are protected • If native fauna is disturbed during clearing it will be allowed to make its own way to adjacent vegetated areas • Should trenches be constructed, which native fauna are unable to escape from, they will be inspected by a “fauna spotter” on a regular basis (commencement of day shift, midday and prior to sunset). If trenches are left open overnight, ramps will be established to permit native fauna to escape • Any native fauna injured as a result of the Proposal construction or operation will be taken to a designated veterinary clinic or a DBCA nominated wildlife carer • Dust, noise and vibration management measures will be implemented during construction and operation
Outcomes	Implementation of the Proposal will result in the loss of 23.09 ha fauna habitat including conservation significant fauna habitat. The habitat types identified within the Proposal Footprint forms part of similar habitats within the local area and greater Murujuga. The ecological linkages connecting the surrounding hills and coast through drainage lines, floodplains and vegetation is sufficient to maintain a contiguous fauna habitat. By implementing fauna management measures, it is considered that construction and operations phases of the Proposal are unlikely to have a significant or long-term impact on terrestrial fauna values

	As the implementation of the Proposal is not assessed to have any significant residual impacts to terrestrial fauna, it is considered that the Proposal meets the EPA objective for this factor such that the biological diversity and ecological integrity of terrestrial fauna are maintained
Social Surroundings	
EPA Objective	*To protect social surroundings from significant harm.*
Policy and guidance	• Environmental Factor Guideline – Social surroundings (EPA 2016f)
Potential impacts	• Potential to indirectly impact known Heritage Sites and areas within the National Heritage Place as a result of blasting debris, vibration and dust deposition from ground preparation works during construction. • Construction of the Proposal has the potential to impact upon the amenity (visual and noise) of the Murujuga (Burrup Peninsula).
Mitigation	**Avoid** • Proposal Footprint designed to avoid impacts on all known Heritage Sites and the areas within the National Heritage Place **Minimise** • Ensure a minimum 10 m buffer is established around each of the heritage sites throughout construction and operation phases • Engage Aboriginal monitors for initial earthworks to manage Aboriginal heritage values of the sites and the land • Partner with Murujuga Aboriginal Corporation (MAC) Rangers to monitor the heritage places to enable knowledge transfer to occur and ensure the heritage values are protected for future generations • Continue to engage with MAC to ensure heritage values are managed • Ensure visual amenity is maximised by colouring buildings to blend into the surrounding terrain, where possible • A glint and glare assessment to ensure there is limited glare towards a road user, YPF, Hearson Cove or Karratha airport • Construction works will be undertaken in accordance with the Environmental Protection (Noise) Regulations 1997 and an out of hours Noise Management Plan will be developed and approved by the City of Karratha as required • Vehicles and equipment access limited to designated roads/access tracks and cleared areas • Dust suppression, including use of water carts to be implemented during construction activities in proximity to National Heritage Place as required
Outcomes	The Proposal will not directly or indirectly impact Aboriginal heritage sites within the Proposal Footprint. Heritage sites will be avoided and minimisation strategies have been adopted to mitigate the risk of identified activities potentially impacting the sites. As the implementation of the Proposal is not assessed to have any significant residual impacts to Social Surroundings, it is considered that the Proposal meets the EPA objective for this factor such that the cultural, heritage and amenity values will be maintained.

Table of contents

Table index

Figure index

Appendices

Acronyms

Abbreviation	Definition
ASS	Acid Sulfate Soil
BC Act	*Biodiversity Conservation Act 2016*
BoM	Bureau of Meteorology
DAWE	Department of Agriculture, Water and the Environment
DBCA	Department of Biodiversity, Conservation and Attractions
DBH	Diameter at breast height
DEWHA	Department of the Environment, Water, Heritage and the Arts (now DAWE)
DMA	Decision-making authority
DoE	Department of the Environment (now DAWE)
DoEE	Department of the Environment and Energy (now DAWE)
DPIRD	Department of Primary Industries and Regional Development
DPLH	Department of Planning, Lands and Heritage
DWER	Department of Water and Environmental Regulation
EIA	Environmental impact assessment
EPA	Environmental Impact Authority
EP Act	*Environmental Protection Act 1986*
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
ERD	Environmental Review Document
ESA	Environmentally Sensitive Area
IBRA	Interim Biogeographic Regionalisation of Australia
MAC	Murujuga Aboriginal Corporation
MCA	Multi-criteria analysis
MNES	Matters of National Environmental Significance
PEC	Priority Ecological Community
PV	Photovoltaic
SIA	Strategic Industrial Area
TSSC	Threatened Species Scientific Committee
TEC	Threatened Ecological Community
WoNS	Weeds of National Significance
YPF	Yara Pilbara Fertilisers Pty Ltd

1. Introduction

1.1 Purpose of this document

Yara Pilbara Fertilisers Pty Ltd (YPF) and ENGIE are proposing to develop a Renewable Hydrogen Plant (the Proposal). The Proposal, including associated infrastructure, will be located adjacent to the existing YPF Plant within the Burrup Strategic Industrial Area (SIA), in the Pilbara region of Western Australia (WA). The Proposal will provide a feed source for the existing YPF Plant on the Murujuga (Burrup Peninsula) to produce green ammonia.

This document has been prepared to support the referral of the Proposal under s 38 of the *Environmental Protection Act 1986* (EP Act). This document has been prepared in accordance with the Environmental Protection Authority (EPA) *Instructions on how to prepare an Environmental Review Document* (EPA 2020a). This Environmental Review Document (ERD) provides information on the Proposal characteristics and activities, key stakeholders, potential environmental impacts and proposed mitigation measures associated with the construction and operation of the Proposal.

1.2 Proposal description

The Proposal includes the construction and operation of a Renewable Hydrogen Plant and associated infrastructure, including a dedicated solar photovoltaic (PV) farm, electrolyser and its balance of plant, and supporting infrastructure, including site tracks. The Proposal forms the commercial demonstration (Phase 0) of a longer term, larger scale renewable hydrogen project. Phase 0 focuses on using solar energy (from the PV farm) to generate hydrogen (an electrolysis plant), which is fed into the existing YPF Plant to make ammonia.

The PV farm will have the production capacity of 18 Megawatt (MW) peak to facilitate the production of approximately 640 tonnes of renewable hydrogen per annum. The Proposal is described in detail in Section 2.

1.3 Proponent

1.3.1 Proponent background

The Proposal is being developed in a partnership between Yara and ENGIE.

Yara is one of the world's leading fertiliser companies, with an integrated business model and a worldwide presence of around 17,000 employees and operations in over 60 countries. The existing YPF plant is one of the largest ammonia production facilities in the world, producing 850,000 tonnes a year of ammonia and supplying approximately 5 per cent of the traded ammonia in the global market. Ammonia is exported to domestic and global customers from the nearby port of Dampier. The existing plant currently relies completely on natural gas for its hydrogen supply to produce ammonia.

ENGIE is the largest independent power producer in the world, operating in over 70 countries on five continents with more than 160,000 employees worldwide. ENGIE's purpose ("raison d'être") is to act to accelerate the transition towards a carbon-neutral economy, through reduced energy consumption and more environmentally-friendly solutions. This purpose brings together the company, its employees, its clients and its shareholders, and reconciles economic performance with a positive impact on people and the planet. ENGIE's assesses its actions in their entirety and over time.

ENGIE's global energy and services focus on:

- Low-carbon electricity generation: including design, build and operation of power generating plants that produce energy from natural gas and renewables, accompanied by low CO_2 emissions
- Energy infrastructure: including design, build and operation of major gas and electricity assets to supply energy

1.3.2 Proponent details

As the Proposal is being developed within the existing YPF Development Envelope, established under Ministerial Statement 586 (Statement 586), the Proponent for the purposes of the Part IV approval process is Yara Pilbara Fertilisers Pty Ltd.

Contact details for the Proponent are:

Contact: Luke Blackbourn

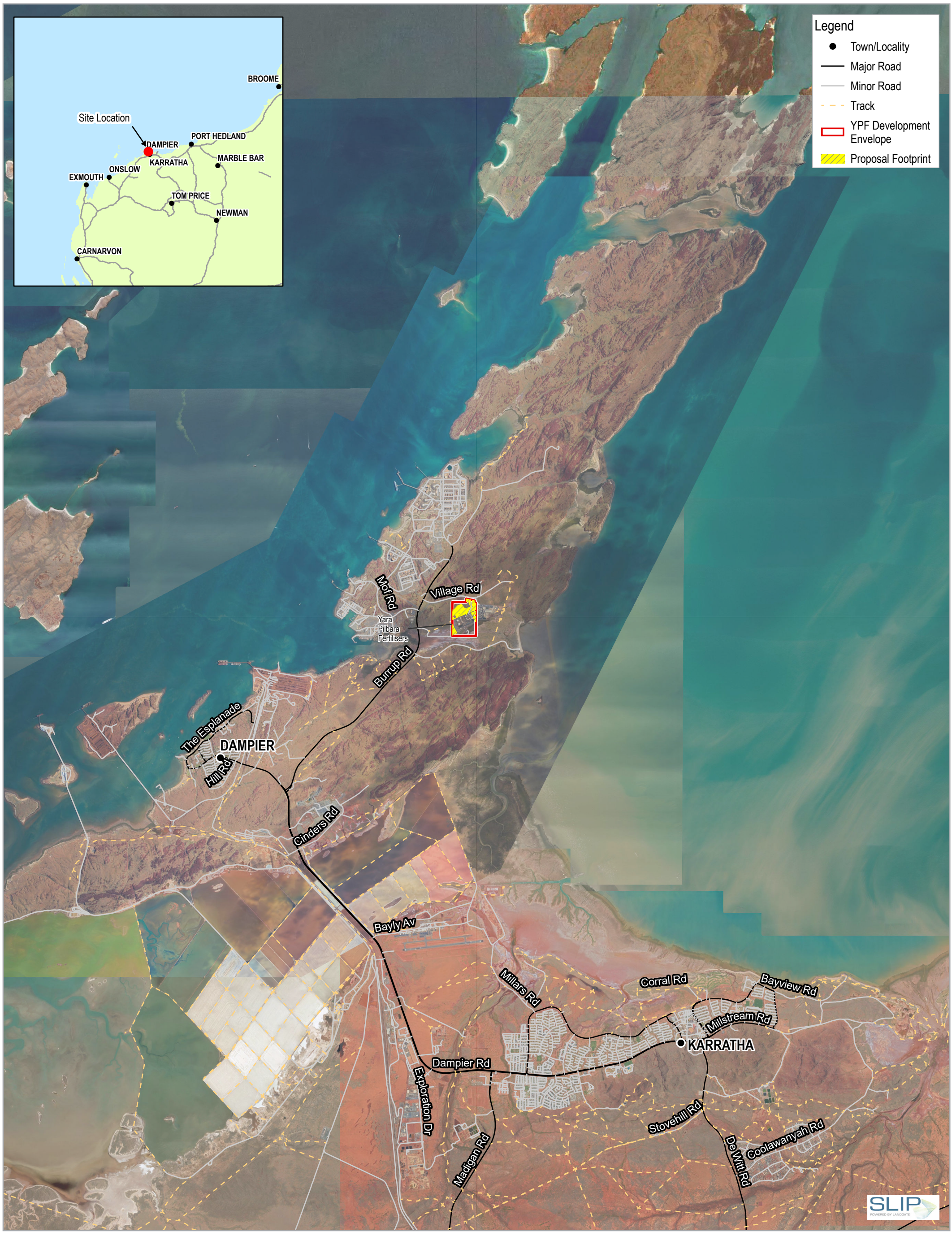
ABN: 74 095 441 151

Address: Level 5, 182 St Georges Terrace, Perth, WA 6000

1.4 Location of the Proposal

The Proposal will be located adjacent to the existing YPF Plant on the Murujuga (Burrup Peninsula), approximately 11 km north-west of Karratha in the Pilbara region of the north-west of WA (Figure 1-1).

The Renewable Hydrogen Plant Footprint (also referred to as the Proposal Footprint) (Figure 1-2) is approximately 24.78 ha and lies completely within the existing YPF Development Envelope.



Paper Size ISO A3

0 0.5 1 1.5 2

Kilometres

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

N

GHD

Yara Pilbara Fertilisers Pty Ltd
Renewable Hydrogen Project

Proposal Location

Project No. **12520684**
Revision No. **1**
Date **16/07/2020**

FIGURE 1-1

G:\61\12520684\GIS\Maps\Working\12520684_Section38ReferralSupportingReport\12520684_Section38.aprx\12520684_1-1_ProposalLocation_Rev
Print date: 16 Jul 2020 - 14:15

Data source: GHD: YPF Development Envelope, Proposal Footprint, Disturbance Footprint - 20200624; DBCA: Legislated Lands and Water - 20190301; Landgate: Roads - 20190128, Cadastre - 20200207, Locality - 20191127, Landgate_Subscription_Imagery\WANow: Landgate / SLIP. Created by: bmorgan

Paper Size ISO A3

0 25 50 75 100

Meters

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

N

GHD

Yara Pilbara Fertilisers Pty Ltd
Renewable Hydrogen Project

Proposal Footprint

Project No. **12520684**
Revision No. **2**
Date **20/07/2020**

FIGURE 1-2

G:\61\12520684\GIS\Maps\Working\12520684_Section38ReferralSupportingReport\12520684_Section38.aprx\12520684_1-2_ProposalFootprint_Rev
Print date: 20 Jul 2020 - 14:58

Data source: GHD: YPF Development Envelope, Disturbance Footprint - 20200624, Proposal Footprint - 20200709; Landgate: Roads - 20190128, Cadastre - 20200207, WMS: . Created by: bmorgan

1.5 Legislative framework

1.5.1 *Environmental Protection Act 1986*, Part IV Environmental Impact Assessment

The EP Act is the primary legislation governing Environmental Impact Assessment (EIA) in WA. Part IV of the EP Act relates to Environmental Impact Assessment, which is carried out in accordance with the EPA Administrative Procedures (2016). This ERD has been prepared to support referral of the Proposal under s 38 under Part IV of the EP Act.

In accordance with s 3.1.3 of the Environmental Impact Assessment (Part IV Divisions 1 and 2) Administrative Procedures 2016, this ERD has been prepared with the intent to provide the EPA sufficient information regarding the potential environmental impacts to enable assessment of the Proposal.

1.5.2 Environment Protection and Biodiversity Conservation Act 1999

The Australian Government *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) covers the assessment of proposals which may have a significant impact on Matters of National Environmental Significance (MNES). A Proposal may be deemed a 'Controlled Action' under the EPBC Act if it impacts on MNES.

This Proposal is being referred to the Department of Agriculture, Water and the Environment (DAWE) due to the presence of protected fauna species listed under the EPBC Act. Relevant MNES to the Proposal are discussed in Section 10. The referral to DAWE concludes that with the avoidance of heritage areas and habitat for species protected under the EPBC Act, the Proposal will not have a significant impact on MNES.

1.6 Other approvals and regulation

1.6.1 Land tenure and zoning

The Proposal will be undertaken on land leased by YPF from the Western Australian Land Authority (DevelopmentWA). The Development Envelope lies on freehold land and is within the Burrup SIA, which is zoned for 'Strategic Industry' under the City of Karratha Local Planning Scheme No. 8 (Figure 1-3).

1.6.2 Land tenure and Native Title

Native Title recognises the traditional rights and interests to land and waters of Aboriginal and Torres Strait Islander people.

In January 2000, the State of Western Australia notified its intention to acquire land for the construction of heavy industrial estates on the Murujuga and adjacent Maitland area, along with any native title rights and interests that the native title parties may have had. At that time there were three registered native title claims covering the proposed acquisition area; the Ngarluma Yindjibarndi, the Yaburara Mardudhunera and the Wong-Goo-Tt-Oo. Being registered native title claimants these groups had the right, under the *Native Title Act 1993* (Commonwealth), to negotiate with the Western Australian Government.

The Burrup and Maitland Industrial Estates Agreement (BMIEA) was made between the State of Western Australia, the Western Australian Land Authority and native title parties being the Wong-Goo-Tt-Oo, Ngarluma Yindjibarndi and Yaburara Mardudhunera peoples.

The BMIEA provides that in exchange for the native title parties' agreement to the surrender and permanent extinguishment of native title on the Burrup and Maitland Estates industrial land and

the land required by the State for residential and commercial purposes in Karratha, the native title parties receive a number of benefits.

In 2006, Murujuga Aboriginal Corporation (MAC) was incorporated as the approved Corporate Body to administer the contractual obligations of the BMIEA.

1.6.3 Summary approvals and decision making authorities

Table 1-1 presents a summary of the relevant approvals and Decision Making Authorities (DMAs) for the Proposal, including additional relevant state legislation and regulations which are guided by key over-arching Government policies and strategies.

Table 1-1 Summary of regulatory approval requirements for the Proposal

Proposal activity	Type of approval	Decision Making Authority / Regulatory Agency	Legislation regulating the activity
Impacts to the environment including native vegetation clearing	Referral of a Proposal to the State – approval type to be determined if the Proposal is assessed	Environmental Protection Authority (EPA) (WA)	EP Act 1986, Part IV
Impact to Matters of National Environmental Significance	Referral of a Proposal – approval type to be determined if the Proposal is deemed a controlled action	Department of Agriculture, Water and Environment (DAWE) (Australia)	EPBC Act 1999
Land use and development	Development approval	City of Karratha, Kimberley/Pilbara/ Gascoyne Joint Development Assessment Panel	*Planning and Development Act 2005*
Proposal construction (store dangerous goods)	Dangerous Goods Site Licence (update to existing licence)	Department of Mines, Industry Regulation and Safety (DMIRS)	*Dangerous Goods Safety Act 2004* and associated regulations
Proposal operation (change operations within a declared major hazard facility)	Approval for the operation of a Major Hazard Facility (update to existing approval)	DMIRS	*Dangerous Goods Safety Act 2004* and associated regulations

1.6.4 Existing project regulatory history

Environmental Protection Act 1986, Part IV

The existing YPF project was assessed by the EPA under Part IV of the EP Act at a Public Environmental Review (PER) level. The PER was publicly advertised from 6 August 2001 to 3 September 2001. Following assessment by the EPA (Bulletin 1036), the existing project was approved by the Minister for the Environment through Statement 586 in February 2002.

Subsequent to this approval there have been five s 45c applications to amend the existing project resulting in the following attachments to Statement 586:

- Attachment to Statement 586 – Increase in the capacity of the two captive power plants from 20 to 22 Megawatts (MW); change the package (plant start-up) boiler configuration from two 100 tonne per hour (tph) boilers to a 150 and 50 tph boiler; and to install one

5 MW emergency diesel generator instead of two 2 MW emergency diesel generators - change to proposal approved under s 45C on 6 October 2004.

- Attachment to Statement 586 – Conditional approval to use Stage 1 of the Bulk Liquids Jetty for the export of ammonia until such time that the jetty is extended to enable other ships to be loaded/unloaded concurrently - change to proposal approved under s45C on 20 October 2004.
- Attachment to Statement 586 – change to a Schedule 1 characteristic (start-up steam generation) - change to proposal approved under s45C on 13 December 2005.
- Attachment to Statement 586 – change (1) to a commitment (isolation valves along the ammonia export pipeline); and (2) to a description in the Public Environmental Review of the ammonia export process, specifically, the management of liquid ammonia in the pipeline - change to proposal approved under s45C on 11 September 2006.
- Attachment 5 to Statement 586 – an increase in disturbance from 28 ha to 29 ha; an increase in ammonia production capacity; an increase in atmospheric emissions; an increase in wastewater discharge and some contaminant concentrations; and amendments to the structure and content of Table 1: Summary of key proposal characteristics in Schedule 1 in Ministerial Statement No. 586 to reflect the above changes and to align its format with the requirements of Environmental Assessment Guideline EAG 1: Environmental Assessment Guideline for Defining the Key Characteristics of a Proposal - change to proposal approved under s45C on 5 August 2015.

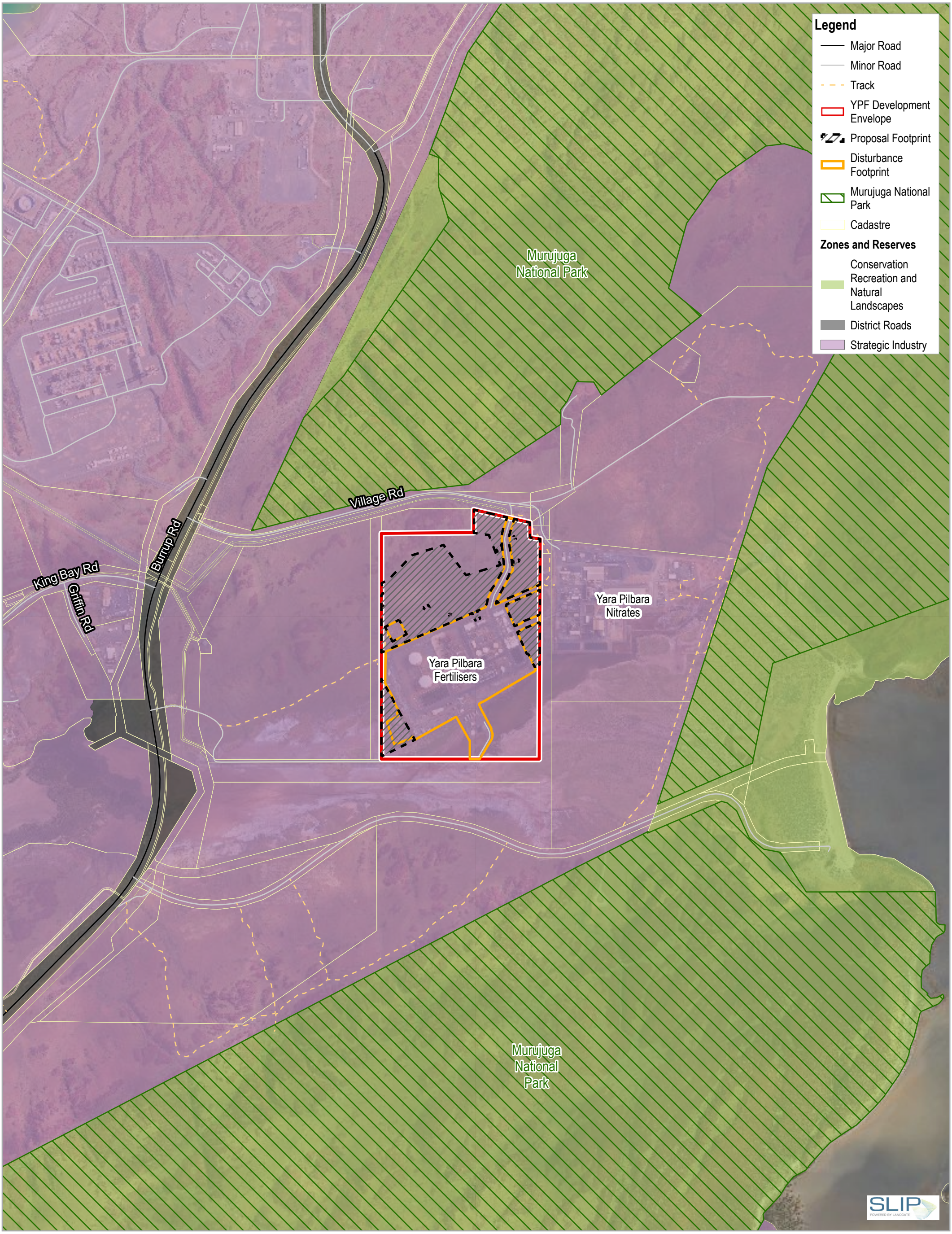
Environment Protection and Biodiversity Conservation Act 1999

The existing YPF Plant was referred to Environment Australia under the EPBC Act in March 2001. The referral, which included concluded that there would be no impact on MNES included the current Proposal Footprint. The referral was placed on the EPBC Act website for public comment. Following review, the Commonwealth Minister for the Environment and Heritage confirmed on 2 April 2001 that the project was not a controlled action (2001/199).

1.7 Proposed regulatory approach

This Proposal would amend the existing YPF Part IV approval to include additional disturbance area. Specifically, this Proposal would establish an additional 24.78 ha Renewable Hydrogen Plant Footprint within the existing 73 ha Development Envelope, which would take the total disturbance area within the Development Envelope to 53.78 ha.

The remainder of the YPF project elements are not proposed to be changed.



Paper Size ISO A3

0 100 200 300 400

Metres

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

N

Yara Pilbara Fertilisers Pty Ltd
Renewable Hydrogen Project

Zoning

Project No. **12520684**
Revision No. **1**
Date **16/07/2020**

FIGURE 1-3

G:\61\12520684\GIS\Maps\Working\12520684_Section38ReferralSupportingReport\12520684_Section38.aprx\12520684_1-3_Zoning_Rev
Print date: 16 Jul 2020 - 14:33

Data source: GHD: YPF Development Envelope, Proposal Footprint, Disturbance Footprint - 20200624; DBCA: Legislated Lands and Water - 20190301; Landgate: Roads - 20190128, Cadastre - 20200207, Locality - 20191127, Landgate_Subscription_Imagery\WANow: Landgate / SLIP. Created by: bmorgan

2. The Proposal

2.1 Proposal overview

The Proposal includes the construction and operation of a Renewable Hydrogen Plant and associated infrastructure. The Renewable Hydrogen Plant will provide a feed source for the existing YPF Ammonia Plant on the Murujuga (Burrup Peninsula). This Proposal forms the commercial demonstration (Phase 0) of a longer term, larger scale renewable hydrogen project. The production of green ammonia will be demonstrated through the use of solar energy to generate renewable hydrogen, and feeding the renewable hydrogen to the existing ammonia YPF Ammonia Plant.

The Proposal will involve modification to Ministerial Statement (Statement 586) granted under the EP Act.

The Proposal will be located within the existing Development Envelope and adjacent to the existing YPF Plant disturbance footprint, established under Statement 586; however, the Proposal will have a discreet Proposal Footprint.

The Renewable Hydrogen Plant footprint will be approximately 24.78 ha which includes the solar plant, electrolyser and its balance of plant, and associated infrastructure.

Table 2-1 presents a summary of the Proposal details and key characteristics.

Table 2-1 Key proposal characteristics of the Proposal

Summary of the Proposal				
Proposal title	Ammonia Plant, Murujuga (Burrup Peninsula)			
Proponent name	Yara Pilbara Fertilisers Pty Ltd			
Short description	The Proposal is to produce liquid ammonia from natural gas using advanced production technology on a site located within the King Bay-Hearson Cove Industrial Area on Murujuga (Burrup Peninsula), approximately 11 km north-west of Karratha in the Pilbara region. **The Proposal also includes the construction and operation of a Renewable Hydrogen Plant, solar PV plant and associated infrastructure, to partially substitute the use of natural gas to feed the existing YPF Ammonia Plant,** located within the King Bay-Hearson Cove Industrial Area on Murujuga (Burrup Peninsula), approximately 11 km north-west of Karratha in the Pilbara region**.**				
Element	**Location**	**Approved extent (existing project under Statement 586)**	**Proposed change (this Proposal)**	**Proposed extent (revised Proposal)**
Physical Elements				
• Ammonia plant • Laydown area • Desalination plant • Access road and product pipeline to plant • **PV solar panels, hydrogen electrolyser, site tracks, and associated infrastructure**	Figure 1-2	Clearing of no more than 29 ha within 73 ha Development Envelope	**Increase in disturbance of 24.78 ha for a Renewable Hydrogen Plant**	Clearing of no more than **53.78** within 73 ha Development Envelope
Operational Elements				
Ammonia Plant capacity		Up to 2,600 t/day of ammonia		No change
Oxygen emissions			**Approximately 14,400 kg/day**	**Approximately 14,400 kg/day**

2.2 Proposal justification

The Proposal will:

- Support decarbonisation on Murujuga and support the developing 'renewable green hydrogen' market whilst maintaining the production of ammonia at the YPF Plant.
- Pave the way towards upcoming extension phases for large-scale production of renewable energy-based ammonia for YPF, thus aligning with the WA Government's Renewable Hydrogen Strategy and Diversify WA economic development framework.
- Provide a demonstration-scale project to catalyse the global journey of decarbonising ammonia production; an industry that produces 180 million tonnes of product per annum, currently almost entirely from hydrocarbon-based feedstock.

- Increase direct and indirect employment opportunities for the local population in both the construction and operational phase, including the opportunity to work together with the local Aboriginal traditional owner groups to develop commercial, employment and training opportunities.
- Promote capital investment and economic growth in the region, diversifying the industrial base and supporting local industries and service providers.

2.3 Construction

Construction is anticipated to commence in 2021 once all regulatory approvals are secured and continue until June 2023. This schedule is subject to change, depending on external approvals, internal funding approvals, and business and market conditions.

Construction works will include:

- Establishment of temporary construction facilities within the Renewable Hydrogen Plant footprint area, including temporary lay-down areas for construction, and storage facilities for chemicals and materials.
- Ground preparation works (including blasting and native vegetation clearing) for the PV, hydrogen plant and associated infrastructure.
- Installation and operation of Renewable Hydrogen Plant, including electrolyser modules (based on alkaline or proton exchange membrane technology), purification system (to remove oxygen and water from the renewable hydrogen stream), compression (to achieve required spiking pressure in the existing Haber Bosh reactor), cooling system, and the balance of plant (separators, potash lye system, heat exchanger, circulation pumps, transformers, rectifier, and metering).
- Installation of required components for the solar PV plant, including PV modules with their mounting structures and foundations, inverters and batteries.
- Storage facilities for chemicals and materials.
- If fill is required, then any material will be clean.

Up to 18 MW of power production resources will be provided by the solar PV plant, with no grid connection. Water resources will be provided by the existing YPF Plant facility. No new access roads are anticipated, although site tracks will be established for maintenance purposes. Drainage and waste water treatments will be routed toward the YPF Plant. No new solid waste management new facilities are anticipated as the Proposal will be using the existing YPF waste management facilities.

YPF will seek to employ local personnel for the plant's construction phase.

A Construction Environmental Management Plan (CEMP) will also be applied to the Proposal and is included in Appendix B.

2.4 Operations

Operation of the Proposal is anticipated to commence in 2023. Engineering studies are ongoing to ensure the technical, environmental, safety and economic performances of the Renewable Hydrogen Plant are optimised.

In the event that the plant is shut down for an extended period (more than 3 months), it will be placed under care and maintenance. It will be maintained by allocated care and maintenance support personnel.

The plant decommissioning will involve the removal of all equipment, waste products and foundations to a depth of 400 millimetres. The plant site will be restored to as near as possible to its 'as found' condition.

Process description

Renewable hydrogen is generated from an electrolysis plant, which uses an electric current generated by the solar PV farm to split water (H_2O) into hydrogen (H_2) and oxygen (O_2) (Figure 2-1). The renewable hydrogen generated from the Proposal will be piped to the adjacent existing YPF Plant, where it will be used to produce renewable ammonia. Oxygen will be emitted with alternative uses being explored. The Renewable Hydrogen Plant is a commercial demonstration stage (pilot project) and will produce approximately 0.4% of the hydrogen required to feed the existing YPF Plant. Existing conventional Steam Methane Reforming (SMR) without Carbon Capture and Storage (CCS) or Carbon Capture and Utilisation (CCU) will continue be used to produce the remaining 99.6% of hydrogen required to feed the existing ammonia synthesis plant. SMR is a chemical synthesis process where methane reacts with high temperature steam and a catalyst, in high pressure conditions to produce hydrogen, carbon monoxide (which then converts to CO_2 downstream), and a relatively small amount of carbon dioxide.

The PV farm will have the production capacity of 18 MW peak to facilitate the production of approximately 640 tonnes of renewable hydrogen per annum.

Figure 2-1 Schematic overview of Phase 0 renewables-based ammonia production process

2.5 Alternative options considered

2.5.1 Site selection process

A number of alternative locations were considered for the Proposal, to reflect three potential infrastructure arrangement options:

- Locating the solar PV and electrolyser off Murujuga, with a hydrogen pipeline to the existing YPF Plant, crossing the causeway near Karratha airport.
- Locating the solar PV off Murujuga with a High Voltage transmission to an electrolyser on Murujuga, crossing the causeway near Karratha airport.
- Locating the solar PV and electrolyser on Murujuga.

Based on a multi-criteria approach, the land parcel adjacent to the existing YPF Plant, within the existing YPF lease, on Murujuga was chosen as the preferred location for the Proposal mainly due to:

- Proximity to the existing YPF Plant reduced the requirement for pipeline and transmission of the electricity between the Renewable Hydrogen Plant and the existing YPF Plant and enabled to take advantage of synergies (like utilities) with YPF.
- By bringing the location inside YPF existing lease, several project risks around land access and approvals were mitigated
- Murujuga Aboriginal Corporation expressed their support for this location.

2.5.2 PV and Renewable Hydrogen Plant Footprint

Within the Development Envelope an assessment was undertaken to identify and thus allow the Proposal to avoid areas of elevated environmental and heritage value. The identified layout avoids:

- All Registered Heritage Sites listed under the *Aboriginal Heritage Act 1972*.
- Areas that are mapped as the Dampier Archipelago (including Burrup Peninsula) National Heritage Place.
- Vegetation and fauna values associated with rocky outcrops including all mapped occurrences of the Burrup Peninsula Rock Pile Communities Priority Ecological Community (PEC) and Department of Biodiversity, Conservation and Attractions (DBCA) Priority listed flora species *Vigna triodiophila* (Priority 3) and *Rhynchosia bungarensis* (Priority 4). Through avoidance of rocky outcrop areas, the Proposal also substantially minimises impacts on Pilbara Olive Python (*Liasis olivaceus* subsp. *barroni*) core habitat and Priority flora species *Terminalia supranitifolia* (Priority 3).

2.6 Local and regional context

2.6.1 Climate

The Proposal is located on Murujuga, which experiences a semi-arid, desert-zone climate with two distinct seasons: a hot, wet summer (October to April) and a mild, dry winter (May to September). The closest current Bureau of Meteorology (BoM) weather station is at the City of Karratha Airport (Station ID: 004083), located approximately 10 km south west from the Proposal footprint and 8 km west of Karratha.

Rainfall in the region is generally low and variable, with a long-term annual average of 292.2 mm (1971 – 2020). Rainfall falls an average of 19.4 days per year, with most rainfall occurring in the late summer months due to the influence of tropical low pressure systems and cyclones (BoM 2020). Tropical cyclones in the region are most frequent between the months of November to April (BoM 2020).

Mean maximum temperatures are warm to hot throughout the year, ranging from a maximum of 36 C in January and March to a low of 26.5 C in June (1993 – 2020) (Figure 2-2). The mean minimum temperature ranges from a high of 28.2°C in January, to a low of 13.8°C in July. The area is characterised by high evaporation (BoM 2020).

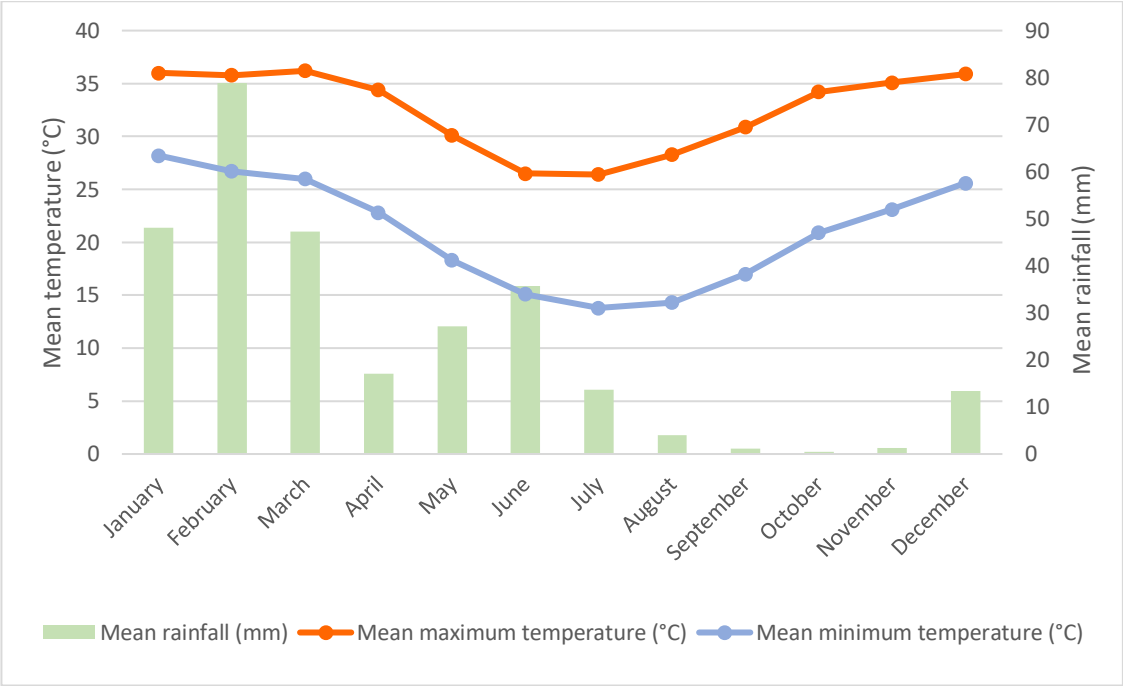


Figure 2-2 Karratha (ID: 004083) climate statistics (BoM 2020)

2.6.2 Geology

The geology of Murujuga is composed of the West Pilbara granite-greenstone terrane of the Pilbara Craton (Hickman et al. 2001). This terrain is comprised of a geological formation from the Archean age (over 250 million years ago) and is predominantly characterised by north-easterly trending granitoid complexes and greenstone belts, and numerous easterly and north-easterly striking faults (Van Kranendonk 2011). The Pilbara Craton terrain is bordered by the Hamersley Basin to the south and east, and the Canning Basin to the north.

2.6.3 Landforms and soil

Murujuga is a rocky headland which extends north from the Pilbara coast. The landform Murujuga is topographically variable and characterised by large rocky outcrops, with alluvial plains bisected by a number of active floodplains (Tille 2006). Along the coast are tidal mudflats, backed by low dunes (Van Vreeswyk et al. 1996). The soils of Murujuga are generally red-brown alluvial deposits to a depth of 2 m in the lower slopes. A low-lying expanse of saline supratidal mud flat and sand dunes characterise the landform between Hearson Cove and King Bay. The region lies within the Karratha Coast Zone of the Pilbara Fortescue Province.

2.6.4 Hydrology

Murujuga has limited surface water, and there are no permanent water bodies in the Development Envelope. Most watercourses in the region are ephemeral, with highly variable flows characterised by short periods of high water flow associated with high intensity weather events such as tropical cyclones. Surface water drains as sheet flooding from elevated rocky areas to the coast, where the soils typically become waterlogged and form mudflats. Groundwater flow tends to be north-westerly towards the coast (Tille 2006).

2.6.5 Regional biogeography

The Proposal is situated in the Eremaean botanical province, and within the Roebourne sub-region of the Pilbara bioregion, as described by the Interim Biogeographic Regionalisation of

Australia (IBRA) (DAWE 2020a). The Roebourne subregion extends across the coastal areas of the Pilbara bioregion.

The Roebourne sub-region of the Pilbara bioregion comprises a range of landscapes, including extensive quaternary alluvial and Aeolian coastal floodplains on the western margin, to broad plateaux and stony ridges, separated by undulating plains of alluvial clays, sands, silts and gravels (Tille, 2006). Vegetation and the associated landscapes in the region are broadly described as:

- Coastal and sub-coastal plains and uplands with mixed bunch and *Triodia* hummock grass Savannahs, and dwarf shrub steppes containing *Acacia stellaticeps* or *A. pyrifolia* and *A*. *inaequilatera*
- Ephemeral drainage lines with *Eucalyptus victrix* or *Corymbia hamersleyana* woodlands
- Marine alluvial flats and river deltas, supporting *Sporobolus* and mangrove communities (Kendrick and Stanley 2001).

The Pilbara bioregion is characterised by high biodiversity and biological endemism, due to its geological diversity and location between the central desert and tropical bioclimatic regions (Pepper et al. 2013).

2.6.6 Environmental values

Nature reserves

There are no nature reserves within the Development Envelope. Murujuga National Park is situated adjacent to the eastern boundary of the existing YPF Plant (Figure 2-3). The Millstream Chichester National Park is located 68 km south east of the site.

2.6.7 Social values

The City of Karratha has a population of approximately 21,473 people (ABS 2016). Within the City of Karratha:

- Approximately 29.9% of the population is younger than 20 years, 64.8% of the population is aged between 20 – 60 years, and approximately 5.4% of the population is aged over 60 years
- Unemployment rate is currently 6.0%. Approximately 69% of those working are employed full time, and a further 17.9% are employed on a part-time basis
- Major industries of employment are iron ore mining, oil and gas extraction, other non-metallic mining and quarrying, and primary education (ABS 2016).

2.6.8 Heritage

Murujuga and its surrounds, support extensive Aboriginal heritage sites and are National Heritage listed. Murujuga was also placed on Australia's World Heritage Tentative List in February 2020. The wider Dampier Archipelago region is known to have one of Australia's greatest collection of rock art (petroglyphs) (DEC 2013).

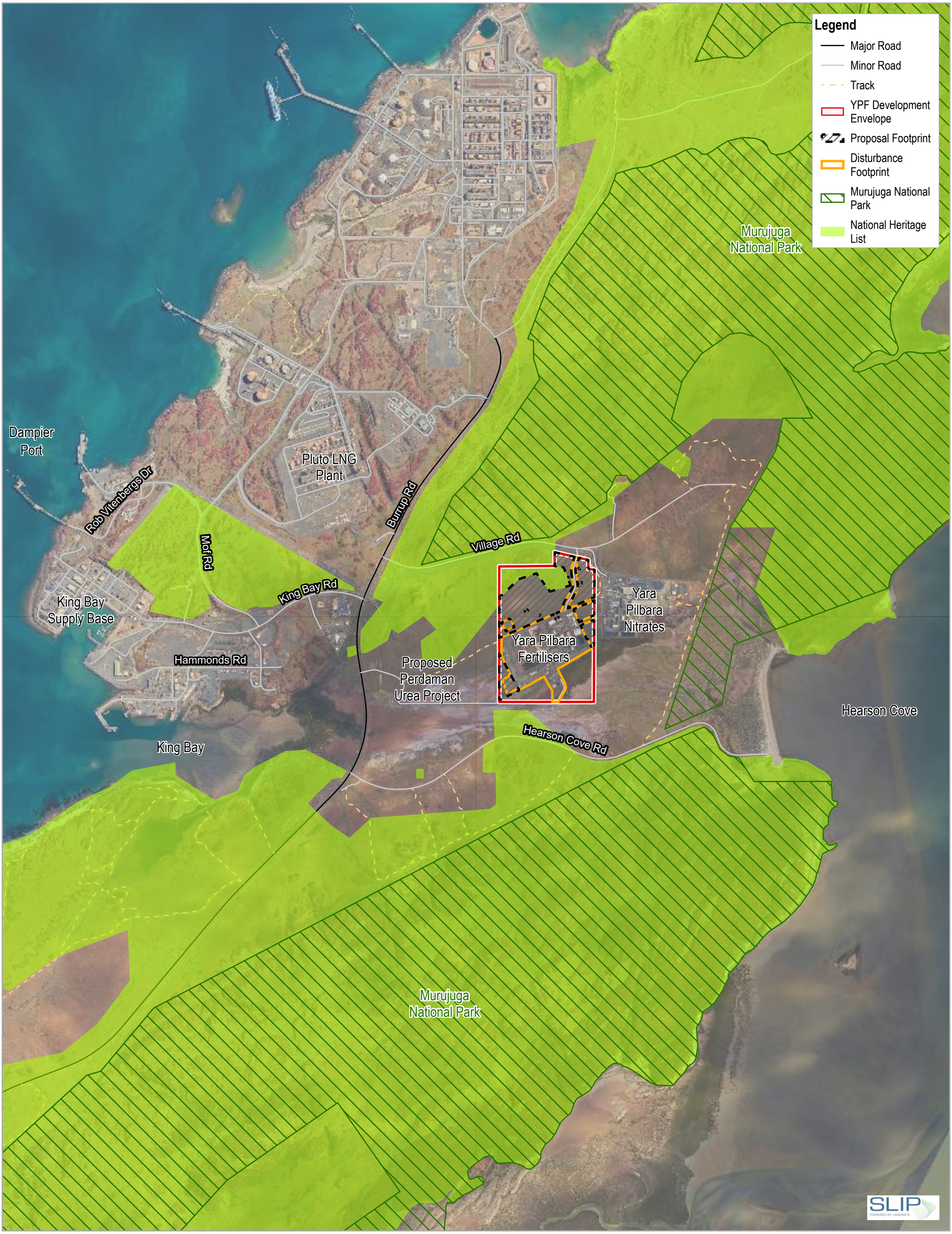
MAC was formed in 2006 as part of the BMIEA with the Western Australian Government. MAC holds freehold title to the Murujuga National Park, which is in close proximity to the Development Envelope (Figure 2-3). There are nine registered Aboriginal Heritage sites within the Development Envelope.

2.6.9 Other developments in surrounding region

The Proposal is within the Burrup SIA, and consequently there is a number of other developments in proximity to this Proposal (Figure 2-3), including, but not limited to:

- YPF and Technical Ammonium Nitrate (TAN) Plant - located adjacent to the Proposal.
- Woodside's Pluto LNG Plant and the Woodside-operated North West Shelf Venture Karratha Gas Plant.
- Proposed Perdaman Urea Project.

These projects have been used to inform the cumulative impacts of the Proposal with other development within the region.



Paper Size ISO A3

0 200 400 600 800

Metres

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

N

GHD

Yara Pilbara Fertilisers Pty Ltd
Renewable Hydrogen Project

Local Context

Project No. **12520684**
Revision No. **1**
Date **16/07/2020**

FIGURE 2-3

G:\61\12520684\GIS\Maps\Working\12520684_Section38ReferralSupportingReport\12520684_Section38.aprx\12520684_2-3_LocalContext_Rev
Print date: 16 Jul 2020 - 14:43

Data source: GHD: YPF Development Envelope, Proposal Footprint, Disturbance Footprint - 20200624; DBCA: Legislated Lands and Water - 20190301; Landgate: Roads - 20190128, Locality - 20191127, Landgate_Subscription_Imagery\WANow: Landgate / SLIP. Created by: bmorgan

3. Stakeholder engagement

3.1 Key stakeholders

YPF undertakes ongoing engagement with key stakeholders. These stakeholders include local Traditional Owners, Commonwealth, State and Local Government members and associated Departments, as well as community members, local and regional industry and media. A summary of the consultation undertaken is provided in Table 3-1.

YPF's ongoing consultation will continue throughout the environmental approval process and beyond, to ensure transparent and clear engagement informs our progress and that all concerns are addressed.

Critically, YPF and Engie engage extensively with MAC and are pursuing a location on Murujuga with the express support of MAC. MAC's support for the Proposal was essential in the decision to proceed. Evidence of the support from MAC is provided in the Letter from MAC's CEO Peter Jefferies and is included in Appendix C.

Table 3-1 Stakeholder consultation

Stakeholder	Date	Issues/topics raised	Proponent response/outcome
Murujuga Aboriginal Corporation (MAC)	Ongoing regular consultation – at least weekly to update, provide advice and support. Both Yara and ENGIE contributed to MAC's request for community support funds during COVID-19.		
	23 March 2020	Pre-fieldwork consultation discussed logistics of the site verification program and how MAC is to be consulted.	
	24 March 2020	Post fieldwork consultation developed strategy to overcome COVID-19 restrictions so that MAC could be consulted on the fieldwork results and comment on the cultural aspects.	
Environmental Protection Authority (EPA)	20 November 2019	Location of Proposal, potential approval pathways, likely environmental impacts to be considered, stakeholder engagement	Appropriate timing of surveys discussed and agreed
	11 December 2019	Location of Proposal, potential approval	

Stakeholder	Date	Issues/topics raised	Proponent response/outcome
		pathways, likely environmental impacts to be considered	
	29 May 2020	Clarification of EPA requirements for Proposal consideration	Pre-referral meeting to be arranged
	19 June 2020	Pre-referral meeting	
Department of Jobs, Tourism, Science and Innovation (DJTSI)	12 December 2019	Location of Proposal, potential approval pathways	
	28 April 2020	Update to Renewable Hydrogen Unit (RHU)	
	3 June 2020	Update to Renewable Hydrogen Unit (RHU)	
City of Karratha	9 December 2019	Diversifying economy of the region, participation of Aboriginal people in economic activities.	
	23 January 2020	Update	
	3 June 2020	Update to Mayor	

4. Environmental principles and factors

4.1 Environmental principles

The EP Act identifies five principles for environmental management. Each of these principles have been considered in relation to the Proposal, in accordance with the EPA's *Statement of Environmental Principles, Factors and Objectives* (EPA 2018b). The EP Act principles considered for this Proposal are specified in Table 4-1.

Table 4-1 *Environmental Protection Act 1986* principles

Principle	Consideration of principle in the Proposal
Precautionary principle Where there are threats of serious or irreversible damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation. In the application of the precautionary principle, decision should be guided by: a. Careful evaluation to avoid, where practicable, serious or irreversible damage to the environment and b. An assessment of the risk-weighted consequences of various options.	Technical investigations and studies have been undertaken for the area potentially affected by the Proposal to ensure impact assessment and/or modelling can be carried out with scientific certainty. All environmental impacts have been carefully evaluated in this environmental review. Where the potential for serious or permanent damage has been identified, mitigation measures, including avoiding impacts where practical, have been applied. A precautionary approach has been taken where residual risk to the surrounding environment is uncertain. In addition to the procedural steps to address the precautionary principle, the nature of this project is to offset emissions and potentially build the foundation to replace emitting industries with non-emitting ones. At a very strategic level, this is a project that has the precautionary principle at its core.
Intergenerational equity The present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations.	The environmental management of the construction, operation and closure of the Proposal will be conducted in a manner which ensures the health and diversity of the surrounding environment is maintained and enhanced for the benefit of future generations, and includes the following commitments: • Prioritising research and implementation programs through technology to reduce impacts to land, enhancing our contribution to biodiversity and improving our efficiency in water and energy use. • Identifying climate change improvement solutions through dedicated optimism work programs.

Principle	Consideration of principle in the Proposal
	• Contributing to the health and well-being of local communities. Again, the replacement of emitting industries with non-emitting industries goes to the heart of the principle of intergenerational equity.
<u>The principle of the conservation of biological diversity and ecological integrity</u> Conservation of biological diversity and ecological integrity should be a fundamental consideration.	Comprehensive baseline studies have been undertaken to understand existing biological diversity in the area and to assess potential threats to the diversity and ecological integrity. Clearing of vegetation has been avoided or minimised. Environmental management strategies will be implemented to minimise impacts to biological diversity and ecological integrity.
<u>Principles relating to improved evaluation, pricing and incentive mechanisms</u> a. Environmental factors should be included in the valuation of assets and services. b. The polluter pays principle – those who generate pollution and waste should bear the cost of containment, avoidance or abatement. c. The users of goods and services should pay prices based on the full life cycle costs of providing goods and services, including the use of natural resources and assets and the ultimate disposal of any wastes. d. Environmental goals, having been established, should be pursued in the most cost effective way, by establishing incentive structures, including market mechanisms, which enable those best placed to maximise benefits and/or minimise costs to develop their own solutions and responses to environmental problems.	The Proponent has, and will continue to, evaluate (and implement wherever possible) opportunities to reduce impact to land, reduce waste and improve efficiencies in water and energy use during the implementation, operation and closure of the Proposal.
<u>The principle of waste minimisation</u> All reasonable and practicable measures should be taken to minimise the generation of waste and its discharge into the environment.	The Proponent will implement waste management measures to minimise the generation of waste and its discharge to the environment. The Proponent will, where practicable, implement ‘reduce, reuse, recycle’ approach to waste management. At a strategic level, this project replaces hydrocarbon feedstock and carbon dioxide by-product with renewable feedstock and oxygen by-product.

4.2 Identification of Key Environmental Factors

The Proponent has assessed the environmental factors relevant to this Proposal, in accordance with the approach in the EPA's Statement of Environmental Principles, Factors, and Objectives (2018b) and the EPA's Environmental Factor Guidelines and Environmental Factor Technical Guidance.

The environmental factors and the EPA's objectives are provided in Table 4-2. The relevance of each factor to the Proposal is summarised and the key environmental factors that require further consideration are identified. The key environmental factors that have been identified as relevant to the Proposal include Flora and Vegetation, Terrestrial Fauna and Social Surroundings.

Table 4-2 Identification of Key Environmental Factors

Factor	Objective	Relevance to Proposal	Key Environmental Factor
Sea			
Benthic Communities and Habitat	To protect benthic communities and habitat so that biological diversity and ecological integrity are maintained.	No impacts to benthic habitats	No
Coastal Processes	To maintain the geophysical processes that shape coastal morphology so that the environmental values of the coast are protected.	No impacts to coastal processes.	No
Marine Environmental Quality	To maintain the quality of water, sediment and biota so that environmental values are protected.	No impacts to marine environmental quality.	No; however, as there will be an increase in discharge of brine to the marine environment an assessment as an 'other factors' has been undertaken in Section 8.
Marine Fauna	To protect marine fauna so that biological diversity and ecological integrity are maintained.	No impacts to marine fauna.	No
Land			
Flora and vegetation	To protect flora and vegetation so that biological diversity and ecological integrity are maintained	Construction will require vegetation clearing	**Yes**, assessed in Section 5
Landforms	To maintain the variety and integrity of distinctive physical landforms so that environmental values are protected.	Distinctive landforms are not present.	No
Subterranean Fauna	To protect subterranean fauna so that biological diversity and ecological integrity are maintained.	No conservation significant subterranean fauna.	No
Terrestrial Environmental Quality	To maintain the quality of land and soils so that environmental values are protected.	Potential Acid Sulfate Soils may be present within the Proposal area.	No

Factor	Objective	Relevance to Proposal	Key Environmental Factor
Terrestrial Fauna	To protect terrestrial fauna so that biological diversity and ecological integrity are maintained.	Construction will result in habitat clearing.	**Yes**, assessed in Section 6
Water			
Hydrological Processes	To maintain the hydrological regimes of groundwater and surface water so that environmental values are protected.	No wetlands present within the Proposal area.	No
Inland Waters Environmental Quality	To maintain the quality of groundwater and surface water so that environmental values are protected.	Inland waters do not occur, including groundwater and surface water.	No
Air			
Air Quality	To maintain air quality and minimise emissions so that environmental values are protected.	Proposal will not produce any air pollutant emissions	No
Greenhouse Gas Emissions	To reduce net greenhouse gas emissions in order to minimise the risk of environmental harm associated with climate change	Proposal will not increase greenhouse gas emissions.	No
People			
Social Surroundings	To protect social surroundings from significant harm.	The Proposal is located within an existing industry area. However, as the Murujuga has significant heritage values an assessment of potential impacts has been undertaken	**Yes**, assessed in Section 7
Human Health	To protect human health from significant harm.	No human health impacts expected. No radiation emissions.	No

5. Flora and vegetation

5.1 EPA objective

To protect flora and vegetation so that biological diversity and ecological integrity are maintained.

For the purposes of the EIA, the EPA defines flora as native vascular plants and vegetation as groupings of different flora patterned across the landscape.

5.2 Policy and guidance

- Statement of Environmental Principles, Factors and Objectives (EPA 2018b)
- Environmental Factor Guideline: Flora and Vegetation (EPA 2016a)
- Technical Guidance: Flora and Vegetation Surveys for Environmental Impact Assessment (EPA 2016b)
- *Environmental Protection Act 1986* (EP Act)
- *Environmental Protection (Clearing of Native Vegetation) Regulations 2004* (Clearing Regulations)

5.3 Receiving environment

5.3.1 Technical studies

GHD undertook a detailed flora and vegetation survey and targeted flora survey of areas within and adjacent to the YPF lease boundary (the survey area). The purpose of the survey was to identify and record key flora and vegetation values within the survey area, which includes the Development Envelope and Proposal Footprint. The detailed flora and vegetation survey and targeted flora survey were undertaken during March 2020, which is during the recommended timing for flora and vegetation surveys in the Eremaean Botanical Province (March-June) (EPA 2016b). The survey methodology employed by GHD was undertaken with reference to the EPA Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment (EPA 2016b). The biological survey report is provided in Appendix A.

5.3.2 Vegetation

Vegetation types

Broad scale pre-European vegetation mapping completed by Beard (1975) indicates one vegetation association occurs within the Development Envelope and Proposal Footprint, association 117, which is described as Hummock grasslands, grass steppe; soft spinifex.

Seven vegetation types were identified during the field survey as well as cleared areas and seasonally inundated/open water. All seven vegetation types (as well as cleared areas and seasonally inundated/open water) occur within the Development Envelope and five occur within the Proposal Footprint. The vegetation within the Proposal Footprint is dominated by hummock grasslands of *Triodia* with scattered to open shrublands dominated by *Acacia, Hakea* and *Grevillea* species on rocky hills. Areas in the western corner of the Proposal Footprint are characterised by samphire shrublands, *Acacia* high shrubland and *Triodia* low hummock grasslands on low lying, saline tidal flats.

The vegetation types within the survey area, Development Envelope and Proposal Footprint are provided in Table 5-1. Vegetation type mapping within the Proposal Footprint is provided in Figure 5-1.

Table 5-1 Vegetation types within the survey area, Development Envelope and Proposal Footprint

Vegetation type	Extent within the survey area (ha)	Extent within the Development Envelope (ha)	Extent in the Proposal Footprint (ha)
Grevillea/Acacia open shrubland (VT01)	9.38	9.38	8.48
Terminalia scattered low trees (VT02)*	2.09	2.09	-
Triodia hummock grassland (VT03)	16.17	16.17	12.15
Triodia closed hummock grassland (VT04)	1.24	1.24	0.47
Tecticornia scattered to open low shrubland (VT05)	18.3	6.21	1.08
Cenchrus tussock grassland (VT06)	12.14	0.69	-
Acacia high shrubland (VT07)	1.96	1.96	0.85
Sub-total (native vegetation)	**72.18**	**37.74**	**23.04**
Seasonally inundated	5.45	4.69	<0.001
Cleared	29.41	29.31	1.74
Total	**96.14**	**71.75**	**24.78**

* Represents the Burrup Peninsula Rock Pile Communities PEC

Vegetation condition

The vegetation condition throughout the Development Envelope and Proposal Footprint ranged from Excellent to Completely Degraded, with majority considered to be in Excellent or Very Good to Excellent condition. Generally, the vegetation structure across the Development Envelope and Proposal Footprint showed no to slight signs of damage with minimal weeds recorded. Areas rated Good and Poor showed more obvious signs of damage/impacts including weed invasion.

The vegetation condition ratings within the survey area, Development Envelope and Proposal Footprint are provided in Table 5-1. Vegetation condition mapping within the Proposal Footprint is provided in Figure 5-2.

Table 5-2 Vegetation condition ratings within the survey area, Development Envelope and Proposal Footprint

Vegetation condition	Extent within the survey area (ha)	Extent within the DE (ha)	Extent in the Proposal Footprint (ha)
Excellent	22.31	22.31	15.37
Excellent-Very Good	3.00	3.00	2.97
Very Good	15.20	4.59	1.77
Very Good-Good	1.48	-	-
Good	5.19	5.19	2.10

Vegetation condition	Extent within the survey area (ha)	Extent within the DE (ha)	Extent in the Proposal Footprint (ha)
Poor	1.85	1.85	0.73
Degraded	0.13	0.13	0.10
Completely Degraded	12.14	0.69	-
No condition (cleared/open water)	34.86	34	1.74
Total	**96.16**	**71.75**	**24.78**

Conservation significant ecological communities

The field survey identified one Priority 1 PEC within the Development Envelope, the Burrup Peninsula Rock Pile Communities. The Burrup Peninsula Rock Pile Communities are pockets of vegetation in the rock piles and outcrops. The rock pile communities vary from open tussock grass assemblages with small herbs and grasses on otherwise bare calcrete, through to hummock sub shrub communities, to dense shrub/tree communities. *Terminalia* scattered low trees (VT02) is considered to be representative of the Burrup Peninsula Rock Pile Communities PEC. There is 2.09 ha of this PEC occurring within the Development Envelope, of which all is in Excellent condition. None of this PEC occurs within the Proposal Footprint (Figure 5-3).

Other significant vegetation

Vegetation located in the tidal inlet between Hearson Cove and King Bay was identified as being of conservation significance by ME Trudgen & Associates (2002). *Tecticornia* scattered to open low shrubland (VT05) is considered to correspond with the basic vegetation units mapped by ME Trudgen & Associates (2002), designated Sm and described as Saline Inlet and Supra-tidal Flats. This vegetation may have some significance as it has a restricted distribution and has been impacted from threatening processes such as clearing and development on the Murujuga. There is 6.21 ha of VT05 in the Development Envelope and 1.08 ha of VT05 within the Proposal Footprint (Figure 5-3).

5.3.3 Flora

Diversity

The *NatureMap* database identified 281 flora species previously recorded within 20 km of the Proposal. This total comprised 257 native taxa and 24 naturalised (introduced) taxa. The field survey recorded a total of 141 flora taxa comprising of 138 native taxa and three introduced taxa. Dominant families recorded during the survey included Fabaceae (28 taxa), Poaceae (19 taxa), and Malvaceae (17 taxa) (GHD 2020a). The floristic diversity recorded during the survey is considered representative of the floristic diversity in the area (GHD 2020a).

Threatened and Priority flora

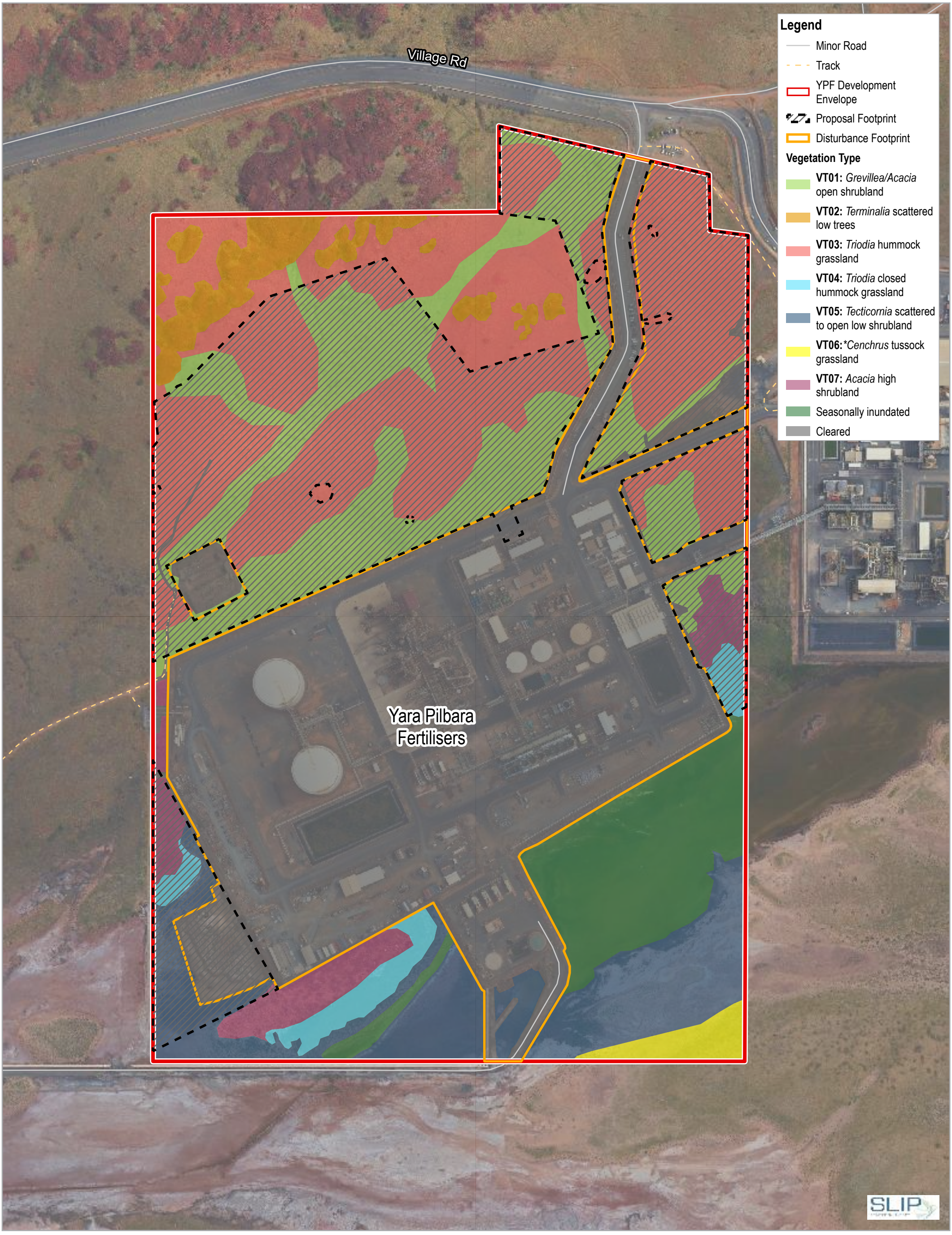
Desktop searches identified the potential presence of six conservation significance flora taxa within the Development Envelope including five Priority 3 taxa and one Priority 4 taxon. The field survey recorded three Priority flora species within the surveyed areas, including *Terminalia supranitifolia* (Priority 3), *Vigna triodiophila* (Priority 3) and *Rhynchosia bungarensis* (Priority 4) (GHD, 2020). All three of these species occur within the Development Envelope, but only *T. supranitifolia* occurs within the Proposal Footprint (Figure 5-3). There are 33 records of *T. supranitifolia* within the Development Envelope occurring on the rockpile capped hills (VT02), on smaller hillslope rockpiles and along the broad drainage lines mid-slope of the rocky hills (VT01 and VT03). Of these, two records of *T. supranitifolia* occur within the Proposal Footprint.

A likelihood of occurrence assessment conducted post-field survey for all conservation significant flora taxa identified in the desktop assessment concluded that no other conservation

significant flora taxa are considered likely or may possibly occur within the Development Envelope and Proposal Footprint. This assessment took into account previous records, habitat requirements, efficacy of the survey, intensity of the survey, flowering times and the cryptic nature of the species. A copy of the likelihood of occurrence assessment is provided in the biological survey report (GHD 2020a) (Appendix A).

Introduced flora

Three introduced taxa were recorded during field survey, **Cenchrus ciliaris* (Buffel grass), **Aerva javanica* (Kapok bush) and **Vachellia farnesiana* (Mimosa bush). None of these species are Weeds of National Significance or listed as Declared Pests under the *Biosecurity and Agricultural Management Act 2007*. Buffel and Kapok were generally most common in previously disturbed areas, and along vehicle tracks and drainage lines. Mimosa bush was recorded in the rocky hills/broad gullies, and occasionally scattered on the low-lying plains.



Paper Size ISO A3

0 25 50 75 100

Meters

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

N

GHD

Yara Pilbara Fertilisers Pty Ltd
Renewable Hydrogen Project

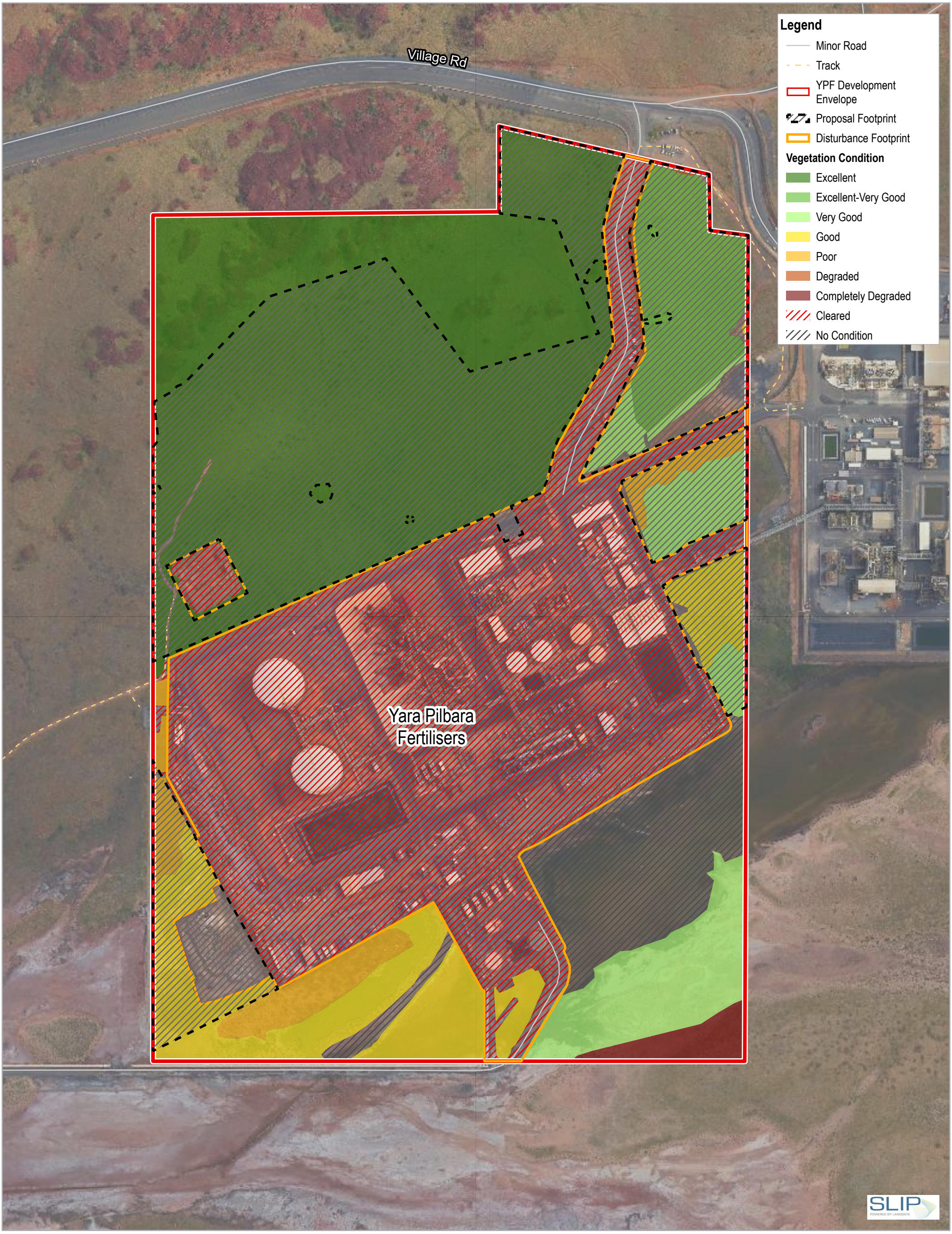
Vegetation Types

Project No. **12520684**
Revision No. **1**
Date **16/07/2020**

FIGURE 5-1

G:\61\12520684\GIS\Maps\Working\12520684_Section38ReferralSupportingReport\12520684_Section38.aprx\12520684_5-1_VegTypes_Rev
Print date: 16 Jul 2020 - 14:54

Data source: GHD: YPF Development Envelope, Proposal Footprint, Disturbance Footprint - 20200624, Vegetation - 20200321; Landgate: Roads - 20190128, Landgate_Subscription_Imagery\WANow: Landgate / SLIP. Created by: bmorgan



Paper Size ISO A3

0 25 50 75 100

Meters

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

N

GHD

Yara Pilbara Fertilisers Pty Ltd
Renewable Hydrogen Project

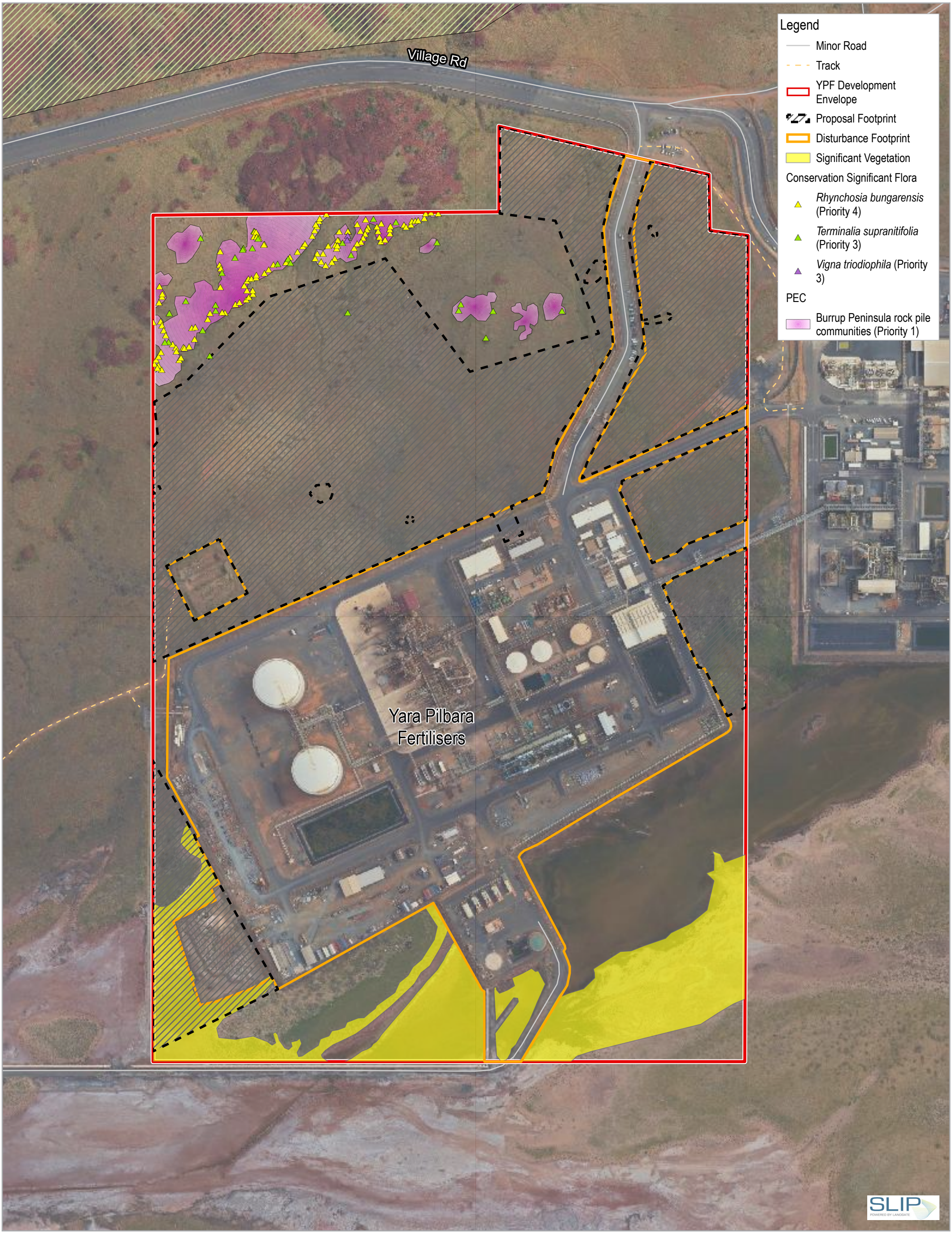
Vegetation Condition

Project No. **12520684**
Revision No. **1**
Date **17/07/2020**

FIGURE 5-2

G:\61\12520684\GIS\Maps\Working\12520684_Section38ReferralSupportingReport\12520684_Section38.aprx\12520684_5-2_VegCondition_Rev
Print date: 17 Jul 2020 - 13:39

Data source: GHD: YPF Development Envelope, Proposal Footprint, Disturbance Footprint - 20200624, Vegetation - 20200321; Landgate: Roads - 20190128, Landgate_Subscription_Imagery\WANow: Landgate / SLIP. Created by: bmorgan



Paper Size ISO A3

0 25 50 75 100

Meters

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

N

Yara Pilbara Fertilisers Pty Ltd
Renewable Hydrogen Project

Significant Vegetation and Flora

Project No. **12520684**
Revision No. **1**
Date **17/07/2020**

FIGURE 5-3

G:\61\12520684\GIS\Maps\Working\12520684_Section38ReferralSupportingReport\12520684_Section38.aprx\12520684_5-3_ConsigVegFlora_Rev
Print date: 17 Jul 2020 - 13:46

Data source: GHD: YPF Development Envelope, Proposal Footprint, Disturbance Footprint - 20200624, PEC - 20200321, Priority Flora - 20200331; Landgate: Roads - 20190128, WANow: Landgate / SLIP Landgate_Subscription_Imagery\WANow: Landgate / SLIP. Created by: bmorgan

5.4 Potential impacts

The Proposal will result in the direct loss of vegetation and flora through clearing including significant vegetation and flora.

The Proposal could also result in the following indirect impacts to vegetation and flora:

- Introduction and spread of environmental weeds.
- Fragmentation of native vegetation.
- Potential reduction in vegetation health as a result of dust generation during construction.
- Changes to vegetation structure and floristic composition in surrounding/adjacent areas through altered surface water drainage patterns and flows.
- Alteration of fire regimes.

5.5 Assessment of impacts

5.5.1 Loss of flora and vegetation

The Proposal will result in the reduction of approximately 0.07% of mapped Vegetation Association 117 at a local scale (City of Karratha) and approximately 0.05% at a regional scale (Pilbara IBRA bioregion). The proposed clearing will not reduce the current extent of association 117 to less than 75% of its pre-European extent at a local scale and 90% at a regional scale, and therefore will not significantly reduce the extent of Vegetation Association 117 at any scale (Table 5-3).

Within the Proposal Footprint five vegetation types will be directly affected from vegetation clearing, including locally restricted vegetation associated the tidal inlet between Hearson Cove and King Bay (*Tecticornia* scattered to open low shrubland, VT05). As shown in Table 5-4 up to 23.04 ha of vegetation will be cleared within the Proposal Footprint, largely located north of the existing YPF. With the exception of VT05, the vegetation present within the Proposal Footprint is not considered locally restricted and is represented in similar condition locally within Murujuga National Park. The majority of the clearing in the Proposal Footprint is within VT03.

Vegetation representative of the Burrup Peninsula Rock Pile Communities Priority 1 PEC within the Development Envelope is in Excellent condition. The Proposal Footprint has been selected to avoid this PEC, and as such no direct or indirect impacts to this PEC expected from the Proposal.

A small extent of locally restricted vegetation associated the tidal inlet between Hearson Cove and King Bay (VT05) intersects the Proposal Footprint. The majority of mapped vegetation representing VT05 is located outside of the Proposal Footprint, east of the existing YPF. There is about 100 ha of the Sm community (described as Saline Inlet and Supra-tidal Flats) known to occur on the Burrup Peninsula (Woodside 2006), of which 56% occurs within the Murujuga National Park. The Proposal will result in the loss of 1.08 ha of VT05, which is approximately 1% of the local extent of this vegetation type.

One DBCA Priority listed flora species will be directly affected by the Proposal. Of the three Priority flora species recorded within the Development Envelope, two individuals of *Terminalia supranitifolia* (Priority 3), occur within the Proposal Footprint. The expected loss through vegetation clearing for the Proposal is less than 2% for *T. supranitifolia* based on the conservative estimates of total individuals across WA (Table 5-5). Known individuals of *Vigna triodiophila* and *Rhynchosia bungarensis* will be avoided and no impacts are anticipated from the Proposal.

The Proposal is not expected to significantly impact flora and vegetation at a local or regional scale. Proposal clearing will result in the loss of approximately 1% of restricted vegetation VT05 at a local scale and <2% of the known records of *T. supranitifolia*. The Proposal will avoid vegetation representative of the Burrup Peninsula Rock Pile Communities Priority 1 PEC and records of *Vigna triodiophila* and *Rhynchosia bungarensis*. Implementation of the Proposal is not expected to result in significant local or regional impacts to flora and vegetation.

Table 5-3 Impacts to Vegetation Association 117 from the Proposal

Scale	Pre-European extent (ha)	Current extent (ha)	% remaining	Extent within Proposal Footprint (ha) (%)	Current extent remaining after Proposal clearing ha) (%)
WA	919,517.05	886,005.79	96.36	24.78 (<0.01%)	885,981.01 (96.36%)
Pilbara IBRA bioregion	82,705.78	78,096.64	94.43	24.78 (0.03%)	78,071.86 (94.40%)
Roebourne subregion	50,962.94	46,901.57	92.03	24.78 (0.05%)	46,876.79 (91.98%)
City of Karratha	41,173.74	31,921.58	77.53	24.78 (0.07%)	31,896.80 (77.46%)

Table 5-4 Impacts to vegetation types from the Proposal

Vegetation Type	Current extent (ha) (Development Envelope)	Extent to be cleared (PF) (ha) (%)	Current extent remaining in DE after Proposal clearing (ha) (%)
Grevillia/Acacia open shrubland (VT01)	9.38	8.48 (90.41%)	0.9 (9.59%)
Terminalia isolated low trees (VT02)	2.09	-	2.09 (100%)
Triodia hummock grassland (VT03)	16.17	12.15 (75.1%)	4.02 (24.90%)
Triodia closed hummock grassland (VT04)	1.24	0.47 (37.9%)	0.77 (62.10%)
Tecticornia isolated shrubs to open low shrubland (VT05)	6.21	1.08 (17.39%)	5.13 (82.6%)
Cenchrus tussock grassland (VT06)	0.69	-	0.69 (100%)
Acacia high shrubland (VT07)	1.96	0.85 (43.37%)	1.11 (56.63%)
Total (native vegetation)	**37.74**	**23.04 (61.02%)**	**14.70 (38.95%)**

Table 5-5 Impacts to Priority flora from the Proposal

Species	Total no. [1]	No. in Development Envelope	No. in Proposal Footprint
Terminalia supranitifolia (Priority 3)	116 individuals	33 individuals	2 individuals
Vigna triodiophila (Priority 3)	89 individuals	6 individuals	-
Rhynchosia bungarensis (Priority 4)	559 individuals	431 individuals	-

[1] Source: NatureMap (DBCA 2007–), FloraBase (WA Herbarium 1998–), GHD (2020). NatureMap and FloraBase records often provide the count (frequency) in descriptors such as common, occasional and scattered without providing an actual number of plants. For the purposes of this assessment these records have been counted as one individual. As such the estimates are underrepresented with the actual number of individuals expected to be much higher. Therefore, the percent impact calculated is considered to be very conservative.

5.5.2 Introduction and spread of environmental weeds

Clearing for the Proposal and increased movement of vehicles, including earth moving machinery may result in the establishment of new populations of weed species. Three environmental weeds have been recorded within the Proposal footprint, mostly in previously disturbed areas, and along vehicle tracks and drainage lines. While generally recorded in low numbers, there is the potential for weed numbers to increase by the spread of windblown seeds from existing nearby populations, the spread of weed seeds from the movement of soil during earthworks, or weed seeds entering the Proposal footprint through contaminated vehicles, earthmoving equipment or construction materials.

Weed impacts may be cumulative in response to other impacts to native vegetation, such that they may exacerbate the decline or change in native vegetation composition or disrupt ecological processes.

Vehicle hygiene, weed control and ground disturbance procedures will be implemented for this Proposal. These mitigation measures include, but are not limited to, ensuring that vehicle access is restricted to designated access roads, and the implementation of a weed monitoring program to minimise the spread of existing weed populations. The implementation of these weed hygiene measures will be conducted in line with the CEMP, and are expected reduce the introduction of weeds into new areas, and is assessed to have no significant impact.

5.5.3 Fragmentation of native vegetation

As a result of clearing during the construction of the Proposal, suitable habitat for significant flora and vegetation will be removed, resulting in the fragmentation of vegetation. This will reduce the ability of the flora species within these groups to diversify or recruit over a larger area. A smaller patch size of vegetation may also result in an altered community structure.

The location of the Proposal Footprint within the Development Envelope is expected to reduce the degree of additional vegetation fragmentation. Further, the small scale of the Proposal is not sufficient to cause fragmentation of the extensive tracts of native vegetation which extend north and south of the Development Envelope on Murujuga. Clearing will not directly or indirectly impact the Murujuga National Park, which occurs to the east of the Proposal Footprint and ensures connectivity of the native vegetation.

The small scale of the Proposal footprint, its location adjacent to an existing disturbance, and the extensive tracts of similar vegetation in local and regional areas, are expected to limit any fragmentation of vegetation, to the extent that any impact is not considered significant.

5.5.4 Dust generation

Dust may be generated during the construction phase of the Proposal, from the movement of vehicles, earthworks, and the clearing of vegetation which creates a larger surface area of exposed ground for the generation of dust.

Dust deposition on foliage has the potential to affect the ability of a plant to photosynthesise, or control water loss through transpiration. Dust accumulation on vegetation can be cyclical with increases in dust load during dry conditions and decreases occurring as a result of rainfall and replacement of affected leaves by new growth. Dust mitigation measures will be outlined in the CEMP, including ensuring vehicles are limited to designated access routes where dust production can be mitigated.

Dust suppression measures will be implemented for the Proposal. These will include surface watering, the restriction of earth moving vehicles if high winds are generating unmanageable dust levels, and the restriction of vehicle speeds to minimise the generation of dust. The

implementation of these mitigation measures is expected to reduce the dust emissions so that no significant impacts occur within or outside of the Proposal Footprint.

Following the construction phase, the operation of the Renewable Hydrogen Plant does not involve extensive machinery or earthworks, and any changes to dust deposition during this phase is expected to be limited to the immediate vicinity of the roads. The Proposal is not anticipated to result in any significant or residual impacts from dust generation.

5.5.5 Alteration to surface water drainage patterns

Vegetation clearing and soil disturbances can result in altered surface water drainage patterns, which can result in erosion and changes to vegetation structure and floristic composition in surrounding/adjacent areas. The Proposal Footprint is characterised by rocky outcrops as well as low relief areas, and some sheet flooding would be anticipated after high rainfall events. However, the annual rainfall in the region is 292.2 mm (1971 – 2020). There are no anticipated contaminant emissions from the Proposal and thus no impacts from surface water pollution.

There are no vegetation communities identified within the Development Envelope considered dependent on surface flow and as the Proposal Footprint is immediately upslope of the existing YPF site it is unlikely that there will be any potential for impacts to vegetation as a result of changes to surface water drainage patterns. On this basis there are no significant anticipated changes to surface water flows due to the construction and operation of the Proposal.

5.5.6 Alteration of fire regimes

A change in fire regimes is often associated with increased human activity, leading to degradation of natural ecosystems. Fire is a major determining factor in affecting species composition. It can cause disturbance of vegetation condition but can also be required for regeneration of some species. None of the vegetation types are identified as a significant fire risk; however vegetation type VT03 is more likely to support bushfire movement through the local area due to the presence of *Triodia* in the lower stratum.

Given the size of the Proposal Footprint and its location adjacent to existing infrastructure and roads, the Proposal is not considered likely to alter existing fire regimes in the local area. While there is an increased risk of fire during the construction phase, appropriate management measures will be implemented to minimise this risk. This will include identifying potential ignition sources and/or activities with the potential to lead to fire, and preventative measures. Weed management and the construction of firebreaks will reduce the risk of fires caused by the Proposal spreading to nearby vegetation. Fire mitigation measures are already implemented by the YPF and these will extend to the Proposal during operation. Fire is considered manageable and implementation of the Proposal is unlikely to significantly impact existing fire regimes.

5.5.7 Cumulative impacts

A summary of the impacts of other developments in close proximity to the Proposal is provided in Table 5-6. A review of the impacts to flora and vegetation from the implementation of the Proposal and from other developments indicates that there are minimal cumulative impacts.

Implementation of the Proposal will result in the loss of vegetation and flora. However, the vegetation types recorded within the Proposal Footprint are not restricted to the local area. Whilst similar vegetation may be impacted from other nearby developments, given the remaining extents of native vegetation at local and regional scales cumulative impacts are expected to be minor and not considered significant.

Table 5-6 Cumulative impacts to flora and vegetation of the Proposal and regional projects

Variable / Company	Yara Pilbara Fertilisers	Yara Pilbara Nitrates	Woodside Energy Ltd	Perdaman Chemicals and Fertilisers Pty Ltd
Project name	YPF Plant	Technical Ammonium Nitrate (TAN) Plant	Pluto LNG Development	Perdaman Urea Project
Type	Fertiliser	Nitrates	LNG	Chemicals/ fertiliser
Location	City of Karratha	City of Karratha	City of Karratha	City of Karratha
IBRA Bioregion	Pilbara	Pilbara	Pilbara	Pilbara
Total vegetation cleared	29 ha of native vegetation clearing	35 ha of native vegetation clearing	23.2 ha (Site A) and 96 ha (Site B) of native vegetation clearing	Proposed 73 ha of native vegetation clearing
Conservation significant flora affected	*Terminalia supranitifolia* (P3) (2 individuals)	No conservation significant flora on the site.	*Terminalia supranitifolia* (P3)	*Terminalia supranitifolia* (P3) (4 individuals) and *Rhynchosia bungarensis* (P4)
Conservation significant ecological communities affected	None. Burrup Peninsula Rock Pile Communities (P1 PEC) avoided	No TECs/PECs affected	No TECs/PECs affected	Loss of 0.13 ha of the Burrup Peninsula Rock Pile Communities (P1 PEC)

5.6 Mitigation

The loss of vegetation and conservation significant flora will be minimised through the following measures:

- Minimise clearing through site selection (clearing of good or better condition native vegetation will be minimised through the selection of the Proposal Footprint).
- Develop and implement ground disturbance procedures for clearing within the Development Envelope.
- Ensure staff and contractors are aware of the location of significant flora and vegetation on site.
- Vehicles and equipment access limited to designated roads/access tracks and cleared areas.

Dust generation impacts will be minimised by:

- Vehicles will be restricted to designated routes, where dust control measures are undertaken.

The introduction and spread of weeds will be minimised by:

- Vehicles access limited to designated roads/access tracks and cleared areas, and prohibition of off-road driving.
- Undertake a weed monitoring program to minimise existing weed populations and reduce the potential spread into adjacent land.

The impacts of altered fire regimes will be minimised by:

- Proposal site induction to include information on prevention and management of fires.
- All machinery and vehicles undertaking clearing activities will be fitted with firefighting equipment.

5.7 Predicted outcome

Implementation of the Proposal will result in the loss of 23.04 ha native vegetation and two individuals of *Terminalia supranitifolia* (Priority 3). With the exception of VT05, the vegetation present within the Development Envelope is not considered locally restricted and is represented in similar condition locally within Murujuga National Park. Given the extent of locally and regionally located high quality vegetation, and the implementation of flora and vegetation mitigation measures, it is considered that the construction and operation of the Proposal are unlikely to have a significant affect or long term impact on flora and vegetation.

There is not expected to be a detrimental impact to adjacent native vegetation during construction or operations through implementation of a CEMP. Therefore, it is expected that the Proposal can meet the EPA objective for this factor.

6. Terrestrial fauna

6.1 EPA objective

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

6.2 Policy and guidance

- Statement of Environmental Principles, Factors and Objectives (EPA 2018b)
- Environmental Factor Guideline: Terrestrial Fauna (EPA 2016c)
- EPA Technical Guidance –Terrestrial Fauna Surveys, Perth, Environmental Protection Authority (EPA 2016d)
- EPA Technical Guidance – Sampling methods for terrestrial vertebrate fauna, Perth, Environmental Protection Authority (EPA 2016e)
- Survey Guidelines for Australia's Threatened Bats (Department of the Environment, Water, Heritage and the Arts 2010a)
- Survey Guidelines for Australia's Threatened Mammals (Department of the Environment, Water, Heritage and the Arts 2010b)
- Survey Guidelines for Australia's Threatened Reptiles (Department of the Environment, Water, Heritage and the Arts 2010c).

6.3 Receiving environment

6.3.1 Technical studies

GHD undertook a single season Level 2 fauna survey of areas within and adjacent to the YPF lease boundary (the survey area). The purpose of the survey was to identify and describe the dominant fauna habitat types present, assess habitats for conservation significant fauna, assess habitat connectivity, and identify and record fauna species through a trapping program and opportunistically. The Level 2 fauna survey covered a survey area, which includes the Development Envelope and Proposal Footprint. The survey was conducted in March 2020, which is considered appropriate timing for the Pilbara IBRA bioregion. Furthermore, the survey was conducted following the wet season which is considered appropriate timing according to the EPA Technical Guidance – Terrestrial Fauna Surveys (EPA 2016d). The biological survey report is provided in Appendix A.

6.3.2 Fauna habitats

Six broad fauna habitats (excluding disturbed/cleared areas) were identified during the field survey, which closely align with the vegetation types and landforms within the area. Of these, all six habitats occur within the Development Envelope and five within the Proposal Footprint. The fauna habitat within the Proposal Footprint consists of foothills, minor drainage line, floodplain, sand plain and waterbody habitat.

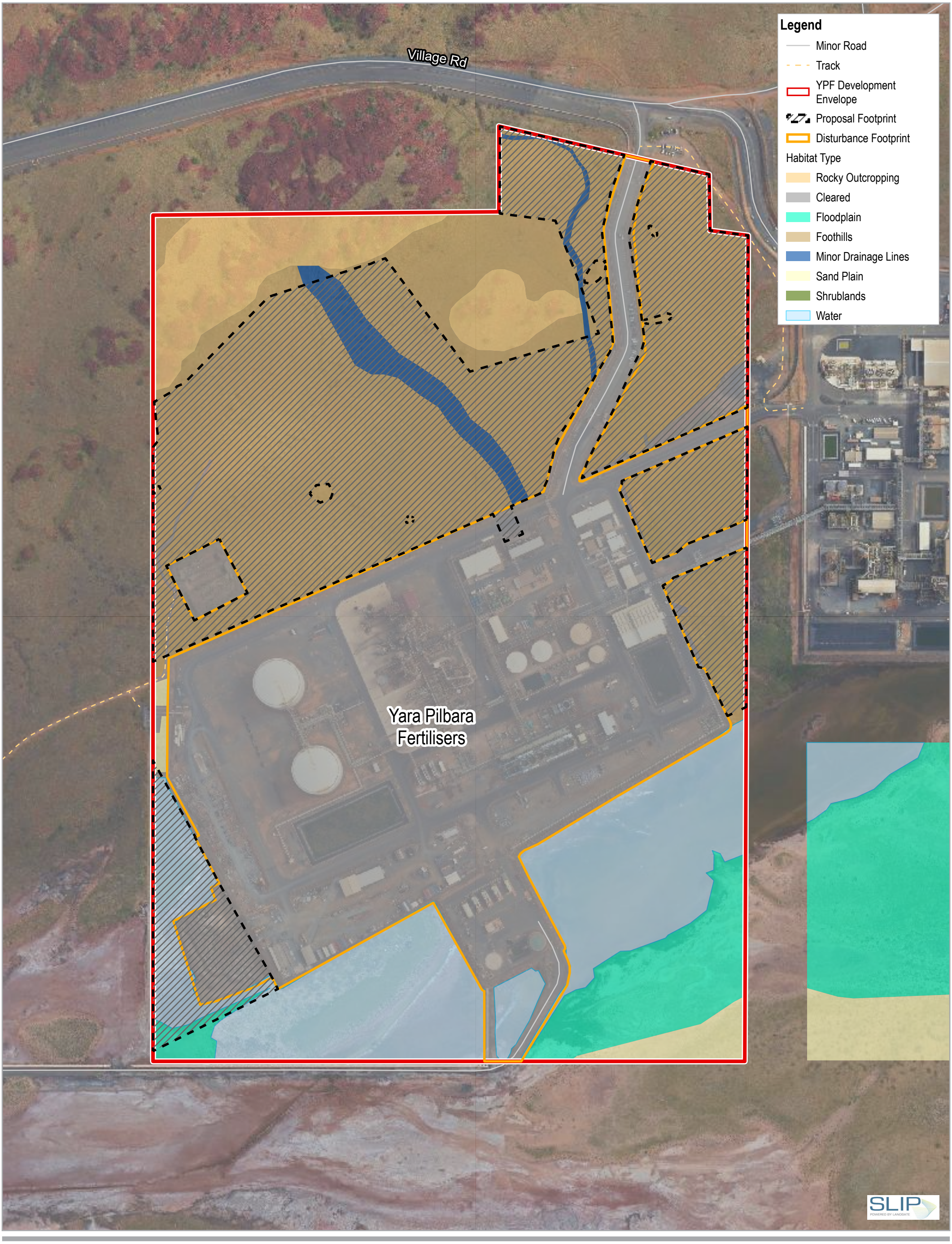
The habitats within the Proposal Footprint have moderate to high habitat value within the environment. Overall the habitats contain a diversity of fauna and all provide habitat for significant fauna species that are present or likely to be present in the local area.

The fauna habitat types within the survey area, Development Envelope and Proposal Footprint are provided in Table 6-1 and shown in Figure 6-1.

Table 6-1 Fauna habitat types within the survey area, Development Envelope and Proposal Footprint

Habitat type and description	Extent within the survey area (ha)	Extent within the Development Envelope (ha)	Extent in the Proposal Footprint (ha)
Rocky outcropping Description: Areas dominated by Triodia hummock grassland interspersed with hills with extensive rock outcropping or boulder piles. Value: High habitat value overall and high habitat value for fauna species of conservation significance. The area is a core habitat for the Pilbara Olive Python, and foraging habitat for the Peregrine Falcon and North-western Free-tail Bat.	3.74	3.74	-
Foothills Description: Triodia hummock grassland adjacent to rocky hills or below boulder piles. Also contains low hills with rock substrates. Value: Moderate to high value overall and habitat value for fauna species of conservation significance. Supportive habitat for species foraging and disbursal particularly the Pilbara Olive Python.	23.38	23.38	20.21
Minor drainage line Description: limited to the linear drainage systems which flow amongst the hills or on the foothills. Primarily consists of a thin, linear corridor of vegetation which drains into the intertidal mudflats and coastline. Contains Triodia hummock grasslands and small shrubs. Value: High habitat value overall and high habitat value for fauna species of conservation significance. Linear corridor of habitat utilised by Pilbara Olive Python and Peregrine Falcon (in rocky environments). A fauna corridor for all other species on the foothills.	9.38	1.34	1.24
Sand plain Description: present between the rocky hills between Hearson Cove and YPF and YPN. Comprises mixed shrublands over Triodia and Buffel on sand plain with scattered shrubs. Value: Low to moderate value overall and Habitat value for fauna species of conservation significance. This habitat provides potential hunting and foraging opportunities for the Peregrine Falcon.	4.98	0.69	0.01
Water/water body	9.69	9.69	1.47

Habitat type and description	Extent within the survey area (ha)	Extent within the Development Envelope (ha)	Extent in the Proposal Footprint (ha)
Description: lie on the southern side of the YPF and YPN and are present due to modification of the existing floodplain and drainage lines in the area. Seasonally filled with water and flanked by chenopod species. Value: High habitat value overall and high habitat value for fauna species of conservation significance. Five conservation significant species were recorded in this habitat type and include Caspian Tern, Gull-billed Tern, Common Sandpiper, Red-necked Stint and Common Greenshank. Other migratory species may also utilise the habitat opportunistically. Due to the amount of bird activity it is also possible Pilbara Olive Pythons may forage and reside in the rock wall on the northern side of the water body. Foraging habitat for the North-western Free-tail Bat. The Peregrine Falcon (*Falco peregrinus*) may also utilise the area for foraging only			
Floodplain Description: Linking King Bay and Hearson Cove is a series of tidal drainage lines and floodplain. When the high tide retracts to several small pools and a minor drainage line during the low period. Vegetation was generally sparse and scattered however in areas clustered to form low samphire shrublands. Value: Moderate to high value overall and habitat value for fauna species of conservation significance. Foraging habitat for migratory birds, North-western Free-tail Bat and Peregrine Falcon.	14.75	3.13	0.16
Cleared	29.24	29.24	1.68
Total	**95.16**	**71.20**	**24.78**



Paper Size ISO A3

0 25 50 75 100

Meters

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

N

Yara Pilbara Fertilisers Pty Ltd
Renewable Hydrogen Project

Fauna Habitats

Project No. **12520684**
Revision No. **1**
Date **17/07/2020**

FIGURE 6-1

G:\61\12520684\GIS\Maps\Working\12520684_Section38ReferralSupportingReport\12520684_Section38.aprx\12520684_6-1_FaunaHabitats_Rev
Print date: 17 Jul 2020 - 13:53

Data source: GHD: YPF Development Envelope, Proposal Footprint, Disturbance Footprint - 20200624, Fauna Habitats - 20200331; Landgate: Roads - 20190128, Landgate_Subscription_Imagery\WANow: Landgate / SLIP. Created by: bmorgan

6.3.3 Habitat linkages

The fauna habitats within the Development Envelope are part of a contiguous, largely intact area of remnant vegetation within land primarily used for industry, national park and recreation. The fauna habitats are part of a large area of similar habitats within the local area and greater Murujuga. The ephemeral floodplain/ drainage lines within the Development Envelope drain towards the coast and the plain areas provide corridors linking the coast to the surrounding hills. Overall, the habitats within the Development Envelope and Proposal Footprint are largely contiguous through the local area and mostly well connected with habitats through local area.

6.3.4 Fauna diversity

The *NatureMap* database identified 407 vertebrate fauna taxa previously recorded within 20 km of the Proposal. This total included 110 birds, 71 reptiles, 30 mammals, four amphibian, 133 invertebrates and 59 fish. Of the 407 fauna species previously recorded, 398 were native species and nine were naturalised (introduced) species.

The wet season (Level 2) 2020 fauna survey recorded 113 vertebrate fauna species (GHD 2020a). A breakdown of species groups recorded during the survey is provided in Table 6-2.

The surveys recorded 19 mammal species, including four introduced and 15 native mammals. The composition of species includes eight bats, two native rodents, two macropod, two small dasyurid, one Echidna and four introduced mammals. Bats were only recorded via echolocation (apart from one sighting of a White-striped Free-tailed Bat) therefore only presence or absence information could be collected. Mammals comprised the only group in which introduced fauna were recorded. In total, four species were observed – Black Rat, Dog, Cat and Fox. The Dogs were likely pets animals roaming while walking at Hearson Cove.

The bird surveys identified 57 bird species from 32 families. Most birds were recorded in the eastern part of the survey area and associated with the water bodies and tidal creek (outside of the Development Envelope and Proposal Footprint). Water bodies often incur greater number of species and numbers due to resources present.

A total of 36 reptile species were recorded from nine families and one amphibian species the Sheep Frog (*Cyclorana maini*) was recorded from the family hylidae.

Overall, it is considered that terrestrial vertebrate fauna were adequately sampled and that survey effort was adequate to provide a true representation of the fauna assemblage present in the survey area at the time of the survey (GHD 2020a).

Table 6-2 Species groups and diversity recorded during the survey

Species group	No. of species
Mammals	19
Birds	57
Reptiles	36
Amphibians	1
Total	**113**

6.3.5 Conservation significant fauna

Desktop searches identified the potential presence of 53 conservation significance fauna within the Development Envelope. This total does not include those species that are exclusively marine as no marine habitat is present within the Development Envelope or will be indirectly impacted by the Proposal. The field survey recorded eight conservation significant fauna species within or close to the Proposal (GHD 2020a) (Figure 6-2). These included:

- Pilbara Olive Python (*Liasis olivaceus barroni*) – Listed as Vulnerable under the BC Act and the EPBC Act
- Western Pebble-mound Mouse (*Pseudomys chapmani*) – Listed as Priority 4 by DBCA
- North-western Free-tail Bat (*Mormopetrus ozimops cobourgianus*) – Listed as Priority 1 by DBCA
- Caspian Tern (*Hydroprogne caspia*) – Listed Marine and Migratory (International Agreements) under the BC Act and the EPBC Act
- Gull-billed Tern (*Gelochelidon nilotica*) – Listed Marine and Migratory (International Agreements) under the BC Act and the EPBC Act
- Common Sandpiper (*Actitis hypoleucos*) – Listed Marine and Migratory (International Agreements) under the BC Act and the EPBC Act
- Common Greenshank (*Tringa nebularia*) – Listed Marine and Migratory (International Agreements) under the BC Act and the EPBC Act
- Red-necked Stint (*Calidris ruficollis*) – Listed Marine and Migratory (International Agreements) under the BC Act and the EPBC Act.

A further 23 conservation significant fauna species were considered likely to occur based on species biology, habitat requirements, and the quality and availability of suitable habitat as determined during the field survey. Of the 23 conservation significant species that are considered likely to occur in the Development Envelope and Proposal Footprint, 22 were considered likely due to the Floodplain and Water body habitats. These habitats provide foraging habitat for migratory shore bird species. The remaining habitats of the Development Envelope and Proposal Footprint are not considered to be used by these species. The remaining one conservation significant species, the Peregrine Falcon is known from the region and would opportunistically use all the habitats present (excluding cleared areas) in the Development Envelope and Proposal Footprint for foraging purposes only.

A summary of the fauna species of conservation significance known or considered likely to occur within the Development Envelope and/or Proposal Footprint is provided in Table 6-3. A copy of the likelihood of occurrence assessment is provided in the biological survey report (GHD 2020a) (Appendix A).

Table 6-3 Conservation significant terrestrial fauna likelihood of occurrence in the Proposal Footprint

Species	Status	Suitable habitat	Outcome
Birds			
Actitis hypoleucos Common Sandpiper	EPBC Act: Ma, Mi BC Act/DBCA: IA	Floodplain, Water body	Recorded in the survey area. The species utilises a wide range of coastal and some inland wetlands and generally forages in shallow water and on bare soft mud at the edges of wetlands. The species is known from the region and one Common Sandpiper was recorded foraging in the survey area (this is not uncommon as this species is solitary). There is habitat present for this species in the Development Envelope and limited foraging habitat for this species within the Proposal Footprint, restricted to floodplain and water body.
Calidris acuminata Sharp-tailed Sandpiper	EPBC Act: Ma, Mi BC Act/DBCA: IA	Floodplain, Water body	Likely to occur. The species is known from the region and would opportunistically use the habitats present in the survey area and Development Envelope for foraging purposes only. There is limited foraging habitat for this species within the Proposal Footprint, restricted to floodplain and water body.
Calidris canutus Red Knot	EPBC Act: Ma, Mi, En BC Act/DBCA: En	Floodplain, Water body	Likely to occur. The species is known from the region and would opportunistically use the habitats present in the survey area and Development Envelope for foraging purposes only. There is limited foraging habitat for this species within the Proposal Footprint, restricted to floodplain and water body.
Calidris ferruginea Curlew Sandpiper	EPBC Act: Ma, Mi, CE BC Act/DBCA: CE	Floodplain, Water body	Likely to occur. The species is known from the region and would opportunistically use the habitats present in the survey area and Development Envelope for foraging purposes only. There is limited foraging habitat for this species within the Proposal Footprint, restricted to floodplain and water body.
Calidris melanotos Pectoral Sandpiper	EPBC Act: Ma, Mi BC Act/DBCA: IA	Floodplain, Water body	Likely to occur. The species is known from the region and would opportunistically use the habitats present in the survey area and Development Envelope for foraging purposes only. There is limited foraging habitat for this species within the Proposal Footprint, restricted to floodplain and water body.

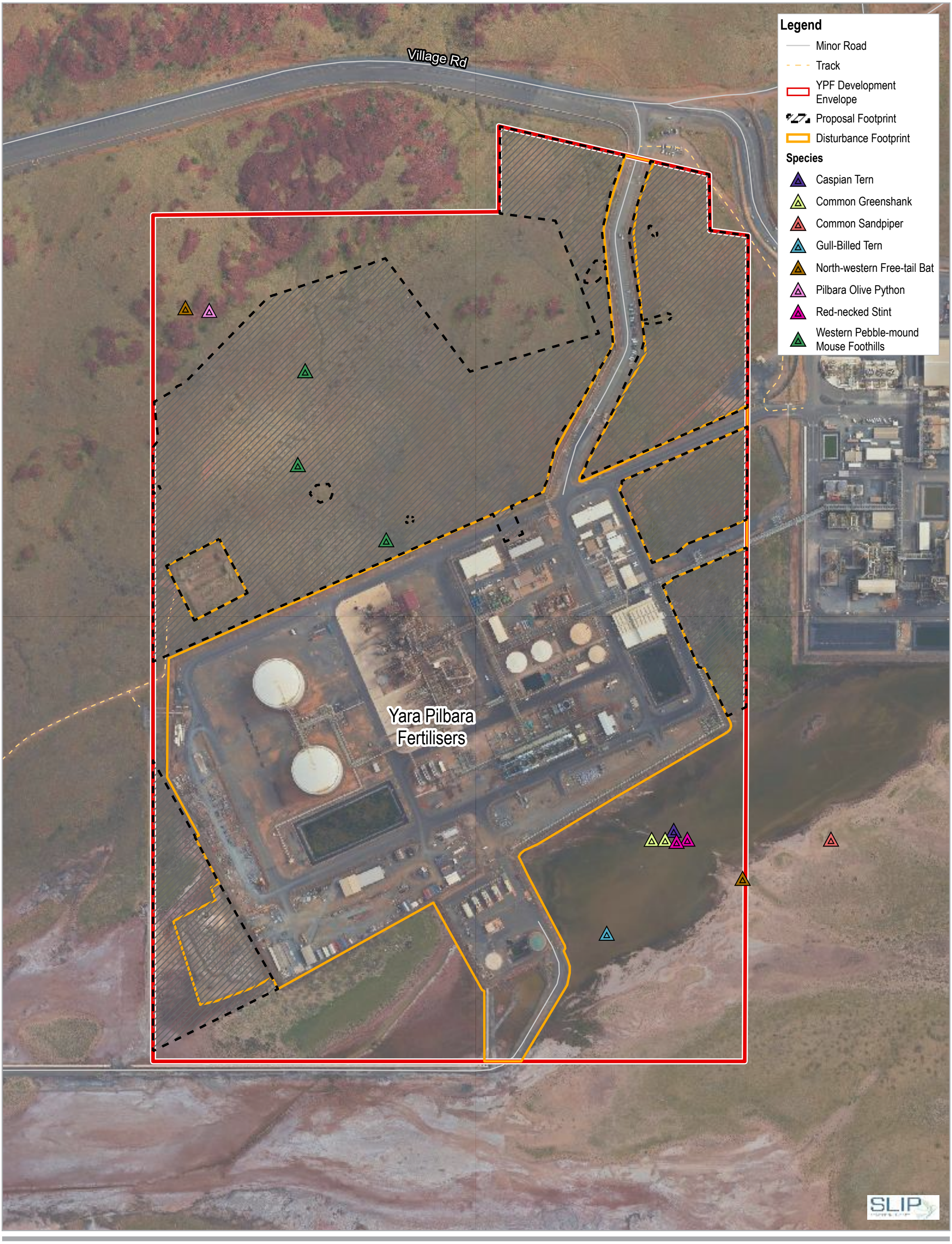
Species	Status	Suitable habitat	Outcome
Calidris ruficollis Red-necked Stint	EPBC Act: Ma, Mi BC Act/DBCA: IA	Floodplain, Water body	Recorded in the survey area and Development Envelope. In Australasia, the species is mostly found in coastal areas, including in sheltered inlets, bays, lagoons and estuaries with intertidal mudflats, often near spits, islets and banks and, sometimes, on protected sandy or coralline shores. Numerous individuals were recorded foraging in the survey area and Development Envelope, and when disturbed flew towards Hearson's Cove. There is limited foraging habitat for this species within the Proposal Footprint, restricted to floodplain and water body.
Calidris subminuta Long-toed Stint	EPBC Act: Ma, Mi BC Act/DBCA: IA	Floodplain, Water body	Likely to occur. The species is known from the region and would opportunistically use the habitats present in the survey area and Development Envelope for foraging purposes only. There is limited foraging habitat for this species within the Proposal Footprint, restricted to floodplain and water body.
Calidris tenuirostris Great Knot	EPBC Act: Ma, Mi, CE BC Act/DBCA: CE	Floodplain, Water body	Likely to occur. The species is known from the region and would opportunistically use the habitats present in the survey area and Development Envelope for foraging purposes only. There is limited foraging habitat for this species within the Proposal Footprint, restricted to floodplain and water body.
Charadrius veredus Oriental Plover	EPBC Act: Ma, Mi BC Act/DBCA: IA	Floodplain, Water body	Likely to occur. The species is known from the region and would opportunistically use the habitats present in the survey area and Development Envelope for foraging purposes only. There is limited foraging habitat for this species within the Proposal Footprint, restricted to floodplain and water body.
Falco peregrinus Peregrine Falcon	BC Act/DBCA: OS	All habitats excluding cleared areas.	Likely to occur. The species is known from the region and would opportunistically use all the habitats present in the survey area and Development Envelope for foraging purposes only. This species would opportunistically use all of the habitats present in the Proposal Footprint, excluding cleared areas for foraging only.
Gelochelidon nilotica Gull-billed Tern	EPBC Act: Ma, Mi BC Act/DBCA: IA	Floodplain, Water body	Recorded in the survey area and Development Envelope. The species is common and widespread in Australia and are found in freshwater swamps, brackish salt lakes, beaches and estuarine mudflats, floodwaters, sewage farms, irrigated croplands and grasslands, where resources are favourable (Morcombe 2008). The species is known from the region and was recorded foraging in the survey area and Development Envelope. There is limited foraging habitat for this species within the Proposal Footprint, restricted to floodplain and water body.

Species	Status	Suitable habitat	Outcome
Glareola maldivarum Oriental Pratincole	EPBC Act: Ma, Mi BC Act/DBCA: IA	Floodplain, Water body	Likely to occur. The species is known from the region and would opportunistically use the habitats present in the survey area and Development Envelope for foraging purposes only. There is limited foraging habitat for this species within the Proposal Footprint, restricted to floodplain and water body.
Hydroprogne caspia Caspian Tern	EPBC Act: Ma, Mi BC Act/DBCA: IA	Floodplain, Water body	Recorded in the survey area and Development Envelope. The species 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. The species was recorded foraging in the survey area and Development Envelope. There is limited foraging habitat for this species within the Proposal Footprint, restricted to floodplain and water body.
Limicola falcinellus Broad-billed Sandpiper	EPBC Act: Ma, Mi BC Act/DBCA: IA	Floodplain, Water body	Likely to occur. The species is known from the region and would opportunistically use the habitats present in the survey area and Development Envelope for foraging purposes only. There is limited foraging habitat for this species within the Proposal Footprint, restricted to floodplain and water body.
Limosa lapponica Bar-tailed Godwit	EPBC Act: Ma, Mi BC Act/DBCA: IA	Floodplain, Water body	Likely to occur. The species is known from the region and would opportunistically use the habitats present in the survey area and Development Envelope for foraging purposes only. There is limited foraging habitat for this species within the Proposal Footprint, restricted to floodplain and water body.
Limosa limosa Black-tailed Godwit	EPBC Act: Ma, Mi BC Act/DBCA: IA	Floodplain, Water body	Likely to occur. The species is known from the region and would opportunistically use the habitats present in the survey area and Development Envelope for foraging purposes only. There is limited foraging habitat for this species within the Proposal Footprint, restricted to floodplain and water body.
Numenius madagascariensis Eastern Curlew	EPBC Act: Ma, Mi, CE BC Act/DBCA: CE	Floodplain, Water body	Likely to occur. The species is known from the region and would opportunistically use the habitats present in the survey area and Development Envelope for foraging purposes only. There is limited foraging habitat for this species within the Proposal Footprint, restricted to floodplain and water body.

Species	Status	Suitable habitat	Outcome
Numenius minutus Little Curlew	EPBC Act: Ma, Mi BC Act/DBCA: IA	Floodplain, Water body	Likely to occur. The species is known from the region and would opportunistically use the habitats present in the survey area and Development Envelope for foraging purposes only. There is limited foraging habitat for this species within the Proposal Footprint, restricted to floodplain and water body.
Numenius phaeopus Whimbrel	EPBC Act: Ma, Mi BC Act/DBCA: IA	Floodplain, Water body	Likely to occur. The species is known from the region and would opportunistically use the habitats present in the survey area and Development Envelope for foraging purposes only. There is limited foraging habitat for this species within the Proposal Footprint, restricted to floodplain and water body.
Pandion cristatus Eastern Osprey	EPBC Act: Ma, Mi BC Act/DBCA: IA	Floodplain, Water body	Likely to occur. The species is known from the region and would opportunistically use the habitats present in the survey area and Development Envelope for foraging purposes only. There is limited foraging habitat for this species within the Proposal Footprint, restricted to floodplain and water body.
Pluvialis fulva Pacific Golden Plover	EPBC Act: Ma, Mi BC Act/DBCA: IA	Floodplain, Water body	Likely to occur. The species is known from the region and would opportunistically use the habitats present in the survey area and Development Envelope for foraging purposes only. There is limited foraging habitat for this species within the Proposal Footprint, restricted to floodplain and water body.
Pluvialis squatarola Grey Plover	EPBC Act: Ma, Mi BC Act/DBCA: IA	Floodplain, Water body	Likely to occur. The species is known from the region and would opportunistically use the habitats present in the survey area and Development Envelope for foraging purposes only. There is limited foraging habitat for this species within the Proposal Footprint, restricted to floodplain and water body.
Rostratula australis Australian Painted Snipe	EPBC Act: Ma, En BC Act/DBCA: En	Floodplain, Water body	Likely to occur. The species is known from the region and would opportunistically use the habitats present in the survey area and Development Envelope for foraging purposes only. There is limited foraging habitat for this species within the Proposal Footprint, restricted to floodplain and water body.
Thalasseus bergii Crested Tern	EPBC Act: Ma, Mi BC Act/DBCA: IA	Floodplain, Water body	Likely to occur. The species is known from the region and would opportunistically use the habitats present in the survey area and Development Envelope for foraging purposes only. There is limited foraging habitat for this species within the Proposal Footprint, restricted to floodplain and water body.

Species	Status	Suitable habitat	Outcome
Tringa brevipes Grey-tailed Tattler	EPBC Act: Ma, Mi BC Act/DBCA: IA, P4	Floodplain, Water body	Likely to occur. The species is known from the region and would opportunistically use the habitats present in the survey area and Development Envelope for foraging purposes only. There is limited foraging habitat for this species within the Proposal Footprint, restricted to floodplain and water body.
Tringa nebularia Common Greenshank	EPBC Act: Ma, Mi BC Act/DBCA: IA	Floodplain, Water body	Recorded in the survey area and Development Envelope. The species is found in a wide variety of inland wetlands and sheltered coastal habitats of varying salinity. Numerous individuals were recorded foraging in the survey area and Development Envelope, and once disturbed flew towards Hearson's Cove. There is limited foraging habitat for this species within the Proposal Footprint, restricted to floodplain and water body.
Tringa stagnatilis Marsh Sandpiper	EPBC Act: Ma, Mi BC Act/DBCA: IA	Floodplain, Water body	Likely to occur. The species is known from the region and would opportunistically use the habitats present in the survey area and Development Envelope for foraging purposes only. There is limited foraging habitat for this species within the Proposal Footprint, restricted to floodplain and water body.
Xenus cinereus Terek Sandpiper	EPBC Act: Ma, Mi BC Act/DBCA: IA	Floodplain, Water body	Likely to occur. The species is known from the region and would opportunistically use the habitats present in the survey area and Development Envelope for foraging purposes only. There is limited foraging habitat for this species within the Proposal Footprint, restricted to floodplain and water body.
Mammals			
Pseudomys chapmani Western Pebble-mound Mouse	DBCA: P4	Foothills	Recorded. The species is restricted to the Pilbara region and suitable habitat consists of stony hills or hillsides with hummock grasslands. It constructs large mounds of pebbles on stony hills which cover an area of 0.5-9.0 square metres (Start 1996). 'Active' mounds are characterized by volcano-like cones capped by 'craters' that mark occluded entrances to subterranean burrow systems in which the mice live (van Dyck and Strahan 2008). Evidence of the species was recorded via five disused mounds during the survey ranging from about 6 months to 2+ years old. There is habitat for the species in the survey area, Development Envelope and Proposal Footprint, restricted to the Foothills.

Species	Status	Suitable habitat	Outcome
Mormopetrus ozimops cobourgianu North-western Free-tail Bat	DBCA: P1	Foraging habitat: Rocky outcropping, Floodplain, Water body	Recorded. The species is known from 12 locations in WA and four in the Northern Territory. The species appears to be restricted in distribution to a few localised habitats. The species can appear to be locally common because it aggregates, however over a landscape is localised and restricted. In WA it inhabits mangrove stands, and has been recorded roosting in hollows and or crevices in mangroves (van Dyck and Strahan 2008). The species was recorded during the survey from calls over five nights. It is likely the species opportunistically forages in the survey area and roosts in the mangroves to the west (in King Bay) or to the east in the northern portion of Hearson's Cove. There is foraging habitat for the species in the survey area and Development Envelope. There limited foraging habitat for this species within the Proposal Footprint, restricted to floodplain and water body.
Reptiles			
Liasis olivaceus subsp. barroni Pilbara Olive Python	EPBC Act: Vu BC Act: Vu	Core habitat: Rocky outcropping, Minor drainage line Supportive habitat: Foothills, water body	Recorded. The species is restricted to the Pilbara region predominantly within the Hamersley Range and Dampier Archipelago (Tutt *et al*., 2002). Suitable habitat consists of granophyre rock escarpments, gorges and waterholes, and microhabitats including rock piles, on top of rocks, and under spinifex as well as in man-made features such as overburden heaps, railway embankments and sewerage treatment ponds. Two individuals were recorded during the survey, one large adult in the northern part of the Development Envelope and one roadkill (juvenile) outside of the Development Envelope. There is core and supportive habitat for the species in the survey area and Development Envelope. There limited core habitat for this species within the Proposal Footprint, restricted to the minor creek line. There is supportive habitat for this species within the Proposal Footprint including Foothills and water body.



Paper Size ISO A3

0 25 50 75 100

Meters

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

N

GHD

Yara Pilbara Fertilisers Pty Ltd
Renewable Hydrogen Project

Conservation Significant Fauna Records

Project No. **12520684**
Revision No. **1**
Date **17/07/2020**

FIGURE 6-2

G:\61\12520684\GIS\Maps\Working\12520684_Section38ReferralSupportingReport\12520684_Section38.aprx\12520684_6-2_FaunaSpeciesRecords_Rev
Print date: 17 Jul 2020 - 13:57

Data source: GHD: YPF Development Envelope, Proposal Footprint, Disturbance Footprint - 20200624, Fauna Results - 20200401; Landgate: Roads - 20190128, Landgate_Subscription_Imagery\WANow: Landgate / SLIP. Created by: bmorgan

6.4 Potential impacts

The Proposal will result in the direct loss of fauna habitat, including habitat for conservation significant fauna through clearing.

The Proposal could also result in the following indirect impacts to fauna:

- Injury and/or death as a result of vehicle strike
- Habitat fragmentation
- Temporary increase in noise and vibration during construction and operation resulting in native fauna avoiding the area.

6.5 Assessment of impacts

6.5.1 Direct loss of fauna habitat

The most significant fauna habitats within the Development Envelope are the rocky outcropping, floodplain and water body due to the conservation significant fauna recorded at these habitats. The rocky outcropping habitat, in particular, is significant fauna habitat as the extensive crevices within the outcrops enable saxicoline species to persist. Additionally it is core habitat for the Pilbara Olive Python. The Proposal has avoided habitat of greatest environmental value (rocky outcropping) and sought to best minimise disturbance in all other habitats with elevated value. On this basis that the Proposal reduces the extent of valuable habitat, development will not result in significant environmental impacts.

The Proposal Footprint will require clearing within five fauna habitats, of which two fauna habitats comprise less than 1 ha of the Proposal Footprint each. Of the 23.09 ha of fauna habitat to be cleared, 20.21 ha will be in the foothills habitat, 1.24 ha is minor drainage lines, 0.16 ha is floodplain, 0.01 ha is sand plain and 1.47 ha is waterbody habitat. The Proposal Footprint avoids all rocky outcropping habitat.

The majority of the clearing will occur with the foothills habitat. The foothills habitat has a moderate to high habitat value for fauna species of conservation significance as it supports species foraging and disbursal, such as the Pilbara Olive Python seasonally. The foothills habitat may also be used by the Peregrine Falcon for foraging. Old (inactive) Western Pebble-mound Mouse mounds were recorded in the foothills with the species considered no longer present on Murujuga.

The foothills habitat is well represented outside the Development Envelope. The vegetation, landform and habitat values (i.e. *Triodia* hummock grassland) are typical of Vegetation Association 117 (which is described as Hummock grasslands, grass steppe; soft spinifex). As identified in Section 5.5.1, the Proposal will result in the reduction of approximately 0.07% of mapped Vegetation Association 117 at a local scale (City of Karratha) and approximately 0.05% at a regional scale (Pilbara IBRA bioregion). The proposed clearing will not reduce the current extent of association 117 to less than 75% of its pre-European extent at a local scale and 90% at a regional scale, and therefore will not significantly reduce the extent of vegetation association 117 at any scale (Table 5-3). On this basis the foothills habitat will continue to be well represented outside the Proposal Footprint.

While the Proposal Footprint has been minimised as much as possible, minor clearing will still be required in the water body, minor drainage line, sand plain and floodplain habitats. Terns and migratory waders are vagrant and would seasonally utilise the waterbody and opportunistically utilise floodplain areas around high tide events. The Pilbara Olive Python would seasonally use the water body for feeding and disbursal purposes. The North-western

Free-tail Bat opportunistically forages in the Proposal Footprint. Its core habitat is mangroves to which there are none in the Development Envelope.

The extent of water body and minor creek line habitats in the Proposal Footprint is limited in size and occurs adjacent to existing infrastructure. It is considered that the limited extent of clearing is unlikely to provide substantial habitat amenity.

6.5.2 Vehicle strike

Construction and operation of the Renewable Hydrogen Plant and associated infrastructure will result in an increase in vehicle movements to and from the Proposal Footprint.

Construction activities will be undertaken in accordance with measures identified in the CEMP, such a requirement for trained fauna handler(s) to be on site during ground disturbing activities. While operational activities may increase the potential for fauna strike, there is already road access to, from and around the current YPF.

The ongoing implementation of speed limits to prevent the likelihood of fauna road deaths, and minimising driving at dusk and dawn will limit the impact of the mining development. It is unlikely that any isolated deaths of individuals will affect the conservation status and distribution of any fauna species.

6.5.3 Habitat fragmentation

All fauna habitats identified within the Development Envelope are present throughout the greater Karratha/Dampier area. However, on the Murujuga, the sandy plain and floodplain is restricted due to the rocky nature of the remainder of the Murujuga.

Terns and migratory waders utilise a wide range of habitats. All species are considered relatively common and to opportunistically use the area. There is only a small amount of habitat within the Development Envelope and Proposal Footprint for these species to use. The impact of habitat fragmentation on terns and migratory waders are likely to be negligible. The North-western Free-tail Bat core habitat is mangroves. The impact of habitat fragmentation is likely to be negligible.

The Proposal will contribute to habitat loss and fragmentation through vegetation clearing of foothills, a water body and a minor creek line; however, impacts to fauna are not expected to be significant given the extensive tracts of similar vegetation in the local and regional areas for the for Pilbara Olive Python and Peregrine Falcon to forage in.

6.5.4 Noise and vibration

During construction, there will be industrial noise due to heavy vehicles entering and exiting the Site, as well as from operation of equipment and machinery. Noise and vibration associated with vehicle movements have the potential to result in short-term disturbance to fauna on a local scale.

During operation there is be only an incremental increase in potential noise impacts to fauna as noise impacts already exist within an industrial area, strategically close to gas, port and other infrastructure in the Pilbara region. As there is existing industrial infrastructure adjacent to the site, fauna are likely to be accustomed to noise and vibration impacts. Noise and vibration is unlikely to have a permanent impact on fauna species as species may temporarily avoid the area.

6.6 Mitigation

Impacts will be minimised through the following mitigation and management measures:

- Avoidance through Site selection. Clearing of high quality native fauna habitat was minimised through selection of the Proposal Footprint.
- Fauna found within the Proposal Footprint during ground disturbing activities and which require relocation, will be relocated by a trained fauna handler.
- Clearing to be timed to minimise impacts on native fauna.
- If native fauna is disturbed during clearing it will be allowed to make its own way to adjacent vegetated areas.
- Should trenches be constructed, which native fauna are unable to escape from, they will be inspected by a “fauna spotter” on a regular basis (commencement of day shift, midday and prior to sunset). If trenches are left open overnight, ramps will be established to permit native fauna to escape.
- Any native fauna injured as a result of the Proposal construction or operation will be taken to a designated veterinary clinic or a DBCA nominated wildlife carer.
- Dust, noise and vibration management measures will be implemented during construction and operation.

6.7 Predicted outcomes

The Proposal Footprint provides low to high habitat value within the environment. The habitat types identified within the Proposal Footprint form part of similar habitats within the local area and greater Murujuga. The ecological linkages connecting the surrounding hills and coast through drainage lines, floodplains and vegetation is sufficient to maintain a contiguous fauna habitat.

By implementing fauna management measures, it is considered that construction and operations phases of the Proposal are unlikely to have a significant or long-term impact on terrestrial fauna values.

7. Social surroundings

7.1 EPA objective

To protect social surroundings from significant harm.

7.2 Policy and guidance

- Environmental Factor Guideline – Social surroundings (EPA 2016f) states that section 3(1) of the EP Act defines environment to include social surroundings.
- Subsection 3(2) of the EP Act states "the social surroundings of man are his aesthetic, cultural, economic and social surroundings to the extent that those surroundings directly affect or are affected by his physical or biological surroundings."

7.3 Receiving environment

7.3.1 Heritage sites

The Development Envelope has been subject to a number of previous archaeological studies. On the basis of the existing data, an archaeological site verifications survey (LAS 2020) was undertaken in July 2020 to verify the heritage values within the Development Envelope. The survey involved archaeologists and an anthropologist and consultation with the MAC (Appendix A).

The aims of the surveys were to:

- Record the location, and describe the archaeological sites, within the YPF development envelope
- If satisfied the archaeological material meets criteria under Section 5 of the AHA, clearly determine the extent of the site, and complete a recording of archaeological features, using a systematic method of site recording.

In light of the developing potential COVID-19 virus, and in order to avoid potential risk of transmission to Aboriginal Elders, the study was structured to include:

- A desktop study
- Pre-fieldwork consultation
- Field survey
- Post-fieldwork consultation.

The desktop assessment involved a search of the Department of Planning, Lands and Heritage (DPLH) Aboriginal Heritage Inquiry System (AHIS), which identified 32 previously recorded Aboriginal heritage places with boundaries overlapping the Development Envelope. Of these 32 places:

- Nine are 'Registered Sites' meaning the Aboriginal Cultural Material Committee (ACMC) has assessed these as places to which the *Aboriginal Heritage Act 1972* applies
- 19 are 'Lodged' meaning the places are yet to be assessed by the ACMC
- Three are 'Stored Data' meaning these places have been assessed as not being Aboriginal Sites under the *Aboriginal Heritage Act 1972*
- One place (23323) has the site status of 'Contact DAA' and does not fall into any of the above categories.

Desktop analysis of these previous site recordings identified 18 of the 32 DPLH AHIS sites are potentially within the Development Envelope. This is based on the fact that three of the sites have been assessed as not Aboriginal Sites (18611, 18614 and 18616), six sites have previously been salvaged under a Section 18 consent under the AHA (9635, 18611, 18614, 18616, 18617 and 21922), many places were recorded on other parts of Murujuga (e.g. 23383, 23402, and 23763), and one covers the whole of Murujuga (23323) but the site status is unclear.

The hills in the northwest of the Development Envelope were considered likely to have a number of heritage sites. In consultation with MAC, the hills in the northwest of the Development Envelope the hill areas were excluded from development and were therefore not surveyed. With the exclusion of hills in the northwest, nine of the potential 18 sites remain in the survey area.

The field survey was undertaken to verify the location of the nine heritage sites. While the site boundaries of eight of the nine sites have been verified, one site (20266) could not be located. The one that could not be located, site 20266, is recorded as being on the same granophyre outcrop as 20265. Figure 7-1 shows the archaeological site types within the survey area are as follows:

- five engravings (18612, 20265, 20266, 20894, 20895)
- two quarries (18612 and 20897)
- one artefact scatter (9839)
- one grinding patch (20264).

The archaeological sites within the surveyed portion of the Development Envelope are all small and relatively modest based on known sites on Murujuga (e.g. Ngajarli / Deep Gorge). The engraving sites contain a maximum of four motifs; none of which are outstanding examples of rock art when compared to other places with the same motifs. The artefact scatters and quarries are small, and do not have a wide variety of technological innovation for stone tool making.

Consultation with MAC representatives acknowledged these nine sites as being of cultural importance, and that the sites should not be disturbed. MAC also advised that the area was not heavily used by Aboriginal people in the past, and was likely a place of temporary habitation where resources were gathered, and art made in an impromptu manner, as people travelled through the country to better watered and sheltered areas on Murujuga.

On the basis of the cultural importance of each site the Proposal Footprint has been modified to avoid all identified sites.

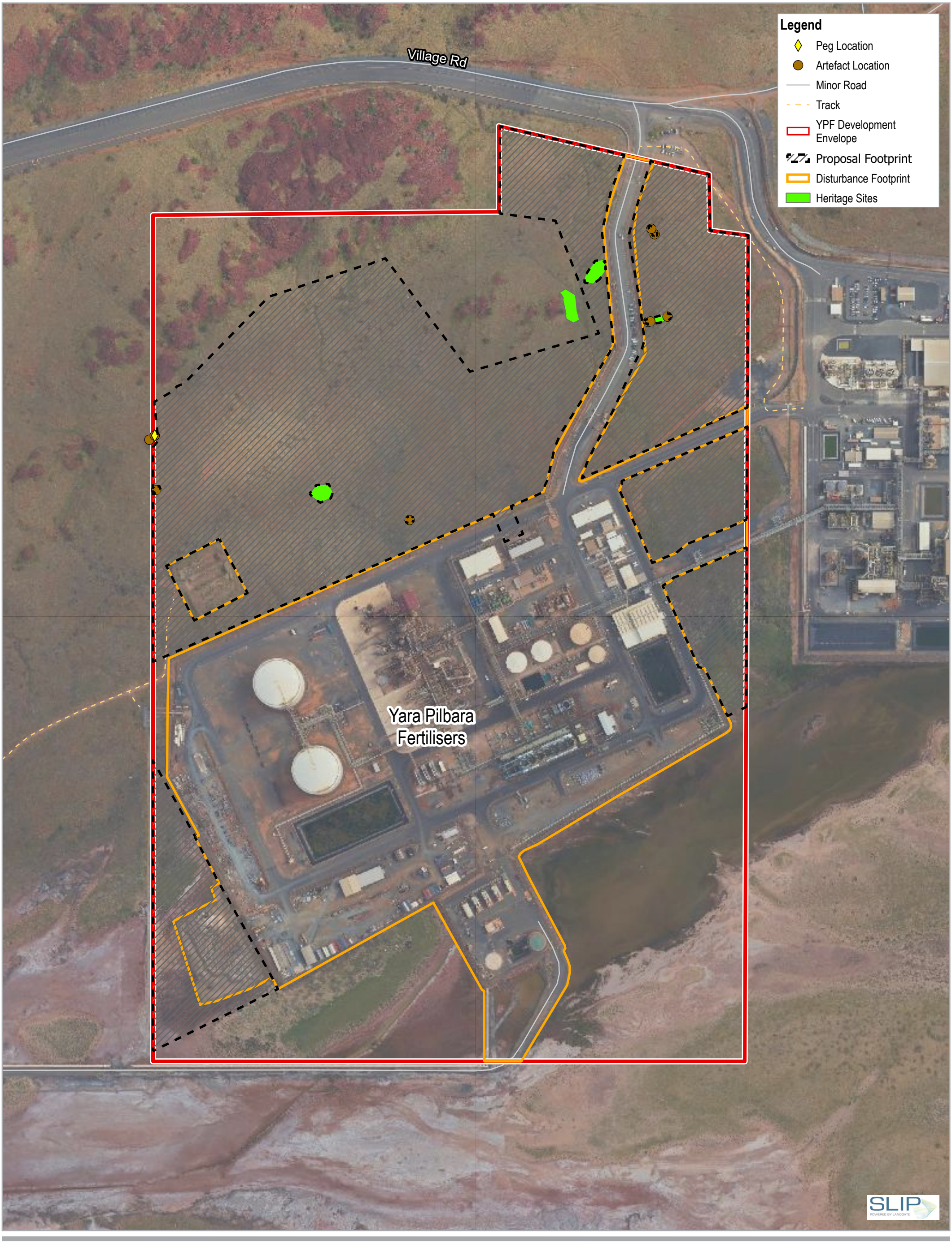
A follow-up heritage survey was undertaken by LAS in July 2020 to identify heritage values in areas west and east of the existing YPF Plant. No heritage values were identified from these areas.

7.3.2 National Heritage

In addition to the recorded heritage sites associated with archaeological sites, the majority of the Dampier Archipelago (including Murujuga) is designated a National Heritage Place. The Dampier Archipelago (including Murujuga) was included in the National Heritage List on 3 July 2007. It contains a diverse array of Aboriginal heritage including dreaming sites, ceremonial sites, rock engravings and archaeological sites, and is one of the densest concentrations of rock engravings in Australia with some sites containing thousands or tens of thousands of images (DAWE 2020c).

A portion of the Development Envelope associated with rocky outcrop in the northwest is included within the National Heritage Place. The National Heritage Place effectively aligns with the Heritage Sites in the Development Envelope.

As shown in Figure 7-2, the Proposal Footprint has been specifically designed to avoid any areas that are classified as National Heritage Place.



Paper Size ISO A3

0 25 50 75 100

Meters

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

N

GHD

Yara Pilbara Fertilisers Pty Ltd
Renewable Hydrogen Project

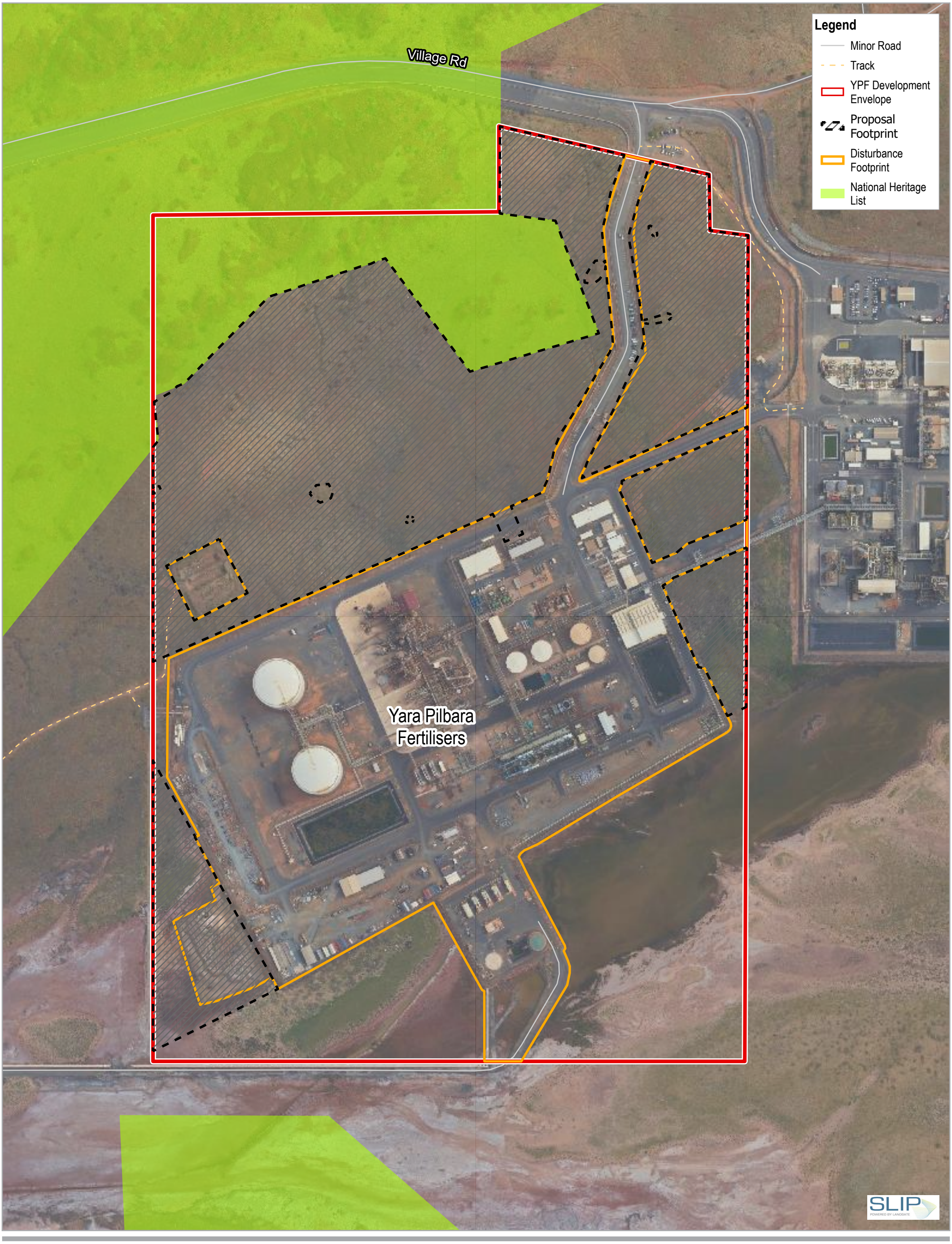
Heritage Records

Project No. **12520684**
Revision No. **1**
Date **17/07/2020**

FIGURE 7-1

G:\61\12520684\GIS\Maps\Working\12520684_Section38ReferralSupportingReport\12520684_Section38.aprx\12520684_7-1_HeritageRecords_Rev
Print date: 17 Jul 2020 - 14:05

Data source: GHD: YPF Development Envelope, Proposal Footprint, Disturbance Footprint, Artefact Location, Heritage Sites, Peg Location - 20200624; Landgate: Roads - 20190128, Landgate_Subscription_Imagery\WANow: Landgate / SLIP. Created by: bmorgan



Paper Size ISO A3

0 25 50 75 100

Metres

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

N

GHD

Yara Pilbara Fertilisers Pty Ltd
Renewable Hydrogen Project

National Heritage Area

Project No. **12520684**
Revision No. **1**
Date **17/07/2020**

FIGURE 7-2

G:\61\12520684\GIS\Maps\Working\12520684_Section38ReferralSupportingReport\12520684_Section38.aprx\12520684_7-2_NationalHeritageArea_Rev
Print date: 17 Jul 2020 - 14:09

Data source: GHD: YPF Development Envelope, Proposal Footprint, Disturbance Footprint - 20200624, Fauna Habitats - 20200331; Landgate: Roads - 20190128, Landgate_Subscription_Imagery\WANow: Landgate / SLIP. Created by: bmorgan

7.3.3 Amenity

The Murujuga is a popular tourist and recreational destination and also comprises the Burrup SIA. The area supports a number of large industrial developments as well as a number of others that are currently being proposed for development.

The Proposal Footprint is located directly north of the existing YPF plant and west of the existing TAN plant. Access to the Proposal Footprint is via Village Road which is located north of the Proposal Footprint.

The Hearson Cove foreshore is located 1.5 km the east of the Proposal Footprint. Hearson Cove beach is a popular recreational place with a strong social value for locals and visitors. Hearson Cove foreshore is currently accessed via Hearson Cove Road which is located south of the Development Envelope.

7.4 Potential impacts

The Proposal Footprint has been designed to specifically avoid all known Heritage Sites and the areas within the National Heritage Place. The Proposal has the potential to indirectly impact known Heritage Sites and areas within the National Heritage Place as a result of blasting debris, vibration and dust deposition from ground preparation works during construction.

Construction of the Proposal also has the potential to impact upon the amenity (visual, noise and vibration) of the Murujuga.

7.5 Assessment of impacts

7.5.1 Disturbance to heritage sites

During construction, earthworks have the potential to accidentally disturb heritage sites through blasting debris, vibration and dust deposition. Construction protocols will be implemented, and these will incorporate ground disturbance procedures for clearing and blasting within the Development Envelope and an induction process that will be developed in consultation with MAC to ensure that all staff and contractors are aware of the location of heritage sites, and the necessity to avoid them. Appropriate physical barriers will be placed to physically isolate heritage sites, and this will be undertaken in consultation with MAC. In addition to the ground disturbance procedures, the presence of Aboriginal monitors during ground disturbance works, will protect any heritage values.

Dust onsite will be controlled principally by restricting vehicles to designated routes, and dust suppression can be introduced if required. Vibration will be controlled through planned blasting and the designation of buffer zones as required. A geotechnical assessment and risk assessment of vibration impact will be completed to guide blasting. Vibration will also be controlled by minimising heavy vehicle movements around the site as far as practicable. It is expected that earthworks will be of short duration, restricted to clearing and levelling of the sites (blasting minimised as rocky areas are being avoided). As such, the generation of dust and vibration during the construction window is considered unlikely to affect heritage values.

7.5.2 Impacts to amenity values

The Proposal has the potential to reduce amenity in the local area through visual impacts. Whilst the Proposal is located upslope of the existing YPF and TAN plants, its presence will be screened to recreational users accessing Hearson Cove beach and Hearson Cove Road by the existing plants. Furthermore, viewing distance from Hearson Cove Road to the Proposal will be >950 m at its closest point. The Proposal will be consistent with the existing industrial character of the local area. No significant impacts on visual amenity are expected from the Proposal.

During construction, there will be noise and vibration due to heavy vehicles entering and exiting the Site, as well as from operation of equipment and machinery. Noise and vibration associated with construction works have the potential to result in impacts to amenity at a local scale. The Proposal Footprint in located within Burrup SIA and surrounded by other industrial facilities. These impacts will be temporary (limited to the construction phase) and are in line with existing noise and vibration given the Proposal Footprint's location in the Burrup SIA.

7.6 Mitigation

MAC representatives were consulted to discuss management options for the nine sites and the EPA's mitigation hierarchy (avoid, minimise, rehabilitate) has been applied to the site.

YPF will avoid all known Aboriginal heritage sites and National Heritage areas by excluding these sites from the Proposal Footprint. To minimise disturbance of the Aboriginal heritage sites, the Proponent will also:

- Exclude the hills in the north-western corner of the lease from development
- Ensure a minimum 10 m buffer is established around each of the heritage sites throughout construction and operation phases
- Engage Aboriginal monitors for initial earthworks to manage Aboriginal heritage values of the sites and the land
- Facilitate monitoring by MAC Rangers to custodianship responsibilities can occur and ensure the heritage values are protected for future generations
- Continue to engage with MAC to ensure heritage values are managed.

Impacts to amenity will be minimised through the following mitigation and management measures:

- Maximise visual amenity through site layout design and construction materials, where possible
- A glint and glare assessment to ensure there is limited glare towards a road user, YPF, Hearson Cove or Karratha airport
- Construction works will be undertaken in accordance with the Environmental Protection (Noise) Regulations 1997
- Construction activities will be limited between 0700 and 1900 Monday to Saturday, excluding public holidays, unless an out of hours Noise Management Plan is developed and approved by the City of Karratha
- Heavy vehicle movements minimised as far as practicable.
- Reduce noise emissions as much as practicable.

Indirect impacts to adjacent National Heritage areas will be minimised through the following mitigation and management measures:

- Demarcate Proposal Footprint boundary using appropriate visual markers prior to ground disturbing activities. Visual inspection and approval of Proposal Footprint boundary prior to ground disturbing activities.
- Vehicles and equipment access limited to designated roads/access tracks and cleared areas.
- Dust suppression, including use of water carts to be implemented during construction activities in proximity to National Heritage Place as required.

7.7 Predicted Outcome

The Proposal will not directly or indirectly impact Aboriginal heritage sites within the Proposal Footprint. Heritage sites will be avoided and minimisation strategies have been adopted to mitigate the risk of identified activities potentially impacting the sites.

By implementing amenity management measures, it is considered the Proposal is unlikely to have a significant impact on amenity values.

There is no significant impact to the social surrounds factor. Therefore, it is expected that the Proposal can meet the EPA objective for this factor.

8. Other factors

Marine Environmental Quality has been identified as an 'other' environmental factors that has the potential to be affected by the proposal.

Table 8-1 Other environmental factors

Element	Description
Marine Water Quality	
EPA Objective	To maintain the quality of water, sediment and biota so that environmental values are protected.
Policy and Guidance	The relevant policies for Marine environmental quality are: • Environmental Factor Guideline - Marine Environmental Quality (EPA 2016g) • Technical Guidance Protecting the Quality of Western Australia's Marine Environment (EPA 2016h).
Background	A Water Corporation owned desalination plant exists within the YPF facility, which forms part of the Burrup Water Supply Scheme. Seawater from the Mermaid Marine harbour development is pumped into the thermal desalination plant located on the existing YPF plant. Desalinated water is used for cooling purposes and firefighting purposes. Cooling tower brine and treated wastewater is then discharged via a 4 km return pipeline and 1.4 km Indian Ocean outfall located within Mermaid Sound, King Bay. The desalinisation plant is approved under the EP Act (MS 594).
Potential Impacts	The Proposal will require additional water from the desalination plant and will accordingly result in an increased discharge of brine from the ocean outfall. The increased discharge has the potential to affect marine water quality.
Mitigation	**Avoid** • No additional desalination plant infrastructure is required for the Proposal Footprint, except for infrastructure required to connect to the existing plant. **Minimise** • The Proposal seeks to increase throughput of seawater into the desalinisation plant, which is achievable as the current desalination is not running at maximum capacity. • The desalination plant is authorised to operate at a capacity of approximately 1.6 ML of seawater per hour, that is, 38 ML per day and a storage capacity of 2 ML. • The proponent use a range of treatment processes on its liquid waste streams in order to minimise the discharge of contaminants and nutrients into the marine environment. • A 40 m mixing zone at the outfall allows wastewater and brine from the existing YPF plant to meet ANZECC & ARMCANZ (2000) 99% species protection criteria for toxicants on entry into the brine discharge system under the existing approvals to operate.
Outcomes	**Residual Impact** The increased water demand (and brine) can be supplied within the existing desalination plant approvals. As a result the Proposal will not result in a significant impact to marine water quality.

9. Offsets

The Proposal is not expected to cause significant residual impacts to environmental factors and no offsets are proposed.

10. Matters of National Environmental Significance

Referral to the Commonwealth DAWE under the EPBC Act is triggered if a proposed action has or potentially has a significant impact on any Matter of National Environmental Significance (MNES). This section assesses potential impacts associated with the Proposal on MNES listed under the EPBC Act.

A detailed flora and vegetation survey, target flora survey and single season Level 2 fauna survey was conducted for the Proposal of areas within and adjacent to the YPF Plant. The surveys covered a survey area, which included the Development Envelope and Proposal Footprint, and included desktop and field components and likelihood of occurrence assessments. A copy of the biological survey report is provided in Appendix A. This section should be read in conjunction with Sections 5 (Flora and vegetation), 6 (Terrestrial fauna) and 7 (Social surroundings).

10.1 Controlling provisions

Controlled action provisions will be discussed with DAWE as part of future consultation.

10.2 Policy and guidelines

The following policies and guidance are considered relevant to the Proposal:

- *Environment Protection and Biodiversity Conservation Act 1999* and associated regulations
- Approved Conservation Advice for *Liasis olivaceus barroni* (Olive Python – Pilbara subspecies) (Department of the Environment, Water, Heritage and the Arts (DEWHA) 2008)
- Survey Guidelines for Australia's Threatened Reptiles (DEWHA 2010)
- Threat abatement plan for predation by feral cats (DotE 2015)
- Approved Conservation Advice for *Rostratula australis* (Australian Painted Snipe) (DSEWPaC 2013)
- Commonwealth Listing Advice on *Rostratula australis* (Australian Painted Snipe) (Threatened Species Scientific Committee (TSSC) 2013)
- Significant Impact Guidelines 1.1 – Matters of National Environmental Significance (DotE, 2013)

10.3 Existing environmental values

10.3.1 National heritage place

The Proposal is located on Murujuga, which is recognised as a National Heritage Place. The Dampier Archipelago (including Murujuga) was included in the National Heritage List on 3 July 2007. It contains a diverse array of Aboriginal heritage including dreaming sites, ceremonial sites, rock engravings and archaeological sites, and is one of the densest concentrations of rock engravings in Australia with some sites containing thousands or tens of thousands of images (DAWE 2020c).

Whilst the Dampier Archipelago is recognised as a National Heritage Place, it also supports resource industries. The Commonwealth recognise that long-term management through a collaborative partnership involving Indigenous groups, industry, governments and the

community is required to ensure both heritage and economy are protected into the future (DAWE 2020c).

A portion of the Development Envelope associated with rocky outcrops is included within the National Heritage area. The Proposal Footprint has been specifically designed to avoid any areas that are classified as National Heritage. No areas classified as National Heritage areas occur within the Proposal Footprint (Figure 7-2).

10.3.2 Listed threatened species and communities

No Threatened Ecological Communities or flora species listed under the EPBC Act are known to occur on the Burrup Peninsula. None were recorded during the field survey or are considered likely to occur (GHD 2020).

One Threatened species, the Pilbara Olive Python (*Liasis olivaceus barroni*), listed as Vulnerable under the EPBC Act was recorded within the Development Envelope during the fauna survey (GHD 2020). An additional Threatened species, the Australian Painted Snipe (*Rostratula australis*), listed as Endangered under the EPBC Act was considered likely to occur in the Development Envelope and Proposal Footprint based on a likelihood assessment.

Pilbara Olive Python (Liasis olivaceus barroni)

The Pilbara Olive Python is restricted to the Pilbara region, predominantly within the Hamersley Range and Dampier Archipelago, with populations at Pannawonica, Millstream, Tom Price and Murujuga (Pearson 1993; Pearson 2006). Estimating population size for this subspecies is difficult due to the cryptic nature of the python, the lack of any reliable trapping or census techniques and the narrow range of reliable surveys (DEWHA 2008).

Suitable habitat for the species consists of granophyre rock escarpments, gorges and waterholes, and microhabitats including rock piles, on top of rocks, and under spinifex as well as in man-made features (DEWHA 2008). Radio-telemetry has shown that individuals spend the cooler winter months hiding in caves and rock crevices away from water sources. In the warmer summer months the pythons were found to move around widely, usually in close proximity to water and rock outcrops (Swan 2007). The subspecies is adept at swimming, utilising water holes to hunt. Prey is captured by ambush on animal trails or by striking from a submerged position in water holes (Pearson 2006).

During the field survey two individuals of the Pilbara Olive Python were recorded including one large adult observed during night spotting in the northern part of the Development Envelope and one roadkill (juvenile) on a public road outside of the Development Envelope. Both records were recorded outside of the Proposal Footprint. The Development Envelope and Proposal Footprint contain both core and supportive habitat for the Pilbara Olive Python (Figure 10-1). There is 1.24 ha of core habitat for this species within the Proposal Footprint, restricted to the minor drainage line, and 21.69 ha of supportive habitat for this species within the Proposal Footprint, restricted to the Foothills.

Australian Painted Snipe (Rostratula australis)

The Australian Painted Snipe is widespread and is not considered to have a limited geographic distribution. It is most common in eastern Australia where important areas for the species include Murray-Darling Basin, Queensland Channel County and Fitzroy Basin of Central Queensland, south-eastern South Australia and adjacent parts of Victoria (DSEWPaC 2013); it has been recorded less frequently in WA (TSSC 2013). The species is a well-camouflaged species that is rarely seen. It is generally seen singly or in pairs, sometimes forming loose gatherings around a group of nests (TSSC 2013).

The Australian Painted Snipe occurs in shallow freshwater (occasionally brackish) wetlands, both ephemeral and permanent such as lakes, swamps and claypans, generally with a good cover of low vegetation (DSEWPaC 2013). The species is nomadic and when an area begins to dry up, becomes flooded or gets too cold it moves away (Marchant and Higgins, 2003). The species breeds in ground scrapes or on mounds in water, lined with grasses, leaves and twigs. Breeding occurs from December to May in the north of the country and October to December in the south (Morcombe 2008).

The Australian Painted Snipe was not observed during the biological survey but was considered likely to occur within the Development Envelope based on the habitats present at the time of survey. The Development Envelope and Proposal Footprint contain foraging habitat for the species (Figure 10-2). There is 1.63 ha of foraging habitat for this species within the Proposal Footprint, restricted to the water body and floodplain.

10.3.3 Listed migratory species

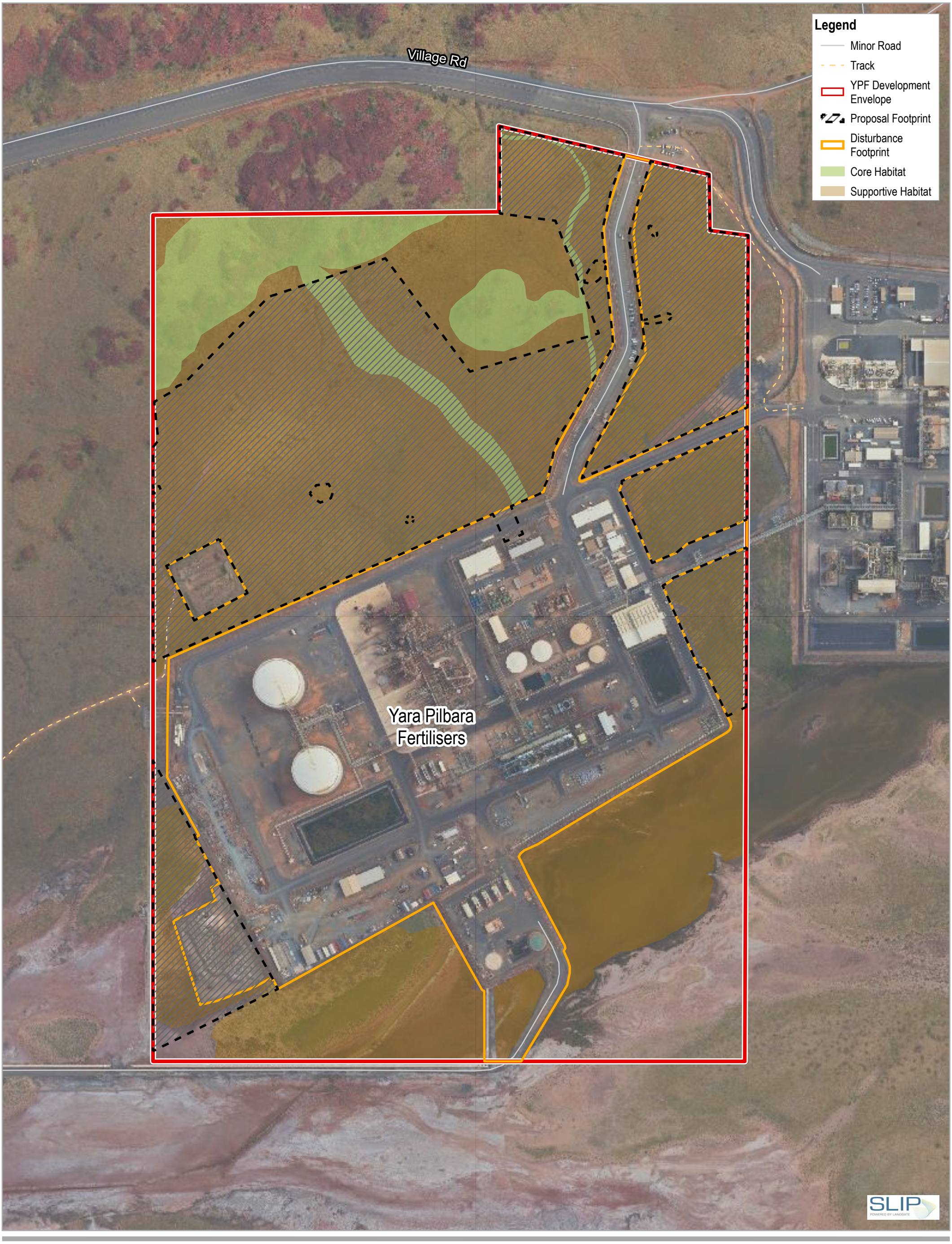
Five birds species, listed as Migratory under the EPBC Act were recorded during the fauna survey (GHD 2020). Four of these species were recorded within the Development Envelope, with the fifth species recorded outside but near to the Development Envelope. A further 21 migratory bird species were considered likely to occur within the Development Envelope based on the habitats present at the time of survey. A summary of the migratory birds recorded and considered likely to occur in the Development Envelope and Proposal Footprint is provided in Table 10-1.

All five migratory species recorded during the survey were observed utilising the floodplain and water body habitats. These habitats would also provide resources for the additional 21 migratory birds considered likely to occur. There are much larger tidal mudflat areas both within King Bay and Hearsons Cove that provide foraging resources for migratory species. The habitats within Development Envelope are considered an opportunistic resource for species moving between King Bay and Hearsons Cove. The Development Envelope and Proposal Footprint contain foraging habitat for migratory bird species (Figure 10-2). There is 1.63 ha of foraging habitat for the species within the Proposal Footprint, restricted to the water body and floodplain.

Table 10-1 Summary of Migratory species likelihood of occurrence assessment

Species	EPBC Act status	Outcome
Actitis hypoleucos Common Sandpiper	Ma, Mi	Recorded during the survey, near to the Development Envelope.
Calidris acuminata Sharp-tailed Sandpiper	Ma, Mi	Likely to occur.
Calidris canutus Red Knot	Ma, Mi, En	Likely to occur.
Calidris ferruginea Curlew Sandpiper	Ma, Mi, CE	Likely to occur
Calidris melanotos Pectoral Sandpiper	Ma, Mi	Likely to occur
Calidris ruficollis Red-necked Stint	Ma, Mi	Recorded during the survey in the Development Envelope
Calidris subminuta Long-toed Stint	Ma, Mi	Likely to occur.
Calidris tenuirostris Great Knot	Ma, Mi, CE	Likely to occur.
Charadrius veredus Oriental Plover	Ma, Mi	Likely to occur.
Gelochelidon nilotica Gull-billed Tern	Ma, Mi	Recorded during the survey in the Development Envelope

Species	EPBC Act status	Outcome
Glareola maldivarum Oriental Pratincole	Ma, Mi	Likely to occur.
Hydroprogne caspia Caspian Tern	Ma, Mi	Recorded during the survey in the Development Envelope
Limicola falcinellus Broad-billed Sandpiper	Ma, Mi	Likely to occur.
Limosa lapponica Bar-tailed Godwit	Ma, Mi	Likely to occur.
Limosa limosa Black-tailed Godwit	Ma, Mi	Likely to occur.
Numenius madagascariensis Eastern Curlew	Ma, Mi, CE	Likely to occur.
Numenius minutus Little Curlew	Ma, Mi	Likely to occur.
Numenius phaeopus Whimbrel	Ma, Mi	Likely to occur.
Pandion cristatus Eastern Osprey	Ma, Mi	Likely to occur.
Pluvialis fulva Pacific Golden Plover	Ma, Mi	Likely to occur.
Pluvialis squatarola Grey Plover	Ma, Mi	Likely to occur.
Thalasseus bergii Crested Tern	Ma, Mi	Likely to occur.
Tringa brevipes Grey-tailed Tattler	Ma, Mi	Likely to occur.
Tringa nebularia Common Greenshank	Ma, Mi	Recorded during the survey in the Development Envelope
Tringa stagnatilis Marsh Sandpiper	Ma, Mi	Likely to occur.
Xenus cinereus Terek Sandpiper	Ma, Mi	Likely to occur.



Paper Size ISO A3

0 25 50 75 100

Metres

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

N

GHD

Yara Pilbara Fertilisers Pty Ltd
Renewable Hydrogen Project

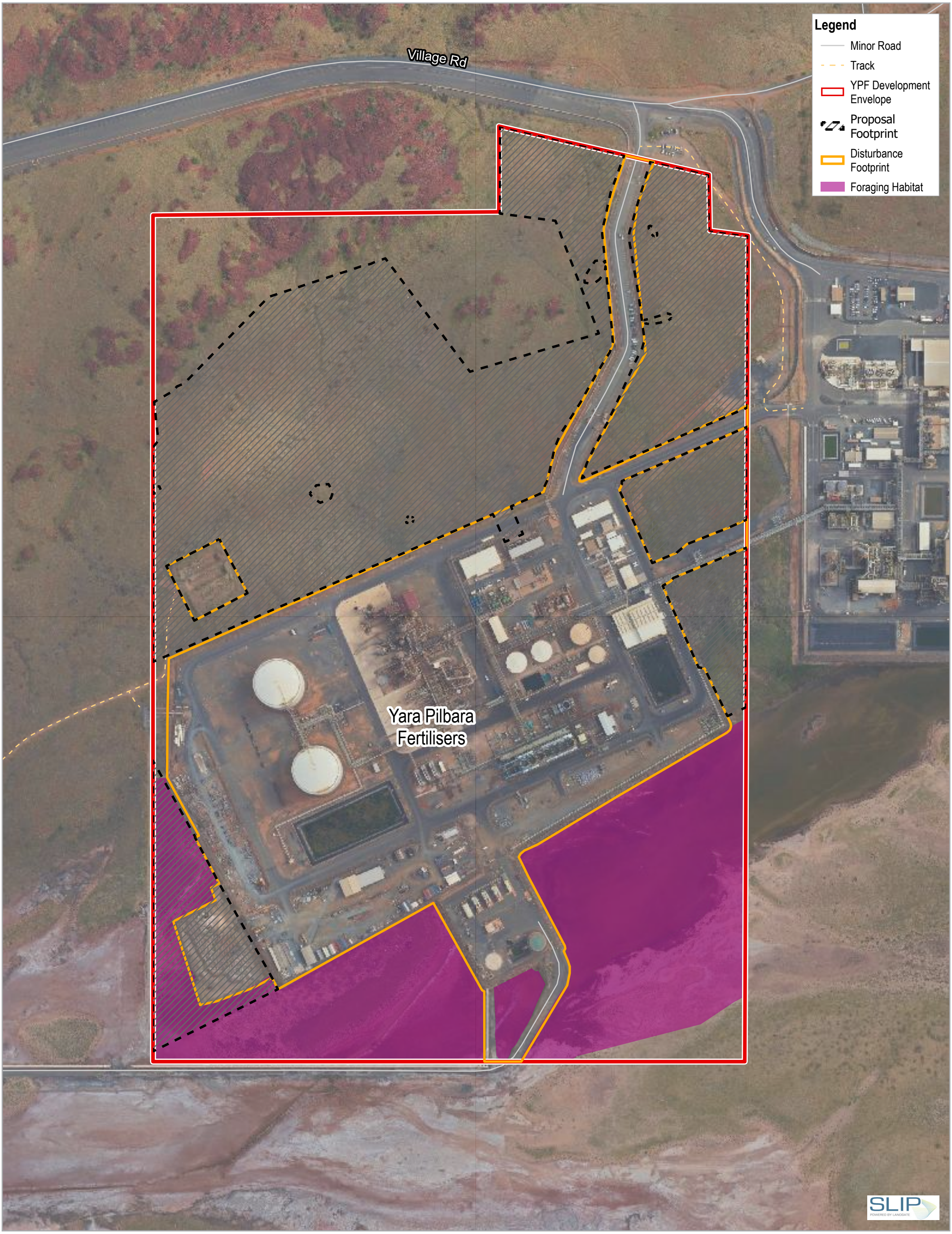
Pilbara Olive Python Habitat

Project No. **12520684**
Revision No. **1**
Date **17/07/2020**

FIGURE 10-1

G:\61\12520684\GIS\Maps\Working\12520684_Section38ReferralSupportingReport\12520684_Section38.aprx\12520684_10-1_PilbaraOlivePythonHabitat_Rev
Print date: 17 Jul 2020 - 14:17

Data source: GHD: YPF Development Envelope, Proposal Footprint, Disturbance Footprint - 20200624, Fauna Habitats - 20200331; Landgate: Roads - 20190128, Landgate_Subscription_Imagery\WANow: Landgate / SLIP. Created by: bmorgan



Paper Size ISO A3

0 25 50 75 100

Metres

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

N

Yara Pilbara Fertilisers Pty Ltd
Renewable Hydrogen Project

Australian Painted Snipe and Migratory Bird Habitat

Project No. **12520684**
Revision No. **1**
Date **17/07/2020**

FIGURE 10-2

G:\61\12520684\GIS\Maps\Working\12520684_Section38ReferralSupportingReport\12520684_Section38.aprx\12520684_10-2_MigratoryBirdHabitat_Rev
Print date: 17 Jul 2020 - 14:21

Data source: GHD: YPF Development Envelope, Proposal Footprint, Disturbance Footprint - 20200624, Fauna Habitats - 20200331; Landgate: Roads - 20190128, Landgate_Subscription_Imagery\WANow: Landgate / SLIP. Created by: bmorgan

10.4 Potential impacts on MNES

10.4.1 National heritage places

The Proposal has been specifically designed to exclude all National Heritage areas. The Proposal will not directly impact the Dampier Archipelago (including Murujuga) National Heritage Place.

During construction earthworks including clearing and blasting have the potential to generate dust and vibration, which could indirectly impact the Dampier Archipelago (including Murujuga) National Heritage Place. These potential indirect impacts will be temporary, and mitigation measures will be implemented to manage the potential impact on heritage values.

10.4.2 Listed threatened species and communities

The Proposal has been specifically designed to avoid rocky outcropping area, which are considered core habitat for the Pilbara Olive Python. However, the Proposal will result in the loss of core and supportive habitat for the Pilbara Olive Python through vegetation clearing and earthworks.

The Proposal will result in the loss foraging habitat for the Australian Painted Snipe through vegetation clearing and earthworks.

The Proposal could also result in the following indirect impacts to these species:

- Injury and/or death as a result of vehicle strike
- Injury and death as a result of introduced predators
- Habitat fragmentation
- Temporary increase in noise and vibration during construction and operation resulting in avoidance of the area.

10.4.3 Listed migratory species

The Proposal will result in the loss of foraging habitat for migratory birds through vegetation clearing and earthworks.

The Proposal could also result in the following indirect impacts to these species:

- Injury and/or death as a result of vehicle strike
- Injury and death as a result of introduced predators
- Habitat fragmentation
- Temporary increase in noise and vibration during construction and operation resulting in avoidance of the area.

10.5 Significance of impacts on MNES

10.5.1 National heritage places

The Proposal has been specifically designed to exclude all National Heritage areas. The Proposal will not directly impact the Dampier Archipelago (including Murujuga) National Heritage Place. Indirect impacts will be limited to dust generation and vibration from construction works. These potential impacts will be temporary and localised. Mitigation measures will be implemented to manage these potential indirect impacts on the Dampier Archipelago (including Murujuga) National Heritage Place.

An assessment of the Proposal against DAWE's Significant Impact Guidelines 1.1 – Matters of National Environmental Significance (DoE 2013), National Heritage places with cultural heritage values criteria is presented in Table 10-2. The review determined that the Proposal will not have a significant impact on the Dampier Archipelago (including Murujuga) National Heritage Place.

10.5.2 Listed threatened species and communities

An assessment of the Proposal against DAWE's Significant Impact Guidelines 1.1 – Matters of National Environmental Significance (DoE 2013) for the Pilbara Olive Python is presented in Table 10-2 and for the Australian Painted Snipe presented in Table 10-4. The assessments determined that the Proposal is not anticipated to have a significant impact on either the Pilbara Olive Python or the Australian Painted Snipe.

10.5.3 Listed migratory species

An assessment of the Proposal against DAWE's Significant Impact Guidelines 1.1 – Matters of National Environmental Significance (DoE 2013) for Migratory bird species is presented in Table 10-5. The assessment determined that the Proposal is not anticipated to have a significant impact on migratory bird species.

Table 10-2 Application of Significant Impact Guidelines on the Dampier Archipelago (including Murujuga) National Heritage Place

Criterion	Significant impact	Assessment
Permanently remove, destroy, damage or substantially alter the fabric of a National Heritage place in a manner which is inconsistent with relevant values	No	The Proposal has been specifically designed to exclude all National Heritage areas. The Proposal will not permanently remove, destroy, damage or substantially alter the fabric of a National Heritage place in a manner which is inconsistent with relevant values.
Extend, renovate, refurbish or substantially alter a National Heritage place in a manner which is inconsistent with relevant values	No	The Proposal has been specifically designed to exclude all National Heritage areas. The Proposal will not extend, renovate, refurbish or substantially alter a National Heritage place in a manner which is inconsistent with relevant values.
Permanently remove, destroy, damage or substantially disturb archaeological deposits or artefacts in a National Heritage place	No	The Proposal has been specifically designed to exclude all National Heritage areas. The Proposal will not directly impact the Dampier Archipelago (including Burrup Peninsula) National Heritage Place. Indirect impacts will be limited to dust generation and vibration from construction works and these will be managed through the implementation of mitigation measures.
Involve activities in a National Heritage place with substantial and/or long-term impacts on its values	No	The Proposal has been specifically designed to exclude all National Heritage areas. The Proposal is not located within the Dampier Archipelago (including Burrup Peninsula) National Heritage Place, and therefore will not involve activities with substantial and/or long-term impacts on its values.
Involve the construction of buildings or other structures within, adjacent to, or within important sight lines of, a National Heritage place which are inconsistent with relevant values	No	The Proposal has been specifically designed to exclude all National Heritage areas. However, the Proposal will involve the construction of solar PV plant, renewable hydrogen plant and associated infrastructure adjacent to the Dampier Archipelago (including Burrup Peninsula) National Heritage Place. Whilst the Proposal is not consistent with the relevant values for the Dampier Archipelago (including Burrup Peninsula) National Heritage Place, the Proposal is located within the Burrup SIA which occurs adjacent to the National Heritage area. Construction of the Proposal will minimise visual amenity impacts through site design and layout, as well as colouring buildings to blend into the surrounding terrain, where possible. The Proposal is not expected to significantly impact upon the Dampier Archipelago (including Burrup Peninsula) National Heritage Place.

Criterion	Significant impact	Assessment
Make notable changes to the layout, spaces, form or species composition of a garden, landscape or setting of a National Heritage place in a manner which is inconsistent with relevant values.	No	The Proposal has been specifically designed to exclude all National Heritage areas. The Proposal is not located within the Dampier Archipelago (including Burrup Peninsula) National Heritage Place, and therefore will not make notable changes to the layout, spaces, form or species composition of the National Heritage place in a manner which is inconsistent with relevant values.

Table 10-3 Application of Significant Impact Guidelines to the Proposal for the Pilbara Olive Python

Criterion	Significant impact	Assessment
Lead to a long-term decrease in the size of an important population of a species	No	The Proposal is located on Murujuga, which is identified as one of four populations of the Pilbara Olive Python by Pearson (2006). A fauna survey undertaken for the Proposal recorded two individuals of the Pilbara Olive Python, one live (large adult) and one roadkill (juvenile) as well as both core and supportive habitat. Whilst the home ranges of the Pilbara Olive Python have not been extensively studied, a radio-tracking study by Tutt et al. (2004) indicates they have large home ranges, from 87.76 to 449.26 ha, with males having larger home ranges than females (DAWE 2020b). The Proposal has been designed to largely avoid impacts to Pilbara Olive Python core habitat and will avoid all rocky outcropping areas. Given the small amount of core habitat present within the Proposal Footprint (1.24 ha, restricted to minor drainage lines), it is unlikely that the Proposal Footprint supports an important population of the species. The Proposal is unlikely to lead to a long-term decrease in the size of an important population of the Pilbara Olive Python.
Reduce the area of occupancy of an important population	No	The Proposal will result in the loss of core and supportive habitat for the Pilbara Olive Python. However, the Proposal has been designed to avoid all rocky outcropping areas and hence limit direct impact to core habitat for the species. The Murujuga population of the Pilbara Olive Python was found to prefer granophyre rock-piles, though occasionally were found in neighbouring spinifex grasslands (DAWE 2020b). It is estimated that there is approximately 1,730 ha of rocky outcropping habitat vested for conservation in the nearby Murujuga National Park. Core habitat within the Proposal Footprint represents less than 0.1% of available core habitat in nearby areas, likely to be in similar or better condition. The Proposal is not expected to significantly reduce the area of occupancy of an important population of the Pilbara Olive Python.
Fragment an existing important population into two or more populations	No	The Proposal will not fragment an existing population of the Pilbara Olive Python as it involves the removal a small amount of core and supportive habitat adjacent to the existing YPF Plant. The Proposal has been designed to avoid all rocky outcropping areas and hence limit direct impact to core habitat for the species. Connections to

Criterion	Significant impact	Assessment
		adjacent core and supportive habitats will remain north, east and west of the Proposal. The scale and nature of the Proposal is not sufficient to sever connections to and between nearby areas suitable habitat, nor sever connections between two or more important populations.
Adversely affect habitat critical to the survival of a species	No	The Proposal will result in the loss of core and supportive habitat for the Pilbara Olive Python. However, the Proposal has been designed to avoid all rocky outcropping areas and hence limit direct impact to core habitat for the species. It is estimated that there is approximately 1,730 ha of rocky outcropping habitat vested for conservation in the nearby Murujuga National Park. Core habitat within the Proposal Footprint represents less than 0.1% of available core habitat in nearby areas, likely to be in similar or better condition. The scale and nature of Proposal clearing is not expected to adversely affect habitat critical to the survival of the Pilbara Olive Python.
Disrupt the breeding cycle of an important population	No	Pilbara Olive Python breeding season occurs from June to August with males moving long distances (up to 4 km) in search of females (Pearson 2003). The Proposal has the potential to disrupt the breeding cycle if ground disturbance activities such as vegetation clearing and geotechnical works are conducted during the breeding season. However, it is unlikely that the Proposal Footprint supports an important population of the species. Management actions will be implemented during construction to minimise impacts to the Pilbara Olive Python and their breeding cycle. The Proposal is not expected to disrupt the breeding cycle of an important population of the Pilbara Olive Python.
Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	No	The Proposal will result in the loss of core and supportive habitat for the Pilbara Olive Python. However, the Proposal has been designed to avoid all rocky outcropping areas and hence limit direct impact to core habitat for the species. Core habitat within the Proposal Footprint represents less than 0.1% of available core habitat in nearby conservation areas, likely to be in similar or better condition. Furthermore, connections to adjacent core and supportive habitats will remain north, east and west of the Proposal. The scale and nature of Proposal clearing is not expected to result in a loss of core habitat that could cause a decline in the population of Pilbara Olive Python.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	No	Predation by introduced species including cats and foxes on juveniles and on its food sources are identified as a major threat for the Pilbara Olive Python (Pearson 2003). Both cats and foxes were recorded during the fauna survey for the Proposal (GHD 2020a). The Proposal is considered unlikely to result in the introduction or spread of any invasive species known to be harmful to the Pilbara Olive Python.
Introduce disease that may cause the species to decline	No	The Proposal is unlikely to introduce or increase transmission of any diseases relevant to the Pilbara Olive Python.
Interfere substantially with the recovery of the species	No	No national recovery plan exists for the Pilbara Olive Python. The Proposal is unlikely to interfere substantially with any conservation recovery initiative for the species.

Table 10-4 Application of Significant Impact Guidelines to the Proposal for the Australian Painted Snipe

Criteria	Significant impact	Assessment
Lead to a long-term decrease in the size of an population	No	The Proposal is located on the Burrup Peninsula, which is not recognised as an important area for the Australian Painted Snipe (TSSC 2013), nor reported to support a large population of the species. A fauna survey undertaken for the Proposal did not record the Australian Painted Snipe, but it was considered likely to occur based on habitats present at the time of survey. Given the small amount of foraging habitat available to the species within the Proposal Footprint (1.63 ha, restricted to the waterbody and floodplain), it is unlikely that the Proposal Footprint supports a population of the species. The Proposal is unlikely to lead to a long-term decrease in the size of a population of the Australian Painted Snipe.
Reduce the area of occupancy of the species	No	The Proposal will result in the loss foraging habitat for the Australian Painted Snipe. However, the Proposal has been designed to avoid floodplain and waterbody habitats where possible, and hence limit direct impact to foraging habitat for the species. There are much larger tidal mudflat areas both within King Bay and Hearsons Cove that provide foraging resources for the Australian Painted Snipe. The habitats within Development Envelope are considered an opportunistic resource for species moving between King Bay and Hearsons Cove. The Australian Painted Snipe is nomadic and when an area begins to dry up, becomes flooded or gets too cold it moves away (Marchant and Higgins 1993). The Proposal is not expected to significantly reduce the area of occupancy of an important population of the Australian Painted Snipe.
Fragment an existing population into two or more populations	No	The Proposal will not fragment an existing population of the Australian Painted Snipe as it involves the removal a small amount of foraging habitat adjacent to the existing YPF Plant. A fauna survey undertaken for the Proposal did not record the Australian Painted Snipe, but it was considered likely to occur based on habitats present at the time of survey. Given no individuals of the Australian Painted Snipe were recorded and the scale and nature of the Proposal, it is not considered sufficient to sever connections between two or more important populations.
Adversely affect habitat critical to the survival of a species	No	The Proposal will result in the loss foraging habitat for the Australian Painted Snipe. However, the Proposal has been designed to avoid floodplain and waterbody habitats where possible, and hence limit direct impact to foraging habitat for the species. There are much larger tidal mudflat areas both within King Bay and Hearsons Cove that provide foraging resources for the Australian Painted Snipe. The habitats within Development Envelope are considered an opportunistic resource for species moving between King Bay and Hearsons Cove. The scale and nature of Proposal clearing is not expected to adversely affect habitat critical to the survival of the Australian Painted Snipe.
Disrupt the breeding cycle of a population	No	Australian Painted Snipe breeding occurs from December to May in the north of the country and October to December in the south (Morcombe 2008). While the species can be found in a range of wetland habitats, its requirements for breeding are more stringent (Rogers et al. 2005). Areas with no surrounding low cover are avoided and nests are made among tall tussocks, frequently on small, muddy islands or mounds surrounded by shallow fresh water, sometimes on shores of swamps or on banks of channels (Marchant and Higgins 2003; Rogers et al. 2005). The Proposal Footprint does not contain habitat suitable for Australian Painted Snipe

Criteria	Significant impact	Assessment
		breeding. The Proposal is not expected to disrupt the breeding cycle of an important population of the Australian Painted Snipe.
Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	No	The Proposal will result in the loss of a small amount of foraging habitat for the Australian Painted Snipe. However, the Proposal has been designed to avoid floodplain and waterbody habitats where possible, and hence limit direct impact to foraging habitat for the species. Furthermore, the habitats within Proposal Footprint are considered an opportunistic resource for species moving between King Bay and Hearsons Cove. The scale and nature of Proposal clearing is not expected to result in a loss of foraging habitat that could cause a decline in the population of Australian Painted Snipe.
Result in invasive species that are harmful to a endangered species becoming established in the endangered species' habitat	No	Predation by feral animals (e.g. nest predation by foxes or cats) has been identified as a possible threat to Australian Painted Snipe but there is no evidence for this (TSSC 2013). Both cats and foxes were recorded during the fauna survey for the Proposal (GHD 2020). The Proposal is considered unlikely to result in the introduction or spread of any invasive species known to be harmful to the Australian Painted Snipe.
Introduce disease that may cause the species to decline	No	The Proposal is unlikely to introduce or increase transmission of any diseases relevant to the Australian Painted Snipe.
Interfere with the recovery of the species	No	No adopted or made recovery plan exists for the Pilbara Australian Painted Snipe. The Proposal is unlikely to interfere substantially with any conservation recovery initiative for the species.

Table 10-5 Application of Significant Impact Guidelines to the Proposal for Migratory species

Criteria	Significant impact	Assessment
Substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species	No	The listed migratory bird species recorded during the fauna survey (GHD 2020) or considered likely to occur have a broad range of preferred habitats. The Proposal Footprint provides a small amount of foraging habitat limited to waterbody and floodplain (1.63 ha) and is considered an opportunistic resource for the species moving between King Bay and Hearsons Cove. The habitat within the Proposal Footprint is associated with supratidal areas and is likely to periodically inundate after extreme tides, storm surges or after heavy rainfall. There are much larger tidal mudflat areas both within King Bay and Hearsons Cove that provide foraging habitat for migratory bird species. Furthermore, similar habitat areas are likely to occur within Murujuga National Park located near to the Development Envelope. Whist the broader Dampier Archipelago may provide habitat for migratory species, the Burrup Peninsula is not recognised as an important habitat area. The small amount of clearing associated with the Proposal is unlikely to substantially modify, destroy or isolate any area which may be important habitat got migratory bird populations.
Result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species	No	Predation by feral animals (e.g. foxes or cats) has been identified as a possible threat to migratory birds (DAWE 2020b). Both cats and foxes were recorded during the fauna survey for the Proposal (GHD 2020). However, the construction and operation of the Proposal is unlikely to exacerbate the spread or establishment of feral animals within the local area. The Proposal is considered unlikely to result in the introduction or spread of any invasive species known to be harmful to the migratory bird species.
Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species	No	The Proposal is unlikely to seriously disrupt the lifecycle of an ecologically significant proportion of the populations of any of the listed migratory bird species, as the Proposal Footprint does not impact breeding habitat for these species. The Proposal impacts a small amount of foraging habitat (1.63 ha, restricted to water body and floodplain) relative to the large extent of suitable supratidal mudflat habitat of likely similar or better condition within the surrounding area. The numbers of migratory birds observed in the region during the biological survey indicates that the impacted foraging area is only used by a small proportion of local populations of migratory waterbirds.

10.6 Mitigation measures

Potential impacts to MNES have been considered during Proposal design, and avoided and minimised as far as practicable. The Proposal Footprint has been designed to:

- Exclude all National Heritage areas
- Avoid disturbance of rocky outcropping areas, which are considered core habitat for the Pilbara Olive Python
- Minimise disturbance of floodplain and water body habitats which are considered foraging habitat for Migratory bird species.

The Proposal Footprint represents the maximum area to be disturbed. Within this Footprint, opportunities to further reduce clearing and minimise disturbance will be considered, where practicable. Only the area absolutely necessary for Proposal development will be cleared and this will be ascertained by adequate planning prior to Proposal implementation.

Impacts on MNES will be minimised through the mitigation and management measures outlined in Sections 5.6 and 6.6 and the CEMP (GHD 2020b; Appendix B).

10.7 Outcome

Through Proposal design and the implementation of fauna management measures, it is considered that construction and operations phases of the Proposal are unlikely to have a significant or long-term impact on MNES.

The Proposal is not expected to cause significant residual impacts to MNES and no offsets are proposed.

11. References

Australian Bureau of Statistics (ABS) (2016). *Census QuickStats*: Karratha. Available from https://quickstats.censusdata.abs.gov.au/census_services/getproduct/census/2016/quickstat/LGA54310. Accessed April 2020.

Bureau of Meteorology (BoM) (2020). *Climate Statistics*. Available from http://www.bom.gov.au/. Assessed April 2020.

Beard, JS (1975). Vegetation Survey of Western Australia: Pilbara, map and explanatory memoir 1:1,000,000 series, Nedlands, University of Western Australia Press.

Department of Agriculture, Water and the Environment (DAWE) (2020a). Australia's Bioregions: IBRA 7. Available from: https://www.environment.gov.au/land/nrs/science/ibra. Accessed April 2020.

Department of Agriculture, Water and the Environment (DAWE) (2020b). Species Profile and Threats Database, retrieved May 2020, from http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl.

Department of Agriculture, Water and the Environment (DAWE) (2020c). National Heritage Places - Dampier Archipelago (including Burrup Peninsula). Available from: https://www.environment.gov.au/heritage/places/national/dampier-archipelago. Accessed May 2020.

Department of Biodiversity, Conservation and Attractions (DBCA) (2007–). NatureMap: Mapping Western Australia's Biodiversity. Available from http://naturemap.dpaw.wa.gov.au/default.aspx/. Accessed February 2020.

Department of Environment and Conservation (DEC) (2013). *Murujuga National Park Management Plan 78.*

Department of the Environment (DoE) (2013). Significant Impact Guidelines 1.1 – Matters of National Environmental Significance, Department of the Environment.

Department of the Environment (DoE) (2015). Threat Abatement Plan for predation by feral cats, Department of the Environment.

Department of the Environment, Water, Heritage and the Arts (DEWHA) (2008). Approved Conservation Advice for Liasis olivaceus barroni (Olive Python - Pilbara subspecies). Canberra: Department of the Environment, Water, Heritage and the Arts. Available from: http://www.environment.gov.au/biodiversity/threatened/species/pubs/66699-conservation-advice.pdf.

Department of the Environment, Water, Heritage and the Arts (DEWHA) (2010a). Survey Guidelines for Australia's Threatened Bats, Department of the Environment, Water, Heritage and the Arts.

Department of the Environment, Water, Heritage and the Arts (DEWHA) (2010b). Survey Guidelines for Australia's Threatened Mammals, Department of the Environment, Water, Heritage and the Arts

Department of the Environment, Water, Heritage and the Arts (DEWHA) (2010c). Survey Guidelines for Australia's Threatened Reptiles, Department of the Environment, Water, Heritage and the Arts.

Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC) (2013). Approved Conservation Advice for Rostratula australis (Australian painted snipe).

Canberra: Department of Sustainability, Environment, Water, Population and Communities. Available from: http://www.environment.gov.au/biodiversity/threatened/species/pubs/77037-conservation-advice.pdf.

Environmental Protection Authority (EPA) (2016a). *Environmental Factor Guideline: Flora and Vegetation*, Environmental Protection Authority.

Environmental Protection Authority (EPA) (2016b). *Technical Guidance: Flora and Vegetation Surveys for Environmental Impact Assessment*, Environmental Protection Authority.

Environmental Protection Authority (EPA) (2016c). *Environmental Factor Guideline: Terrestrial Fauna*, Environmental Protection Authority.

Environmental Protection Authority (EPA) (2016d). *Technical Guidance: Terrestrial Fauna Surveys*, Perth, Environmental Protection Authority.

Environmental Protection Authority (EPA) (2016e). *Technical Guidance: Sampling methods for terrestrial vertebrate fauna*, Environmental Protection Authority.

Environmental Protection Authority (EPA) (2016f). *Environmental Factor Guideline: Social Surroundings*, Environmental Protection Authority.

Environmental Protection Authority (EPA) (2016g). *Environmental Factor Guideline: Marine Environmental Quality*, Environmental Protection Authority.

Environmental Protection Authority (EPA) (2016h). *Technical Guidance Protecting the Quality of Western Australia's Marine Environment*, Environmental Protection Authority.

Environmental Protection Authority (EPA) (2020a). *Instructions on how to prepare an Environmental Review Document*, Environmental Protection Authority.

Environmental Protection Authority (EPA) (2020b). *Statement of Environmental Principles, Factors and Objectives*, Environmental Protection Authority.

GHD PTY Ltd (2020a). Renewable Hydrogen Project, Flora and Fauna Survey, unpublished report prepared for Yara Pilbara Fertilisers Pty Ltd.

GHD PTY Ltd (2020b). Renewable Hydrogen Project Construction Environmental Management Plan, unpublished report prepared for Yara Pilbara Fertilisers Pty Ltd.

Hickman, AH (2012). *Review of the Pilbara Craton and Fortescue Basin, Western Australia: Crustal evolution providing environments for early life.* Geological Survey of Western Australia. Western Australia. doi:10.1111/j.1440-1738.2011.00783.

Hickman, AH, Smithies, RH, Pike, G, Farrell, TR, Beintema, KA (2001). *Evolution of the West Pilbara Granite-Greenstone Terrane and Mallina Basin*, *Western Australia – A Field guide*. Geological Survey of Western Australia.

Kendrick, P and Stanley, F, (2001). Pilbara 4 (PIL4 – Roebourne synopsis). Available from https://www.researchgate.net/publication/310726802_Pilbara_4_PIL4_-_Roebourne_synopsis. Accessed April 2020.

Land Access Solutions (LAS) (2020). *Yara Development Envelope Archaeological Site Verifications, Burrup Peninsula, WA – Report*.

Mckenzie NL, Van Leeuwin S, Pinder, AM (2009). *Introduction to the Pilbara Biodiversity Survey, 2002 -2007.* Records of the Western Australian Museum, Supplement. 78:3 – 89.

ME Trudgen and Associates (2002). *A flora, vegetation and floristic survey of the Burrup Peninsula, some adjoining areas and part of the Dampier Archipelago, with comparisons to the floristics of areas on the adjoining mainland Volume 2*. For the Department of Mineral and Petroleum Resources. Perth, WA.

Morcombe, M (2004). Field Guide to Australian Birds, Queensland, Australia, Steve Parish Publishing Archer Field.

Morcombe M (2008). Field Guide to Australian Birds (second edition).Steve Parish Publishing Pty Ltd, Australia.

Murujuga Aboriginal Corporation (MAC) (2020). Available from https://www.murujuga.org.au/about/. Accessed April 2020.

Pearson, DJ (1993). 'Distribution, status and conservation of pythons in Western Australia', In: Lunney, D & Ayers, D (Eds) Herpetology in Australia: a Diverse Discipline, pp. 383-395, Royal Zoological Society of NSW, Sydney.

Pearson, DJ (2006). Giant Pythons of the Pilbara, Landscope, vol. 19, pp. 32-39.

Pepper, M, Doughty P and Keogh, JS (2013). *Geodiversity and endemism in the iconic Australian Pilbara region: a review of landscape evolution and biotic response in an ancient refugium*. Journal of Biogeography. doi:10.1111/jbi.12080.

Rogers, D., I. Hance, S. Paton, C. Tzaros, P. Griffioen, M. Herring, R. Jaensch, L. Oring, A. Silcocks & M. Weston (2005). The breeding bottleneck: breeding habitat and population decline in the Australian Painted Snipe. In: Straw, P., ed. Status and Conservation of Seabirds in the East Asian-Australasian Flyway. Pp. 15-23.

Start, AN (1996). A Review of the Conservation status of the Ngadji (Western Pebble-mound Mouse) Pseudomys chapmani. Kitchener, 1980 (Rodentia Muridae). Department of Conservation and Land Management Science and Information Division.

Swan, M (2007). Keeping and Breeding Australian Pythons, Mike Swan Herp Books, Lilydale.

Threatened Species Scientific Committee (TSSC) (2013). Commonwealth Listing Advice on Rostratula australis (Australian Painted Snipe). Department of Sustainability, Environment, Water, Population and Communities. Available from: http://www.environment.gov.au/biodiversity/threatened/species/pubs/77037-listing-advice.pdf.

Tille, P (2006). *Soil-landscapes of Western Australia's rangelands and arid interior.* Department of Primary Industries and Regional Development. Perth, Report 313.

Tutt, M, Mitchell, S, Brace, P and Pearson, D (2002). Conserving Pilbara olive pythons on the Burrup. Threatened Species Network community grants annual report, Project WA04/100. Karratha: Nickol Bay Naturalists' Club/WA CaLM.

Tutt, M, Fekete, S, Mitchell, S, Brace, P & Pearson, D (2004). Unravelling the mysteries of Pilbara Olive Python ecology. Threatened Species Network Community Grants Final Report-Project WA11/101. Karratha: Nickol Bay Naturalists' Club/WA CaLM.

Van Dyck, S and Strahan, R (2008). The Mammals of Australia, third edition, Sydney, Australia, New Holland Publishers.

Van Vreeswyk, A, Leighton, KA, Payne, AL, Hennig, P (1996). *An inventory and condition survey of the Pilbara region, Western Australia*. Department of Agriculture and Food, Western Australia, Perth. Technical Bulletin 92.

Van Kranendonk, MJ, Hickman, AH, Smithies, RH, Nelson. DR, Pike, G (2002). *Geology and Tectonic Evolution of the Archean North Pilbara Terrain, Pilbara Craton, Western Australia.* Economic Geology. 97(4), 695 - 732.

Western Australian (WA) Herbarium (1998–). FloraBase–the Western Australian Flora, Biodiversity, Conservation and Attractions, retrieved February 2020, from http://florabase.dpaw.wa.gov.au/.

Woodside Energy Ltd (2006). Pluto LNG Development: Public Environment Report, Woodside.

Appendices

Appendix A – Supporting Technical Studies

Renewable Hydrogen Project, Flora and Fauna Survey (GHD 2020a)

Yara Development Envelope Archaeological Site Verifications, Burrup Peninsula, WA (Land Access Solutions 2020)

Appendix B – Construction Environmental Management Plan

Appendix C – Letter from Murujuga Aboriginal Corporation

GHD
Level 10
999 Hay Street
T: 61 8 6222 8222 F: 61 8 9463 6012 E: permail@ghd.com

12520684-1206-54/
https://projectsportal.ghd.com/sites/pp18_04/yarapilbararnh3proje/ProjectDocs/12520684-REP_Renewable Hydrogen Project EPA s38 Referral Supporting Report.docx
Document Status

Revision	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
0	N Lutz, S Ascott J Tindiglia	M Brook		J Foley		22/07/2020

www.ghd.com