



**NGH**



# **JUNJA SOLAR FARM**

## **DA Supplementary Report**

August 2021

Project Number: 19-513



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**Certification**

For submission of a Development Application under the Town of Port Hedland Local Planning Scheme No. 7.

**EIS prepared by:** NGH Pty Ltd

**Applicant:** Pilbara Solar Pty Ltd

**Proposed development:**

The Junja Solar Farm proposal includes the construction, operation and decommissioning of a photovoltaic solar farm that would produce up to 10 Megawatts (MW) of alternating current (AC) electricity. Associated infrastructure includes a substation, storage shed, internal access tracks and fencing.

**Land to be developed:**

Lot 268, Great Northern Highway, Pippingarra WA 6722

**Certification:**

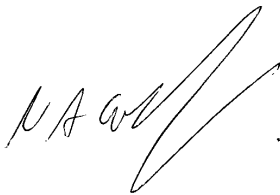
I certify that I have prepared the contents of this Development Application in accordance with the *WA Planning and Development Act 2005*. To the best of my knowledge, this assessment contains all available information that is relevant to the environmental assessment of the project and that information is neither false nor misleading.

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Date: 26 July 2021

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## ACRONYMS AND ABBREVIATIONS

AEP	Annual exceedance probability
BAL	Bushfire Attack Level
BOM	Australian Bureau of Meteorology
Cwth	Commonwealth
DA	Development Application
DAP	Development Assessment Panel
Development site	Portion of the subject land to be leased for the proposed Junja Solar Farm – approximately 25.6 ha.
DPLH	Department of Planning, Lands and Heritage
DWER	Department of Water and Environmental Regulation
EP Act	<i>Environmental Protection Act 1986 (WA)</i>
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999 (Cwth)</i>
EPC	Engineering, Procurement & Construction
ha	hectares
km	kilometres
LPS7	Local Planning Scheme No. 7
m	metres
MNES	Matters of national environmental significance under the EPBC Act ( <i>c.f.</i> )
P&D Act	<i>Planning and Development Act 2005 (WA)</i>
PMF	Probable maximum flood
Proposal	Junja Solar farm
TO	Traditional owners
ToPH	Town of Port Hedland
Strategic Community Plan	<i>Town of Port Hedland Strategic Community Plan 2018 – 2028</i>
sp/spp	Species/multiple species
Subject land	Affected land parcels – Lot 268 Great Northern Highway, Pippingarra
WA	Western Australia
WAPC	Western Australian Planning Commission
YMAC	Yamatji Marlpa Aboriginal Corporation

# 1. INTRODUCTION

## 1.1. OUTLINE

Pilbara Solar proposes to construct a 10 megawatt (MW) alternating current (AC) solar farm approximately 26 km east of Port Hedland, Western Australia (WA). This Development Application (DA) Supplementary Report provides detailed information on key planning considerations and environmental impact assessment relevant to the DA submitted under the Town of Port Hedland (ToPH) Local Planning Scheme No. 7. (LPS7).

Planning approvals are administered under the *WA Planning and Development Act 2005* (P&D Act). All proposals outside of the City of Perth with an estimated cost of \$5 million or more and that require planning approval under the relevant town planning scheme must be determined by a Development Assessment Panel (DAP).

## 1.2. PURPOSE OF THIS REPORT

The purpose of this DA is to:

- Establish an earthworks strategy that coordinates access and construction of the solar farm.
- Undertake required environmental investigations including an Aboriginal heritage survey of the development site and threatened flora, fauna and vegetation community assessments.
- Resolve high-level matters that require management in response to development of the proposed solar farm including access, stormwater, bushfire, environmental constraints, and infrastructure servicing.
- Confirm the likely conditions that will be imposed on this application in order to construct the proposal.

This DA has been developed by NGH on behalf of Pilbara Solar in consultation with sensitive receptors within 500 m of the development site, the ToPH and Horizon Power.

## 1.3. ABOUT THE PROPONENT – PILBARA SOLAR

Pilbara Solar is a renewable energy development company and registered Supply Nation supplier, developing utility scale solar, wind and storage products in WA with Indigenous equity participation.

Pilbara Solar develops robust commercial, utility-scale renewable energy solutions in partnership with Aboriginal people to provide power to the mining industry, communities, government, and business with options for grid-connection, off-grid, and hybrid systems. The Pilbara Solar ownership structure includes 50% ownership by Yamatji Marlpa Aboriginal Corporation (YMAC), a not-for-profit Aboriginal Corporation and the native title representative body for over one million square kilometres in WA's Pilbara, Mid-West and Gascoyne regions.



## **2. BACKGROUND**

### **2.1. LOCATION**

The proposed Junja Solar Farm, shown in Figure 2-1, is located in the Pippingarra locality, approximately 26 km east of Port Hedland on the Great Northern Highway. The disused Goldsworthy railway line runs directly north of the subject land. The 66 kV Goldsworthy electricity transmission line owned and operated by Horizon Power runs north of the development site parallel to the disused railway line.

The development site occupies approximately 25.6 ha within Lot 268 Northern Highway, Pippingarra, which has a total area of 396 ha. Lot 268 is Crown land subject to a perpetual lease by Jinparinya Aboriginal Corporation. The proposal would be accessed via an existing unsealed access track that connects the development site with the Great Northern Highway.

The Petermarer Creek, approximately 1.8 km west, is the nearest watercourse to the development site. Like most watercourses in the region, Petermarer Creek is tidal and is usually inundated for only a few hours each day. No surface waterbodies exist within the subject land.



**Junja Solar Farm  
Location**

Legend

- Local features
- Study area
- Road



Data Attribution  
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© Pilbara Solar 2020  
© Landgate 2020  
© ESRI 2020



Ref: 19-513 Jinparinya Solar Farm  
Author: Tim.c  
Date created: 08/07/2021  
Datum: EPSG:28355 GDA94 / MGA zone 50



Figure 2-1 Junja Solar Farm location

## **2.2. PROPOSAL AREA DESCRIPTION**

### **2.2.1. Area and land use**

The development site occupies approximately 25.6 ha of the 396 ha subject land, which is currently vacant and unused with the exception of the Jinparinya Aboriginal Community located approximately 250 m south of the development site boundary. The development site within the subject land is shown in Figure 3-1.

### **2.2.2. Legal description and ownership**

The subject land is Crown land currently under a long term lease agreement between DPLH and Jinparinya Aboriginal Corporation. Landowner consent for the proposal is provided in Appendix A.

### **2.2.3. Future landuses**

The ToPH Local Planning Scheme No. 7 (LPS7) was gazetted on 20 January 2021. LPS7 replaces the Town of Port Hedland Local Planning Scheme No. 5 as the Town's principal statutory planning document. LPS7 is the principal statutory planning tool for controlling land use and development in the Port Hedland local government area.

LPS7 has included a number of key changes to LPS5, mainly relating to the urban areas of Port Hedland and South Hedland and industrial areas including Wedgefield and Port Hedland International Airport.

Solar Farm is appropriately categorised as 'Renewable Energy Facility', which is an identified use and development class identified in Table 4 of LPS7. Renewable Energy Facility is designated "D," not permitted over Rural zoned land, unless the local government has exercised its discretion by granting development approval. The development site is located over Rural zoned land.

A portion of the site is identified as reserved for railways, which extends beyond the Goldsworthy Railway Line lease/cadastral boundary. The proponent understands that this mapped inaccuracy is a legacy issue between LPS5 & LPS7 and may be changed with an Omnibus policy review.

## **2.3. COMMUNITY DESCRIPTION**

As of the 2016 census, the ToPH local government area has approximately 14,500 residents (ABS, 2020). Aboriginal and Torres Strait Islander people represent approximately 16.7% of the ToPH population (ToPH, 2018). The TOs of region are the Kariyarra, Ngarla and Nyamal people.

Port Hedland, supported by the mining industry, has a higher proportion of male residents than the Australian average, a relatively young median age of 31 and a high median weekly household income of \$2,563. Approximately 70% of the adult population are employed full time. People aged 65 and over represent only 3.4% of the population.

Approximately only 12% of people aged 15 and over have a highest level of educational attainment of a bachelor's degree or above, compared to 20% in Western Australia (WA) and 22% nationally (ABS, 2020). Technicians and trade workers represent approximately 35% of the workforce, 13.9% are machinery operators and drivers, 13% are professionals and 11.3% are clerical and administrative workers. Less than 10% of workers are employed in the government sector.

## 3. DEVELOPMENT PROPOSAL

### 3.1. PROJECT DESCRIPTION

Key features of the proposal are summarised in Table 3-1 with the proposed layout including design drawings provided in Appendix B. Component specifications are subject to detailed design and product selection.

Table 3-1 Key features of proposed Junja Solar Farm.

Proposal element	Description
<b>Proposal</b>	Junja Solar Farm
<b>Proponent</b>	Pilbara Solar Pty Ltd
<b>Capacity</b>	10 MW (AC) Note: the approximate capacity is based on the proposed technology available at the time of the DA but may change through the life of the solar farm, as advances in technology occur.
<b>Subject land</b>	396 ha.
<b>Development site</b>	25.6 ha.
<b>Site description</b>	Lot 268 Great Northern Highway, Pippingarra. Rural zoned under the Town of Port Hedland Town Planning Scheme No. 7.
<b>Local Government Area</b>	Town of Port Hedland.
<b>Solar array</b>	Approximately 30,000 solar panels mounted in arrays, with 5 m to 12 m row spacing. The 2 m x 1 m solar panels would be fixed or arranged in rows on single axis trackers with a maximum height not exceeding 4 m above the natural ground level. The PV mounting structure would comprise steel posts driven approximately 1.2 – 2.5 m into the ground using a pile driver.
<b>Modular inverters</b>	The proposal would include approximately two modular inverter units located within the solar array, each up to 5 m in height.
<b>Substation</b>	The substation would occupy approximately 0.5 ha with gravelled hardstand. The dimensions of the substation would be approximately 100 m x 50 m. The substation would have an approximate height of 9 m. The substation would be fenced separately to the solar farm with Horizon Power having unrestricted access to their asset. Overhead cabling would connect the substation to the 66 kV Horizon Power transmission line.
<b>Cabling</b>	The majority of cabling across the development site would be below ground at approximate depths of between 0.3 m and 1.5 m.

Proposal element	Description
<b>Site Access</b>	Site access would be off the Great Northern Highway using the existing unsealed tracks shown in Figure 3-1. The intersection off Great Northern Highway and tracks are sufficiently wide for construction vehicles. No upgrade works, apart from periodical grading would be required.
<b>Internal access tracks</b>	Internal access tracks would be compacted to minimise dust. Internal access roads to the substation would be approximately 5 m wide (including shoulders and any required drainage).
<b>20ft storage container</b>	One transportable storage container would be placed at the site outside the solar array within the fenced area.
<b>Security fencing</b>	Security fencing, at a height of approximately 2.4 m, would be installed around the site.
<b>Construction hours</b>	Construction hours would generally be 7.00am to 7.00pm Monday to Saturday. No construction activities would be undertaken on Sundays or public holidays.
<b>Construction timing</b>	Approximately 6 months commencing in the fourth quarter 2022.
<b>Workforce</b>	Construction – peak of around 60 workers. Operation – four FTE based in Wedgefield with periodic site visits.
<b>Operation period</b>	Approximately 30 years.
<b>Decommissioning</b>	The site would be returned to its pre-works state. All infrastructure would be removed. The site would be rehabilitated in consultation with the landowner, consistent with land use requirements.
<b>Capital investment</b>	Estimated \$25 million.

## 3.2. INFRASTRUCTURE SERVICING

### 3.2.1. Water supply

Construction water including that used for controlling dust would be obtained from a ToPH standpipe and stored for use onsite. Potable water for staff amenities would not be required during operation. A 10,000 L water tank, featuring appropriate fire-fighting couplings would be maintained onsite during the life of the proposal for firefighting purposes. The Jinparinya Community would maintain the water tank.

### 3.2.2. Power

An electrical connection to the development site for construction and operation activities is not required. Electricity during construction would be provided via a portable generator.

### **3.2.3. Wastewater**

Wastewater generated by the proposal includes worker amenities required during construction only and stormwater runoff. Stormwater management including sediment and erosion control are addressed in section 6.3 and Appendix D.

Ancillary worker facilities including toilets and kitchen area would be provided during construction. Wastewater would be stored onsite in aboveground tanks that would be periodically emptied and disposed of at an appropriately licenced facility.

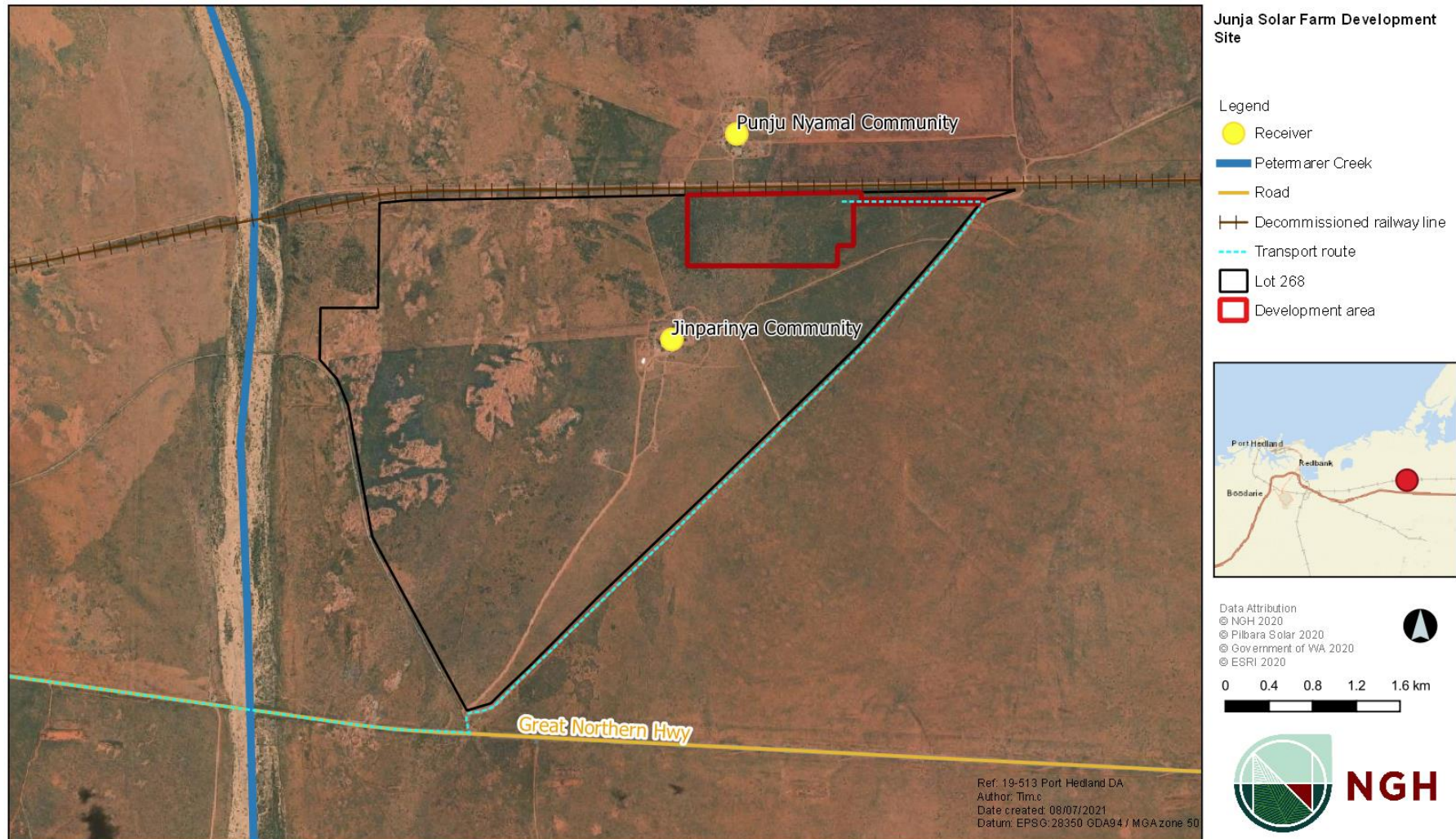


Figure 3-1 Junja Solar Farm development site

## 4. PLANNING FRAMEWORK

### 4.1. STRATEGIC JUSTIFICATION

#### 4.1.1. National renewable energy targets

The Kyoto Protocol is an international agreement created under the United Nations Framework Convention on Climate Change in Kyoto, Japan in 1997. The Australian Prime Minister signed Australia's instrument of ratification of the Kyoto Protocol in 2007, thereby committing Australia to reduce its collective GHG emissions.

There have been a number of Government policies in place in Australia influencing the development of renewable energy. In 2001, the Commonwealth Government introduced the MRET Scheme to increase the amount of renewable energy being used in Australia's electricity supply. The initial MRET was for Australian to provide 9500 gigawatt hours (GWh) of new renewable energy generation by 2010 (CER, 2018).

This target was revised and increased to 45,000 GWh from 2001 to 2020 in January 2011. The MRET was split into a Small-scale Renewable Energy Scheme and the Large-scale Renewable Energy Target (LRET) components to ensure that adequate incentives were provided for large scale grid connected renewable energy (CER, 2018). The LRET aims to create a financial incentive for the establishment and growth of renewable energy power stations, such as wind and solar farms, or hydro-electric power stations through the creation of large-scale generation certificates.

In June 2015, the Australian parliament passed the *Renewable Energy (Electricity) Amendment Bill 2015*. As part of the amendment bill the LRET was reduced from 41,000 GWh to 33,000 GWh by 2020 with interim and post 2020 targets adjusted accordingly. The current projection is that about 23.5% of Australia's electricity generation in 2020 would be from renewable sources (CER, 2018).

#### 4.1.2. Position Statement: Renewable energy facilities

The Renewable energy facilities position statement prepared by the Department of Planning, Lands and Heritage (DPLH) on behalf of the Government of WA outlines WAPC requirements to support the consistent consideration and provision of renewable energy facilities within WA (DPLH, 2020).

*The policy identifies assessment measures to facilitate appropriate development of renewable energy facilities. It seeks to ensure these facilities are in areas that minimise potential impact upon the environment, natural landscape and urban areas while maximising energy production returns and operational efficiency.*

The development site for the proposal has few environmental constraints and is located away from urban town centres. The proposal's contribution of renewable electricity to the local electricity network is consistent with this position statement.

#### 4.1.3. Local Planning Strategy

The ToPH Local Planning Strategy (2021) (the Strategy) was endorsed by the Western Australian Planning Commission (WAPC) on 13 May 2021. The Strategy replaces the Pilbara's Port City Growth Plan as the Town's principal strategic planning document.

Section 3.2.3 of the Strategy outlines the Western Australian Government's \$5.5 billion WA Recovery Plan (released July 2020) which evidences a strong focus on expanding WA's footprint in renewable energies and introducing new manufacturing capabilities. Section 4.2.3 of the Strategy identifies renewable energy facilities as one of the opportunities relating to rural, mining and pastoral industries, within the locality. A direct action is listed specific to diversifying the range of permissible land uses for the Rural zone within LPS7. An



associated action also includes encouraging new climate-appropriate industries that can capitalise on technological innovation, renewable energy, or availability of natural resources.

The proposal facilitates the desired actions of the Strategy, with regard to facilitating growth in new innovative industries, in conjunction with a renewable energy proposal outcome.

#### 4.1.4. The Pilbara’s Port City Growth Plan

The Pilbara’s *Port City Growth Plan* (the Growth Plan) was endorsed by the Western Australian Planning Commission (WAPC) on in July 2012 and provides a high level strategic blueprint to grow Port Hedland into a Port City with a population of 50,000 people. Market impacts on the mining industry and other pressures like COVID 19 have reduced the population of Pilbara town centres over the past five years.

The proposal’s contribution of electricity to the local electricity network managed by Horizon Power is consistent with the Growth Plan.

#### 4.1.5. ToPH Strategic Community Plan 2018 – 2028

The Junja Solar Farm proposal strongly aligns with ToPH’s *Strategic Community Plan 2018 – 2028* (Strategic Community Plan). Consistencies between the objectives of the Strategic Community Plan and the proposal are provided in Table 4-1.

Table 4-1 Junja Solar Farm alignment with the ToPH Strategic Community Plan 2018 – 2028

Outcome	Alignment
<b>Theme: Our community</b>	
<b>1.d.1 The present and future facilities and requirements of the Town are planned for and developed in-line with relevant facility standards and community needs.</b>	The proposal would contribute approximately 10 WM of renewable energy to support the community’s future requirements.
<b>Theme: Our economy</b>	
<b>2.c.1 Business and government agencies and other relevant stakeholders are engaged to:</b> <ul style="list-style-type: none"> <li>• <b>Identify strategic employment and economic development priorities</b></li> <li>• <b>Assess and address market failures affecting the cost of living</b></li> <li>• <b>Assess and address cost of doing business challenges.</b></li> </ul>	Electricity from utility scale solar farms is widely demonstrated to be cheaper to produce than electricity from fossil fuel power stations. Should these cost savings be passed onto the consumer, this would contribute to reducing the cost of living.
<b>2.c.2 Opportunities for social enterprise, innovators, and small and medium sized businesses are identified, and strategies to attract and support them are implemented.</b>	Pilbara Solar is a local small business with strong ties to traditional owners (TOs) and the Port Hedland community. Pilbara Solar is also an innovator of renewable energy solutions for the harsh climatic conditions of the Pilbara region.

Outcome	Alignment
<b>Theme: Our built and natural environment</b>	
<b>3.b.3 Sustainable energy, waste and water management practices are provided and promoted.</b>	The proposal would generate approximately 10 WM of renewable energy reducing the Port Hedland community's reliance on fossil fuels. The proposal would generate approximately 29,421 MWh in its first year. An approximate 672,626MWh would be generated over the project life, saving a substantial amount of CO <sub>2</sub> emissions compared with electricity from coal.

#### 4.1.6. Local planning policies

No planning policies currently exist regarding building specifications for developments within Rural land zone, particularly for renewable energy facilities and ancillary development (solar farm related infrastructure). The solar array would have a maximum rotating height of 4 m or 3.5 m for fixed panels. The substation transformer and inverters would have a maximum height of 9 m.

Accurate design details would be provided in future building permit applications for specific elements of the proposal listed in section 3.1.

## 4.2. RELEVANT LEGISLATION

This DA Supplementary Report has been prepared in accordance with the P&D Act and relevant Commonwealth and State Government legislation listed in Table 4-2.

Table 4-2 Relevant Commonwealth and WA legislation

Legislation	Relevance
<b>Commonwealth legislation</b>	
<i>Renewable Energy (Electricity) Act 2000</i>	The Mandatory Renewable Energy Target Scheme (MRET) provides creates demand for renewable energy by requiring electricity wholesalers to source a portion of the electricity sold from renewable energy sources. Alignment of the proposal with National, State and local strategies is provided in section 4.1.
<i>Environment Protection and Biodiversity Conservation Act 1999</i> (EPBC Act)	EPBC Act provides a list of matters of national environmental significance (MNES), which includes significant fauna, flora and communities.
<b>State legislation</b>	
<i>Planning and Development Act 2005</i> (P&D Act).	Recent changes to the P&D Act have amended the definition of 'significant development' to include: Development that has an estimated cost of \$5 million or more outside of the metropolitan region. Significant developments may be referred directly to the Western Australian Planning Commission (WAPC) for determination.

Legislation	Relevance
<i>Environmental Protection Act 1986</i> (EP Act)	<p>The EP Act is designed to prevent, control and abate environmental harm as well as to protect and manage the natural environment. The EP Act is administered by the Department of Water and Environmental Regulation (DWER) and the Environmental Protection Authority (EPA). Referral of the proposal to either agency is not required as the proposal would have very minimal impact on the environment.</p> <p>Potential dust impacts of the proposal are assessed in Appendix E. The Dust Management Plan also provides dust management controls for the proposal.</p>
<i>Biodiversity Conservation Act 2016</i> (BC Act)	<p>The BC Act provides for the conservation and protection of biodiversity and in WA, the ecologically sustainable use of biodiversity components in WA.</p> <p>Plants and animals that are considered Threatened and need to be specially protected because they are under identifiable threat of extinction are listed under the BC Act. Species not yet adequately surveyed to warrant being listed under the BC Act, or otherwise data deficient are added to the Priority Lists under Priorities 1, 2 or 3.</p> <p>Potential impacts on Threatened or data deficient flora and fauna are addressed in Appendix C.</p> <p>Potential impacts on Biodiversity are addressed in Appendix C.</p>
<i>Biosecurity and Agriculture Management Act 2007</i> (BAM Act)	<p>The BAM Act and its regulations aim to prevent new animal pests, weeds and diseases from entering WA. The BAM Act also provides for the control and prevention of spreading pest, weeds and diseases already present in the State.</p> <p>Animal pest and weed management are addressed in Appendix C.</p>
<i>Environmental Protection (Noise) Regulations 1997</i> (Noise Regulations)	<p>The Noise Regulations provide criteria for allowable noise from the proposal. Noise impacts on sensitive receptors are assessed in Appendix F. The Noise Management Plan defines noise management controls for the proposal.</p>
<i>Waste Avoidance and Resource Recovery Act 2007</i> (WARR Act)	<p>Pilbara Solar has developed a Waste Management Plan for the proposal in accordance with the WARR Act. See section 6.9.</p>
State Planning Policy 3.7 – Planning in Bushfire Prone Areas (SSP 3.7)	<p>State Planning Policy 3.7 Planning in Bushfire Prone Areas (SPP 3.7) directs how land use should address bushfire risk management in Western Australia. It applies to all land which has been designated as bushfire prone by the Fire and Emergency Services (FES).</p> <p>ToPH have confirmed that a BAL assessment and Bushfire Management Plan are not required due to the low risk level of the proposal.</p>

### 4.3. ZONING AND LANDUSE PERMISSIBILITY

The subject land is zoned 'Rural' under Local Planning Scheme No.7 (LPS7). The objectives for the Rural zone listed under Part 3 of the LPS7, include:

- To provide for the maintenance or enhancement of specific local rural character.
- To protect broad acre agricultural activities such as cropping and grazing and intensive uses such as horticulture as primary uses, with other rural pursuits and rural industries as secondary uses in circumstances where they demonstrate compatibility with the primary use.
- To maintain and enhance the environmental qualities of the landscape, vegetation, soils and water bodies, to protect sensitive areas especially the natural valley and watercourse systems from damage.
- To provide for the operation and development of existing, future and potential rural land uses by limiting the introduction of sensitive land uses in the Rural zone.
- To provide for a range of non-rural land uses where they have demonstrated benefit and are compatible with surrounding rural uses.

Renewable Energy Facility is not included within the list of permissible land uses assessed in 'Table 4 – Zoning Table' of LPS7. A Renewable Energy Facility is not permitted unless the local government has exercised its discretion by granting development approval. The proposed solar farm is consistent with the land use objectives for Rural Zoned land for the following reasons:

- The subject land would not be subdivided but leased for the life of the proposal (approximately 30 years).
- The proposal involves a small portion of the subject land, enabling rural land uses to continue to occur in the future, concurrently with the proposal.
- Following decommissioning, all above and below-ground infrastructure would be removed, and the development site returned to its current rural land use.
- The proposal satisfies the objectives of the ToPH Local Planning Strategy, refer to Section 4.3.1 below.

It is also identified that a portion of the site is reserved for railways, which extends beyond the Goldsworthy Railway Line lease/cadastral boundary. The proponent understands that this mapped inaccuracy is a legacy issue between LPS5 & LPS7 and may be changed with an Omnibus policy review.

#### 4.3.1. Local Planning Policy 04 – Percent for Public Art

As identified in Section 4.1.3, the Town's Strategy is the principal strategic planning document that applies to ToPH. The Strategy seeks to:

- *establish a vision for the future of the district;*
- *provide direction for growth and development within the Town over the next 15 years;*
- *establish strategies and actions in response to identified opportunities and constraints;*
- *provide a rationale for land release to support sustainable urban growth; and*
- *identify the need for further studies and investigations to respond to issues within the district.*

The Strategy provides precinct objectives which encourage landscaping and public art to be provided throughout specific urban areas (i.e. West End and South Hedland City Centre). For example, the West End Precinct objectives under the Town's Strategy (2021) include:

- *Protect built heritage and enable adaptive reuse of heritage buildings to preserve the character of the West End;*

- *Limit new residential development and other sensitive land uses in accordance with the Improvement Scheme;*
- *Consolidate fragmented land ownership and road networks to support urban renewal;*
- *Develop a maritime precinct that focuses on high quality built form and port supporting commercial land uses;*
- *Encourage the establishment of a landscape buffer that separates industrial uses from sensitive uses to improve air quality and acoustic amenity;*
- *Designate land for tourism related land uses to encourage visitation of the precinct and contribute to economic activation;*
- *Adapt to coastal hazards by recognising land at risk of coastal erosion and inundation and apply a framework to reduce risk of damage during storm events;*
- *Improve the amenity of urban spaces through encouraging developments to provide landscaping and public art to contribute to the West End character.*

The proposal area is not situated in a designated precinct (West End and South Hedland City Centre), therefore would be unable to contribute to the public art objective, identified above. Therefore the broader application of Local Planning Policies applies in this instance, under LPS7.

2As referred to in Section 2.2, the ToPH LPS7 was gazetted on 20 January 2021. LPS7 is the principal statutory planning tool for controlling land use and development in the Port Hedland local government area. Section 9 of LPS7 outlines the aims of the scheme, regarding Community and Culture, and include:

- i. Encourage and facilitate the provision of high quality community facilities;*
- ii. Protect and enhance culturally sensitive areas and places of heritage value;*
- iii. Celebrate local culture and encourage the provision of public art in developments;***
- iv. Maintain and enhance the network of open space;*
- v. Enhance the public health of the community.*

## **Local Planning Policy 04 – Percent for Public Art**

The Local Planning Policy Percent for Public Art (LPP/04) was adopted in April 2020 and is guided by the Percent for Art Guidelines. The Percent for Art Guidelines were recently revised by ToPH, in May 2021.

The Percent for Public Art Policy provides the framework for the development, funding, and management of public art in, or visible from, public spaces. It aims to engage artists in creatively celebrating the values of Port Hedland, its unique character, Indigenous history, and future aspirations, influencing built form and the way people interact with the public realm.

### **Application of LPP/04**

The LPP/04 requires eligible development applications over the value of \$2,000,000 to set aside 1 percent of the total project cost of the development for public art, up to a maximum contribution of \$150,000. Junja Solar Farm has an estimated capital investment value of \$25 million. Therefore, the maximum contribution of \$150,000 would apply.

Clause 3.6 (Location) of LPP/04 requires Artwork to satisfy the following:

- *3.6.1 Artworks are to be situated where they are clearly visible to the general public. This means that artworks are to be clearly visible from the adjacent public street(s), public pathway(s), public open space, and/or other publically accessible spaces.*

**Comment:** Proposed artwork would not be visible to the public. The proposal footprint would not permit artwork to be clearly visible from public streets, pathways, public open space, and publicly accessible spaces, as no such spaces exist in the locality of the proposal.

- 3.6.2 *Private developers shall have Public Art located wholly on Private Property*

**Comment:** If public art were provided within the proposal, the requirements identified in Section 3.6.1 would not be satisfied.

## Percent for Art Guidelines (2021)

The Percent for Art Guidelines require public art to be considered in the early stages of a development. The objective is to enable a component of public art to be integrated into a suitable location, to educate people, build connections and promote cultures and traditions. The criteria for public art is public access; the artwork is visible from the public realm and positively contributes to the visual amenity and location.

Ordinarily, for commercial, mixed use, residential or recreational development occurring within the urban boundary of Port Hedland, artwork could be incorporated into the proposal. Development of this nature and more importantly, where situated in a centralised location, would generally be subject to high volumes of pedestrian and vehicular traffic (from public spaces).

Due to the location of the proposal area, which is situated 26km east of Port Hedland, it is not considered an appropriate location given artwork would not receive ample visitor traffic, thus not effectively visible by the public realm.

The location does not enable the proposal to include artwork, which would meet the objective of being visible from the public realm, thus contributing to the visual amenity and location. As artwork would not be provided within, or in areas adjacent to (or visible from) the public domain, there would be little opportunity for on-site artwork to educate people, build connections and promote cultures and traditions, in accordance with the objectives of the guidelines.

## Departure to application of LPP/04

As LPP/04 applies to all development applications (over \$2m) on zoned or reserved land, unless an exemption applies under Clause 3.1.2 of LPP/04, the following proponent (Pilbara Solar) seeks a departure to the broad application of LPP/04. The foundation for the departure is based on the remote geographic location of the proposal and more importantly, the positive environmental, social, community and economic benefits that Junja Solar Farm would provide to the region.

The location of the proposal is:

- The subject land is zoned 'Rural' under LPS7.
- The proposal area is located 26km east of Port Hedland.
- The proposal area is not immediately adjacent major thoroughfares (i.e. Great Northern Highway).
- Due to the isolated location of the proposal area, the site is not visible from the public realm, and
- The proposal is setback from the public road approximately 1km into the landscape. The location of art, if incorporated into the proposal, would be sited approximately 1km from the closest access road.

The applicant, Pilbara Solar:

- Is a renewable energy development company, and registered Supply Nation supplier, developing utility scale solar, wind and storage products in WA with Indigenous equity participation.
- Develops robust commercial, utility-scale renewable energy solutions in partnership with Aboriginal people.

- Ownership structure includes 50% ownership by Yamatji Marlpa Aboriginal Corporation (YMAC), a not-for-profit Aboriginal Corporation and the native title representative body for over one million square kilometres in WA's Pilbara, Mid-West, and Gascoyne regions, and
- Provides power to the mining industry, communities, government, and business with options for grid-connection, off-grid, and hybrid systems.

The environmental benefits include:

- The proposal would generate approximately 10 MW of renewable energy reducing the reliance on fossil fuels, by the Port Hedland community.
- The proposal would generate approximately 29,421 MWh in its first year. An approximate 672,626MWh would be generated over the project life, saving a substantial amount of CO2 emissions compared with electricity from coal.

The economic benefits include:

- Local jobs throughout the construction and operation and maintenance phases.
- Upskilling of the local workforce.
- Local Aboriginal Communities would be involved in the project, through roles for ongoing maintenance.
- The Engineering, Procurement & Construction (EPC) contract includes a clause to preference the use the community subcontractors, assuming they are able and commercially viable during the construction and also operations and maintenance phases of the project, and
- Pilbara Solar is a social enterprise with 50% of the profits supporting YMAC in providing a range a professional services to Traditional Owners of the Pilbara, Midwest, and Gascoyne regions.

The social and community benefits include:

- Equity ownership for the local Aboriginal people via a free-carry arrangement for the life of the project.
- Option of a community benefit/development fund.
- Ongoing land lease fees payable by the project to the local community.
- Significant increase in local employment during construction (60 fulltime equivalent proposed).
- Cultural preservation via an Aboriginal heritage survey.
- Community solar – Pilbara Solar is looking at options to support the local community in transitioning to rooftop solar.
- Education and skills development for locals, and
- Increase in business for local contractors.

The objectives of LPP/04 are outlined in Table 4-3 below. Discussion is included to consider whether strict compliance with the policy would be unreasonable or unnecessary and whether there are sufficient grounds to justify contravening the policy.

Table 4-3 LPP/04 objectives

Objective	Comment
<b>1</b> <i>Increase the social, cultural, and economic value of the Town in conjunction with the Town's Arts &amp; Culture Strategy 2019-2022;</i>	<p>Due to the category of proposal and its location, the proposal and subject land would not provide the opportunity to incorporate public art, which would provide tangible value to the public.</p> <p>The proposal, when considered against the intent of the objective, would be unable achieve an increase in values of social, cultural, and economic value within Port Hedland.</p>

Objective		Comment
		Art, if associated with the Junja Solar farm, would not be visible by the public realm, thus a true appreciation of its value would not be satisfied.
2	<i>Acknowledge and celebrate Indigenous culture and heritage;</i>	Public art incorporated into the proposal would not be able to acknowledge and celebrate Indigenous culture and heritage. A full appreciation and acknowledgement of indigenous culture and heritage would not be achieved due to the site's isolation and general absence from the public realm.  However, the proposal is in part, prepared for, and owned by YMAC (a not-for-profit Aboriginal Corporation), where a proportion of profits would be utilised in providing professional services to Traditional Owners of the Pilbara, Midwest, and Gascoyne regions.
3	<i>Develop and promote community identity within the Town to bridge communities;</i>	Art, if incorporated within the proposal would not achieve the objective of promoting community identity within the town, to bridge communities.  The subject land is located 26km east of Port Hedland and is situated over 1km from the nearest access road. Artwork would not contribute to achievement of a sense of community identity, where the community cannot appreciate the artwork.
4	<i>Establish new design partnerships between artists, architects, and other professionals;</i>	If public art is provided, this objective would be satisfied. However, the prevailing objectives relating to promotion of public arts and the celebration of culture and identity would not be achieved.
5	<i>Celebrate environment, industry, and lifestyle; and</i>	Public art could be provided to celebrate environment, industry, and lifestyle. However, as identified previously, when considering the location of the proposal and its prevailing rural landscape setting, a true appreciation of the artwork would not be achieved. Therefore the objective to celebrate environment, industry and lifestyle would not be achieved.
6	<i>Increase public awareness of the value of art, design, and culture.</i>	Public art provided within the proposal would not meet the objective of increasing public awareness of the value of art, design, and culture.  The artwork would not be visible by the public realm, therefore the ability to increase public awareness could not be met.

As discussed above, the application of the LPP/04 policy and its objectives would be fully satisfied. Strict compliance with the policy would be unreasonable and unnecessary considering the remote location of the proposal area wouldn't allow for artwork to be viewed by the public domain.

The proposal would provide economic, social and community benefits to the region. These benefits are not limited to a single occasion; benefits would be ongoing through the operational life of the project.

The purpose of LPP/04 is outlined below in Table 4-4. Discussion is included to consider whether strict compliance with the policy would be unreasonable or unnecessary.



Table 4-4 LPP/04 purpose

Purpose	Comment
The development of public spaces contributes to a sense of identity and place, whilst contributing to the quality of the built environment.	Art incorporated into the proposal would not contribute to the development of public spaces. Therefore, artwork would be unable to contribute to the quality of the built (urban) environment. This item would not be achieved.
Public Art has the ability to deliver a range of social, economic, and cultural benefits that can influence the built form and the way people interact within a public space.	Art incorporated into the proposal would not influence the built form, or the way people interact within a public space.  The proposal is not a commercial, mixed use, residential or recreational development (which can often include areas for public use and appreciation), occurring within the urban boundary of Port Hedland.  The proposed solar farm is situated in a remote location could not provide the same opportunity to interact and influence the public realm with artwork, in the same way as other categories of development could.
Public Art can enhance the appearance of buildings and provide opportunities for social interaction enhancing visitor experience.	Art within the proposal would not improve the appearance of buildings or provide opportunities for social interaction or enhancement of visitor experience.

The purpose of the LPP/04 policy would not be fully achieved. There are no public areas within or immediately adjacent to Junja Solar Farm. The application of public artwork would not be able deliver the social and cultural benefits through social interaction.

With consideration given to the above discussion contained within Section 4.3.1, it is demonstrated that the proposal would not be able to achieve the policy objectives and purpose of LPP/04. In this instance, it would be unreasonable for strict compliance of LPP/04 to be applied. Given the long term environmental, economic, social and community benefits the proposal provides, it is considered that there are sufficient grounds to justify contravening the application of the LPP/04 policy.

## 5. STAGEHOLDER ENGAGEMENT

### 5.1. GOVERNMENT AGENCIES

Pilbara Solar have engaged with the following key government agencies:

- Town of Port Hedland
- Horizon Power.

#### 5.1.1. Town of Port Hedland

ToPH have been engaged throughout the preparation of this DA in order to seek clarification on the level of detail required for various components of this application, particularly site investigations, environmental impacts assessment, engagement with sensitive receptors and mitigation measures to minimise the impacts of the proposal for adjacent land users. ToPH planners were invited to attend a site visit of the proposal on 2 December 2020, in order to discuss various aspects of the proposal and to ensure the Junja Solar Farm is delivered smoothly and to ToPH's satisfaction.

Issue	Engagement details
<b>Planning process</b>	ToPH was initially contacted in July 2019 to discuss the planning process and their expectations for components of the DA application.
<b>Bushfire management</b>	Followed by an inspection of the development site by Bushfire Prone Planning, ToPH advised that the proposal does not need to comply with State Planning Policy (SPP) 3.7 Planning in Bushfire Prone Areas due to the low fire risk of the proposal. Notwithstanding this, the development site would incorporate a 10,000 L water tank fitted with a 65 mm Storz fitting, to be maintained onsite during the life of the proposal for firefighting purposes. The Jinparinya Community would maintain the water tank.  The development site would also include a fire break around the perimeter of the proposed infrastructure.
<b>Soil assessment</b>	ToPH were consulted regarding the requirements of geotechnical and soil assessments by phone in early November 2020. NGH were advised that a desktop soil summary would be sufficient to support the DA and that a geotechnical investigation may be required to obtain building permits post-planning assessment.
<b>Stormwater management and flooding</b>	ToPH were consulted regarding the level of detail required in the Flood Assessment. Free regional topographic data (STRM DEM from Geoscience Australia) was considered sufficient for the Flood Assessment considering the rural surroundings of the development site.
<b>General project and delivery overview</b>	ToPH have agreed to review and provide comments on this DA in early December 2020 prior formal lodgement with DPLH.

### **5.1.2. Horizon Power**

Pilbara Solar has been in consultation with Horizon Power since inception of the proposal and throughout the design process. Horizon Power has confirmed that the Goldsworthy line has the capacity and integrity to accept the generation from the solar farm. The detailed grid connection study is underway at the time of writing. Pilbara Solar has been involved in frequent consultation with Horizon Power through the preparation of the proposal.

## **5.2. COMMUNITY ENGAGEMENT**

The proposal is located between two Aboriginal communities, which are the only sensitive land users within 10 km of the development site. The Punju Nyamal Aboriginal community currently comprises approximately 10 residents and is located approximately 180 m north of the development site boundary. Jinparinya Aboriginal Community comprises approximately 15 residents and is located approximately 250 m south of the development site boundary. The residents of both communities have been consulted in the preparation of the DA. The Pilbara Solar Project Manager for the proposal visited the communities on 2 of December 2020 and provided residents with an overview of the solar farm. Elements of the proposal discussed include:

- Size, capacity and location of the solar farm.
- Infrastructure components.
- Construction hours and timeframes.
- Development application assessment process.
- Noise and dust impacts.
- Project Manager contact details.

In respect of the IAP2 spectrum, Punju Nyamal has been informed of the project via a fact sheet, refer to Appendix G. Unfortunately, Pilbara Solar has attempted to make contact with Punju Nyamal on numerous occasions without success. Pilbara Solar has sent a hardcopy and email to the community representative and has followed up with a number of calls that remain unreturned. At the time of writing, Pilbara Solar was informed that only one person lives at Punju Nyamal by the Jinparinya Community.

Pilbara Solar is collaborating with Jinparinya Community on the project and has provided Jinparinya with the fact sheet. The Community has been pivotal in deciding the best location for the solar farm. Pilbara Solar meets with Jinparinya on community land often to provide project updates.

Both communities have been given an opportunity to provide feedback via the factsheet. While positive feedback on the project has been provided by the Jinparinya Community in passing, no formal feedback has been received.

## 6. ENVIRONMENTAL IMPACT ASSESSMENT

Environmental impact assessment for the proposal including bushfire, traffic, soil, flooding and stormwater, and waste are addressed in this section of the DA Supplementary Report below. Standalone assessments for flooding, biodiversity, Aboriginal heritage, dust and noise are provided in the appendices.

### 6.1. BUSHFIRE

The subject land is mapped Bushfire Prone Area as shown Figure 6-1. The development site is located within a bushfire prone area, which experiences regular and quick grass fires which may impact built infrastructure and human safety. Bushfire Prone Planning carried out a bushfire assessment of the site in late September 2020 to determine the level of assessment required for the solar farm.

Following consultation with Bushfire Prone Planning, ToPH advised (by phone 9 October 2020) that the Bushfire Standard Policy does not apply, and a BAL assessment is not required. This decision is due to the absence of operational staff, at the solar farm following commissioning, which would be unmanned except for periodical site inspections and maintenance works.

ToPH recommended, however, that:

- Bushfire mitigation measures be incorporated into the solar farm design.
- Bushfire preparedness measures be put in place to control the risk to workers during the 4 to 6 month construction period.

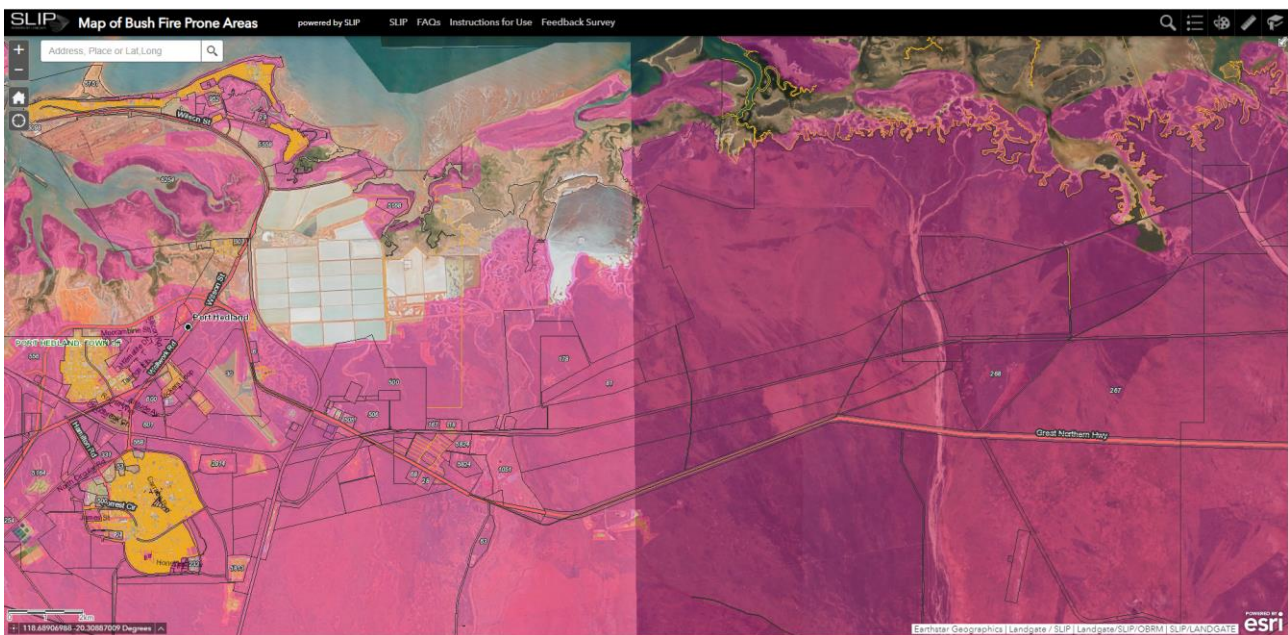


Figure 6-1 Bushfire Prone Area search (source: Landgate 2020)

#### 6.1.1. Bushfire risks

Potential bushfire (including grass fire) hazards relate to the risk of causing a bushfire and the risk of any bushfires affecting the solar farm. This could include:

- Hot works activities such as welding, soldering, grinding and use of a blow torch.
- Sparks and contact ignition from vehicles in long combustible vegetation.

- Smoking and careless disposal of cigarettes.
- Use of petrol-powered tools.
- Operating plant fitted with power hydraulics on land containing combustible material.
- Electrical faults during testing and commissioning.
- Storage of chemicals and hazardous materials.

### 6.1.2. Bushfire preparedness

While a Bushfire Management Plan is not a requirement of this DA, Pilbara Solar would implement the following bushfire preparedness measures to manage bushfire risks to their workers, surrounding land users and solar farm assets.

#### General

Bushfire preparedness measures to be maintained throughout the life of the proposal include:

- Firebreak maintenance – a three metre firebreak surrounding the solar farm would be maintained every six months to remove all flammable organic matter.
- The firebreak surrounding the substation would include gravel surfacing to minimise the risk of fire escaping from the facilities and the risk of external fire affecting the facilities.
- Ensure that the solar farm is suitably equipped to respond to any fires onsite including provision of a 10,000 L water supply tank fitted with a 65 mm Storz fitting. The on-site position of the water supply tank is to be determined throughout the detailed design phase.
- Provision of fire extinguishers at each inverter station and storage container.
- Project/maintenance staff suitably trained in basic firefighting.
- Firefighting PPE kept at the site office/storage shed (2 suits).
- Water tank fittings and fire extinguishers should be inspected monthly.

#### Construction and decommissioning

There is low fire risk during construction and decommissioning from the use of materials. The buildings on site would be constructed of low combustibility or non-combustible materials suitable for buildings of class 5 to 8 and 10 in accordance with the National Construction Code (NCC). All electrical components would be designed and managed to minimise potential for ignition. The solar array, which will occupy the majority of the site, would be largely constructed of glass, silicon, steel and aluminium/steel and will have very low flammability. The site office and staff amenity building would be located on the temporary laydown area located in the south eastern corner of the development site.

A Sign in/Sign out register will be kept on site. This container will be clearly sign posted to notify emergency response personnel and provide accountability of onsite personnel during the event of an emergency.

In the event of a fire at or near the development site: staff would be directed by radio and verbal communication to proceed to the assembly point at the site office/laydown area. Evacuation would be overseen by the SHEQ Manager.

#### Operation

The solar farm energy generation would be monitored and operated remotely with operation staff able to initiate a shutdown of electricity generating equipment in response to bushfire at or near the development site. Following commissioning, the substation would be owned and operated by Horizon Power.

## 6.2. TRAFFIC

Traffic impacts of the proposal were considered in accordance with the *Traffic impact assessment guidelines* (DP and WAPC, 2016).

The proposal would generate an approximate total of 1000 light vehicle trips and 200 heavy vehicle trips to the development site over the 6 month construction period. The commencement of construction would see one to two light vehicles and one heavy vehicle per day rise to approximately 10 to 12 light vehicles and two heavy vehicles per day during peak construction. The construction contractor will be required to maintain traffic movements to below 10 trips per hour by encouraging carpooling or a shuttle bus service for construction workers. Traffic impact assessment requirements for 'low impact' developments such as the proposal are shown in Figure 6-2.

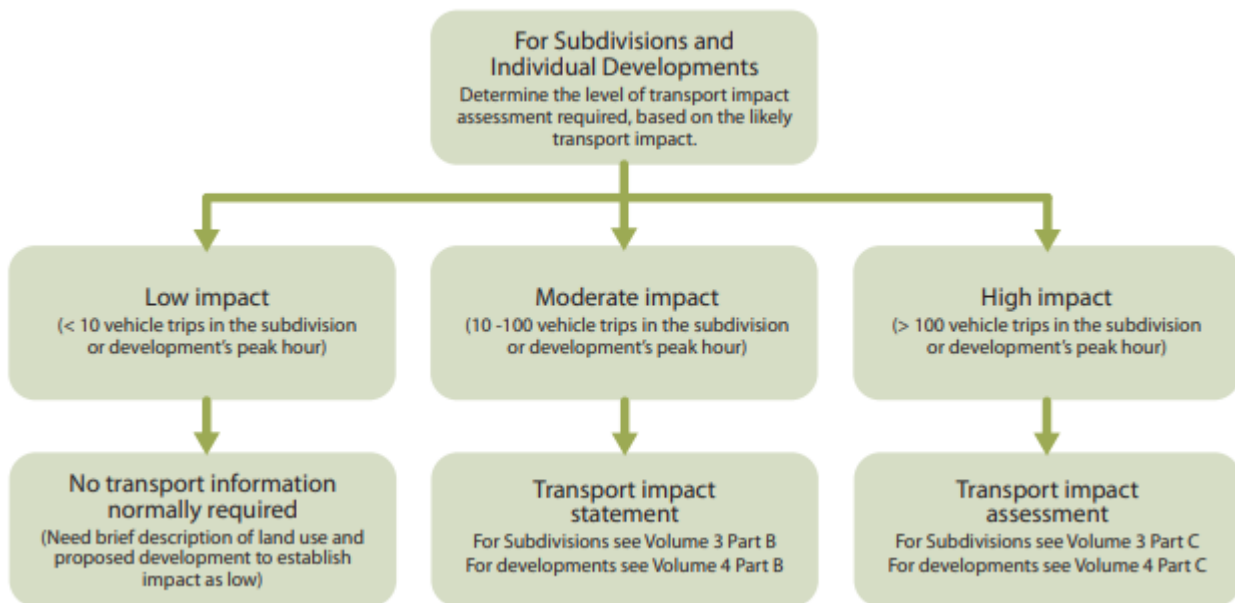


Figure 6-2 Level of assessment required (source: DP and WAPC, 2016)

Operation of the proposal would generate negligible traffic impacts with one light vehicle trip to the site for periodical site inspections and maintenance works. Firebreaks would require one grader to visit the site approximately every six months. Washing panels and maintenance works would occur occasionally as required.

## 6.3. SOIL

### 6.3.1. Existing environment

The site is located on red deep sandy duplex according to available soil landscape mapping (CSIRO, 2020). Sandy duplexes are defined as 'soils with a sandy surface and a texture or permeability contrast at 3 to 80 cm,' (DAF, 2013). Red deep sandy duplex soils, characterised by the red appearance of the first 30 cm of the soil profile, mainly occur throughout the southern Pilbara Rangelands but are also scattered within the Southwestern Region of WA (DAF, 2013). Typical Australian Soil Classification of red deep sandy duplex soil are predominantly Red Chromosol/Red Sodosol overlaying loam, clay or rocky substrate. These soils are often hard setting and typically of neutral pH. Saline subsoils are common in this soil group (DAF, 2013).

## Contamination

A contaminated sites search for the locality of the proposal was undertaken via the SLIP (Landgate, 2020) as shown in Figure 6-3. No registered contaminated sites occur within 10 km of the proposal.

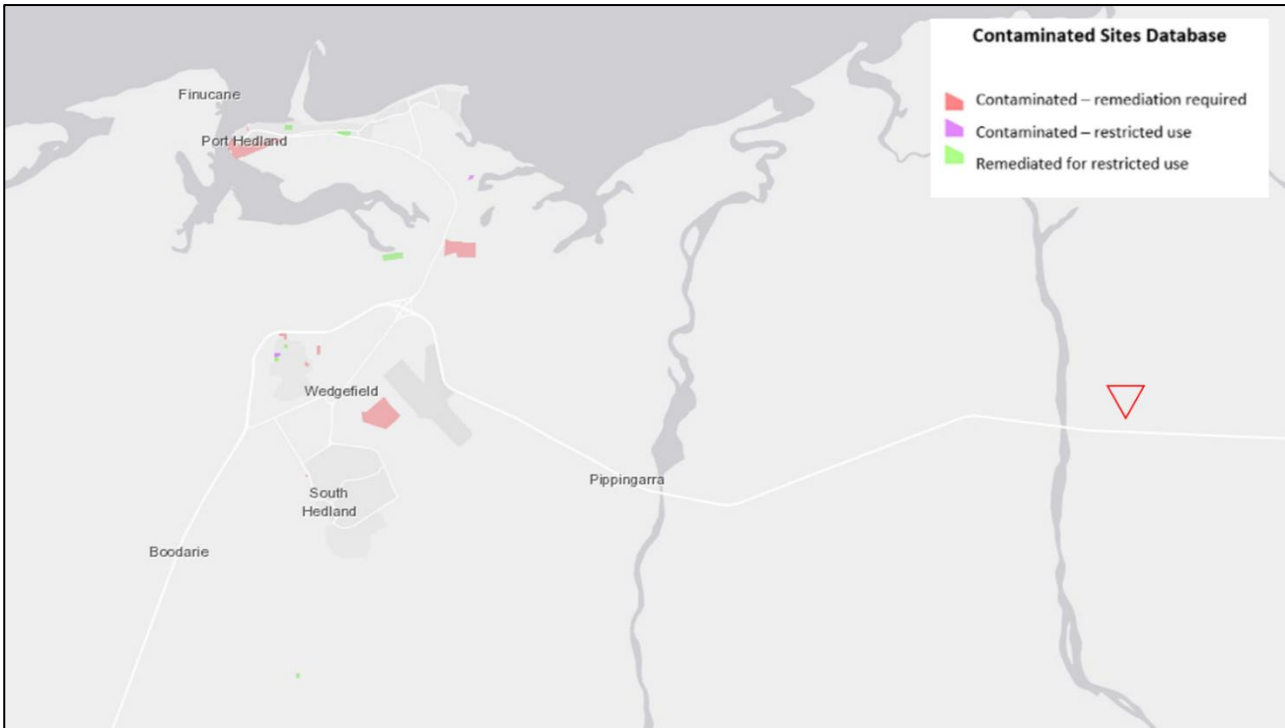


Figure 6-3 Contaminated Sites Database search results. Proposal subject land indicated by red outline

No available acid sulphate soil mapping exists for the proposal area however, disturbance of acid sulphate soils by the proposal is unlikely due to the limited depth of proposed earthworks (<2 m).

### 6.3.2. Potential impacts

The proposal would have limited impact on the topography of the development site. Earthworks would be limited to the following activities:

- Construction of internal access road.
- Firebreaks.
- Pile driving solar panel frames.
- Substation and inverter hardstands.

## 6.4. FLOODING AND STORMWATER

A Preliminary Flood Assessment has been developed by Hydrologia (2021) and is provided in Appendix D.

### 6.4.1. Existing environment

The aim of this study is to characterise flood risk for the site and indicate potential impacts of the development on local flooding. The 5% and 1% annual exceedance probability (AEP) and the probable maximum flood (PMF) events were assessed using the available data.

The site is located across a low ridge in a broad plain grading from south to north as shown in Figure 6-4. A number of diffuse, shallow flow paths draining relatively small but variably sized catchments occur in the vicinity of the site.

The largest defined streamline is Petermarer Creek, which lies 1.8 km to the west of the site. Petermarer Creek has a deep, well-defined channel but a moderate sized catchment compared to other creeks and rivers in the region. Larger creeks and rivers pass to the east and west, but these are too far away for their floodwater to impact the site.

There is some linear infrastructure near the site that could influence local flood characteristics. This includes the Goldsworthy railway, which passes just downstream of the site, and the Great Northern Highway, 2.5 km upstream of the site. Roads and other infrastructure are likely too far away to influence flooding at the site. The ocean is too far downstream for storm surge to impact the site. Infrastructure at the site will involve limited ground disturbance and interaction with local drainage. The panels will be located on poles and will not affect local flow paths (Hydrologia, 2021).

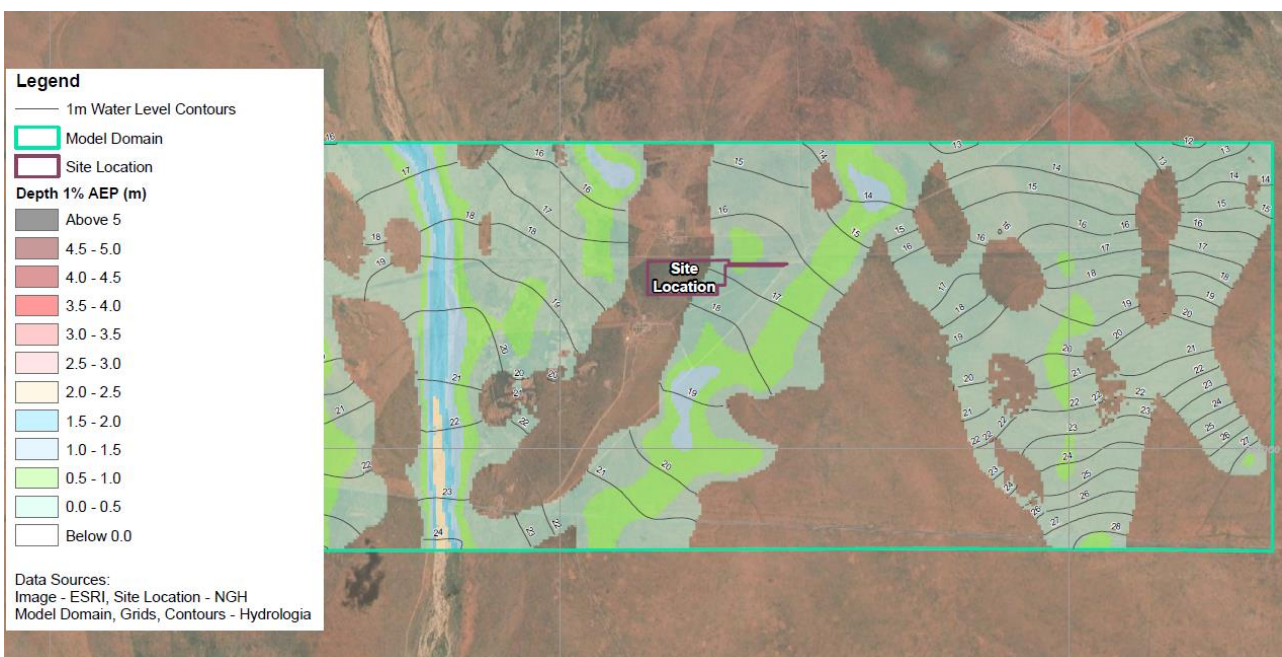


Figure 6-4 Predicted flooding for 1% AEP events (source: Hydrologia, 2021)

### 6.4.2. Potential impacts

The development site is strategically located outside a large proportion of the modelled 1% AEP, as shown in Figure 6-4, therefore flood impacts for the proposal are not anticipated. Infrastructure that affects the ground surface, such as roads or raised pads, in areas predicted to be affected by flooding would be designed to account for flood impacts.

Additionally, solar farm infrastructure typically has a low level of impact on surface water flows. The proposal is also located approximately 26 km east of Port Hedland and away from any existing or planned residential areas, as such an Urban Water Management Plan is not considered necessary for the proposal. Erosion would be controlled as required, most likely through the installation of rock armour at points where stormwater flows are concentrated i.e. discharge points from culverts.

Any fuel and chemical storage would be on areas elevated above the 100 year ARI level. Further, these areas will need to be self-contained through the use of methods such as bunds, kerbing and grates to capture runoff. Safeguards and mitigation measures for flooding and stormwater management



Safeguards and mitigation measures for flooding and stormwater management are provided in Table 6-1.

Table 6-1 Safeguards and mitigation measures for stormwater management

Safeguards and Mitigation Measures	Phase
Ensure the design of site infrastructure accounts for uncertainty in flood modelling. This should include collecting accurate topographic data for the site and surrounds and quantifying the risk of localised flow, particularly related to the railway embankment, on site infrastructure	Design
<p>An Emergency Response Plan (ERP) incorporating a flood response would be prepared prior to construction covering all phases of the proposal. The ERP would:</p> <ul style="list-style-type: none"> <li>• Detail who is responsible for monitoring the flood threat and how this is to be done.</li> <li>• Detail specific response measures to ensure site safety and environmental protection.</li> <li>• Outline a process for removing any necessary equipment and materials offsite and out of flood risk areas (i.e. rotate array modules to provide maximum clearance of the predicted flood level).</li> <li>• Consider site access in the event that some tracks become flooded.</li> <li>• Establish an evacuation point.</li> </ul> <p>Define communication protocols with Department of Fire and Emergency Services (DFES) and ToPH.</p>	Construction Operation Decommissioning
<p>Best practice management measures should be employed where applicable to reduce the risk of erosion and offsite sedimentation:</p> <ul style="list-style-type: none"> <li>• Preserve and stabilise disturbed areas, drainageways and steep slopes.</li> <li>• Minimise the extent and duration of disturbance.</li> <li>• Install perimeter controls.</li> <li>• Employ the use of sediment control measures to prevent off- and on-site damage. Inspect and maintain sediment and erosion control measures regularly.</li> <li>• Control stormwater flows onto, through and from the site in stable drainage structures. Protect inlets, storm drain outlets and culverts.</li> <li>• Provide access and general construction controls.</li> </ul>	Construction Decommissioning

Safeguards and Mitigation Measures	Phase
Any area temporarily used during construction and decommissioning (laydown and trailer complex areas) would be restored to original condition or re-vegetated with native plants.	Construction Decommissioning

## 6.5. BIODIVERSITY

A Biodiversity Survey Report was undertaken by SW environmental (2021) and is provided in Appendix C. The Biodiversity Survey Report presents the results of reconnaissance, targeted terrestrial fauna, flora and vegetation surveys. The objective of the Biodiversity Survey Report was required to address environmental investigations in order to guide the planning and approval pathway.

### 6.5.1. Existing environment

Flora and vegetation field surveys were conducted on 6<sup>th</sup> October 2020 and identified the following vegetation types within the development footprint:

- *Acacia stellaticeps* open heath, sometimes low shrubland over *Triodia schinzii* with *Triodia epactia* hummock grassland, sometimes open hummock grassland, and
- *Owenia reticulata*, *Dolichandrone occidentalis* open low woodland often with *Atalaya hemiglauca* and *Acacia colei* tall shrubs, over *Acacia stellaticeps* open low shrubland over *Triodia schinzii* hummock grassland.

The first vegetation type occupies two-thirds of the survey area. *Acacia stellaticeps* within this area is very dense and appears to be preventing the establishment and growth of other species. This vegetation type occurs along the proposed access track, including the revised extension to the eastern boundary, with forty percent of the eastern end having been burnt. The area has experienced a history of frequent fires, which have encouraged the dense growth of *Acacia stellaticeps*. Following fire, this species is known to coppice from the base and will also regenerate profusely from seed.

The second vegetation type present may represent a remnant of a less fire impacted area. This vegetation type was more species diverse. Many annual species were evident, although most were dead and many not identifiable. The tree species, *Owenia reticulata* is present in this vegetation type along with small trees/tall shrubs of *Dolichandrone occidentalis*, and *Atalaya hemiglauca*. These species are tropical remnants.

Fauna field surveys were carried out on 7 September 2020 and 13 May 2021. The survey area does not contain wetlands, watercourses, rock outcrops, caves or fallen hollow logs. Leaf litter is generally absent or very sparse and trees contain no hollows. Overall fauna habitat quality was considered to be poor.

Species diversity is relatively low throughout the survey area. A total of 53 taxa were recorded during the survey representing 23 families. As a result of local conditions, some fauna species, which would not typically reside in the survey area itself, in particular those that occur at low densities but have a large home range, may occasionally be encountered.

The Northern Quoll (*Dasyurus hallucatus*) (S2 BC Act, Endangered EPBC Act) scat was found within the survey area. No other evidence of the species was seen. It is unlikely that the species would permanently reside within the survey area due to lack of suitable refuge habitat (i.e. caves, rock outcrops, hollow logs/trees or large burrows).

### **6.5.2. Potential impacts**

The vegetation recorded within the survey area is relatively widespread within the Uaroo Land System, both to the east and west of Port Hedland. Two thirds of the survey area is occupied by low heath of *Acacia stellaticeps*, which inhibits the establishment and growth of other species, resulting in a low species diversity within that vegetation type. The survey area is small, hence the removal of vegetation via clearing will not have a significant impact on this vegetation type.

Potential impacts on fauna species and fauna in general would be negligible due to the small area of clearing required and the large areas of similar or improved habitat of adjoining and nearby land.

### **6.5.3. Biodiversity Management**

With regard to flora and fauna considerations identified in Appendix C, the proposal would include the following measures:

- Care should be taken to prevent the spread of the highly invasive, single kapok (*Aerva javanica*) plant recorded in the survey area. This plant and its surrounding soil, should be removed, placed in a plastic bag, sealed and disposed of to prevent the spread of seeds throughout the area.
- Prior to any clearing being undertaken, any young *Owenia reticulata* trees should be removed and transplanted around the Jinparinya Aboriginal Community to increase shade.
- Given the possible presence of some ground dwelling fauna species of conservation significance it is recommended that immediately prior to any clearing taking place, vegetation to be removed be inspected by a suitably licensed “fauna specialist” for the presence of fauna (in particular mulgara and bilby burrows) so that the appropriate management measures can be employed.

## **6.6. DUST**

### **6.6.1. Existing environment**

The air quality around the development site is generally expected to be good and typical of that found in a rural setting in the Pilbara region of WA. Existing sources of dust for the development site include:

- Agricultural activities including livestock movements across cattle stations.
- Dust from nearby unsealed roads.
- Strong winds moving across a flat landscape with naturally sparse groundcover.

### **6.6.2. Potential impacts**

The proposal is consistent with the principle of waste management set out in section 4A of the EP Act and includes practical measures to minimise harmful dust emissions. Dust emissions generated by the proposal is a potential consequence of the following actions:

- Additional vehicle movement on unsealed tracks.
- Trenching to lay underground cables.
- Soil stockpiling.
- Limited vegetation removal for installation of inverter modules, transformer and storage shed.

Soils would be stockpiled onsite in low mounds under two metres in height with concave tops to encourage plant growth.

Solar panels would be mounted on frames installed by piling directly into the soil profile. This construction technique would result in no soil extraction and limited groundcover removal. Thus, the anticipated dust emissions from solar panel installation is minimal.

Dust generating activities and impact assessment is outlined in Appendix E.

### **6.6.3. Dust management controls**

In order to successfully mitigate onsite and offsite dust emissions, the following controls would be implemented:

- Minimise and manage vehicle movements.
- Retain vegetation where possible.
- Limit areas of exposed soil.
- Schedule earthworks in relation to wind direction, wind strength, rainfall and temperature (daily and seasonally).
- Consideration of direction and strength of wind during excavating and filling trenches.
- Cover temporary soil stockpiles and excavations.
- Compact unsealed access track in consultation with landowners.
- Watercart on standby and used if required i.e. dust reached sensitive receivers.
- Progressive rehabilitation.

## **6.7. NOISE**

### **6.7.1. Existing environment**

The existing noise environment around the development site is generally expected to be typical of that found in a rural setting in the Pilbara region of WA. Existing sources of noise for the development site include:

- Traffic noise from nearby sealed and unsealed roads.
- Strong winds moving across a flat landscape rustling vegetation.
- Domestic animals and wildlife such as dogs, insects and birds.

It is anticipated that receptors within 1 km of the development site experience low levels of background noise consistent with remote largely natural areas and some road traffic noise.

### **Topography and obstacles**

The site is located across a low ridge with an elevation of up to 18.5 – 19 m AHD (as measured by the SRTM topographic data). The lowest areas of the site have ground elevations down to approximately 17 m AHD. The area surrounding the development site is flat with few trees or built structures. The characteristics of the landscape will not hinder wind and noise travel.

### **Sensitive receptors**

The only sensitive receptors within 10 km of the proposal are the Punju Nyamal Aboriginal community, which currently comprises approximately 10 residents and the Jinparinya Community, which comprises approximately 15 residents. The residents of both communities have been consulted in the preparation of the DA. Consultation details are provided in section 5 of the DA Supplementary Report.

### **6.7.2. Potential impacts**

The proposal would involve the construction of a ground-mounted photovoltaic (PV) solar farm with fixed or tracking arrays, generating around 10 megawatts (alternating current) of renewable energy. The power generated would be exported to the local electricity grid.

In total, the construction phase of the proposal is expected to take between three and six months, and the facility is expected to operate for around 30 years. Maintenance staff and service contractors would periodically attend the facility. At the end of its operational life, the solar farm would be decommissioned. All infrastructure would be removed, and the site returned to its existing agricultural land capability.

Construction noise impacts would likely be from the operation of construction equipment. Several key activities on the site that are likely to produce the most noise include:

- Earth works for the construction of access roads, compounds, and hard stands.
- Pile driving for solar panel frames and trenching for the installation of cabling.
- The delivery and movement of vehicles transporting materials on site.

Noise levels from operation of the solar farm are demonstrably low due to the low level of noise generating equipment used during operation. Noise from the operation of the solar farm would be generated by:

1. Two inverter modules located in the centre of the solar array.
2. Tracking motors and movement of the solar panels.
3. One substation transformer.
4. Maintenance activities such as light vehicle use for inspections and general maintenance (e.g., electrical repairs, replacing panels), slashing and cleaning of panels.
5. Site inspection – the solar farm would be unattended but one vehicle would visit the site for short periods during the day.

### **6.7.3. Noise Management**

#### **Construction noise controls**

In accordance with the Noise Regulations, construction activities would be carried out between 7:00am and 7:00pm hours Monday to Saturday:

1. The construction work must be carried out in accordance with AS 2436-2010.
2. The equipment used for the construction work must be the quietest reasonably available.
3. The EPA may request a noise management plan (this NMP) may be submitted for construction at any time (DEP, 1997).

The noise assessment for the proposal (refer to Appendix F) indicates that assigned noise levels would not be reached at either sensitive receptor at any time and additional voluntary noise management actions are not considered necessary. However, in compliance with point two above, measures for minimising the noise emissions from construction plant are listed in Table 5-1 of Appendix F.

#### **Operation noise controls**

The predicted operational noise levels for the proposed solar farm are described in Section 3.3.2 of Appendix F. Exceedances of assigned noise levels are possible in the early mornings before 7:00am Monday to Saturday and before 9:00am Sundays and public holidays for the Punju Nymal receptor and before 9:00am on Sundays and public holidays for the Jinparinya Community.

The operational noise modelling represents the worst case scenario including light vehicle movements and tracking panels, which may not be undertaken outside standard work hours. Controls for operation noise include restricting certain activities to occur between the standard working hours of 7:00am to 7:00pm in response to community consultation and noise monitoring results.

Noise mitigation measures are outlined in Appendix F.

## **6.8. ABORIGINAL HERITAGE**

At present, the heritage survey remains incomplete. Pilbara Solar would attend a meeting as soon as possible with the Ngarla People via Wanparta Aboriginal Corporation to discuss the project and the heritage survey process and requirements. It is envisaged that the heritage survey would take place soon after. Upon completion, the specialist heritage assessment would be lodged with ToPH for consideration with the Development Application.

## **6.9. WASTE AND RESOURCE USE**

### **6.9.1. Approach**

#### **Resource use**

Key resources and estimated quantities (pending the completion of the detailed project design) required to construct the proposed solar farm include those listed in Table 3-1.

During operation and decommissioning, resources used would be associated with maintenance activities and use of machinery and vehicles. Water requirements during operation are estimated to be 24 kL/year based on the estimate of 0.8 L per panel.

#### **Waste generation**

##### **Policy position**

Legal requirements for the management of waste are established under the WARR Act and the Waste Avoidance and Resource Recovery Regulations 2008. Unlawful transportation and deposition of waste is an offence under section 69 of the WARR Act. Littering is an offence in WA under the *Litter Act 1979*.

The WARR Act includes resource management hierarchy principles to encourage the most efficient use of resources and to reduce environmental harm. Pilbara Solar is committed to adopting environmental best practice and would follow the waste hierarchy throughout all stages of the proposal, with priority given to minimising waste generation. Resource management options would be considered against a hierarchy shown in Figure 6-5.



Figure 6-5 Waste hierarchy (source: wastelessfuture.com)

Adopting the above principles would encourage the most efficient use of resources and reduce costs and environmental harm in accordance with the principles of ecologically sustainable development.

### **Construction**

Solid waste is one of the major pollutants caused by construction. Several construction activities would produce solid wastes, such as:

- Unpackaging materials.
- Excess building materials.
- Scrap metal and cabling materials.
- Plastic and masonry products, including concrete wash.
- Excavation of topsoils and vegetation clearing (expected to be minimal).
- Liquid bio wastes from portable ablution facilities (construction only).

In accordance with definitions *Landfill Waste Classification Definitions 1996 (as amended 2019)* (Landfill Definitions), most waste generated during the construction phase would be classified as Class 1 (Inert Landfill). Ancillary facilities in the site compound would also produce liquid wastes and sanitary (clinical waste) classified in accordance with the Landfill Definitions and the Health (Treatment of Sewage and Disposal of Effluent and Liquid Waste) Regulations 1974.

Pilbara Solar is committed to environmental best practice and would ensure that panels are supplied in biodegradable packaging, where practicable. Pilbara Solar would also work with ToPH and commercial services to recycle as much packaging as practicable.

Soil removed for underground trenches would be stockpiled to a depth < 2 m and rehabilitated.

### **Operation**

During operation, the solid waste streams would be associated with maintenance activities and presence of employees. Some materials, such as cables, metals and electrical parts may require replacement over the operational life of the project.

### **Decommissioning**

Decommissioning of the site would involve the recycling or reuse of materials including:

- Solar panels and mounting system.
- Metals from posts, cabling, fencing.
- Storage shed.

The vast majority of solar panel materials can be recycled. Items that cannot be recycled or reused would be disposed of in accordance with applicable regulations and to appropriate facilities. All infrastructure above and belowground would be removed from the site during decommissioning.

### **Lifecycle analysis**

Lifecycle analysis assesses and quantifies the energy and material flows associated with a given process to identify the resource impacts of that process and potential for resource recovery. Lifecycle analysis estimates energy and emissions based on the total lifecycle of materials used for a project, being the total amount of energy consumed in procuring, processing, working up, transporting and disposing of the respective materials (Schleisner, 2000).

A lifecycle inventory of multicrystalline PV panels was undertaken by European and US photovoltaic module manufacturing companies in 2005-2006. Over the 30-year lifetime of the panels, it is expected that 28 g of GHG emissions would be produced per kWh of energy generated (Fthenakis et al. 2011). The 'energy payback time' for multicrystalline PV panels is dependent on the geographical location, however on average it is estimated to be 1.5 years. A solar installation in Southern Europe would be even less than 1.5 years (Fraunhofer ISE, 2015). The payback time for the Pilbara region is expected to be less than that.

The purification of the silicon, which is extracted from quartz, accounts for 30% of the primary energy to produce the panel. This stage also produces the largest amount of pollutants with the use of electricity and natural gas for heating (Fthenakis et al. 2011). The waste produced during production of the panels which can be recycled include graphite crucibles, steel wire and waste slurry (silicon and polyethylene glycol). However, silicon crystals cannot be recycled during this stage (Fthenakis et al. 2011). The production of the frames and other system components, including cabling, would also produce emissions and waste but less than the production of panels.

The energy yield ratio of a product is a ratio of the energy produced by, in this case, a solar PV system over its lifetime, to the energy required to make it is referred to as the system's. PV system energy yield ratio in Northern Europe was estimated to be more than ten, indicating the system would produce more than ten times the amount of energy required to make it (Fraunhofer ISE, 2015). This positive energy yield ratio also means that GHG emissions generated from the production of solar energy systems are more than offset over the systems' lifecycle (GA and ABARE, 2010).

When compared to the major electricity generating methods employed in Australia, solar farms are favourable for the following reasons:

- CO<sub>2</sub> emissions generated per kilowatt hour of energy produced.
- Short energy payback time in comparison to the life span of the project.
- Potential to reuse and recycle component parts.

### **Resources and waste streams**

Electricity production using photovoltaics emits no pollution, produces no GHGs, and uses no finite fossil-fuel resources (US Department of Energy, 2004). Only limited amounts of fuels would be required for maintaining vehicles during operation of the solar farm.

Operational waste streams would be very low given the low maintenance requirements of the solar farm.

It is likely that some electrical components, such as inverters, transformers and electrical cabling, would need replacement over the proposed life of the solar farm. This would require further use of metal and plastic based products. Repair or replacement of infrastructure components would result in some waste generation.



However, these activities would occur very infrequently and there would be a high potential for recycling or reuse of the waste.

## 7. ROLES AND RESPONSIBILITIES

Roles and responsibilities required for the delivery of the proposal are identified and described in Table 7-1. These responsibilities will be included in the contract between the proponent and the contractor.

Contractors shall ensure specific responsibilities are communicated to all personnel via appropriate environmental management training (part of the initial safety and environment induction).

Table 7-1 Roles and responsibilities for the delivery of the proposal

Role	Responsibility	Authority
<b>Contractor Site Manager</b>	<ul style="list-style-type: none"> <li>• Responsible for the implementation of environmental management plans.</li> <li>• Responsible for the induction of staff and contractors.</li> <li>• Responsible for all aspects of the worksite including the coordination and management of all staff and subcontractors.</li> <li>• Undertake routine environmental site inspection.</li> <li>• Maintaining environmental records.</li> <li>• Receiving plant, materials and chemicals and ensuring all items are appropriately stored.</li> <li>• Responsible for addressing corrective actions arising from environmental inspections.</li> </ul>	<ul style="list-style-type: none"> <li>• Order Stop-work for an activity that may cause material or environmental harm.</li> <li>• Approve and accept waste disposal methods requested by staff or subcontractors.</li> <li>• Approve minor changes to environmental sub-plans, including ESCP.</li> </ul>
<b>Contractor Health Safety and Environment and Quality Manager (HSEQ)</b>	<ul style="list-style-type: none"> <li>• Maintaining all environmental management documents.</li> <li>• Identifying where environmental measures are not meeting the targets and where improvements can be achieved.</li> <li>• Monitoring and reporting environmental compliance.</li> <li>• Reviewing environmental management documents.</li> <li>• Reporting pollution incidents.</li> </ul>	<ul style="list-style-type: none"> <li>• Recommend Stop-work for an activity that may cause material or environmental harm.</li> </ul>
<b>Pilbara Solar Staff:</b> <ul style="list-style-type: none"> <li>• <b>Project Manager</b></li> <li>• <b>Owners Engineer</b></li> </ul>	<ul style="list-style-type: none"> <li>• Ensure contractors are working in accordance with conditions of approval and the construction contract.</li> <li>• Undertake site visits during construction to monitor</li> </ul>	<ul style="list-style-type: none"> <li>• Report any issues that may have the potential to cause material or environmental harm.</li> <li>• Report any incidents or near-misses that may impact on the environment or breach of conditions of approval.</li> </ul>

	<p>compliance conditions of approval.</p> <ul style="list-style-type: none"> <li>• Report and raise any issues that arise that may have an environmental impact.</li> <li>• Report and raise the discovery of any Threatened species or Aboriginal heritage finds and cease work until the matter has been addressed.</li> </ul>	
<p><b>Subcontractors</b></p>	<ul style="list-style-type: none"> <li>• Operate as instructed by the Contractor Site Manager in compliance with all environmental requirements.</li> </ul>	<ul style="list-style-type: none"> <li>• Contractor Site Manager</li> </ul>

## **8. CONDITIONS OF DEVELOPMENT APPROVAL**

In order to coordinate the delivery of the Junja Solar farm as proposed by this DA, the following conditions of approval are considered appropriate to ensure the intended outcomes:

- Development to be in accordance with the approved plans provided in Appendix B.
- Bushfire risk management in accordance with section 6.1 of this DA Supplementary Report.
- Stormwater and flood risk management in accordance with section 6.4 of this DA Supplementary Report.
- Waste management in accordance with section 6.5 of this DA Supplementary Report.
- Building permits for all elements of the proposed infrastructure be obtained from ToPH.
- Dust management in accordance with Appendix E.
- Noise management in accordance with Appendix F.

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# APPENDIX A LANDOWNER CONSENT



Department of Planning,  
Lands and Heritage

Land Use Management

Case 2101232  
Our ref: File 01403-1991, IDA11298286.  
Enquiries: Kevin Harrison, ph 9791 0860  
Fax: 6118 8116

11<sup>th</sup> June 2021

Yamatji Marlpa Aboriginal Corporation  
PO Box 3072  
Perth WA 6892

Email only [gpoppas@ymac.org.au](mailto:gpoppas@ymac.org.au)

Dear *George*

**Section 18 Ministers Consent for proposed amendment to sub-lease portion of Lease I150265, Jinparinya Aboriginal Corporation ICN 129 ABN 38 311 456 297 (Sub-Lessor) between Junja Solar Farm Pty Ltd ACN 646 026 753 (Sub-Lessee)**

Thank you for your recent correspondence regarding permission to Sub-Lease portion of Lease I150265 which is set aside for the purpose of "Residential and Economic Development Associated with Aboriginal Heritage an Cultural use" subject to the consent of the Minister for Lands.

In accordance with section 18 of the *Land Administration Act 1997* (LAA) approval from the Minister for Lands is granted to the proposed Sub-Lease provided to the Department of Planning, Lands and Heritage (DPLH) by email dated 11<sup>th</sup> June 2021 on the condition that the final document executed by the parties is on the same terms as that provided to DPLH with that email. If the final document executed by the parties is not on the approved terms, then it may be void under section 18 LAA.

Please note that this approval is for the purposes of section 18 LAA only and does not constitute an endorsement as to the terms and effect of the document. DPLH cannot provide any advice in respect of the Sub-Lease and recommends that each party obtain their own independent advice as to their rights and obligations under the Sub-Lease.

This approval is subject to the registration requirements of the *Transfer of Land Act 1893*. You will need to provide a copy of this letter to Landgate if the documents are to be lodged for registration at Landgate.

Should you have any enquiries please don't hesitate to contact me on any of the above details.

Yours sincerely

**Kevin Harrison**  
**Senior Land Officer**  
**Case Delivery**



# **APPENDIX B DESIGN DRAWINGS**

## **B.1 GENERAL ARRANGEMENT – SITE LAYOUT PLAN**



PRELIMINARY FOR DISCUSSION ONLY

LEGEND	
	ROAD RESERVE
	PIPINGARRA PASTORAL LEASE
	JINPARINYA LEASE BOUNDARY
	BHP LEASE MGA50
	JSF SUBLEASE AREA
	SECURITY FENCE
	OVERHEAD 66KV LINES (NOT SURVEY DATA)
	UNDERGROUND MV CABLE

Minimal Site grading and re-contouring required for development approval purpose  
 Fenced Area: Approx 25ha

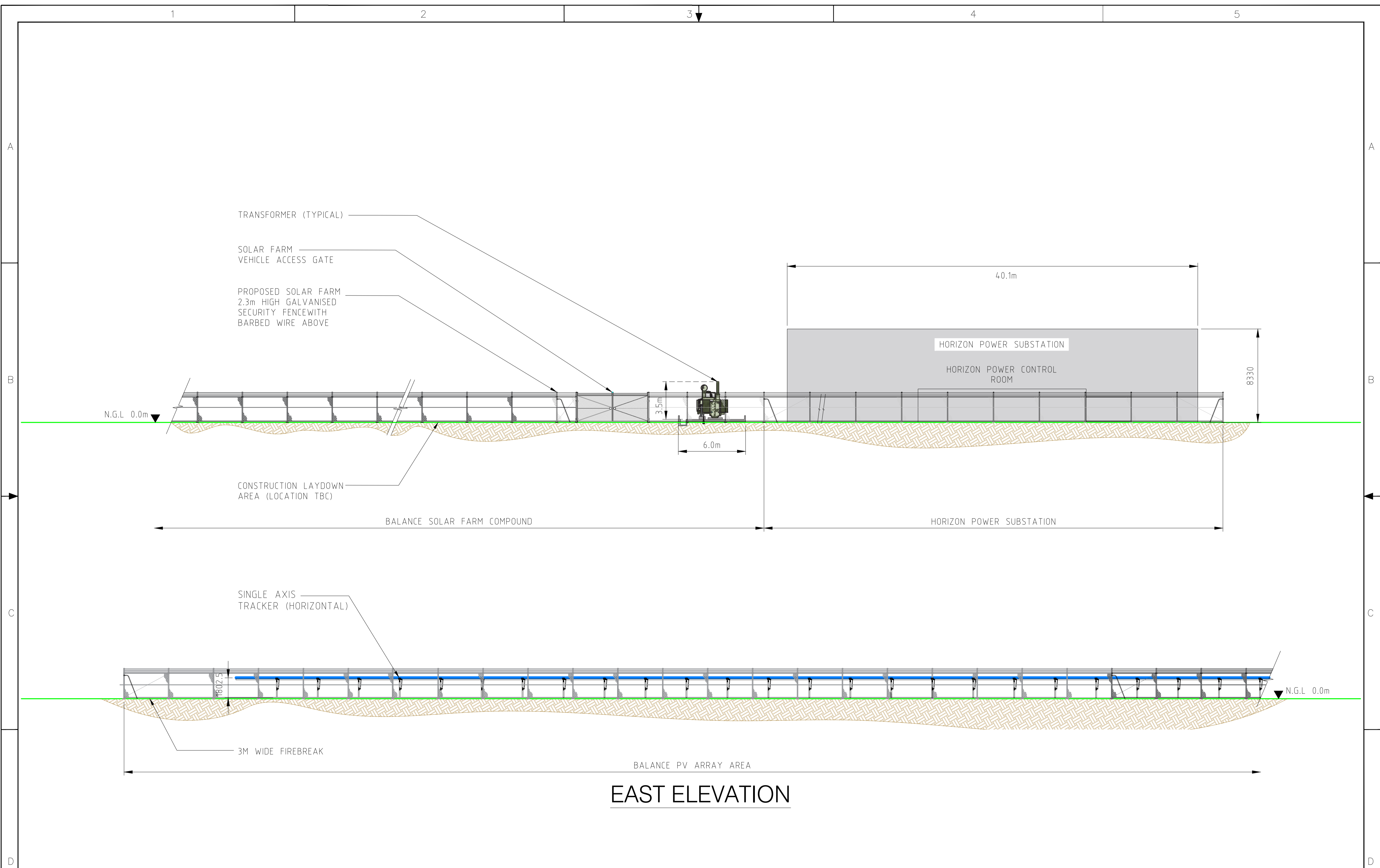


REV	DATE	DESCRIPTION	DRWN	CHKD	APPR.
C	10.06.2021	ISSUED FOR REVIEW	CLB	NB	
B	10.11.2020	DRAFT FOR DA	TD	TD	
A	11.06.2020	FIRST ISSUE	JM	JM	

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TITLE	SCALE
PILBARA SOLAR JUNJA	1:5000
SOLAR FARM	SIZE
GENERAL ARRANGEMENT	A3
(PRELIMINARY)	REVISION
DWG No. 2236-G-GAD-01_1	C

## **B.2 GENERAL ARRANGEMENT – ELEVATION PLANS**



REV.	DATE	DESCRIPTION	DRWN.	CHKD.	APPR.

REV.	DATE	DESCRIPTION	DRWN.	CHKD.	APPR.
C	26.05.2021	ISSUED FOR REVIEW	CLB		
B	10.11.2020	DRAFT FOR DA	TD	TD	
A	11.06.2020	FIRST ISSUE	JM	JM	

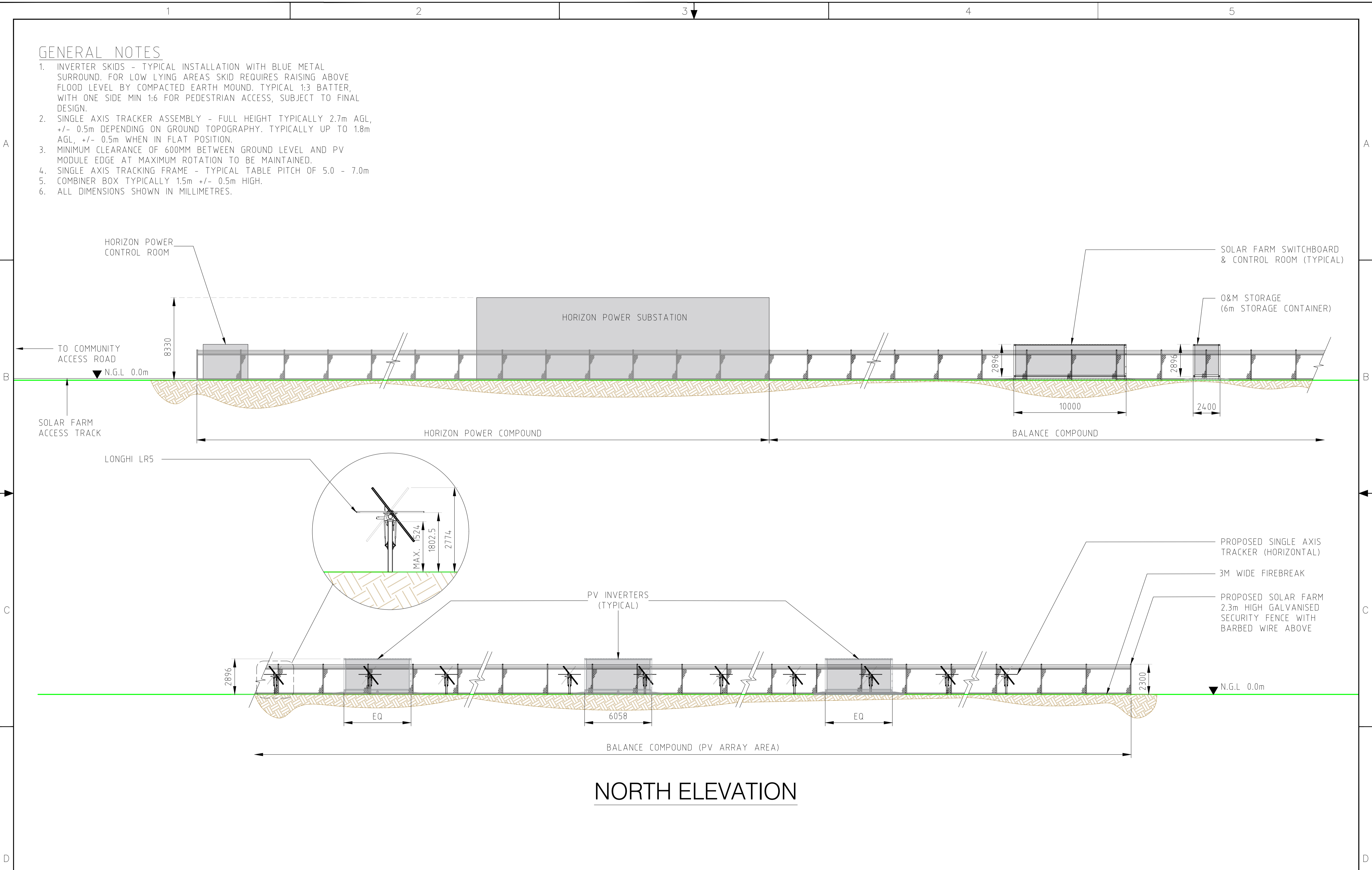
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TITLE	PILBARA SOLAR JUNJA SOLAR FARM GENERAL ARRANGEMENT (PRELIMINARY)
DWG No.	2236-G-GAD-02-2

SCALE	1:300
SIZE	A3
REVISION	C

**GENERAL NOTES**

1. INVERTER SKIDS - TYPICAL INSTALLATION WITH BLUE METAL SURROUND. FOR LOW LYING AREAS SKID REQUIRES RAISING ABOVE FLOOD LEVEL BY COMPACTED EARTH MOUND. TYPICAL 1:3 BATTER, WITH ONE SIDE MIN 1:6 FOR PEDESTRIAN ACCESS, SUBJECT TO FINAL DESIGN.
2. SINGLE AXIS TRACKER ASSEMBLY - FULL HEIGHT TYPICALLY 2.7m AGL, +/- 0.5m DEPENDING ON GROUND TOPOGRAPHY. TYPICALLY UP TO 1.8m AGL, +/- 0.5m WHEN IN FLAT POSITION.
3. MINIMUM CLEARANCE OF 600MM BETWEEN GROUND LEVEL AND PV MODULE EDGE AT MAXIMUM ROTATION TO BE MAINTAINED.
4. SINGLE AXIS TRACKING FRAME - TYPICAL TABLE PITCH OF 5.0 - 7.0m
5. COMBINER BOX TYPICALLY 1.5m +/- 0.5m HIGH.
6. ALL DIMENSIONS SHOWN IN MILLIMETRES.



**NORTH ELEVATION**



REV.	DATE	DESCRIPTION	DRWN	CHKD.	APPR.

REV.	DATE	DESCRIPTION	DRWN	CHKD.	APPR.
C	26.05.2021	ISSUED FOR REVIEW	CLB		
B	10.11.2020	DRAFT FOR DA	TD	TD	
A	11.06.2020	FIRST ISSUE	JM	JM	

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TITLE	PILBARA SOLAR JUNJA SOLAR FARM GENERAL ARRANGEMENT (PRELIMINARY)
DWG No.	2236-G-GAD-02-1

SCALE	1:300
SIZE	A3
REVISION	C

# **APPENDIX C BIODIVERSITY ASSESSMENT REPORT**

# Biodiversity Survey Report

Junja Solar Farm, Port Hedland

MAY 2021



## Version control

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Project file path:	SW264 Junja Solar Area Port Hedland flora and fauna survey 20201130.docx			
Client:	NGH Consulting			
Revision	Date	Prepared by (name)	Reviewed by (name)	Approved by (name)
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V1	31/05/21	Shane Priddle SW Environmental	Shane Priddle SW Environmental	Shane Priddle SW Environmental

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## Statement of limitations

The authors have made every effort to ensure the accuracy of the information used; information detailed in this report is based upon the information available at the time SW environmental conducted its work. This report has been solely prepared for the Client. All intellectual property rights in documents created by SW environmental remain the property of SW environmental. The information contained within this document is confidential. It may only be used by the Client for the stated purpose for which it is provided. The document or parts thereof must not be imparted to any third person without the prior written approval of SW environmental. SW environmental does not accept any responsibility for the use of or reliance on the contents of this report by any third party.

## Acknowledgements

SW Environmental engaged Vicki Long & Associates (VLA) (2021) to prepare the flora and vegetation, and Greg Harewood to prepare the fauna components of this report. SW Environmental has relied on the accuracy and information supplied by Vicki Long & Associates and Greg Harewood directly in the preparation of the relevant sections of this report.

- Vicki Long & Associates (VLA) (2021). Pilbara Solar Junja Vegetation and Flora Survey – Town of Port Hedland. Unpublished report prepared for SW Environmental.
- Harewood (2021) Fauna Assessment Junja Solar Area Port Hedland. Unpublished report prepared for SW Environmental.



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**Common terms/acronyms**

BC Act	WA <i>Biodiversity Conservation Act 2016</i>
DAWE	Federal Department of Agriculture, Water and the Environment
DBCA	WA Department of Biodiversity, Conservation and Attractions
DWER	WA Department of Water and Environmental Regulation
EP Act	WA <i>Environmental Protection Act 1986</i>
EPBC Act	Federal <i>Environment Protection and Biodiversity Conservation Act 1999</i>
Project	The proposed action
Survey area	The Project extent as provided by the client
WA	Western Australia

## Executive summary

Pilbara Solar are proposing to develop a 10 MW solar farm, over a 25.7 hectare area of land including an easement, at Jinparinya, Port Hedland. A Biodiversity Survey Report was required in conjunction with other environmental investigations to guide project planning and approvals. This report presents the results of the Biodiversity Survey. The surveys consisted of a basic (reconnaissance) and targeted terrestrial fauna, flora and vegetation surveys.

The flora and vegetation field surveys were conducted by Principal botanist, Vicki Long (Vicki Long and Associates) on 6<sup>th</sup> October 2020. The vegetation recorded is relatively widespread within the Uaroo Land System, both to the east and west of Port Hedland. Two thirds of the survey area is occupied by low heath of *Acacia stellaticeps*, which inhibits the establishment and growth of other species, resulting in a low species diversity. The second vegetation type is more species diverse and is less well represented in the wider area. Scattered to open *Owenia reticulata* trees over tall and low *Acacia shrubland* is relatively widespread throughout the surrounding area, however, the abundance of *Dolichandrone occidentalis* in the survey area makes it less common.

The survey was undertaken as a dry season survey. Plants were dry, defoliated, dormant or dead. Most annual species were senesced and although some could be identified from persisting material, some were unidentifiable. However, the survey area is small, and it is probable that all component species of the two vegetation types recorded, would be well represented in the relatively widespread vegetation types in the surrounding region.

Three of the four Conservation Significant plant species known to occur within 20 km of the survey area are categorised as P3 annuals, two of which may be present following rainfall. A population of about 50- 100 dead plants of P3 *Heliotropium muticum* were recorded outside of the survey area on a windrow of an existing track. Any impact to conservation significant species if they were to occur within the survey area, would not significantly reduce their known populations

The P1 species, *Tephrosia rosea* var *Port Hedland* is a perennial species and although the habitat indicates the species is likely to be present, it was not recorded during the survey. It was assessed as having a low likelihood of occurrence following the field visit. Clearing within the surveyed area is unlikely to have a significant impact on conservation significant flora.

Weeds (\**Cenchrus ciliaris* and \**C. setiger*) were recorded at very low densities (<2%) over the entire survey area.

The fauna field survey was carried out on the 7<sup>th</sup> September 2020 and 13<sup>th</sup> May 2021 by Zoologist Greg Harewood. The survey area does not contain wetlands, watercourses, rock outcrops, caves or fallen hollow logs. Leaf litter is generally absent or very sparse and trees contain no hollows. Overall fauna habitat quality was considered to be Poor.

Given the small size of the survey area and the lack of habitat variety, the total fauna assemblage present is likely to be depauperate, and well represented locally with similar fauna habitats extensive in the wider area. Some fauna species, which would not typically reside in the survey area itself, in particular those that occur at low densities but have a large home range, may occasionally be encountered.

Northern Quoll (*Dasyurus hallucatus*) (S2 BC Act, Endangered EPBC Act) scat was found within the survey area. No other evidence of the species was seen. It is considered unlikely that this species permanently

resides within the survey area given there is a total lack of refuge habitat (i.e. caves, rock outcrops, hollow logs/trees or large burrows). No evidence of any other fauna species of conservation significance identified during the literature review was observed.

Additional species of conservation significance may also utilise the survey area, though, as no evidence of their presence was identified during the field survey, their status in the area remains uncertain:

- Barn Swallow *Hirundo rustica* – S5 (BC Act), Migratory (EPBC Act)
- Peregrine Falcon *Falco peregrinus* – S7 (BC Act)
- Grey Falcon *Falco hypoleucos* – S3 (BC Act), Vulnerable (EPBC Act)
- Fork-tailed Swift *Apus pacificus* – S5 (BC Act), Migratory (EPBC Act)
- Bilby *Macrotis lagotis* – S3 (BC Act), Vulnerable (EPBC Act)
- Brush-tailed Mulgara *Dasyercus blythi*. - P4 (DBCA Priority Species)

Potential impacts on these fauna species and fauna in general are likely to be nil to low due to the relatively small area of clearing required and the large expanses of adjoining and nearby similar and in some cases better quality habitat.

#### Recommendations

- Care should be taken to prevent the spread of the highly invasive, single kapok (*Aerva javanica*) plant recorded in the survey area. This plant and its surrounding soil, should be removed, placed in a plastic bag, sealed and disposed of to prevent the spread of seeds throughout the area.
- Prior to any clearing being undertaken, any young *Owenia reticulata* trees should be removed and transplanted around the Jinparinya Aboriginal Community to increase shade.
- Given the possible presence of some conservation significant ground dwelling fauna it is recommended that immediately prior to any clearing, vegetation to be inspected by a licensed "fauna specialist" (in particular to identify mulgara and bilby burrows) so that the appropriate management measures can be employed.

# 1 Introduction

## 1.1 Background

Pilbara Solar proposes to construct a 10 megawatt (MW) alternating current (AC) solar farm approximately 26 km east of Port Hedland, Western Australia (WA) (herein referred to as 'the project'). The project site includes a circa 22.5 ha development area and 4.4 ha easement (Figure 1). A Development Application (DA) has been developed by NGH on behalf of Pilbara Solar in consultation with adjacent landowners, the Town of Port Hedland (ToPH) and Horizon Power.

To support the planning submission, NGH Consulting required a biodiversity survey to be conducted for the project. The Biodiversity Survey Report consists of basic (reconnaissance) and targeted terrestrial fauna, flora and vegetation components.

## 1.2 Scope of work

### 1.2.1 The survey area

The circa 25.7 ha survey area is situated approximately 350 m north of the Jinparinya Aboriginal Community (JAC). It is part of a larger area currently leased to JAC by State Government. The survey area is a relatively small rectangular area approximately 600 m in length by 400 m in width, with a 50 m wide access track extending approximately 1200 m to the east. Access to the survey area is via existing tracks, and the general area surrounding the survey area is covered with native vegetation, much of which has been burnt within the past 12 months. There is a disused railway line which runs immediately adjacent and parallel to the proposed access track and northern edge of the survey area. The survey area is comprised of red sand, coastal plain, the majority of which is covered with low, relatively dense, Acacia shrubland.

### 1.2.2 Surveys required

The biodiversity survey consisted of the following over the survey area:

- Vertebrate fauna survey (basic) and targeted survey, in accordance with EPA Technical Guidance (EPA 2020).
- Reconnaissance level flora and vegetation assessment in accordance with EPA Technical Guidance (EPA 2016). If species of conservation significance were found, a Targeted survey was to be incorporated into the survey.
- The surveys also identify whether any Matters of National Environmental Significance *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) are likely to occur within the survey area.



Figure 1. Project location and survey area

## 1.3 Regulatory context

### 1.3.1 Key legislation

Key environmental legislation that may be relevant to the biodiversity survey is outlined in Table 1-1.

**Table 1-1 Environmental legislation that may be relevant to the project**

Legislation	Responsible Government Department	Aspect
<i>Federal Environment Protection and Biodiversity Conservation Act 1999</i> (EPBC Act)	Federal Department of Agriculture, Water and the Environment (DAWE)	Matters of National Environmental Significance including threatened fauna, flora and communities and environmental offsets.
<i>Biodiversity Conservation Act 2016</i> (BC Act)	WA Department of Biodiversity, Conservation and Attractions Parks and Wildlife Service (DBCA)	Threatened species habitats, threatening processes, environmental pests and weeds.
<i>Biosecurity and Agricultural Management Act 2007</i> (BAM Act)	WA Department of Primary Industries and Regional Development	Weeds, feral animals and other pests.
<i>Environmental Protection Act 1986</i> (EP Act)	Environmental Protection Authority or DWER	Environmental impact assessment and management and offsets.

### 1.3.2 Fauna, flora and ecological communities

Flora, fauna and ecological communities in WA may be afforded protection under the BC Act and or federal EPBC Act.

Species listed as threatened or migratory under the above legislation are referred to collectively in this document as being 'conservation significant' or 'target' species. These terms include species and communities listed under the DBCA Priority lists.

#### BC Act

The WA BC Act and associated Regulations provide for the licensing and management of activities that affect biodiversity. The BC Act provides for the listing of threatened native plants (flora), threatened native animals (fauna) and threatened ecological communities that need protection as critically endangered, endangered or vulnerable species or ecological communities because they are under identifiable threat of extinction (species) or collapse (ecological communities).

The *Wildlife Conservation (Specially Protected Fauna) Notice 2018* and the *Wildlife Conservation (Rare Flora) Notice 2018* under regulations 170, 171 and 172 of the *Biodiversity Conservation Regulations 2018* contain the lists of Threatened, Extinct and Specially Protected species under Part 2 of the BC Act. These are described below.



#### Threatened species

- CR: Critically endangered species
- EN: Endangered species
- VU: Vulnerable species

#### Extinct species

- EX: Extinct species
- EW: Extinct in the wild species

#### Specially protected species

- MI: Migratory species
- CD: Species of special conservation interest (conservation dependent fauna)
- OS: Other specially protected species

#### Priority species

- Priority 1: Poorly-known species
- Priority 2: Poorly-known species
- Priority 3: Poorly-known species
- Priority 4: Rare, Near Threatened and other species in need of monitoring

A full description of conservation codes is provided in Appendix A.

#### **EPBC Act**

In accordance with Commonwealth legislation, the EPBC Act provides a list of 'Matters of National Environmental Significance' (NES), which includes significant fauna, flora, and communities. Under the EPBC Act matters of NES may be listed in any one of the following categories as defined in *Section 179* of the Act:

- Extinct,
- \*Extinct in the wild,
- \*Critically endangered,
- \*Endangered,
- \*Vulnerable,
- Conservation dependent.

\*Only these categories are matters of NES under the Act.

The EPBC Act also lists migratory species that are recognized under international treaties including the Japan Australia Migratory Bird Agreement (JAMBA), the China Australia Migratory Bird Agreement (CAMBA) and the Bonn Convention (The Convention on the conservation of Migratory Species of Wild Animals). The EPBC Act is regulated by DAWE.

#### **BAM Act**

Significant weed species are identified at both the State and National level. At a State level the management of weeds in WA is primarily regulated through the BAM Act. Species listed under this Act

are allocated one of three declared pest categories which define the required level of management (Department of Primary Industries and Regional Development 2019). The Australian Weeds Strategy (Australian Weeds Committee 2012) identifies 'Weeds of National Significance' (WoNS) which have the potential to impact primary industry and/or environmental and social values.

### **IUCN Red List**

The IUCN Red List is an inventory of the global conservation status of species and used to assist DBCA and other agencies in attributing a given threatened species status. It does not have any statutory authority and is not considered in detail in this assessment.

## 2 Methods

The survey included a Basic / Reconnaissance and Targeted surveys in line with the EPA's Technical Guidance:

- *Technical Guidance – Terrestrial Guidance for Fauna Surveys for Environmental Impact Assessment*. Environmental Protection Authority (2020).
- *Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment*, Environmental Protection Authority (2016).

The following Guidelines were also considered:

- *Commonwealth Matters of National Environmental Significance – Significant impact guidelines 1.1 Environmental Protection and Biodiversity Conservation Act 1999*, Department of the Environment, Water, Heritage and the Arts (DEWHA)', (2009).

The surveys included the following components:

- Desktop assessment,
- Field validation and habitat assessment,
- Consultation, reporting, mapping, and recommendations.

### 2.1 Desktop study

A desktop assessment of fauna, flora and vegetation and associated biodiversity values within and near the survey area was undertaken. A key aim of the assessment was to determine the likelihood of any species of conservation significance (target species) occurring within the survey area and the importance of the site to them. Common (non-target) species are also considered more generally.

#### 2.1.1 Flora and Vegetation

Searches for conservation significant flora (Threatened and Priority Flora) and Environmentally Sensitive Areas (ESAs) within 20 km of the survey area were conducted using WA government datasets (Government of Western Australia 2020). TECs and PECs listed by DBCA (DBCA 2020b) were also reviewed to determine if any were likely to be present or analogous with vegetation communities recorded in the survey area.

In addition to these searches, broad-scale information was reviewed and available from Beard (1975) and van Vreeswyk et al (2004) for the Pilbara Region.

#### Likelihood of Occurrence Assessment

Habitat requirements of conservation significant flora species identified from the database and literature searches were assessed to determine whether suitable habitat was present within the survey locations.

Descriptions of criteria utilised to assess the likelihood of species occurrence within the survey locations are presented in Table 2.1.

**Table 2-1 Likelihood of occurrence of Priority Flora criteria.**

Likelihood of Occurrence	Desktop Criteria
<b>Likely</b>	<ul style="list-style-type: none"> <li>Species has been recorded before in survey area or within 10 km of the survey areas</li> <li>Known to be present in the survey areas based on site observations (expert advice)</li> <li>Species has been recorded within the same habitat as occurs in the survey areas</li> </ul>
<b>Potential</b>	<ul style="list-style-type: none"> <li>Species has been recorded within 20 km of the survey areas</li> <li>Species reported as known in the survey areas by local community</li> <li>Species has been recorded within the same habitat type as occurs in the survey areas.</li> </ul>
<b>Unlikely</b>	<ul style="list-style-type: none"> <li>Species has not been recorded within 20 km of the survey areas</li> <li>No suitable habitat occurs in the survey areas</li> </ul>

Following the survey, the conservation significant flora species identified during the desktop assessment as having the highest potential to occur within the survey locations, but not recorded during the current surveys, were again assessed to determine their likelihood of occurrence within the survey locations. Post-field survey likelihood was primarily based on validating the presence (and thorough inspection) of suitable habitats within each of the survey locations, combined with life form, habitat and flowering information for each flora species.

### 2.1.2 Fauna

A list of fauna recorded or likely to occur within the survey area has been compiled by a review of available databases and literature including, but not limited to the following data sources:

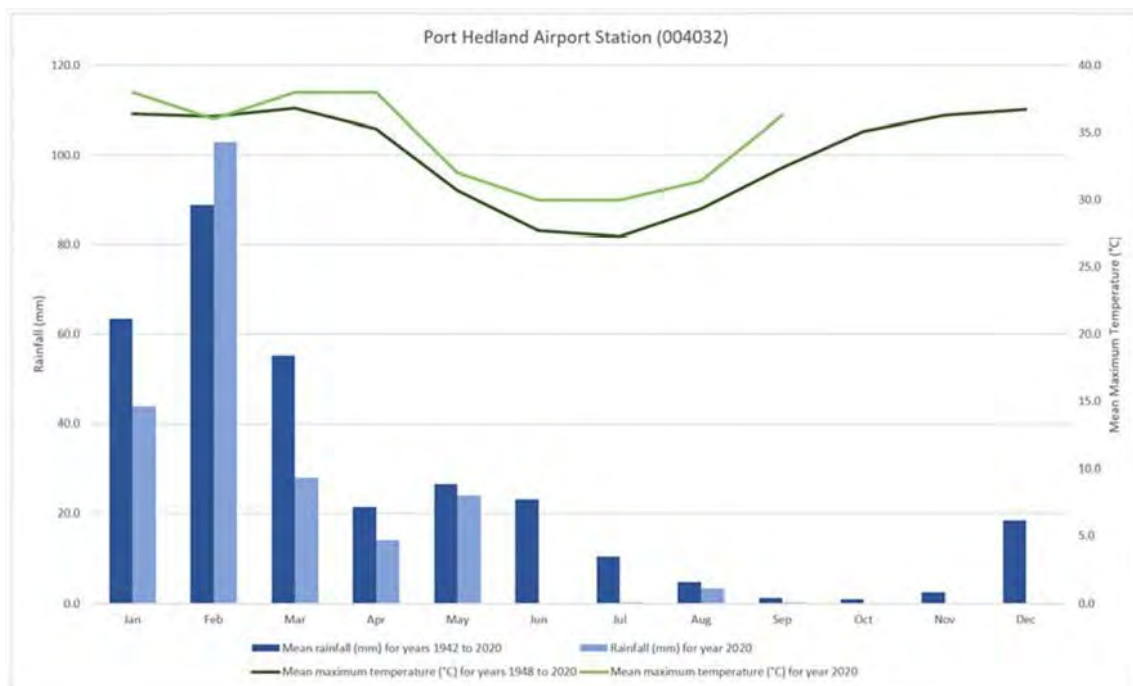
- Department of Biodiversity, Conservation and Attractions (DBCA) Threatened Fauna Database (NatureMap) (DBCA 2020). A 20 km buffer around the survey area was applied to capture previous fauna records within the immediate vicinity.
- EPBC Act Protected Matters database for fauna of national environmental significance (DAWE 2020). The minimum buffer (1 km) was applied to this search as the databases contains distribution data (areas) and not actual fauna records.
- Literature search and review of other fauna surveys in the vicinity.

## 2.2 Field surveys

### 2.2.1 Flora and Vegetation

#### Weather

In the 12-month period prior to the survey being undertaken, a total of 136.2 mm of rain had been recorded at the Port Hedland weather station (004032) (Bureau of Meteorology 2020). This rainfall is below average for that period (Figure 2).



**Figure 2. Mean (for years 1940 to 2020) and actual (2020) monthly rainfall and temperature data for Port Hedland Airport weather station (004032) (BOM 2020)**

#### Flora and Vegetation Survey

The field survey was conducted by Principal botanist, Vicki Long (Vicki Long and Associates) (Flora Collection Licence FB62000120) on 6<sup>th</sup> October 2020. Vicki has conducted numerous flora and vegetation surveys in the Port Hedland area since 1987 and is well qualified to identify vegetation and flora of conservation significance. The survey was undertaken in accordance with the requirements outlined in the Scope of Works provided with each vegetation type being traversed on foot.

Species were identified in the field by the Principal Botanist. Any species not able to be identified in the field were collected, labelled and pressed for later identification by Vicki Long (utilising the Pilbara Regional Herbarium). Priority species identified in the field were noted in the transect description.

Rainfall recorded in the six months prior to the survey totalled 41.4 mm (BOM 2020), which is well below the average of 87mm for this period.

The survey was conducted in accordance with the scope of work detailed in Section 1.2. Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment (EPA 2016) was also consulted to ensure consistency with recognised botanical survey guidance in WA.

A minimum of two 50m x 50m quadrats per vegetation type encountered, were sampled to be consistent with regulatory expectations for the Pilbara bioregion.

The following information was collected for each quadrat:

- Location – co-ordinates measured using a hand-held GPS (MGA 50, GDA94). One set of co-ordinates taken from the north-western corner of each quadrat.
- Recorder and date - personnel involved in sampling that location and date.
- Species – all vascular plant species present, including weed species. Species that are not readily identifiable during the field survey will be collected for later identification in the VLA office herbarium, or at the WA Herbarium. GPS co-ordinates were recorded for any conservation significant flora identified.
- Foliar cover – the estimated percent cover for the dominant species in each stratum.
- Vegetation description – vegetation units will be described according to Aplin's (1979) modification of the vegetation classification system of Specht (1970) (Appendix B) and the National Vegetation Information System Level 5 (DAWE 2020a). Vegetation is described to 'association' where up to three dominant genera for each of the upper, mid and ground strata are categorised based on dominant growth form, cover and height.
- Vegetation condition –vegetation condition adapted by Trudgen (1988) (Appendix B).
- Habitat – a broad landscape description based on landform, topography and soil.
- Disturbance – records of any obvious disturbances such as fire, tracks, weed infestations.
- Photographs – a photograph will be taken of each quadrat and vegetation unit.

A revision to the solar farm and access track footprint was made in May 2021. This revision resulted in southern boundary of the solar area being reduced but an equivalent area added to the eastern boundary. The access track was shortened and narrowed considerably. Field Mapping Note MN01 was made within the south-eastern most corner of the new solar boundary, confirming the vegetation type found there.

### 2.2.2 Fauna

The field component of the fauna assessment was carried out on the 7<sup>th</sup> September 2020 and 13<sup>th</sup> May 2021 by Greg Harewood (Zoologist) and consisted of a reconnaissance survey, described in the sections below. About 11.5 km of foot transects were completed during the survey.

#### Habitat assessment

The objective of the habitat assessment was to assess the likelihood of species of conservation significance utilising the habitats identified within the survey area.

During the field survey, fauna habitats within the survey area were assessed, and specific elements identified, which informed the likelihood of listed conservation significant species utilising the area and fauna habitat significance.

Vegetation units, landforms and soils identified during a flora and vegetation survey of the site (VLA 2020) were used to define broad fauna habitat types across the survey area. This information was supplemented by observation made during the fauna reconnaissance survey.

Fauna habitat quality was based on Table 2-2. Representative site photos are shown in Table 4.1.

**Table 2-2 Fauna habitat quality categories and descriptions (SW Environmental, undated).**

Quality	Description
<b>Good</b>	<ul style="list-style-type: none"> <li>• Native vegetation with intact and diverse habitat structure. Different vegetation age classes present at most stratum levels (ground, understorey, midstorey, canopy).</li> <li>• Forest/woodland: abundant hollow-bearing trees, including those with or likely to develop large hollows. Mature trees offer more foraging resources (nectar/seed).</li> <li>• Presence of shelter/refuges at ground level (dense understorey plants, tussock, rocky outcrop, hollow logs).</li> <li>• High habitat complexity (ecotones between vegetation types or habitat mosaic). This increases the range of foraging and shelter opportunities within a habitat.</li> <li>• Presence of key foraging and microhabitat components for target species.</li> <li>• Little to no obvious weed invasion or evidence of grazing.</li> <li>• May be large patch and/or connected to other areas of native vegetation.</li> </ul>
<b>Moderate</b>	<ul style="list-style-type: none"> <li>• Native flora species dominant with moderate habitat structure complexity appropriate to vegetation type. Ground litter intact or slightly disturbed. More than one age class present.</li> <li>• Forest/woodland: low to moderate abundance of hollow-bearing trees or trees likely to develop hollows.</li> <li>• Some shelter and refuge present for ground dwelling fauna.</li> <li>• Some habitat complexity (ecotones between vegetation types or areas forming a habitat mosaic).</li> <li>• Marginal presence of key microhabitat components for target species.</li> <li>• May be small or large in scale, and isolated or well connected.</li> </ul>
<b>Poor</b>	<ul style="list-style-type: none"> <li>• Habitat highly disturbed and simplified with low structural complexity. Ground litter layer absent or highly modified. Complexity reduced by only one age class present.</li> <li>• Little or no shelter and refuge for ground dwelling fauna.</li> <li>• Forest/woodland: not likely to support hollow-bearing trees.</li> <li>• Lack of key foraging and microhabitat components for target species.</li> <li>• May have evidence of weed invasion or grazing.</li> <li>• May be narrow or small area and substantially influenced by edge effects, and isolated from other areas of native vegetation.</li> </ul>

### Fauna observations

The aim of this part of the assessment was to obtain enough information to assess the likely significance of the survey area to fauna species of conservation significance.

Based on the results of the literature review, evidence of the presence or likely presence of fauna species of conservation significance known to or likely to frequent the general area was searched for and recorded during the field survey.

This included but was not limited to:

- Undertaking a series of close spaced, on foot transects across the survey area.

- Searching for evidence (i.e. individuals, tracks, scats, calls) of potential conservation significant species under logs, rocks and leaf litter.
- Observing bird species with binoculars.

## 2.3 Limitations

In accordance with *Technical Guidance* (EPA 2016 and EPA 2020) potential survey limitations are identified below.

**Table 2-3 Limitations of survey adequacy and accuracy**

Aspect	Constraint	Comment
Sources of information and availability of contextual Information- Is the region well documented?	No	Previous biological surveys have been conducted in the broader regional area, and broad-scale information is available from Beard (1975) and van Vreeswyk et al. (2004). Contextual information is therefore not a limiting factor for this survey.
Competency / experience of the survey team, including experience in the bioregion surveyed	No	Suitably qualified individuals carried out the work. The zoologist Greg Harewood is an experienced field surveyor (20 years plus) and has carried numerous projects in the Pilbara.  The field botanist responsible for undertaking the field survey has considerable (35 years) experience in conducting vegetation and flora surveys along the Pilbara/Carnarvon/Kimberley coastline including offshore islands. Personnel experience was not considered a limiting factor.
Scope, e.g. where faunal groups were excluded from the survey, was there adequate time to complete the surveys to the desired standard?	No	The scope is adequate to provide the information required to support a clearing assessment. Fish and invertebrates were outside of the project scope. There was adequate time to complete the flora surveys and conduct targeted searches for Threatened and Priority flora within identified preferred habitats and landforms within the survey area. Time was not considered a limiting factor.
Proportion of flora and fauna identified, recorded and/or collected?	Negligible	The single survey was considered adequate despite conditions being dry. The field botanist is very experienced with Pilbara coastal flora having worked with it for over 35 years. Some perennial species were dormant, some defoliated but their particular habit still allowed the field botanist to determine their identity in most cases. Some annual species were beyond being identifiable and some were considered to be potentially absent. However, the survey area is small and the proportion of species identified was considered to be adequate for that habitat
Adequacy of the survey intensity and proportion of survey achieved	No	Suitable survey effort has been adopted to identify the constraints associated with the survey area. A precautionary approach has also been adopted.  No seasonal sampling was carried out as part of this fauna assessment. The conclusions presented are based upon



Aspect	Constraint	Comment
		field data and the environmental monitoring and/or testing carried out over a limited period of time and are therefore merely indicative of the environmental condition of the site at the time of the field assessments. It should be recognised that site conditions can change with time. Lack of observational data on some species should also not necessarily be taken as an indication that a species is absent from the site or does not utilise it for some purpose at times.
The proportion of the task achieved and further work / Completeness of the survey	No	The surveys were completed adequately, to a sufficient level with respect to the scope. The survey area was considered adequately surveyed to compile a representative list of flora species, (including Priority and introduced flora species), as well as describe vegetation at a level appropriate for management decisions. A complete list of annual species could not be made due to dry conditions. However, because the survey area is small it is considered these annual species will be well represented in similar habitat/vegetation types which are quite extensive in areas surrounding the survey area. The survey area was comprehensively surveyed and as such completeness is not a limiting factor.
Mapping reliability	No	Colour aerial photography at a scale of 1:5,000 was used to locate the survey area and to assist in navigation and delineation of vegetation boundaries. The aerial photography was of good resolution and, in general, accurately represented ground conditions. As such mapping reliability was not considered a limiting factor.
Timing/weather/season	Low	The survey was conducted during a dry period. Rainfall had not been received for 5 months prior to the survey and hot weather was experienced in August and September. Prior to May, low rainfall was received in January, March and April, and while 102 mm was received in February, it occurred over a period of 2 days which is not considered effective rainfall. It is estimated that a further 25% of flora would be recorded following significant rain.
Disturbances that may have affected results of survey	Negligible	Approximately 40% of the access track had been subject to fire. The survey area is particularly small, any disturbance is historical and not seen as a limitation to what is currently present.
Intensity (in retrospect, was the intensity adequate)	No	The intensity of the survey was considered adequate to compile representative species lists. Intensity was not considered a limiting factor.
Completeness (e.g. was relevant area fully surveyed)	No	The entire area was accessed and surveyed.
Resources	No	Resources were adequate to complete the survey and all appropriate tools and materials required to complete the task were available. Resources were not considered a limiting factor.
Access problems	No	The entire survey area was accessible and was traversed in its entirety by foot.

## 3 Desktop study

### 3.1 Local and regional context

#### 3.1.1 *Interim Biogeographic Regionalisation of Australia (IBRA) values*

The Interim Biogeographic Regionalisation for Australia (IBRA) classifies Australia's landscapes into 89 large geographically distinct bioregions (419 subregions) based on climate, geology, landform, native vegetation and species information. The survey area lies within the Pilbara Bioregion (PIL). There are four biological sub-regions within the Pilbara bioregion. The survey area is within the PIL 04 Roebourne sub-region which is described as:

Quaternary alluvial and older colluvial coastal and sub-coastal plains with a grass savannah of mixed bunch and hummock grasses and dwarf shrub-steppe of *Acacia stellaticeps*, or *A. pyrifolia* and *A. inaequilatera*. Uplands are dominated by *Triodia* hummock grasslands. Ephemeral drainage lines support *Eucalyptus victrix* or *Corymbia hamersleyana* woodlands. Samphire, *Sporobolus* and mangal occur on marine alluvial flats and deltas. Resistant linear ranges of basalts occur across the coastal plains, with minor exposures of granite. Islands are either Quaternary sand accumulations or composed of basalt or limestone, or combinations of any of these three. The sub-region experiences an arid (semi-desert) tropical climate with highly variable rainfall, often influenced by cyclonic activity in the north-west of WA and falling during the summer (Kendrick and Stanley, 2001).

#### 3.1.2 *Land Systems*

The survey area falls within the 'Uaroo' Land System which is described by van Vreeswyk et al. 2004 as: 'Broad sandy plains supporting shrubby hard and soft spinifex grasslands'.

#### 3.1.3 *DBCA managed lands*

There are no nearby DBCA managed reserves (SLIP 2020). The nearest is over 75 km away.

#### 3.1.4 *Habitat connectivity, linkage, or corridor values*

In a local context nearly the entire area within 10km of the project is mapped as continuous native vegetation (Government of Western Australia 2019). The project will not impact local habitat connectivity, linkage, or corridor values.

### 3.1.5 Important Bird Areas (IBA)

Important Bird Areas (IBAs) are areas identified by Birdlife International. IBAs are considered conservation priorities, sites able to be conserved in their entirety and are usually part of a protected-area network or recognised as having global bird conservation importance (Birdlife International, 2020). The Port Hedland Saltworks IBA, an intertidal mudflat, occurs eight kilometres north east of the project but will not be impacted.

## 3.2 Environmental values of the survey area

### 3.2.1 Wetlands and watercourses

The term 'wetlands' refers to damplands, estuary-peripheral and water body, floodplains, palusplain and sumplands. The wetland categories are recognised by the EPA, DBCA, DWER and other decision making authorities. There are no wetlands or watercourses mapped within or near with the survey area.

### 3.2.2 Vegetation

#### Vegetation mapping

The vegetation of the survey area falls within Beard's Vegetation Association Abydos Plain\_647 which is described as "Hummock grassland with scattered shrubs or mallee *Triodia spp.* *Acacia spp.*, *Grevillea spp.* *Eucalyptus spp.*".

#### Vegetation of Conservation Significance

No TECs or PECs have been previously recorded within the survey area. Database search results indicate that the closest recorded TEC/PECs are located approximately 107 km south-west and 131 km north-east of the survey area (Government of Western Australia 2020). Neither of these areas of significance will be impacted by the proposed clearing activities.

### 3.2.3 Flora

Database search results indicated that no Threatened (T) flora species, one Priority (P) P1 and three P3 species have been recorded within 20 km of the survey locations (DBCA 2020c). Of the four Priority flora species identified from the desktop assessment, the Priority 1 *Tephrosia rosea subsp Port Hedland* and two P3 species, *Heliotropium muticum* and *Rothia indica subsp. australis* are considered to have potential to occur in the survey area, based on pre-survey assessment of previous location and preferred habitat information. The likelihood of occurrence assessment is provided below.

**Table 3-1 Likelihood of occurrence of Threatened and Priority flora recorded within 20 km of the survey area (DBCA 2020c).**

Species	Habit and flowering information	Life form	Habitat	Likelihood of occurrence	
				Pre-survey	Post-survey
<b>Threatened (Declared Rare Flora)</b>					
Not applicable					
<b>Priority 1</b>					
<b><i>Tephrosia rosea</i> var. <i>Port Hedland</i> (AS George 1114)</b>	Erect spreading shrub 60-120 cm, dull green-silver, flowers (September) deep pink	Perennial	Very rare and only recorded on dunes near Point Samson / Sam's Creek, Finucane Island and East of Port Hedland Airport, sand plains between Port Hedland and South Hedland	Likely	Unlikely
<b>Priority 3</b>					
<b><i>Eragrostis crateriformis</i></b>	Tussock grass	Perennial	Floodplain with red-brown loamy clays; claypans;	Unlikely	Unlikely
<b><i>Heliotropium muticum</i></b>	Ascending to spreading herb, to 0.3 m high	Perennial	Loam, sandy loam on plains and floodplains.	Likely	Likely - Recorded adjacent to survey area
<b><i>Rothia indica</i> subsp. <i>australis</i></b>	Prostrate herb, to 0.3 m high, densely covered in spreading hairs. Fl. Apr to Aug.	Annual	Sandy soils. Sandhills and sandy flats	Likely	Likely

### 3.2.4 Fauna

The literature review identified multiple fauna species of conservation significance as potentially occurring in the general area as listed in Table 3.2. The NatureMap (DBCA 2020) and Protected Matter Search Tool (DAWE 2020) results, used as a primary source for compiling this listing, are provided in Appendix D. Because of the proximity of the survey area to the ocean a number of conservation significant marine species have appeared in the database search results. These species have been excluded from the assessment as they would not under normal circumstance occur within the survey area given a total lack of suitable habitat.

**Table 3-2 Threatened and Priority fauna that may occur within the survey area (DBCA 2020, DAWE 2020)**

Species	Conservation Status <sup>1</sup>	
	BC Act / DBCA Priority	EPBC Act
Airlie Island Ctenotus <i>Ctenotus angusticeps</i>	P3	-
Pilbara Olive Python <i>Liasis olivaceus barroni</i>	S3	VU
Migratory Shorebirds/Seabirds/Wetland Species	Various	Various
Oriental Pratincole <i>Glareola maldivarum</i>	S5	Mig
Barn Swallow <i>Hirundo rustica</i>	S5	Mig
Eastern Osprey <i>Pandion cristatus</i>	S5	Mig
Peregrine Falcon <i>Falco peregrinus</i>	S7	-
Grey Falcon <i>Falco hypoleucos</i>	VU	VU
Night Parrot <i>Pezoporus occidentalis</i>	CR	CE
Fork-tailed Swift <i>Apus pacificus</i>	S5	Mig
Grey Wagtail <i>Motacilla cinerea</i>	S5	Mig
Yellow Wagtail <i>Motacilla flava</i>	S5	Mig
Northern Quoll <i>Dasyurus hallucatus</i>	S2	EN
Bilby <i>Macrotis lagotis</i>	S3	VU
Brush-tailed Mulgara <i>Dasyercus blythi</i>	P4	-
Western Pebble-mound Mouse <i>Pseudomys chapmani</i>	P4	-
Ghost Bat <i>Macroderma gigas</i>	S3	VU
Pilbara Leaf-nosed Bat <i>Rhinonictis aurantia</i>	VU	VU

<sup>1</sup> See Appendix A for conservation codes

## 4 Results

### 4.1 Vegetation

#### 4.1.1 Vegetation types

The survey area comprises of two vegetation types:

- *Acacia stellaticeps* open heath, sometimes low shrubland over *Triodia schinzii* with *Triodia epactia* hummock grassland, sometimes open hummock grassland, and
- *Owenia reticulata*, *Dolichandrone occidentalis* open low woodland often with *Atalaya hemiglauca* and *Acacia colei* tall shrubs, over *Acacia stellaticeps* open low shrubland over *Triodia schinzii* hummock grassland.





The first vegetation type occupies two-thirds of the survey area with *Acacia stellaticeps* being so dense, it appears to be preventing the establishment and growth of other species. This vegetation type occurs along the proposed access track, including the revised extension to the eastern boundary (2021), with forty percent of the eastern end having been burnt. The area has experienced a history of frequent fires, which have encouraged the dense growth of *Acacia stellaticeps*. Following fire, this species is known to coppice from the base and will also regenerate profusely from seed. (B. Maslin, worldwidewattle.com).



The second vegetation type present may represent a remnant of a less fire impacted area. This vegetation type was more species diverse. Many annual species were evident, although most were dead and many not identifiable. The tree species, *Owenia reticulata* is present in this vegetation type along with small trees/tall shrubs of *Dolichandrone occidentalis*, and *Atalaya hemiglauca*. These species are tropical remnants.

Both vegetation types recorded are broadly consistent with those described for the Uaroo Land System under the sandy, loamy plains landform, although that description does not include the tree species listed above (van Vreeswyk et al. 2004).

The vegetation types are summarised in Table 4-1 along with representative photos of each, and their distribution within the survey area is shown on Figure 3.

**Table 4-1 Vegetation types present within the survey area (VLA, 2020)**

Code	Description	Sites	Condition	Photo
<b>AsTsTe</b>	<i>Acacia stellaticeps</i> open heath, sometimes low shrubland over <i>Triodia schinzii</i> with <i>Triodia epactia</i> hummock grassland, sometimes open hummock grassland.	1, 1a, 1b, 1c, 1d (burnt) and MN1	Good	
				Plate 1: <i>Acacia stellaticeps</i> open heath over open hummock grassland - typical
				
				Plate 2: <i>Acacia stellaticeps</i> low shrubland over open hummock grassland.
				
				Plate 3: Recently burnt, now regenerating AsTsTe
<b>OrDoAsTs</b>	<i>Owenia reticulata</i> , <i>Dolichandrone occidentalis</i> open low woodland often with <i>Atalaya hemiglauca</i> and <i>Acacia colei</i> tall shrubs over <i>Acacia stellaticeps</i> open low shrubland over <i>Triodia schinzii</i> hummock grassland.	2, 2a, 3	Excellent <2% * <i>Cenchrus ciliaris</i> , * <i>C. setiger</i> beneath <i>Owenia</i> trees. 1 x large * <i>Aerva javanica</i> plant only beside an old <i>Owenia</i> stump	
				Plate 4: OrDoAsTs where low trees are more dense

Code	Description	Sites	Condition	Photo
				 <p>Plate 5: OrDoAsTe where tall trees are less dense</p>
<p><b>Cleared</b></p>	<p><i>Existing disturbed areas (roads/rail line)</i></p>	<p>N/A</p>	<p>Cleared, Completely Degraded</p>	 <p>Plate 6: Existing disturbed areas (roads/rail line)</p>



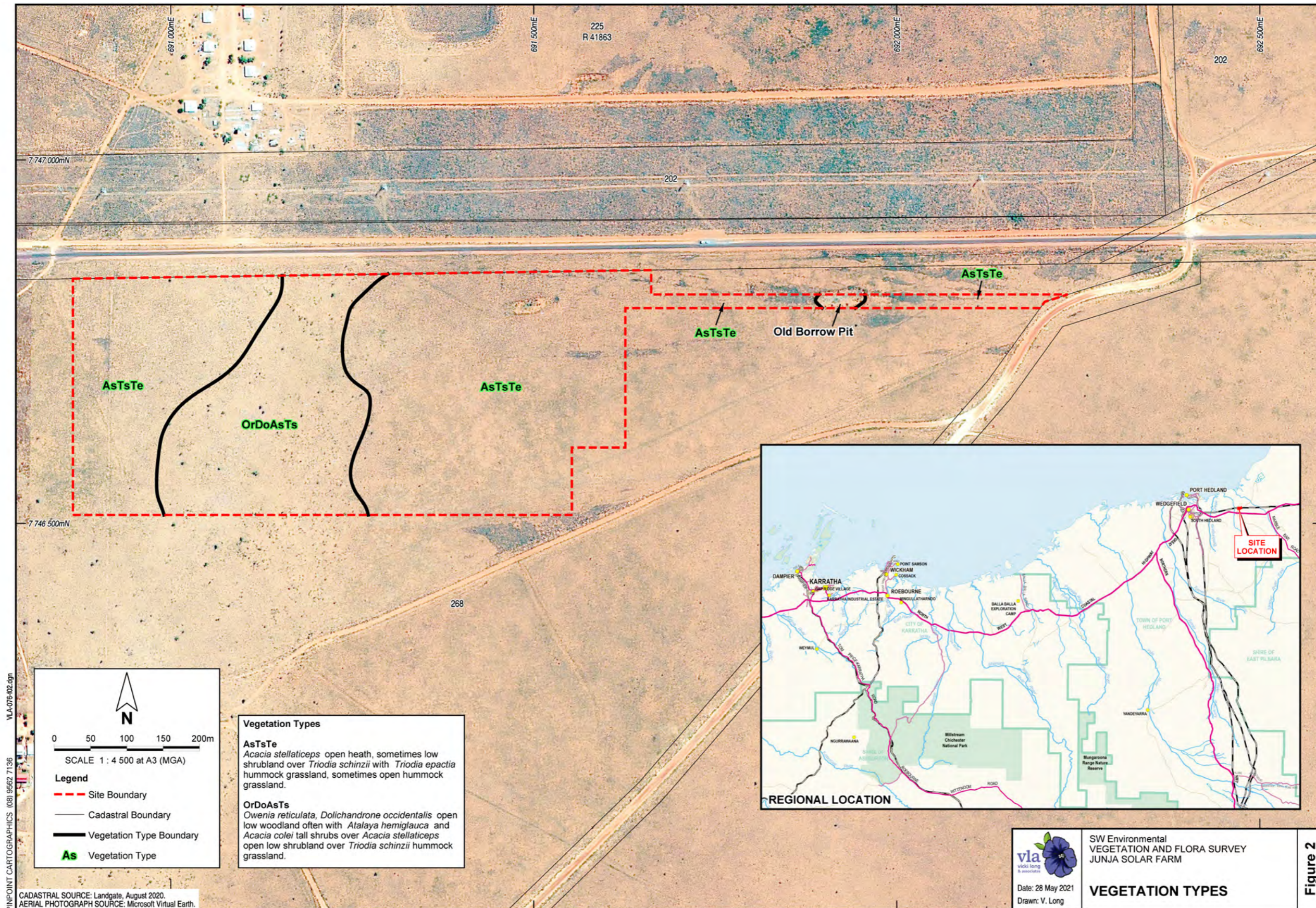


Figure 3. Vegetation types (and corresponding fauna habitat types) (VLA, 2021).

### 4.1.2 Vegetation condition

Vegetation condition was assessed using the Trudgen (1988) condition scale (Appendix B), as recommended by the EPA (2016). It is rated predominantly on external factors such as man-made disturbance, fire, clearing, grazing and A and does not account for seasonality (dry conditions where flora may be dormant and dry) or the impacts of natural events such as coastal processes and cyclones.

The vegetation at the time of this survey was dry, with many dormant species (some species were leafless, whilst annuals were mostly dead); this however does not influence the Vegetation Condition Score. The very low number and cover of weed species found on the survey area would generally be associated with an "Excellent" score. However, a long history of fire events, evidenced by the dominance of a single species, *Acacia stellaticeps*, over two thirds of the survey area, has resulted in a lower condition score of "Good". The low shrubland, which is a result of frequent fire events over time, is very dense and prevents the establishment of other species, hence the very low species diversity in the area.

## 4.2 Flora

### 4.2.1 Flora recorded

Species diversity is relatively low throughout the survey area. A total of 53 taxa were recorded during the survey representing 23 families. A complete list of the flora identified in the survey area during this survey is summarised in Appendix C.

Forty four of the plants recorded were perennial, with more annual species likely to be present following decent rain. The most well represented family was Fabaceae (pea family) with nine species and the next represented family was Poaceae (grasses) with eight species. The species recorded are all typically found around the Port Hedland region.

The low species numbers are probably due to the dry conditions and below average rainfall in the six months preceding the survey, as well as the dense *Acacia stellaticeps* heath which covers two-thirds of the survey area, inhibiting the establishment and growth of other species.

Pindan sand usually produces many short-lived ephemerals and annuals following rain and it is expected more flora would be present following a season of adequate and effective rainfall.

### 4.2.2 Conservation significant flora

No Priority species were found within the survey area, but approximately 50-100 dead P3 *Heliotropium muticum* were recorded along the northern windrow of the existing track at GPS location 691538E 7746892N outside of the project. This area had been subject to fire within the previous 12 months. The 2021 revision of the track width excludes this windrow entirely so this population of *Heliotropium muticum* should be avoided completely.

### 4.2.3 Weeds

The most commonly recorded weeds were buffel grass (*\*Cenchrus ciliaris*) and birdwood grass (*\*Cenchrus setiger*) which occurred in densities well below 2% of total vegetation for the majority of the survey area. A borrow pit occurs midway along the proposed access track as shown in Figure 1. This pit is about 1.25 m deep, with the floor of the pit supporting a dense population of approximately 30% *\*Cenchrus setiger*, which is a lot greater than the rest of the survey area.

A single kapok (*\*Aerva javanica*) plant was found at GPS location 691123E 7746772N. It was mature and seeding abundantly in association with birdwood grass (*\*Cenchrus setiger*), near an old *Owenia reticulata* tree stump.

None are listed as WoNS or specifically requiring management under the BAM Act.

## 4.3 Fauna

### 4.3.1 Fauna habitat

Fauna habitats (largely based on vegetation units mapped by VLA 2021) are shown in Figure 3. Example images of each of the identified units are provided in Table 4-1.

The survey area is located on coastal, red sand plain, the majority of which is covered with low, relatively dense, Acacia shrubland. One section contains some widely scattered, relatively small trees and as a consequence has been mapped as an open low woodland. An area in the eastern part of the survey area shows signs of being recently burnt. A small section of the survey area is represented by existing cleared roads/access tracks.

The survey area contains no wetlands, watercourses, rock outcrops, caves or fallen hollow logs. Leaf litter is generally absent or very sparse and trees contain no hollows of note.

Given the relatively small size of the survey area (25.7 hectares) and the lack of habitat variety, the total fauna assemblage present is likely to be depauperate as a consequence. The assemblage is also unlikely to be remarkable in any sense given that similar fauna habitats are extensive in the wider area. Given the nature of the fauna habitats present and the survey areas small size some fauna species, which would not typically reside in the survey area itself, in particular those that occur at low densities but have a large home range, may occasionally be encountered. Overall, the fauna habitat quality was considered to be Poor.

### 4.3.2 Fauna recorded

Seventeen fauna species were observed, or secondary evidence of their presence recorded during the field survey (Appendix C). The low number of fauna species observed can largely be attributed to the survey areas small size and limited habitat variety. The majority of the fauna recorded are common widespread bird species.

Secondary evidence of the northern quoll (Endangered) was found in the form of a scat (Photo 1). No other evidence of the species was seen. It is considered unlikely that this species permanently resides

within the survey area given there is a total lack of refuge habitat (i.e. caves, rock outcrops, hollow logs/trees or large burrows).



**Photo 1 Northern Quoll Scat found within the survey area**

No evidence of any other fauna species of conservation significance identified during the literature review was observed. However, this does not eliminate the potential for some species to still occur, if only infrequently.

#### *4.3.3 Conservation significant fauna*

Based on the information gathered during the site reconnaissance survey and the documented distribution and habitat preferences of the species of conservation significance identified as potentially being present in the general area, their likelihood of occurrence within the survey area itself has been assessed following fieldwork. A summary is provided below in Table 4-2.

**Table 4-2 Fauna of conservation significance likelihood of occurrence following fieldwork**

Species	Conservation Status		Habitat Preferences	Habitat Present	Likelihood of Occurrence	Comments/Possible Impacts
	BC Act / DBCA Priority	EPBC Act				
Airlie Island Ctenotus <i>Ctenotus angusticeps</i>	P3	-	On the mainland, generally inhabits the landward fringe of salt marsh communities in samphire shrubland or marine couch grassland in the intertidal zone along mangrove margins.	No	Would Not Occur.	No suitable habitat. No impact on this species will occur.
Pilbara Olive Python <i>Liasis olivaceus barroni</i>	S3	VU	Prefers escarpments, gorges usually in close proximity to water and rock outcrops that attract suitable sized prey species.	No	Would Not Occur.	No suitable habitat. No impact on this species will occur.
Migratory Shorebirds/Wetland Species	S5, Various	Ma, Mig, Various	Varies between species but includes open ocean, beaches and permanent/temporary wetlands varying from billabongs, swamps, lakes, floodplains, sewerage farms, saltwork ponds, estuaries, lagoons, mudflats sandbars, pastures, airfields, sports fields and lawns.	No	Would Not Occur.	No suitable habitat. No impact on these species will occur.
Oriental Pratincole <i>Glareola maldivarum</i>	S5	Mig	Usually inhabits open plains, floodplains or short grassland (including farmland or airstrips), often with extensive bare areas and near water.	No/Marginal	Unlikely to Occur.	abitat appears marginal at best. No impact on this species is anticipated.
Barn Swallow <i>Hirundo rustica</i>	S5	Mig	Open country in coastal lowlands, often near water in or over freshwater wetlands, paperbark <i>Melaleuca</i> woodland, mesophyll shrub thickets and tussock grassland.	Yes/Marginal (foraging habitat only)	Unlikely to Occur, Occasional flyover only.	Unlikely to occur except on very rare occasions for a limited period. No impact on this species is anticipated.
Eastern Osprey <i>Pandion haliaetus</i>	S5	Ma, Mig	Coasts, estuaries, bays, inlets, islands, and surrounding waters, coral atolls, reefs, lagoons, rock cliffs and stacks. Ascends larger rivers.	No	Would Not Occur.	No suitable habitat. No impact on this species will occur.
Peregrine Falcon <i>Falco peregrinus</i>	S7	-	Diverse from rainforest to arid shrublands, from coastal heath to alpine Mainly about cliffs along coasts, rivers and ranges and about wooded watercourses and lakes.	Yes (foraging habitat only)	Possibly Occurs, but only on very rare occasions for limited periods.	Uncommon but the survey area may represent part of a larger home range used by individuals of this species. No significant impact on this species anticipated.

Grey Falcon <i>Falco hypoleucos</i>	VU	VU	Lightly treed plains, gibber deserts, sand ridges, pastoral lands, timbered water courses but seldom in driest deserts. Typically nest in tall eucalypt trees near water	Yes (foraging habitat only)	Possibly Occurs, but only on very rare occasions for limited periods.	Uncommon but the subject site may represent part of a larger home range used by individuals of this species. No significant impact on this species anticipated.
Night Parrot <i>Pezoporus occidentalis</i>	CR	CE	Preferred habitat is thought to be spinifex grasslands or samphire and chenopod shrublands on claypans, floodplains or the margins of salt lakes, creeks or other water bodies.	No/Very Marginal	Unlikely to Occur.	abitat appears very marginal at best. No impact on this species is anticipated.
Fork-tailed Swift <i>Apus pacificus</i>	S5	Mig, Ma	Low to very high airspace over varied habitat from rainforest to semi desert.	Yes (foraging habitat only)	Unlikely to Occur, Flyover only on very rare occasions.	May occur very occasionally for brief periods. Entirely aerial. No impact on this species will occur.
Grey Wagtail <i>Motacilla cinerea</i>	S5	Mig, Ma	In Australia, near running water in disused quarries, sandy, rocky streams in escarpments and rainforest, sewerage ponds, ploughed fields and airfields.	No	Would Not Occur.	No suitable habitat. No impact on this species will occur.
Grey Wagtail <i>Motacilla cinerea</i>	S5	Mig	Near running water in disused quarries, sandy, rocky streams in escarpments and rainforest, sewerage ponds, ploughed fields and airfields.	No	Would Not Occur. Very uncommon vagrant.	No suitable habitat. No impact on this species will occur.
Yellow Wagtail <i>Motacilla flava</i>	S5	Mig	Short grass and bare ground, swamp margins, sewage ponds, saltmarshes, playing fields, airfields, ploughed land town lawns.	No	Would Not Occur. Very uncommon vagrant.	No suitable habitat. No impact on this species will occur.
Northern Quoll <i>Dasyurus hallucatus</i>	S2	EN	Can occur in a variety of habitats across their range. Important areas include rocky hills, scree slopes and river systems/creek lines which have larger hollow bearing trees. Other areas surrounding the above mentioned "important" habitats including open spinifex meadows, gibber plains, hill systems and similar landforms that provide foraging habitat	Yes/Marginal (foraging habitat only)	Known to Occur	Recorded within the survey area but only likely to be present as occasional transients for short periods. Loss/modification of a small area of marginal foraging habitat.
Bilby <i>Macrotis lagotis</i>	S3	VU	Acacia shrublands, spinifex and hummock grassland. Mitchell grass and stony downs country if cracking clay, also desert sand plains and dune fields sometimes with spinifex hummock grassland and acacia shrubland	Yes	Possibly Occurs	Known to occur in wider area, however no evidence (e.g. burrows) observed within survey area. Loss/modification of a small area of potential habitat.

Brush-tailed <i>Dasyercus blythi</i>	Mulgara	P4	-	Occurs in a range of vegetation types including hummock grass plains, sand ridges, mulga shrubland on loamy sand, however, the principal habitat is mature hummock grasslands of spinifex, especially <i>Triodia basedowii</i> and <i>T. pungens</i> where it lives in burrows that it digs on the flats between low sand dunes.	Yes/Marginal	Possibly Occurs	Known to occur in wider area, however no evidence (e.g. burrows) observed within survey area. Habitat appears to be generally marginal (i.e. sparse spinifex). Loss/modification of a small area of potential though marginal habitat.
Western Pebble-mound Mouse <i>Pseudomys chapmani</i>		P4	-	Stony hillsides with hummock grassland.	No	Would Not Occur.	No suitable habitat. No impact on this species will occur.
Ghost Bat <i>Macroderma gigas</i>		S3	VU	Requires undisturbed caves, rock piles and mine shafts for roosting. They forage for food over a wide range of habitats including arid spinifex hillsides, black soil grasslands, monsoon forest, open savannah woodland, tall open forest, deciduous vine forest and tropical rainforest.	No/Marginal (foraging habitat only)	Unlikely to Occur.	Unlikely to occur except on rare occasions for a limited period. No impact on this species is anticipated.
Pilbara Leaf-nosed Bat <i>Rhinioncteris aurantia</i>		VU	VU	During the dry season this species roosts in caves and mine adits with stable, warm and humid microclimates. It is thought that forest areas can be used in the wet season if conditions are hot and humid	No/Marginal (foraging habitat only)	Unlikely to Occur.	Unlikely to occur except on very rare occasions for a limited period. No impact on this species is anticipated.

One vertebrate fauna species of conservation significance was identified from the survey area:

- Northern Quoll *Dasyurus hallucatus* – S2 (BC Act), Endangered (EPBC Act).

A scat was found within the survey area during the daytime reconnaissance survey. No other evidence of the species was seen. It is considered unlikely that this species permanently resides within the survey area given there is a total lack of refuge habitat (i.e. caves, rock outcrops, hollow logs/trees or large burrows) and the animal which laid the scat was probably in transit between more suitable areas or foraging across its home range. The proposed solar development will result in the loss/modification of a small area of potential foraging habitat used by this species, but impact is unlikely to be significant given the areas small size and large expanses of similar habitat in adjoining areas.

Several additional species of conservation significance may utilise the survey area for some purpose at times, but their status on-site and/or in the general area is difficult to determine because they were not sighted during the field survey, or evidence of use was not observed:

- Barn Swallow *Hirundo rustica* – S5 (BC Act), Migratory (EPBC Act)

Listed as a potential species based on available information however actual status in the general area is difficult to determine. The species is however only likely to occur on rare occasions and then only for brief periods. The species is largely aerial and survey area lacks roost sites. No/negligible impact on this species anticipated.

- Peregrine Falcon *Falco peregrinus* – S7 (BC Act)

Listed as a potential species based on available information. This species potentially utilises some sections of the survey area for foraging as part of a much larger home range though it is only likely to occur infrequently and then only for brief periods. No potential nest sites. No/negligible impact on this species anticipated.

- Grey Falcon *Falco hypoleucos* – S3 (BC Act), Vulnerable (EPBC Act)

Listed as a potential species based on available information. This species potentially utilises some sections of the survey area for foraging as part of a much larger home range though it is only likely to occur infrequently and then only for brief periods. No potential nest sites. No/negligible impact on this species anticipated.

- Fork-tailed Swift *Apus pacificus* – S5 (BC Act), Migratory (EPBC Act)

Listed as a potential species based on available information however actual status in the general area is difficult to determine. The species is however only likely to occur on rare occasions and then only for brief periods. The species is largely aerial and survey area lacks roost sites. No/negligible impact on this species anticipated.

- Bilby *Macrotis lagotis* – S3 (BC Act), Vulnerable (EPBC Act)

Listed as a potential species based on available information, however no evidence of the species presence (e.g. burrow, scats or tracks) observed during the survey period suggesting that at the time it was absent from the site. The proposed solar array development will result in the loss/modification of a small area of potential habitat for this species, but impact is unlikely to be significant given the areas small size and large expanses of similar habitat in adjoining areas.

- Brush-tailed Mulgara *Dasyercus blythi*. - P4 (DCA Priority Species)



Listed as a potential species based on available information, however no evidence of the species presence (e.g. burrow, scats, or tracks) observed during the survey period suggesting that at the time it was absent from the site. The proposed solar development will result in the loss/modification of a small area of potential habitat for this species, but impact is unlikely to be significant given the areas small size and large expanses of similar habitat in adjoining areas.

A number of other species of conservation significance (as listed in Table 4-2), while possibly present in the wider area (in particular in nearby rocky ranges) are not listed as potentially occurring within the survey area primarily due to a complete lack of suitable habitat (quality and extent) and/or known local/regional extinction.

In cases where some habitat is present and available information indicates at least some probability of the species occurrence, likely impacts are anticipated to be very low/no-existent due to the small area of clearing required and the large expanses of adjoining and nearby similar and in some cases better quality habitat.

No overall change in the conservation status of any fauna species currently or potentially utilising the survey area is therefore anticipated. While some small, localised residual loss of fauna habitat may occur for some species, regional impacts on the status of any one species are anticipated to be negligible/non-existent.

## 5 Discussion and Recommendations

### 5.1 Flora and Vegetation

The vegetation recorded within the survey area is relatively widespread within the Uaroo Land System, both to the east and west of Port Hedland. Two thirds of the survey area is occupied by low heath of *Acacia stellaticeps*, which inhibits the establishment and growth of other species, resulting in a low species diversity within that vegetation type. Additionally, the survey area is small, hence the removal of vegetation via clearing will not have a significant impact on this vegetation type. The second vegetation type recorded, is more species diverse and is less well represented in the wider area. Scattered to open *Owenia reticulata* trees over tall and low Acacia shrubland is relatively widespread throughout the surrounding area, however, the abundance of *Dolichandrone occidentalis* in the survey area makes it less common.

*Dolichandrone occidentalis* tends to occur in isolated groves (one of which occurs in the survey area) with the frequency of occurrence of these groves increasing, as you travel further north (V Long pers obs).

The survey was undertaken as a dry season survey. Plants were dry, defoliated, dormant or dead. Most annual species were senesced and although some could be identified from persisting material, some were unidentifiable. Many perennials had died back significantly, were without flowering or fruiting material and many had partially defoliated. Most were identifiable, but a lack of flowering or fruiting material meant that identifications could not be verified. However, the survey area is small, and it is probable that all component species of the two vegetation types recorded, would be well represented in the relatively widespread vegetation types in the surrounding region. Pindan sand generally produces

a relatively diverse range of species following rainfall and it is estimated a further 25% of flora would be recorded following a significant rainfall event, enabling the verification of any questionable species.

Three of the four Conservation Significant plant species known to occur within 20 km of the survey area are categorised as P3 annuals, two of which may be present following rainfall. A population of about 50- 100 dead plants of P3 *Heliotropium muticum* were recorded outside of the survey area on a windrow of an existing track, but the narrowing of the track footprint (2021 revision) will exclude any impact to this population. Any impact to conservation significant species if they were to occur within the survey area, would not significantly reduce their known populations.

The P1 species, *Tephrosia rosea var Port Hedland* (A.S. George 1114) is a perennial species and although the habitat indicates the species is likely to be present, it was not recorded during the survey. Therefore, clearing within this surveyed area is unlikely to have a significant impact on conservation significant flora.

Weeds (*\*Cenchrus ciliaris* and *\*C. setiger*) were recorded at very low densities (<2%) over the entire survey area. Care should be taken to prevent the spread of the highly invasive, single kapok (*\*Aerva javanica*) plant recorded in the survey area. This plant and its surrounding soil, should be removed, placed in a plastic bag, sealed and disposed of to prevent the spread of seeds throughout the area.

Prior to any clearing being undertaken, any young *Owenia reticulata* trees should be removed and transplanted around the Jinparinya Aboriginal Community to increase shade.

## 5.2 Fauna

Given the relatively small size of the survey area and the lack of habitat variety, the total fauna assemblage present is likely to be depauperate. The assemblage is also unlikely to be remarkable in any sense given that similar fauna habitats are extensive in the wider area. Given the nature of the fauna habitats present and the survey areas small size some fauna species, which would not typically reside in the survey area itself, in particular those that occur at low densities but have a large home range, may still occasionally be encountered.

During the survey period one vertebrate fauna species of conservation significance was positively identified as utilising the survey area, this being:

- Northern Quoll *Dasyurus hallucatus* – S2 (BC Act), Endangered (EPBC Act).

Several additional species of conservation significance may also utilise the survey area, though, as no evidence of their presence was identified during the field survey, their status in the area remains uncertain:

- Barn Swallow *Hirundo rustica* – S5 (BC Act), Migratory (EPBC Act)
- Peregrine Falcon *Falco peregrinus* – S7 (BC Act)
- Grey Falcon *Falco hypoleucos* – S3 (BC Act), Vulnerable (EPBC Act)
- Fork-tailed Swift *Apus pacificus* – S5 (BC Act), Migratory (EPBC Act)
- Bilby *Macrotis lagotis* – S3 (BC Act), Vulnerable (EPBC Act)
- Brush-tailed Mulgara *Dasyercus blythi*. - P4 (DPCA Priority Species)

Potential impacts on these fauna species and fauna in general will be nil to low due to the small area of clearing required and the large areas of adjoining and nearby similar and in some cases better quality

habitat. Nonetheless ongoing planning should consider the potential presence of fauna so that any impacts can be further minimised where considered reasonable and practicable.

Given the possible presence of some ground dwelling fauna species of conservation significance it is recommended that immediately prior to any clearing taking place, vegetation to be removed be inspected by a suitably licensed "fauna specialist" for the presence of fauna (in particular mulgara and bilby burrows) so that the appropriate management measures can be employed.

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# Appendix A Conservation codes



# CONSERVATION CODES

## For Western Australian Flora and Fauna

Threatened, Extinct and Specially Protected fauna or flora<sup>1</sup> are species<sup>2</sup> which have been adequately searched for and are deemed to be, in the wild, threatened, extinct or in need of special protection, and have been gazetted as such.

**The *Wildlife Conservation (Specially Protected Fauna) Notice 2018* and the *Wildlife Conservation (Rare Flora) Notice 2018* have been transitioned under regulations 170, 171 and 172 of the *Biodiversity Conservation Regulations 2018* to be the lists of Threatened, Extinct and Specially Protected species under Part 2 of the *Biodiversity Conservation Act 2016*.**

Categories of Threatened, Extinct and Specially Protected fauna and flora are:

### **T**     **Threatened species**

Listed by order of the Minister as Threatened in the category of critically endangered, endangered or vulnerable under section 19(1), or is a rediscovered species to be regarded as threatened species under section 26(2) of the *Biodiversity Conservation Act 2016* (BC Act).

**Threatened fauna** is that subset of 'Specially Protected Fauna' listed under schedules 1 to 3 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018* for Threatened Fauna.

**Threatened flora** is that subset of 'Rare Flora' listed under schedules 1 to 3 of the *Wildlife Conservation (Rare Flora) Notice 2018* for Threatened Flora.

The assessment of the conservation status of these species is based on their national extent and ranked according to their level of threat using IUCN Red List categories and criteria as detailed below.

### **CR**     **Critically endangered species**

Threatened species considered to be "*facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with criteria set out in the ministerial guidelines*".

Listed as critically endangered under section 19(1)(a) of the BC Act in accordance with the criteria set out in section 20 and the ministerial guidelines. Published under schedule 1 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018* for critically endangered fauna or the *Wildlife Conservation (Rare Flora) Notice 2018* for critically endangered flora.

### **EN**     **Endangered species**

Threatened species considered to be "*facing a very high risk of extinction in the wild in the near future, as determined in accordance with criteria set out in the ministerial guidelines*".

Listed as endangered under section 19(1)(b) of the BC Act in accordance with the criteria set out in section 21 and the ministerial guidelines. Published under schedule 2 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018* for endangered fauna or the *Wildlife Conservation (Rare Flora) Notice 2018* for endangered flora.

### **VU**     **Vulnerable species**

Threatened species considered to be "*facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with criteria set out in the ministerial guidelines*".

Listed as vulnerable under section 19(1)(c) of the BC Act in accordance with the criteria set out in section 22 and the ministerial guidelines. Published under schedule 3 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018* for vulnerable fauna or the *Wildlife Conservation (Rare Flora) Notice 2018* for vulnerable flora.

## **Extinct species**

Listed by order of the Minister as extinct under section 23(1) of the BC Act as extinct or extinct in the wild.

### **EX Extinct species**

Species where “*there is no reasonable doubt that the last member of the species has died*”, and listing is otherwise in accordance with the ministerial guidelines (section 24 of the BC Act).

Published as presumed extinct under schedule 4 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018* for extinct fauna or the *Wildlife Conservation (Rare Flora) Notice 2018* for extinct flora.

### **EW Extinct in the wild species**

Species that “*is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; and it has not been recorded in its known habitat or expected habitat, at appropriate seasons, anywhere in its past range, despite surveys over a time frame appropriate to its life cycle and form*”, and listing is otherwise in accordance with the ministerial guidelines (section 25 of the BC Act).

Currently there are no threatened fauna or threatened flora species listed as extinct in the wild. If listing of a species as extinct in the wild occurs, then a schedule will be added to the applicable notice.

## **Specially protected species**

Listed by order of the Minister as specially protected under section 13(1) of the BC Act. Meeting one or more of the following categories: species of special conservation interest; migratory species; cetaceans; species subject to international agreement; or species otherwise in need of special protection.

Species that are listed as threatened species (critically endangered, endangered or vulnerable) or extinct species under the BC Act cannot also be listed as Specially Protected species.

### **MI Migratory species**

Fauna that periodically or occasionally visit Australia or an external Territory or the exclusive economic zone; or the species is subject of an international agreement that relates to the protection of migratory species and that binds the Commonwealth; and listing is otherwise in accordance with the ministerial guidelines (section 15 of the BC Act).

Includes birds that are subject to an agreement between the government of Australia and the governments of Japan (JAMBA), China (CAMBA) and The Republic of Korea (ROKAMBA), and fauna subject to the *Convention on the Conservation of Migratory Species of Wild Animals* (Bonn Convention), an environmental treaty under the United Nations Environment Program. Migratory species listed under the BC Act are a subset of the migratory animals, that are known to visit Western Australia, protected under the international agreements or treaties, excluding species that are listed as Threatened species.

Published as migratory birds protected under an international agreement under schedule 5 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018*.

### **CD Species of special conservation interest (conservation dependent fauna)**

Fauna of special conservation need being species dependent on ongoing conservation intervention to prevent it becoming eligible for listing as threatened, and listing is otherwise in accordance with the ministerial guidelines (section 14 of the BC Act).

Published as conservation dependent fauna under schedule 6 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018*.

### **OS Other specially protected species**

Fauna otherwise in need of special protection to ensure their conservation, and listing is otherwise in accordance with the ministerial guidelines (section 18 of the BC Act).

Published as other specially protected fauna under schedule 7 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018*.

**P Priority species**

Possibly threatened species that do not meet survey criteria, or are otherwise data deficient, are added to the Priority Fauna or Priority Flora Lists under Priorities 1, 2 or 3. These three categories are ranked in order of priority for survey and evaluation of conservation status so that consideration can be given to their declaration as threatened fauna or flora.

Species that are adequately known, are rare but not threatened, or meet criteria for near threatened, or that have been recently removed from the threatened species or other specially protected fauna lists for other than taxonomic reasons, are placed in Priority 4. These species require regular monitoring.

Assessment of Priority codes is based on the Western Australian distribution of the species, unless the distribution in WA is part of a contiguous population extending into adjacent States, as defined by the known spread of locations.

**1 Priority 1: Poorly-known species**

Species that are known from one or a few locations (generally five or less) which are potentially at risk. All occurrences are either: very small; or on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, road and rail reserves, gravel reserves and active mineral leases; or otherwise under threat of habitat destruction or degradation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes. Such species are in urgent need of further survey.

**2 Priority 2: Poorly-known species**

Species that are known from one or a few locations (generally five or less), some of which are on lands managed primarily for nature conservation, e.g. national parks, conservation parks, nature reserves and other lands with secure tenure being managed for conservation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes. Such species are in urgent need of further survey.

**3 Priority 3: Poorly-known species**

Species that are known from several locations, and the species does not appear to be under imminent threat, or from few but widespread locations with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Species may be included if they are comparatively well known from several locations but do not meet adequacy of survey requirements and known threatening processes exist that could affect them. Such species are in need of further survey.

**4 Priority 4: Rare, Near Threatened and other species in need of monitoring**

(a) Rare. Species that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection but could be if present circumstances change. These species are usually represented on conservation lands.

(b) Near Threatened. Species that are considered to have been adequately surveyed and that are close to qualifying for vulnerable but are not listed as Conservation Dependent.

(c) Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.

<sup>1</sup> The definition of flora includes algae, fungi and lichens

<sup>2</sup> Species includes all taxa (plural of taxon - a classificatory group of any taxonomic rank, e.g. a family, genus, species or any infraspecific category i.e. subspecies or variety, or a distinct population).



## Appendix B Vegetation classification and condition scales

**Table B.1: Vegetation Classification System Specht (1970) as modified by Aplin (1979).**

Stratum	70-100% cover	30-70% cover	10-30% cover	2-10% cover	<2% cover
<b>Trees &gt; 30 m</b>	Tall closed forest	Tall open Forest	Tall woodland	Tall open woodland	Scattered tall trees
<b>Trees 10-30 m</b>	Closed forest	Open forest	Woodland	Open woodland	Scattered trees
<b>Trees &lt; 10 m</b>	Low closed forest	Low open forest	Low woodland	Low open woodland	Scattered low trees
<b>Shrubs &gt; 2 m</b>	Tall closed scrub	Tall open scrub	Tall shrubland	Tall open shrubland	Scattered tall shrubs
<b>Shrubs 1-2 m</b>	Closed heath	Open heath	Shrubland	Open shrubland	Scattered shrubs
<b>Shrubs &lt; 1 m</b>	Low closed heath	Low open heath	Low shrubland	Low open shrubland	Scattered low shrubs
<b>Hummock grasses</b>	Closed hummock grassland	Hummock grassland	Open hummock grassland	Very open hummock grassland	Scattered hummock grasses
<b>Grasses, sedges, herbs</b>	Closed tussock grassland/ sedgeland/ herbland	Tussock grassland/ sedgeland/ herbland	Open tussock grassland/ sedgeland/ herbland	Very open tussock grassland/ sedgeland/ herbland	Scattered tussock grasses /sedges/herbs

**Table B.2: Vegetation condition scale as adapted from Trudgen (1988) (EPA 2016a).**

Condition	Description
<b>Excellent</b>	Pristine or nearly so, no obvious signs of damage caused by human activities since European settlement.
<b>Very Good</b>	Some relatively slight signs of damage caused by human activities since European settlement. For example, some signs of damage to tree trunks caused by repeated fire, the presence of some relatively non-aggressive weeds, or occasional vehicle tracks.
<b>Good</b>	More obvious signs of damage caused by human activity since European settlement, including some obvious impact on the vegetation structure such as that caused by low levels of grazing or slightly aggressive weeds.
<b>Poor</b>	Still retains basic vegetation structure or ability to regenerate it after very obvious impacts of human activities since European settlement, such as grazing, partial clearing, frequent fires or aggressive weeds.
<b>Degraded</b>	Severely impacted by grazing, very frequent fires, clearing or a combination of these activities. Scope for some regeneration but not to a state approaching good condition without intensive management. Usually with a number of weed species present including very aggressive species.
<b>Completely Degraded</b>	Areas that are completely or almost completely without native species in the structure of their vegetation; i.e. areas that are cleared or 'parkland cleared' with their flora comprising weed or crop species with isolated native trees or shrubs.

# Appendix C Flora and fauna species recorded

**Table C.1: Flora Species recorded during the Field Survey**

Family	Species	Annual	Perennial	Conservation Code	Weed Species
<b>Amaranthaceae</b>	<i>*Aerva javanica</i>		+		*
	<i>Ptilotus astrolasius</i>		+		
	<i>Ptilotus calostachyus</i>		+		
	<i>Ptilotus polystachys</i>	+			
<b>Aizoaceae</b>	<i>Trianthema pilosa</i>	+			
<b>Apocynaceae</b>	<i>Carissa lanceolata</i>		+		
<b>Asteraceae</b>	<i>Pluchea tetranthera</i>		+		
	<i>Streptoglossa cylindriceps</i>	+		Range extension	
<b>Bignoniaceae</b>	<i>Dolichandrone occidentalis</i>		+		
<b>Boraginaceae</b>	<i>Heliotropium muticum</i>		+		
	<i>Trichodesma zeylanicum</i>		+		
<b>Chenopodiaceae</b>	<i>Rhagodia eremaea</i>		+		
<b>Convolvulaceae</b>	<i>Bonamia alatisemina</i>		+		
	<i>Bonamia linearis</i>		+		
	<i>Bonamia rosea</i>		+		
	<i>Distimake davenportii</i>		+	Disjunct and Range extension	
	<i>Evolvulus alsinoides</i>	+			
<b>Cucurbitaceae</b>	<i>Cucumis maderaspatanus</i>	+			
<b>Euphorbiaceae</b>	<i>Euphorbia tannensis</i> subsp. <i>eremophila</i>	+			
<b>Fabaceae</b>	<i>Acacia coleii</i>		+		
	<i>Acacia ligulata</i>		+	Northernmost end of its range	
	<i>Acacia stellaticeps</i>		+		
	<i>Acacia tumida</i>		+		
	<i>Crotalaria ramosissima</i>		+		
	<i>Desmodium filiforme</i>	+			
	<i>Rhynchosia minima</i>		+		
	<i>Senna notabilis</i>	+			
<b>Goodeniaceae</b>	<i>Dampiera candicans</i>		+	Not previously recorded in area	
	<i>Goodenia microptera</i>		+		
<b>Gyrostemonaceae</b>	<i>Codonocarpus cotinifolius</i>		+		
<b>Lamiaceae</b>	<i>Clerodendrum tomentosum</i> var. <i>lanceolatum</i>		+		

Family	Species	Annual	Perennial	Conservation Code	Weed Species
<b>Lauraceae</b>	<i>Cassytha capillaris</i>		+		
<b>Malvaceae</b>	<i>Corchorus incanus</i> subsp <i>incanus</i>		+		
	<i>Gossypium australe</i>		+		
	<i>Seringia nephrosperma</i>		+		
	<i>Sida</i> sp Pilbara (AA Mitchell PRP1543)		+		
	<i>Triumfetta ramosa</i>		+		
<b>Meliaceae</b>	<i>Owenia reticulata</i>		+		
<b>Myrtaceae</b>	<i>Corymbia flavescens</i>		+		
	<i>Melaleuca lasiandra</i>		+		
<b>Poaceae</b>	<i>Aristida</i> sp. 1 (medium) (dormant)		+		
	<i>Aristida</i> sp 2 (tall) (dormant)		+		
	* <i>Cenchrus ciliaris</i>		+		*
	* <i>Cenchrus setiger</i>		+		*
	<i>Eriachne aristidea</i>	+			
	<i>Eragrostis eriopoda</i>		+		
	<i>Triodia epactia</i>		+		
	<i>Triodia schinzii</i>		+		
<b>Proteaceae</b>	<i>Hakea lorea</i> subsp. <i>lorea</i>		+		
<b>Sapindaceae</b>	<i>Atalaya hemiglauca</i>		+		
<b>Solanaceae</b>	<i>Solanum phlomoides</i>		+		
<b>Thynekaeaceae</b>	<i>Pimelea ammocharis</i>		+		

# Appendix D Naturemap and PMST database results

# NatureMap Species Report

Created By Greg Harewood on 23/11/2020

Kingdom Animalia  
Current Names Only Yes  
Core Datasets Only Yes  
Method 'By Circle'  
Centre 118° 49' 54" E, 20° 22' 07" S  
Buffer 20km  
Group By Conservation Status

Conservation Status	Species	Records
Non-conservation taxon	237	1541
Priority 3	1	2
Priority 4	4	36
Protected under international agreement	34	431
Rare or likely to become extinct	10	918
<b>TOTAL</b>	<b>286</b>	<b>2928</b>

Name ID	Species Name	Naturalised	Conservation Code	<sup>1</sup> Endemic To Query Area
<b>Rare or likely to become extinct</b>				
1.	24784 <i>Calidris ferruginea</i> (Curlew Sandpiper)		T	
2.	24790 <i>Calidris tenuirostris</i> (Great Knot)		T	
3.	25575 <i>Charadrius leschenaultii</i> (Greater Sand Plover)		T	
4.	25576 <i>Charadrius mongolus</i> (Lesser Sand Plover)		T	
5.	24093 <i>Dasyurus hallucatus</i> (Northern Quoll)		T	
6.	24473 <i>Falco hypoleucos</i> (Grey Falcon)		T	
7.	24796 <i>Limosa lapponica</i> subsp. <i>menzbieri</i> (Bar-tailed Godwit (northern Siberian))		T	
8.	24180 <i>Macroderma gigas</i> (Ghost Bat)		T	
9.	25344 <i>Natator depressus</i> (Flatback Turtle)		T	
10.	24798 <i>Numenius madagascariensis</i> (Eastern Curlew)		T	
<b>Protected under international agreement</b>				
11.	41323 <i>Actitis hypoleucos</i> (Common Sandpiper)		IA	
12.	25736 <i>Arenaria interpres</i> (Ruddy Turnstone)		IA	
13.	24779 <i>Calidris acuminata</i> (Sharp-tailed Sandpiper)		IA	
14.	24780 <i>Calidris alba</i> (Sanderling)		IA	
15.	25738 <i>Calidris canutus</i> (Red Knot, knot)		IA	
16.	24786 <i>Calidris melanotos</i> (Pectoral Sandpiper)		IA	
17.	24788 <i>Calidris ruficollis</i> (Red-necked Stint)		IA	
18.	24789 <i>Calidris subminuta</i> (Long-toed Stint)		IA	
19.	24378 <i>Charadrius veredus</i> (Oriental Plover)		IA	
20.	41332 <i>Chlidonias leucopterus</i> (White-winged Black Tern, white-winged tern)		IA	
21.	24478 <i>Fregata ariel</i> (Lesser Frigatebird)		IA	
22.	47954 <i>Gelochelidon nilotica</i> (Gull-billed Tern)		IA	
23.	24481 <i>Glaucous alba</i> (Oriental Pratincole)		IA	
24.	25630 <i>Hirundo rustica</i> (Barn Swallow)		IA	
25.	48587 <i>Hydroprogne caspia</i> (Caspian Tern)		IA	
26.	25739 <i>Limicola falcinellus</i> (Broad-billed Sandpiper)		IA	
27.	24795 <i>Limnodromus semipalmatus</i> (Asian Dowitcher)		IA	
28.	30932 <i>Limosa lapponica</i> (Bar-tailed Godwit)		IA	
29.	25741 <i>Limosa limosa</i> (Black-tailed Godwit)		IA	
30.	24799 <i>Numenius minutus</i> (Little Curlew, Little Whimbrel)		IA	
31.	25742 <i>Numenius phaeopus</i> (Whimbrel)		IA	
32.	48591 <i>Pandion cristatus</i> (Osprey, Eastern Osprey)		IA	
33.	24801 <i>Phalaropus lobatus</i> (Red-necked Phalarope)		IA	
34.	24802 <i>Philomachus pugnax</i> (Ruff, reeve)		IA	
35.	24843 <i>Plegadis falcinellus</i> (Glossy Ibis)		IA	
36.	24382 <i>Pluvialis fulva</i> (Pacific Golden Plover)		IA	
37.	24383 <i>Pluvialis squatarola</i> (Grey Plover)		IA	
38.	25642 <i>Sterna hirundo</i> (Common Tern)		IA	
39.	48593 <i>Sternula albifrons</i> (Little Tern)		IA	

Name ID	Species Name	Naturalised	Conservation Code	<sup>1</sup> Endemic To Query Area
40.	48597 <i>Thalasseus bergii</i> (Crested Tern)		IA	
41.	24806 <i>Tringa glareola</i> (Wood Sandpiper)		IA	
42.	24808 <i>Tringa nebularia</i> (Common Greenshank, greenshank)		IA	
43.	24809 <i>Tringa stagnatilis</i> (Marsh Sandpiper, little greenshank)		IA	
44.	41351 <i>Xenus cinereus</i> (Terek Sandpiper)		IA	
<b>Priority 3</b>				
45.	25024 <i>Ctenotus angusticeps</i> (Airlie Island Ctenotus, Northwestern coastal Ctenotus)		P3	
<b>Priority 4</b>				
46.	30903 <i>Dasyercus blythi</i> (Brush-tailed Mulgara, Ampurta)		P4	
47.	48395 <i>Dasyercus</i> sp. (mulgara)		P4	
48.	24233 <i>Pseudomys chapmani</i> (Western Pebble-mound Mouse, Ngadji)		P4	
49.	24803 <i>Tringa brevipes</i> (Grey-tailed Tattler)		P4	
<b>Non-conservation taxon</b>				
50.	<i>Acanthophis</i> GT NOTHERN species			Y
51.	25243 <i>Acanthophis pyrrhus</i> (Desert Death Adder)			
52.	<i>Acariformes</i> sp.			
53.	25536 <i>Accipiter fasciatus</i> (Brown Goshawk)			
54.	30833 <i>Amphibolurus longirostris</i> (Long-nosed Dragon)			
55.	<i>Aname ellenae</i>			
56.	24312 <i>Anas gracilis</i> (Grey Teal)			
57.	24316 <i>Anas superciliosa</i> (Pacific Black Duck)			
58.	47414 <i>Anhinga novaehollandiae</i> (Australasian Darter)			
59.	25318 <i>Antaresia perthensis</i> (Pygmy Python)			
60.	25670 <i>Anthus australis</i> (Australian Pipit)			
61.	24285 <i>Aquila audax</i> (Wedge-tailed Eagle)			
62.	25559 <i>Ardea intermedia</i> (Intermediate Egret)			
63.	41324 <i>Ardea modesta</i> (great egret, white egret)			
64.	24340 <i>Ardea novaehollandiae</i> (White-faced Heron)			
65.	24341 <i>Ardea pacifica</i> (White-necked Heron)			
66.	24610 <i>Ardeotis australis</i> (Australian Bustard)			
67.	<i>Areacandona 'iuno'</i> (PSS)			
68.	<i>Areacandona 'jessicae'</i> (PSS)			
69.	25566 <i>Artamus cinereus</i> (Black-faced Woodswallow)			
70.	25567 <i>Artamus leucorhynchus</i> (White-breasted Woodswallow)			
71.	24354 <i>Artamus leucorhynchus</i> subsp. <i>leucopygialis</i> (White-breasted Woodswallow)			
72.	<i>Arthrorhabdus paucispinus</i>			
73.	<i>Australobolbus pseudobscurus</i>			
74.	<i>Blackburnium neocavicolle</i>			
75.	<i>Bolboleaus truncatus</i>			
76.	24251 <i>Bos taurus</i> (European Cattle)	Y		
77.	24359 <i>Burhinus grallarius</i> (Bush Stone-curlew)			
78.	47897 <i>Butorides striata</i> (Striated Heron, Mangrove Heron)			
79.	25715 <i>Cacatua roseicapilla</i> (Galah)			
80.	25716 <i>Cacatua sanguinea</i> (Little Corella)			
81.	<i>Carenum pulchrum</i>			
82.	<i>Carenum venustum</i>			
83.	25017 <i>Carlia triacantha</i> (Desert Rainbow Skink)			
84.	<i>Cavisternum clavatum</i>			
85.	25600 <i>Centropus phasianinus</i> (Pheasant Coucal)			
86.	24186 <i>Chalinolobus gouldii</i> (Gould's Wattled Bat)			
87.	24377 <i>Charadrius ruficapillus</i> (Red-capped Plover)			
88.	<i>Chilibathynella</i> sp.			
89.	<i>Chlaenius australis</i>			
90.	<i>Chroicocephalus novaehollandiae</i>			
91.	24431 <i>Chrysococcyx basalis</i> (Horsfield's Bronze Cuckoo)			
92.	24288 <i>Circus approximans</i> (Swamp Harrier)			
93.	24289 <i>Circus assimilis</i> (Spotted Harrier)			
94.	24774 <i>Cladorhynchus leucocephalus</i> (Banded Stilt)			
95.	24399 <i>Columba livia</i> (Domestic Pigeon)	Y		
96.	25568 <i>Coracina novaehollandiae</i> (Black-faced Cuckoo-shrike)			
97.	25592 <i>Corvus coronoides</i> (Australian Raven)			
98.	25593 <i>Corvus orru</i> (Torresian Crow)			
99.	25701 <i>Coturnix ypsilophora</i> (Brown Quail)			
100.	24420 <i>Cracticus nigrogularis</i> (Pied Butcherbird)			
101.	25458 <i>Ctenophorus caudicinctus</i> (Ring-tailed Dragon)			
102.	24865 <i>Ctenophorus caudicinctus</i> subsp. <i>caudicinctus</i> (Ring-tailed Dragon)			
103.	25459 <i>Ctenophorus isolepis</i> (Crested Dragon, Military Dragon)			
104.	24876 <i>Ctenophorus isolepis</i> subsp. <i>isolepis</i> (Crested Dragon, Military Dragon)			
105.	24882 <i>Ctenophorus nuchalis</i> (Central Netted Dragon)			

Name ID	Species Name	Naturalised	Conservation Code	<sup>1</sup> Endemic To Query Area
106.	25036 <i>Ctenotus duricola</i>			
107.	25462 <i>Ctenotus grandis</i>			
108.	25043 <i>Ctenotus grandis</i> subsp. <i>titan</i>			
109.	25045 <i>Ctenotus helenae</i>			
110.	25463 <i>Ctenotus pantherinus</i> (Leopard Ctenotus)			
111.	25064 <i>Ctenotus pantherinus</i> subsp. <i>ocellifer</i> (Leopard Ctenotus)			
112.	25073 <i>Ctenotus saxatilis</i> (Rock Ctenotus)			
113.	25077 <i>Ctenotus serventyi</i>			
114.	24322 <i>Cygnus atratus</i> (Black Swan)			
115.	24091 <i>Dasykaluta rosamondae</i> (Little Red Kaluta)			
116.	25000 <i>Delma haroldi</i>			
117.	25002 <i>Delma pax</i>			
118.	25004 <i>Delma tincta</i>			
119.	<i>Diacyclops cockingi</i>			
120.	<i>Diacyclops humphreysi humphreysi</i>			
121.	<i>Diacyclops scanloni</i>			
122.	<i>Diacyclops sobeprolatus</i>			
123.	24926 <i>Diplodactylus conspicillatus</i> (Fat-tailed Gecko)			
124.	24899 <i>Diporiphora valens</i> (Southern Pilbara Tree Dragon)			
125.	42402 <i>Diporiphora vescus</i> (Northern Pilbara Tree Dragon)			
126.	24470 <i>Dromaius novaehollandiae</i> (Emu)			
127.	25092 <i>Egernia depressa</i> (Southern Pygmy Spiny-tailed Skink)			
128.	<i>Egretta garzetta</i>			
129.	<i>Egretta novaehollandiae</i>			
130.	<i>Elanus axillaris</i>			
131.	25540 <i>Elanus caeruleus</i> (Black-shouldered Kite)			
132.	24290 <i>Elanus caeruleus</i> subsp. <i>axillaris</i> (Australian Black-shouldered Kite)			
133.	<i>Elaphoidella humphreysi</i>			
134.	47937 <i>Elseyornis melanops</i> (Black-fronted Dotterel)			
135.	24631 <i>Emblema pictum</i> (Painted Finch)			
136.	<i>Eolophus roseicapillus</i>			
137.	24653 <i>Eopsaltria pulverulenta</i> (Mangrove Robin)			
138.	25578 <i>Ephippiorhynchus asiaticus</i> (Black-necked Stork)			
139.	24568 <i>Epthianura aurifrons</i> (Orange Chat)			
140.	24570 <i>Epthianura tricolor</i> (Crimson Chat)			
141.	43381 <i>Eremiascincus pallidus</i> (Western Narrow-banded Skink, Narrow-banded Sand Swimmer)			
142.	24379 <i>Erythronyctis cinctus</i> (Red-kneed Dotterel)			
143.	47938 <i>Esacus magnirostris</i> (Beach Stone-curlew, Beach Thick-knee)			
144.	<i>Ethmostigmus curtipes</i>			
145.	24368 <i>Eurostopodus argus</i> (Spotted Nightjar)			
146.	<i>Euryscaphus waterhousei</i>			
147.	25621 <i>Falco berigora</i> (Brown Falcon)			
148.	24471 <i>Falco berigora</i> subsp. <i>berigora</i> (Brown Falcon)			
149.	25622 <i>Falco cenchroides</i> (Australian Kestrel, Nankeen Kestrel)			
150.	24472 <i>Falco cenchroides</i> subsp. <i>cenchrus</i> (Australian Kestrel, Nankeen Kestrel)			
151.	25623 <i>Falco longipennis</i> (Australian Hobby)			
152.	24041 <i>Felis catus</i> (Cat)	Y		
153.	25727 <i>Fulica atra</i> (Eurasian Coot)			
154.	42314 <i>Gavicalis virescens</i> (Singing Honeyeater)			
155.	24956 <i>Gehyra pilbara</i>			
156.	24958 <i>Gehyra punctata</i>			
157.	24957 <i>Gehyra purpurascens</i>			
158.	24959 <i>Gehyra variegata</i>			
159.	24401 <i>Geopelia cuneata</i> (Diamond Dove)			
160.	24402 <i>Geopelia humeralis</i> (Bar-shouldered Dove)			
161.	25585 <i>Geopelia striata</i> (Zebra Dove)			
162.	24404 <i>Geophaps plumifera</i> (Spinifex Pigeon)			
163.	24276 <i>Gerygone tenebrosa</i> (Dusky Gerygone)			
164.	24443 <i>Grallina cyanoleuca</i> (Magpie-lark)			
165.	24484 <i>Grus rubicunda</i> (Brolga)			
166.	25627 <i>Haematopus fuliginosus</i> (Sooty Oystercatcher)			
167.	24487 <i>Haematopus longirostris</i> (Pied Oystercatcher)			
168.	24293 <i>Haliaeetus leucogaster</i> (White-bellied Sea-Eagle)			
169.	25541 <i>Haliastur indus</i> (Brahminy Kite)			
170.	24295 <i>Haliastur spheonurus</i> (Whistling Kite)			
171.	<i>Halicyclops (Rochacyclops) calm</i>			
172.	24961 <i>Heteronotia binoei</i> (Bynoe's Gecko)			
173.	24962 <i>Heteronotia spelea</i> (Desert Cave Gecko, Pilbara Cave Gecko)			
174.	47965 <i>Hieraaetus morphnoides</i> (Little Eagle)			

Name ID	Species Name	Naturalised	Conservation Code	<sup>1</sup> Endemic To Query Area
175.	25734 <i>Himantopus himantopus</i> (Black-winged Stilt)			
176.	24491 <i>Hirundo neoxena</i> (Welcome Swallow)			
177.	24367 <i>Lalage tricolor</i> (White-winged Triller)			
178.	<i>Lampona ampeinna</i>			
179.	<i>Lamponina scutata</i>			
180.	25125 <i>Lerista bipes</i>			
181.	30928 <i>Lerista clara</i>			
182.	25005 <i>Lialis burtonis</i>			
183.	25661 <i>Lichmera indistincta</i> (Brown Honeyeater)			
184.	30933 <i>Lucasium stenodactylum</i>			
185.	<i>Lycidas</i> sp. 1			
186.	25489 <i>Macropus robustus</i> (Euro, Biggada)			
187.	24135 <i>Macropus robustus</i> subsp. <i>erubescens</i> (Euro, Biggada)			
188.	24136 <i>Macropus rufus</i> (Red Kangaroo, Marlu)			
189.	25651 <i>Malurus lamberti</i> (Variegated Fairy-wren)			
190.	25652 <i>Malurus leucopterus</i> (White-winged Fairy-wren)			
191.	24583 <i>Manorina flavigula</i> (Yellow-throated Miner)			
192.	<i>Masasteron tealei</i>			
193.	<i>Melitidae</i> sp.			
194.	24736 <i>Melopsittacus undulatus</i> (Budgerigar)			
195.	25184 <i>Menetia greyii</i>			
196.	24598 <i>Merops ornatus</i> (Rainbow Bee-eater)			
197.	<i>Microcarbo melanoleucos</i>			
198.	25542 <i>Milvus migrans</i> (Black Kite)			
199.	<i>Minasteron minusculum</i>			
200.	25545 <i>Mirafa javanica</i> (Horsfield's Bushlark, Singing Bushlark)			
201.	<i>Monopylephorus</i> n. sp. WA29 (ex <i>Pristina</i> WA3) (PSS)			
202.	25495 <i>Morethia ruficauda</i>			
203.	25193 <i>Morethia ruficauda</i> subsp. <i>exquisita</i>			
204.	<i>Mormopterus</i> ( <i>Ozimops</i> ) <i>cobourgianus</i>			
205.	<i>Naididae</i> (ex <i>Tubificidae</i> )			
206.	<i>Nedsia</i> nr <i>hurlberti</i>			
207.	<i>Nedsia</i> sp.			
208.	<i>Nematoda</i> sp.			
209.	24969 <i>Nephurus levis</i> subsp. <i>pilbarensis</i>			
210.	No invertebrates			
211.	25430 <i>Notaden nicholsi</i> (Desert Spadefoot)			
212.	24224 <i>Notomys alexis</i> ( <i>Spinifex</i> Hopping-mouse)			
213.	25564 <i>Nycticorax caledonicus</i> (Rufous Night Heron)			
214.	24742 <i>Nymphicus hollandicus</i> (Cockatiel)			
215.	24407 <i>Ocyphaps lophotes</i> (Crested Pigeon)			
216.	<i>Onthophagus margaretensis</i>			
217.	24618 <i>Oreoica gutturalis</i> (Crested Bellbird)			
218.	<i>Ostracoda</i> (unident.)			
219.	24620 <i>Pachycephala lanioides</i> (White-breasted Whistler)			
220.	25678 <i>Pachycephala melanura</i> (Mangrove Golden Whistler)			
221.	25680 <i>Pachycephala rufiventris</i> (Rufous Whistler)			
222.	<i>Parastenocaris jane</i>			
223.	24627 <i>Pardalotus rubricatus</i> (Red-browed Pardalote)			
224.	24648 <i>Pelecanus conspicillatus</i> (Australian Pelican)			
225.	48060 <i>Petrochelidon ariel</i> (Fairy Martin)			
226.	48061 <i>Petrochelidon nigricans</i> (Tree Martin)			
227.	24144 <i>Petrogale rothschildi</i> (Rothschild's Rock-wallaby)			
228.	25697 <i>Phalacrocorax carbo</i> (Great Cormorant)			
229.	24667 <i>Phalacrocorax sulcirostris</i> (Little Black Cormorant)			
230.	25699 <i>Phalacrocorax varius</i> (Pied Cormorant)			
231.	<i>Phorticosomus gularis</i>			
232.	<i>Phreodrilid</i> with dissimilar ventral chaetae			
233.	<i>Phreodrilid</i> with similar ventral chaetae			
234.	<i>Pilbarascutigera incola</i>			
235.	24842 <i>Platalea regia</i> (Royal Spoonbill)			
236.	42306 <i>Platyplectrum spenceri</i> (Centralian Burrowing Frog)			
237.	25510 <i>Pogona minor</i> (Dwarf Bearded Dragon)			
238.	24908 <i>Pogona minor</i> subsp. <i>mitchelli</i> (Dwarf Bearded Dragon)			
239.	24681 <i>Poliocephalus poliocephalus</i> (Hoary-headed Grebe)			
240.	25706 <i>Pomatostomus temporalis</i> (Grey-crowned Babbler)			
241.	25199 <i>Proablepharus reginae</i>			
242.	24106 <i>Pseudantechinus woolleyae</i> (Woolley's Pseudantechinus)			
243.	24235 <i>Pseudomys desertor</i> (Desert Mouse)			
244.	24237 <i>Pseudomys hermannsburgensis</i> (Sandy Inland Mouse)			



Name ID	Species Name	Naturalised	Conservation Code	<sup>1</sup> Endemic To Query Area
245.	25263 <i>Pseudonaja modesta</i> (Ringed Brown Snake)			
246.	<i>Ptilonorhynchus guttatus</i>			
247.	25724 <i>Ptilonorhynchus maculatus</i> (Spotted Bowerbird)			
248.	25009 <i>Pygopus nigriceps</i>			
249.	<i>Ramphotyphlops</i> GT NOTHERN species			Y
250.	24776 <i>Recurvirostra novaehollandiae</i> (Red-necked Avocet)			
251.	<i>Rendahlia jaubertensis</i>			
252.	25614 <i>Rhipidura leucophrys</i> (Willie Wagtail)			
253.	24457 <i>Rhipidura phasiana</i> (Mangrove Grey Fantail)			
254.	<i>Scolopendra laeta</i>			
255.	<i>Scolopendra morsitans</i>			
256.	24200 <i>Scotorepens greyii</i> (Little Broad-nosed Bat)			
257.	24120 <i>Sminthopsis youngsoni</i> (Lesser Hairy-footed Dunnart)			
258.	24482 <i>Stiltia isabella</i> (Australian Pratincole)			
259.	24927 <i>Strophurus elderi</i>			
260.	<i>Stygonitocrella trispinosa</i>			
261.	25307 <i>Suta punctata</i> (Spotted Snake)			
262.	25705 <i>Tachybaptus novaehollandiae</i> (Australasian Grebe, Black-throated Grebe)			
263.	24207 <i>Tachyglossus aculeatus</i> (Short-beaked Echidna)			
264.	30870 <i>Taeniopygia guttata</i> (Zebra Finch)			
265.	24175 <i>Taphozous georgianus</i> (Common Sheath-tailed Bat)			
266.	<i>Tesserodon novaehollandiae</i>			
267.	<i>Thalasseus bengalensis</i>			
268.	24845 <i>Threskiornis spinicollis</i> (Straw-necked Ibis)			
269.	25202 <i>Tiliqua multifasciata</i> (Central Blue-tongue)			
270.	42351 <i>Todiramphus pyrrhopygius</i> (Red-backed Kingfisher)			
271.	25549 <i>Todiramphus sanctus</i> (Sacred Kingfisher)			
272.	<i>Trichocyclus gnalooma</i>			
273.	24851 <i>Turnix velox</i> (Little Button-quail)			
274.	24852 <i>Tyto alba</i> subsp. <i>delicatula</i> (Barn Owl)			
275.	25439 <i>Uperoleia glandulosa</i> (Glandular Toadlet)			
276.	25209 <i>Varanus acanthurus</i> (Spiny-tailed Monitor)			
277.	25210 <i>Varanus brevicauda</i> (Short-tailed Pygmy Monitor)			
278.	25212 <i>Varanus eremius</i> (Pygmy Desert Monitor)			
279.	25216 <i>Varanus giganteus</i> (Perentie)			
280.	25218 <i>Varanus gouldii</i> (Bungarra or Sand Monitor)			
281.	25224 <i>Varanus pilbarensis</i> (Pilbara Rock Monitor, Northern Pilbara Rock Goanna)			
282.	24205 <i>Vespadelus finlaysoni</i> (Finlayson's Cave Bat)			
283.	24040 <i>Vulpes vulpes</i> (Red Fox)	Y		
284.	<i>Zebraplatys keyserlingi</i>			
285.	24857 <i>Zosterops luteus</i> (Yellow White-eye)			
286.	24248 <i>Zyomys argurus</i> (Common Rock-rat)			

**Conservation Codes**

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

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



# EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about [Environment Assessments](#) and the EPBC Act including significance guidelines, forms and application process details.

Report created: 23/11/20 14:02:55

[Summary](#)

[Details](#)

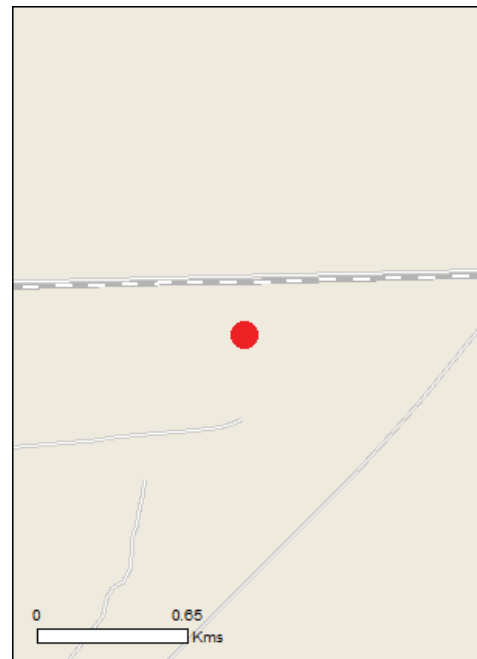
[Matters of NES](#)

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

[Extra Information](#)

[Caveat](#)

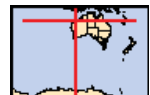
[Acknowledgements](#)



This map may contain data which are  
©Commonwealth of Australia  
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[Coordinates](#)

Buffer: 0.0Km



# Summary

## Matters of National Environmental Significance

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

<a href="#">World Heritage Properties:</a>	None
<a href="#">National Heritage Places:</a>	None
<a href="#">Wetlands of International Importance:</a>	None
<a href="#">Great Barrier Reef Marine Park:</a>	None
<a href="#">Commonwealth Marine Area:</a>	None
<a href="#">Listed Threatened Ecological Communities:</a>	None
<a href="#">Listed Threatened Species:</a>	11
<a href="#">Listed Migratory Species:</a>	14

## Other Matters Protected by the EPBC Act

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

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

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

<a href="#">Commonwealth Land:</a>	None
<a href="#">Commonwealth Heritage Places:</a>	None
<a href="#">Listed Marine Species:</a>	20
<a href="#">Whales and Other Cetaceans:</a>	None
<a href="#">Critical Habitats:</a>	None
<a href="#">Commonwealth Reserves Terrestrial:</a>	None
<a href="#">Australian Marine Parks:</a>	None

## Extra Information

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

<a href="#">State and Territory Reserves:</a>	None
<a href="#">Regional Forest Agreements:</a>	None
<a href="#">Invasive Species:</a>	11
<a href="#">Nationally Important Wetlands:</a>	None
<a href="#">Key Ecological Features (Marine)</a>	None

# Details

## Matters of National Environmental Significance

Listed Threatened Species		[ Resource Information ]
Name	Status	Type of Presence
<b>Birds</b>		
<a href="#">Calidris canutus</a> Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area
<a href="#">Calidris ferruginea</a> Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
<a href="#">Falco hypoleucos</a> Grey Falcon [929]	Vulnerable	Species or species habitat likely to occur within area
<a href="#">Numenius madagascariensis</a> Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
<a href="#">Pezoporus occidentalis</a> Night Parrot [59350]	Endangered	Species or species habitat may occur within area
<a href="#">Rostratula australis</a> Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area
<b>Mammals</b>		
<a href="#">Dasyurus hallucatus</a> Northern Quoll, Digul [Gogo-Yimidir], Wijingadda [Dambimangari], Wiminji [Martu] [331]	Endangered	Species or species habitat likely to occur within area
<a href="#">Macroderma gigas</a> Ghost Bat [174]	Vulnerable	Species or species habitat likely to occur within area
<a href="#">Macrotis lagotis</a> Greater Bilby [282]	Vulnerable	Species or species habitat likely to occur within area
<a href="#">Rhinonictes aurantia (Pilbara form)</a> Pilbara Leaf-nosed Bat [82790]	Vulnerable	Species or species habitat likely to occur within area
<b>Reptiles</b>		
<a href="#">Liasis olivaceus barroni</a> Olive Python (Pilbara subspecies) [66699]	Vulnerable	Species or species habitat may occur within area

Listed Migratory Species		[ Resource Information ]
Name	Threatened	Type of Presence
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.		

Name	Threatened	Type of Presence
<b>Migratory Marine Birds</b>		
<a href="#">Apus pacificus</a> Fork-tailed Swift [678]		Species or species habitat likely to occur within area
<b>Migratory Terrestrial Species</b>		
<a href="#">Hirundo rustica</a> Barn Swallow [662]		Species or species habitat likely to occur within area
<a href="#">Motacilla cinerea</a> Grey Wagtail [642]		Species or species habitat may occur within area
<a href="#">Motacilla flava</a> Yellow Wagtail [644]		Species or species habitat likely to occur within area
<b>Migratory Wetlands Species</b>		
<a href="#">Actitis hypoleucos</a> Common Sandpiper [59309]		Species or species habitat may occur within area
<a href="#">Calidris acuminata</a> Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
<a href="#">Calidris canutus</a> Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area
<a href="#">Calidris ferruginea</a> Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
<a href="#">Calidris melanotos</a> Pectoral Sandpiper [858]		Species or species habitat may occur within area
<a href="#">Charadrius veredus</a> Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area
<a href="#">Glareola maldivarum</a> Oriental Pratincole [840]		Species or species habitat may occur within area
<a href="#">Numenius madagascariensis</a> Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
<a href="#">Pandion haliaetus</a> Osprey [952]		Species or species habitat may occur within area
<a href="#">Tringa nebularia</a> Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area

## Other Matters Protected by the EPBC Act

Listed Marine Species		[ Resource Information ]
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.		
Name	Threatened	Type of Presence
<b>Birds</b>		
<a href="#">Actitis hypoleucos</a> Common Sandpiper [59309]		Species or species habitat may occur within area
<a href="#">Apus pacificus</a> Fork-tailed Swift [678]		Species or species habitat likely to occur within area
<a href="#">Ardea alba</a> Great Egret, White Egret [59541]		Species or species habitat likely to occur within area
<a href="#">Ardea ibis</a> Cattle Egret [59542]		Species or species habitat may occur within area
<a href="#">Calidris acuminata</a> Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
<a href="#">Calidris canutus</a> Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area
<a href="#">Calidris ferruginea</a> Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
<a href="#">Calidris melanotos</a> Pectoral Sandpiper [858]		Species or species habitat may occur within area
<a href="#">Charadrius veredus</a> Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area
<a href="#">Chrysococcyx osculans</a> Black-eared Cuckoo [705]		Species or species habitat may occur within area
<a href="#">Glareola maldivarum</a> Oriental Pratincole [840]		Species or species habitat may occur within area
<a href="#">Haliaeetus leucogaster</a> White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area
<a href="#">Hirundo rustica</a> Barn Swallow [662]		Species or species habitat likely to occur within area
<a href="#">Merops ornatus</a> Rainbow Bee-eater [670]		Species or species habitat may occur within area
<a href="#">Motacilla cinerea</a> Grey Wagtail [642]		Species or species habitat may occur within area
<a href="#">Motacilla flava</a> Yellow Wagtail [644]		Species or species habitat likely to occur

Name	Threatened	Type of Presence
<a href="#">Numenius madagascariensis</a> Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
<a href="#">Pandion haliaetus</a> Osprey [952]		Species or species habitat may occur within area
<a href="#">Rostratula benghalensis (sensu lato)</a> Painted Snipe [889]	Endangered*	Species or species habitat may occur within area
<a href="#">Tringa nebularia</a> Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area

## Extra Information

### Invasive Species [ Resource Information ]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resources Audit, 2001.

Name	Status	Type of Presence
<b>Birds</b>		
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Passer montanus Eurasian Tree Sparrow [406]		Species or species habitat likely to occur within area
<b>Mammals</b>		
Camelus dromedarius Dromedary, Camel [7]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Equus asinus Donkey, Ass [4]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Sus scrofa Pig [6]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species

Name	Status	Type of Presence
<b>Plants</b>		
Cenchrus ciliaris Buffel-grass, Black Buffel-grass [20213]		habitat likely to occur within area
Jatropha gossypifolia Cotton-leaved Physic-Nut, Bellyache Bush, Cotton-leaf Physic Nut, Cotton-leaf Jatropha, Black Physic Nut [7507]		Species or species habitat likely to occur within area
<b>Reptiles</b>		
Hemidactylus frenatus Asian House Gecko [1708]		Species or species habitat likely to occur within area



# Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

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

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

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

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

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

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

## Coordinates

-20.36874 118.83172

# Acknowledgements

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

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

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

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

# **APPENDIX D PRELIMINARY FLOOD ASSESSMENT**



*Junga Solar Farm – Preliminary Flood Assessment*

*Client: NGH Pty Ltd*

*Job number: J0100100*

*Date: 19 May 2021*

## Executive Summary

### Background and scope

NGH is completing environmental approvals for the proposed Junga Solar Farm at Jinparinya, 26 km east of Port Hedland. A 10 MW solar farm and associated infrastructure will be built on a 30 ha site.

The aim of this study is to characterise flood risk for the site and indicate potential impacts of the development on local flooding. The 5% and 1% annual exceedance probability (AEP) and the probable maximum flood (PMF) events were assessed using the available data.

### Review of site hydrology

The site is located across a low ridge in a broad plain grading from south to north. A number of diffuse, shallow flow paths draining relatively small but variably sized catchments occur in the vicinity of the site.

The largest defined streamline is Petermarer Creek, which lies 2.2 km to the west of the site. The Creek has a deep, well-defined channel but a moderate sized catchment compared to other creeks and rivers in the region. Larger creeks and rivers pass to the east and west, but these are too far away for their floodwater to impact the site.

There is some linear infrastructure near the site that could influence local flood characteristics. This includes the Goldsworthy railway, which passes just downstream of the site, and the Great Northern Highway, 2.5 km upstream of the site.

Roads and other infrastructure are likely too far away to influence flooding at the site. The ocean is too far downstream for storm surge to impact the site.

### Flood impact assessment

Modelling indicates that flooding is characterised by a main flow path west of the site, associated with Petermarer Creek, and another flow path to the east. The eastern flow path is associated with local drainage lines but also receives flow from a breakout from Petermarer Creek above the site. Flooding in catchments further to the east and west don't interact with the site.

The majority of the site sits across a low, south-north trending ridge. Flood water tends to encroach on the western and eastern ends of the site depending on the flood magnitude, but don't completely inundate the site, even for the PMF event. A narrow corridor extending to the east above the railway lines cuts across part of the eastern flow path.

Given the limited available data (particularly resolution of the topographic data and representation of the Goldsworthy railway embankment) these model results don't rule out inundation of the site nor define local flow paths or areas with elevated flow velocity that could interact with the site.

Infrastructure at the site will be mainly solar panels located on poles elevated above the ground. There should be minimal ground disturbance and the panels and poles won't impact on local runoff characteristics or drainage. Infrastructure that affects the ground surface, such as roads or raised pads, in areas predicted to be affected by flooding should be designed to account for flood impacts. This is particularly relevant for the narrow corridor extending into the eastern flow path.

### Recommendations for further work

It is recommended that design of site infrastructure accounts for uncertainty in these model results. This should include collecting accurate topographic data for the site and surrounds and quantifying the risk of localised flow, particularly related to the railway embankment, on site infrastructure.

Design and construction of infrastructure should account for interaction with floodwaters.

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## 1. Introduction

### 1.1 Background

NGH is completing environmental approvals for the proposed Junga Solar Farm. The site is located 26 km east of Port Hedland, near the Great Northern Highway and adjacent to and upstream of the BHP railway. Petermarer Creek, a large local drainage line, passes about 2 km west of the site.

A 10 MW solar farm and associated infrastructure will be built on a 30 ha site. Infrastructure at the site will involve limited ground disturbance and interaction with local drainage. The panels will be located on poles and will not affect local flow paths.

The aim of the study is to characterise flood risk for the site and indicate potential impacts of the development on local flooding. No detailed site topography is available for the site nor design information. It was assumed that the main flood risk for the site is from floodwaters in Petermarer Creek.

The project location is shown in Figure 1.




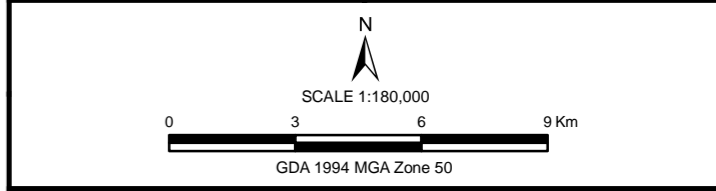


**Legend**

 Site Location

Data Sources:  
 250K Topography - Geoscience Australia  
 Site Location - NGH

Location		1:100 000 Map Sheet Location			
		North Turtle 2658	Poissonnier 2758		
Cossigny 2457	Thouin 2557	<b>Port Hedland 2657</b>	De Grey 2757	Pardoo 2857	
Sherlock 2456	Yule 2556	Wallarenya 2656	Carlindie 2756	Coongan 2856	



**Project: Junga Solar Farm – Preliminary Flood Assessment**  
 Job no: J0100100

**Figure 1**  
**Project Extent**

Additional Information

COMPILED: Gaia Resources	DATE: 18/05/2021	LOCN: PERTH	A3	SCALE: 1:180,000
GDA 1994 MGA Zone 50		PLAN No: GR604-15_Junga_Fig1.pdf		
DOCUMENT NAME: GR604-15_Junga_Fig1.mxd				

## 1.2 Scope of work

The scope of work was to:

- Undertake a preliminary flood assessment for the Junga solar farm site; and
- Identify potential impacts of the development on local flooding.

The deliverable is this report.

## 1.3 Summary of methods

The work was undertaken in the following stages:

- Source and review data;
- Characterise site hydrology;
- Flood impact assessment; and
- Reporting.

### Source and review data

The following data were used in the project:

- An indicative site location, supplied by NGH;
- Regional topographic data (SRTM DEM-H), supplied by Geoscience Australia;
- Aerial imagery for the alignment, supplied by ESRI; and
- Other data and reports, as referenced in this report.

The only topographic data available were regional topographic data. No site survey nor details of the railway embankment nor crossing of Petermarer Creek were available.

The regional topographic dataset was a one second SRTM digital elevation model, supplied by Geoscience Australia (GA 2011). This is a nation-wide ground surface model with a spatial resolution of approximately 30 m and a vertical accuracy of up to 7.6 m.

### Hydrology

Catchment hydrology for Petermarer Creek and other drainage lines near the site were derived using a regional flood estimation procedure – the Australian Rainfall and Runoff RFE tool (Ball *et al.*, 2016; RFFE 2016) with extrapolation to PMF.

Steady-state peak flow estimates were made for the 5% and 1% AEP events and the probable maximum flood (PMF).

### Flood impact assessment

A two dimensional hydraulic model (Mike 21FM, DHI 2020) was used to characterise flooding in the area of the site. The model was built using the available data. The SRTM topographic dataset was used in the model as-is. The nearby railway line and other features are not necessarily captured in this data.

Existing conditions were represented.

The model domain covered the area of the site, Petermarer Creek and other minor drainage lines near the site and extended upstream and downstream of the site to enable boundaries to be set.

Steady-state flows from the hydrology assessment were input to the Mike 21 FM model as upstream boundaries and point sources. An outflow boundary was located on the downstream

edge of the model domain to allow flows to exit the model, approximating normal flow conditions. The site is sufficiently elevated to not be impacted by storm surge from the ocean.

Peak flood extents were predicted for the same events (5% and 1% AEP events and the probable maximum flood PMF) as the hydrology assessment. The resulting flood extents were mapped for the design events.

## Reporting

This report is the deliverable for the project.

### 1.4 Limitations

#### General

This report has been prepared by Hydrologia Pty Ltd for the NGH Pty Ltd and may only be used and relied on by the NGH Pty Ltd for the purpose agreed between Hydrologia Pty Ltd and the NGH Pty Ltd as set out in Section 1.2 of this report.

Hydrologia Pty Ltd otherwise disclaims responsibility to any person other than the NGH Pty Ltd arising in connection with this report. Hydrologia Pty Ltd also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by Hydrologia Pty Ltd 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. Hydrologia Pty Ltd 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 Hydrologia Pty Ltd described in this report (refer Section 1.3 of this report). Hydrologia Pty Ltd disclaims liability arising from any of the assumptions being incorrect.

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

#### Model Results

Flood magnitude predictions have a probability of occurrence. For example, a predicted 1% (or 1 in 100) AEP flood extent has a 1% probability of occurring or being exceeded in any given year. A flood of this magnitude could occur more than once in a year.

Floods greater than 1% AEP can occur. During such floods, impacts from flooding could be greater than indicated in this study. Conversely properties within the study area can be affected by floods of a lesser magnitude.

Predicted flood level, depth and velocity is predicted based on the available data and on assumptions and limitations described in our report. These results should be read in conjunction with this report.

The Mike 21 FM model was applied using a flexible mesh (maximum element size 500 m<sup>2</sup>) interpolated from the SRTM data. Topographic and drainage features, such as swales, gutters, levees, roads, railway embankments, changes in land use or hydraulic roughness are not necessarily accurately represented in the model. Buildings or elevated flood levels at or in buildings are not represented in the original topographic data nor in the model. Underground pipework, culverts or other structures are not represented in the model.

Local increases in flood levels, depths and/or velocities from those predicted in this study can occur as a result of local factors. Using more accurate topography will also affect the predicted flood extent.

No account of the impact of climate change on the magnitude or frequency of occurrence of flood events has been considered. It is widely accepted in the scientific community that changing climate could affect rainfall and runoff in Australia, including in the project area. Accordingly, the probability of occurrence for predictions given in this study could change in the future.

Catchment delineation was undertaken using the available data (SRTM data) with no ground truthing. Catchment boundaries and streamlines may be affected by constructed drainage and ground surface different to that represented in the data. The accuracy and resolution of the data may also affect delineation.

## 2. Catchment hydrology

### 2.1 Introduction

This section presents a description of the hydrology of catchments and drainage lines near the site and presents the design flow estimates used in the model. The flood impact assessment is described in Section 3.

### 2.2 Catchments and drainage

The site is located across a low ridge in a broad plain grading from south to north. Catchment details are given in Table 1 and mapped in Figure 2.

A number of diffuse, shallow flow paths draining relatively small but variably sized catchments occur in the vicinity of the site (Catchments 1-2 and 4-9). Apart from Petermarer Creek, no incised drainage lines are evident from aerial imagery, suggesting shallow, slow moving flow occurs during rainfall events.

Petermarer Creek lies 2.2 km to the west of the site. The Creek has a deep, well-defined channel but a moderate sized catchment compared to other creeks and rivers in the region. The Goldsworthy railway and Great Northern Highway cross the creek on bridges.

There are a number of other large rivers and creeks in the area. These include Tabba Creek, 11 km to the east, Beebingarra Creek, 14 km west and the Turner River, 39 km west. These were considered to be too far away to influence flooding at the site.

The site lies adjacent to and just upstream of the Goldsworthy railway line. This has a raised embankment with limited cross drainage (as indicated by aerial imagery). It is likely that south-north drainage will be influenced by the embankment.

The Great Northern Highway passes on an east-west alignment 2.5 km south of the site, cutting across a number of catchments and flow paths that drain past the site. The Highway is formed on a low embankment that may likewise influence local drainage.

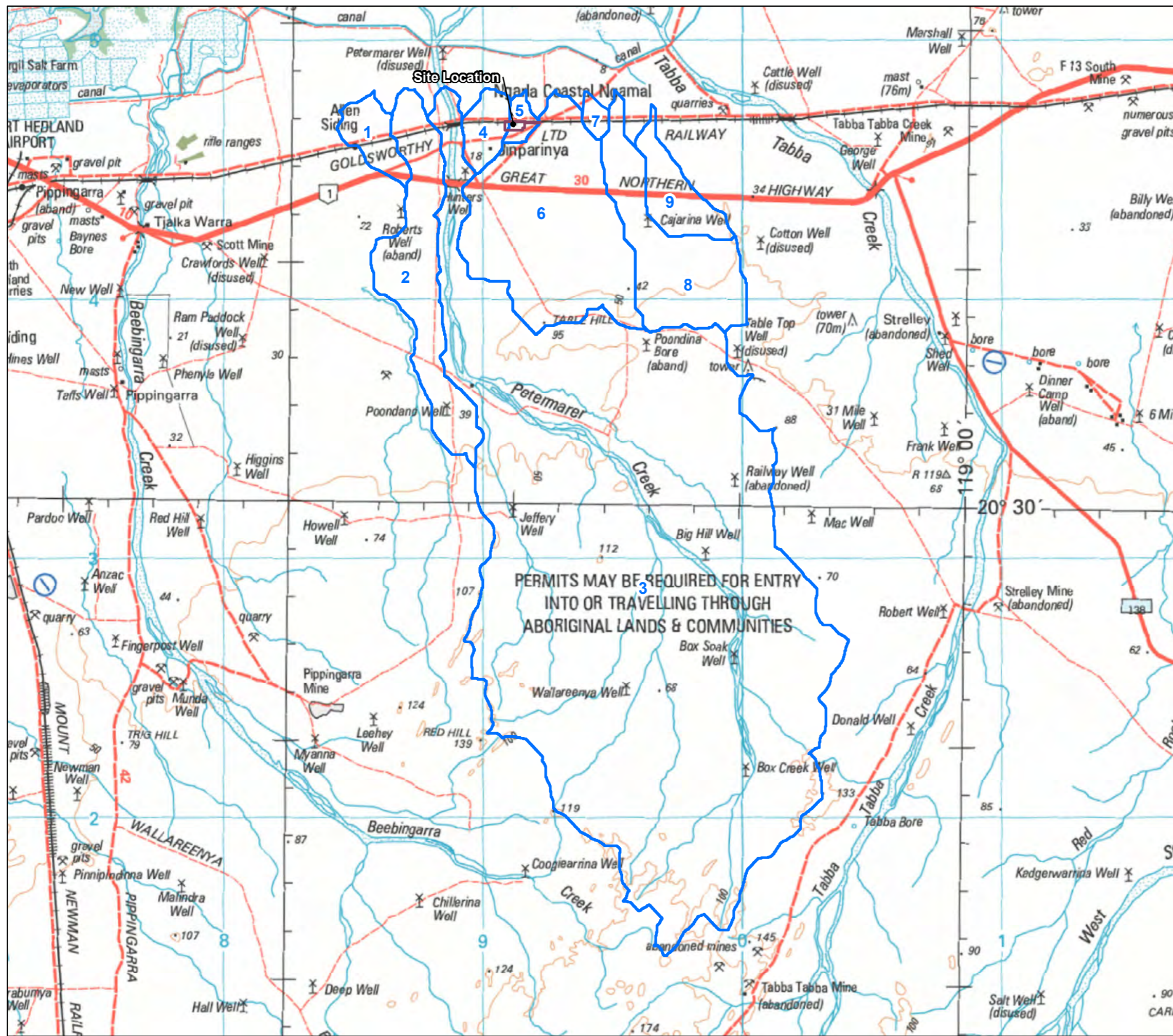
There are a number of smaller roads and tracks in the area. These are likely to be constructed at ground level, possibly with low banks alongside constructed as part of road formation and maintenance. These roads are not likely to substantially alter overland flow paths.

A canal lies 2.8 km to the north of the site. This is an earthen structure with banks that would intercept and divert overland flow. A number of openings in the channel allow overland flow to cross to the north. An opening is left at Petermarer Creek. The canal is probably too far downstream to affect flood conditions at the site.

The ocean is 10 km north of the site. Local drainage lines and flow paths terminate at the ocean. The main potential influence of the ocean on the site is from storm surge. Storm surge studies for Port Hedland (Cardno 2011) suggest a peak storm surge level in the order of 5-6 m AHD. This is well below ground level at the site, which is in the range of 17 to 19 m ADH (as indicated by the SRTM topographic data). Accordingly, storm surge is not likely to influence flooding at the site.

*Table 1 Catchments*

Catchment name	Catchment Number	Area (km <sup>2</sup> )	Comment
Drainage line	1	5.0	Minor overland flow pathway.
Drainage line	2	22.3	Larger catchment but ill-defined drainage line.
Petermarer Ck	3	259.1	The main drainage line near the site, passing to the west. Large defined stream channel.
Drainage line	4	4.3	Minor overland flow pathway.
Drainage line	5	1.6	Minor overland flow pathway.
Drainage line	6	40.9	Larger catchment with a number of ill-defined drainage lines.
Drainage line	7	1.3	Minor overland flow pathway.
Drainage line	8	20.9	Minor overland flow pathway.
Drainage line	9	7.6	Minor overland flow pathway.

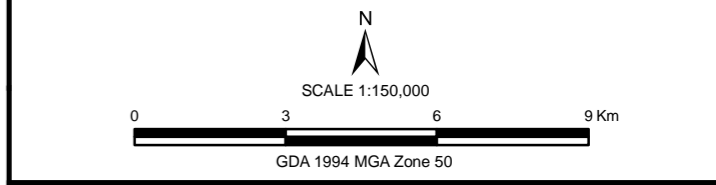


**Legend**

- Site Location
- Catchments

Data Sources:  
 250K Topography - Geoscience Australia  
 Catchments - Hydrologia

Location		1:100 000 Map Sheet Location				
				North Turtle 2658	Poissonnier 2758	
		Cossigny 2457	Thouin 2557	Port Hedland 2657	De Grey 2757	Pardoo 2857
		Sherlock 2456	Yule 2556	Wallaringa 2656	Carlindie 2756	Coongan 2856



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 Job no: J0100100

**Figure 2**  
**Catchments**  
 Additional Information

COMPILED: Gaia Resources	DATE: 18/05/2021	LOCN: PERTH	A3	SCALE 1:150,000
GDA 1994 MGA Zone 50	PLAN No: GR604-15_Junga_Fig2.pdf			
DOCUMENT NAME: GR604-15_Junga_Fig2.mxd				

## 2.3 Design flows

Design flows adopted for use in the flood modelling are given in Table 2.

Petermarer Creek, with the largest catchment, has the largest design flows. However, other catchments, particularly Catchments 2, 6 and 8 also have substantial flow even in relatively frequent events.

Note that these estimates are based on a regional method, using observed flow from often larger catchments with more defined drainage lines than the overland flow catchments near the site (i.e., all but the Petermarer Creek catchment). These estimates also do not account for diversion or ponding associated with the Great Northern Highway nor the Goldsworthy railway, which could affect local flow rates.

*Table 2 Design flows*

Catchment name	Catchment Number	Area (km <sup>2</sup> )	Peak flow (m <sup>3</sup> /s) for AEP (%)		
			5	1	PMF
Drainage line	1	5.0	60	108	575
Drainage line	2	22.3	138	250	1,300
Petermarer Ck	3	259.1	532	963	5,000
Drainage line	4	4.3	54	98	500
Drainage line	5	1.6	31	56	300
Drainage line	6	40.9	190	344	1,800
Drainage line	7	1.3	27	50	250
Drainage line	8	20.9	130	236	1,250
Drainage line	9	7.6	74	133	700



## 3. Flood impact assessment

### 3.1 Introduction

This section presents results of the flood impact modelling for the site.

### 3.2 Potential impacts of flooding on the development

Predicted peak flood depth, velocity and water level contours for the 5%, 1% and PMF design events are shown in Figure 3.

Flooding in the area of the site is characterised by a main flow path to the west, associated with Petermarer Creek, and another flow path to the east. The eastern flow path is associated with the drainage lines for Catchment 5 and 6 but receives flow from a breakout from Petermarer Creek above the site. To the west, flooding from Petermarer Creek extends into Catchments 4 and 2. Flooding in catchments further to the east and west don't interact with the site.

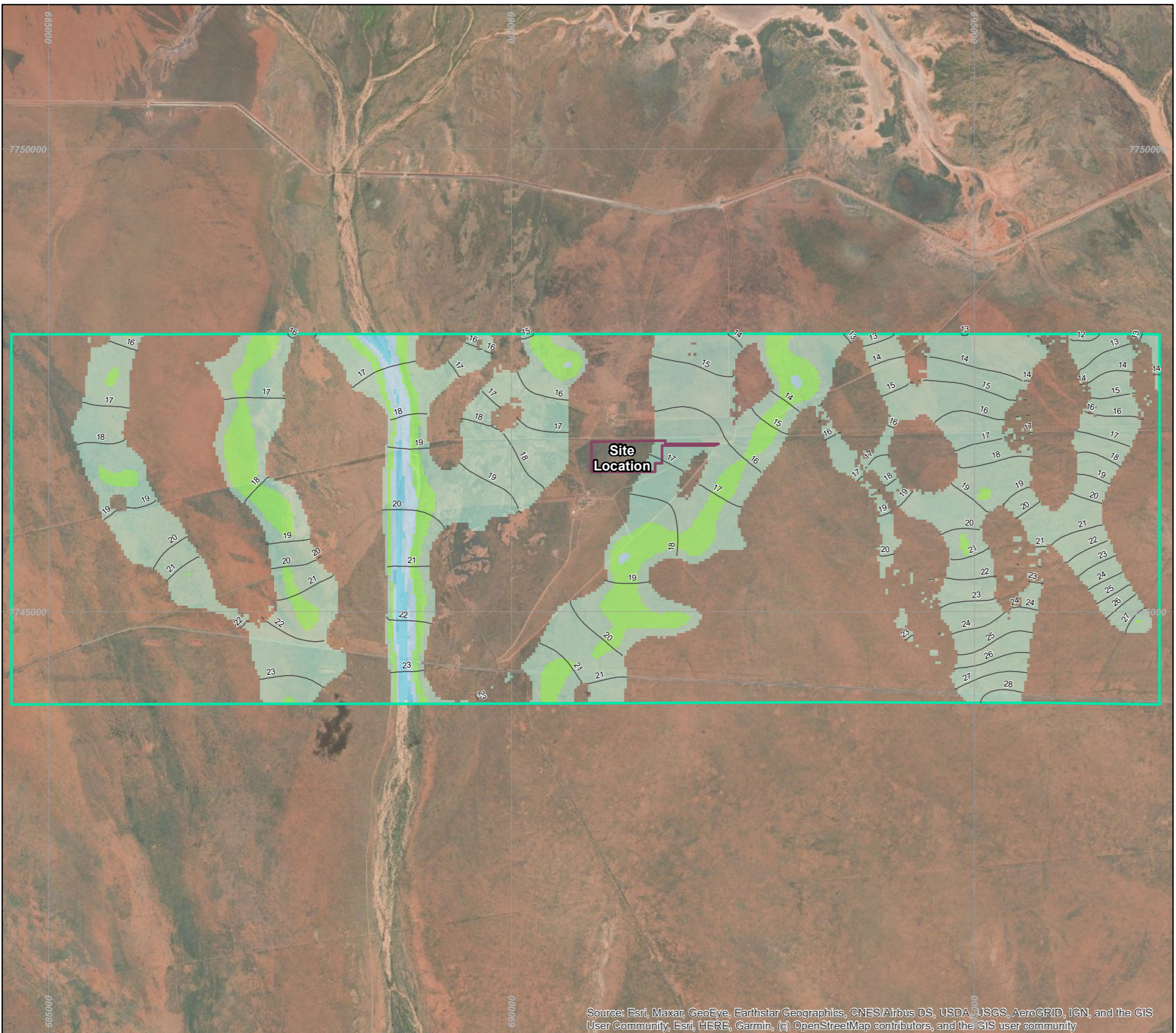
The site sits across a low ridge with an elevation of up to 18.5 – 19 m AHD (as indicated by the SRTM topographic data). The lowest parts of the site have ground elevations down to approximately 16 m AHD. Flood water tends to encroach on the western and eastern ends of the site depending on the flood magnitude, but don't completely inundate the site. A narrow corridor extending to the east above the railway lines cuts across part of the eastern flow path. The predicted 1% peak flood level at the site varies from approximately 17.8 to 16.7 m AHD.

The modelling indicates that the majority of the site is located across a local high spot with less flooding than much of the adjacent area. However, given the resolution of the SRTM topographic data and as the railway embankment and other local drainage features are not represented in the model, these results don't rule out inundation of the site nor define local flow paths or areas with elevated flow velocity. The railway embankment, in particular, could cause significant lateral flow across the northern side of the site, which could pose a flood and/or scour risk to infrastructure located within the proposed footprint.

### 3.3 Potential impacts of the development on flooding

Infrastructure at the site will be mainly solar panels located on poles elevated above the ground. There should be minimal ground disturbance and the panels and poles won't impact on local runoff characteristics or drainage.

Infrastructure that affects the ground surface, such as roads or raised pads, in areas predicted to be affected by flooding should be designed to account for flood impacts. This is particularly relevant for the narrow corridor extending into the eastern flow path.



**Legend**

- 1m Water Level Contours
- Site Location
- Model Domain

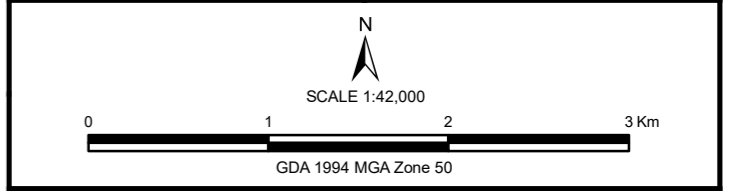
**Depth 5% AEP (m)**

- Above 5
- 4.5 - 5.0
- 4.0 - 4.5
- 3.5 - 4.0
- 3.0 - 3.5
- 2.5 - 3.0
- 2.0 - 2.5
- 1.5 - 2.0
- 1.0 - 1.5
- 0.5 - 1.0
- 0.0 - 0.5
- Below 0.0

**Data Sources:**  
 Image - ESRI, Site Location - NGH  
 Model Domain, Grids, Contours - Hydrologia

**Location** **1:100 000 Map Sheet Location**

		North Turtle 2658	Poissonnier 2758	
Cossigny 2457	Thouin 2557	Port Hedland 2657	De Grey 2757	Pardoo 2857
Sherlock 2456	Yule 2556	Walleringa 2656	Carlindie 2756	Coongan 2856



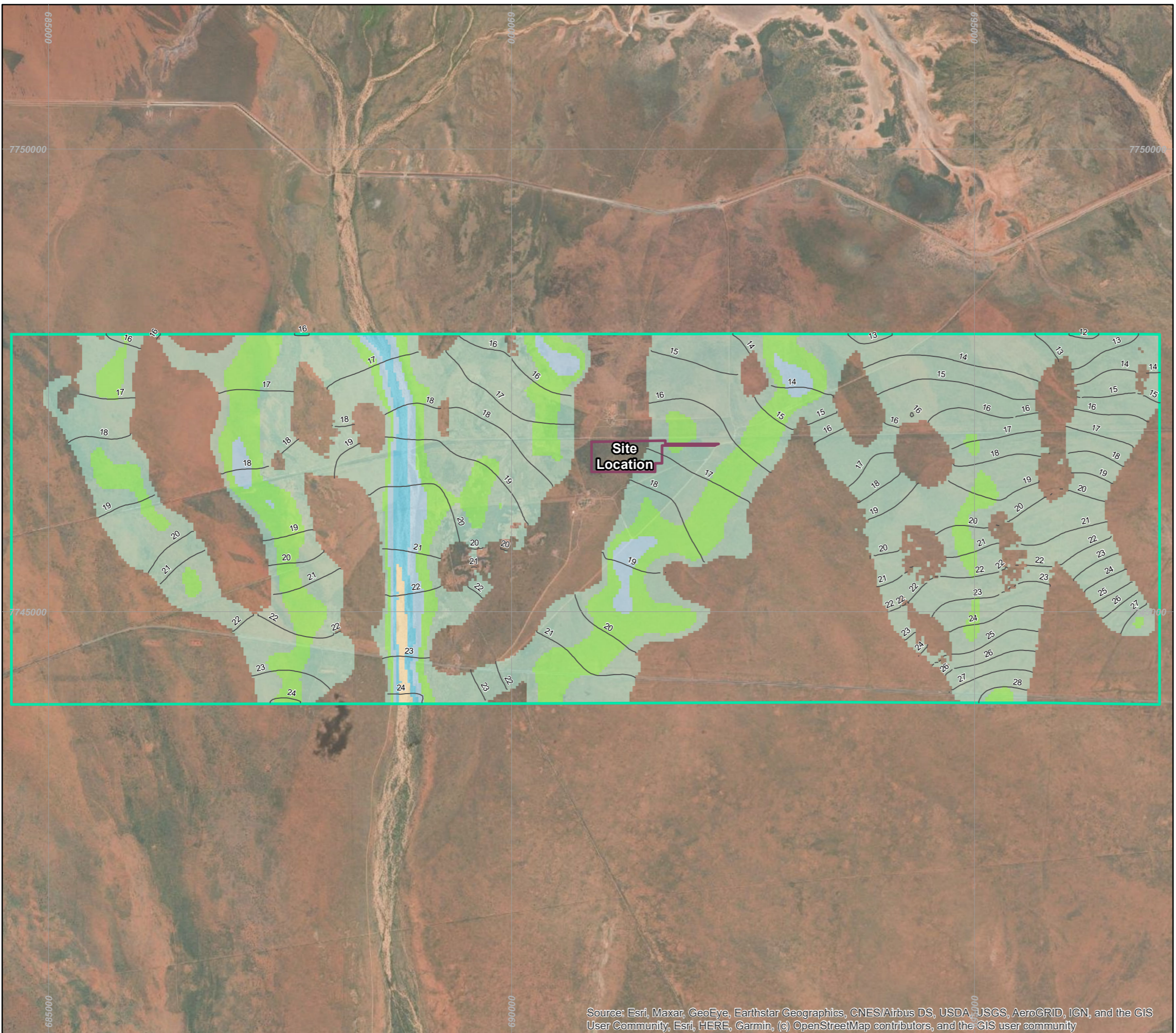
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 Preliminary Flood Assessment  
 Job no: J0100100**

**Figure 3a  
 Predicted Flooding - Depth 5% AEP**

Additional Information

COMPILED: Gaia Resources	DATE: 18/05/2021	LOCN: PERTH	A3	SCALE 1:42,000
GDA 1994 MGA Zone 50		PLAN No: GR604-15_Junga_Fig3a.pdf		
DOCUMENT NAME: GR604-15_Junga_Fig3a.mxd				

Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community, Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community



Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, JGS, AeroGRID, IGN, and the GIS User Community, Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community

### Legend

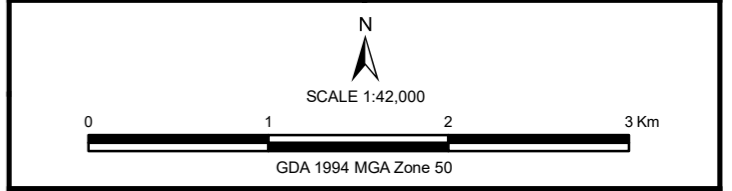
- 1m Water Level Contours
- ▭ Model Domain
- ▭ Site Location

#### Depth 1% AEP (m)

- █ Above 5
- █ 4.5 - 5.0
- █ 4.0 - 4.5
- █ 3.5 - 4.0
- █ 3.0 - 3.5
- █ 2.5 - 3.0
- █ 2.0 - 2.5
- █ 1.5 - 2.0
- █ 1.0 - 1.5
- █ 0.5 - 1.0
- █ 0.0 - 0.5
- █ Below 0.0

Data Sources:  
 Image - ESRI, Site Location - NGH  
 Model Domain, Grids, Contours - Hydrologia

Location		1:100 000 Map Sheet Location				
			North Turtle 2658	Poissonnier 2758		
	Cossigny 2457	Thouin 2557	Port Hedland 2657	De Grey 2757	Pardoo 2857	
	Sherlock 2456	Yule 2556	Warralinga 2656	Carlindie 2756	Coongan 2856	

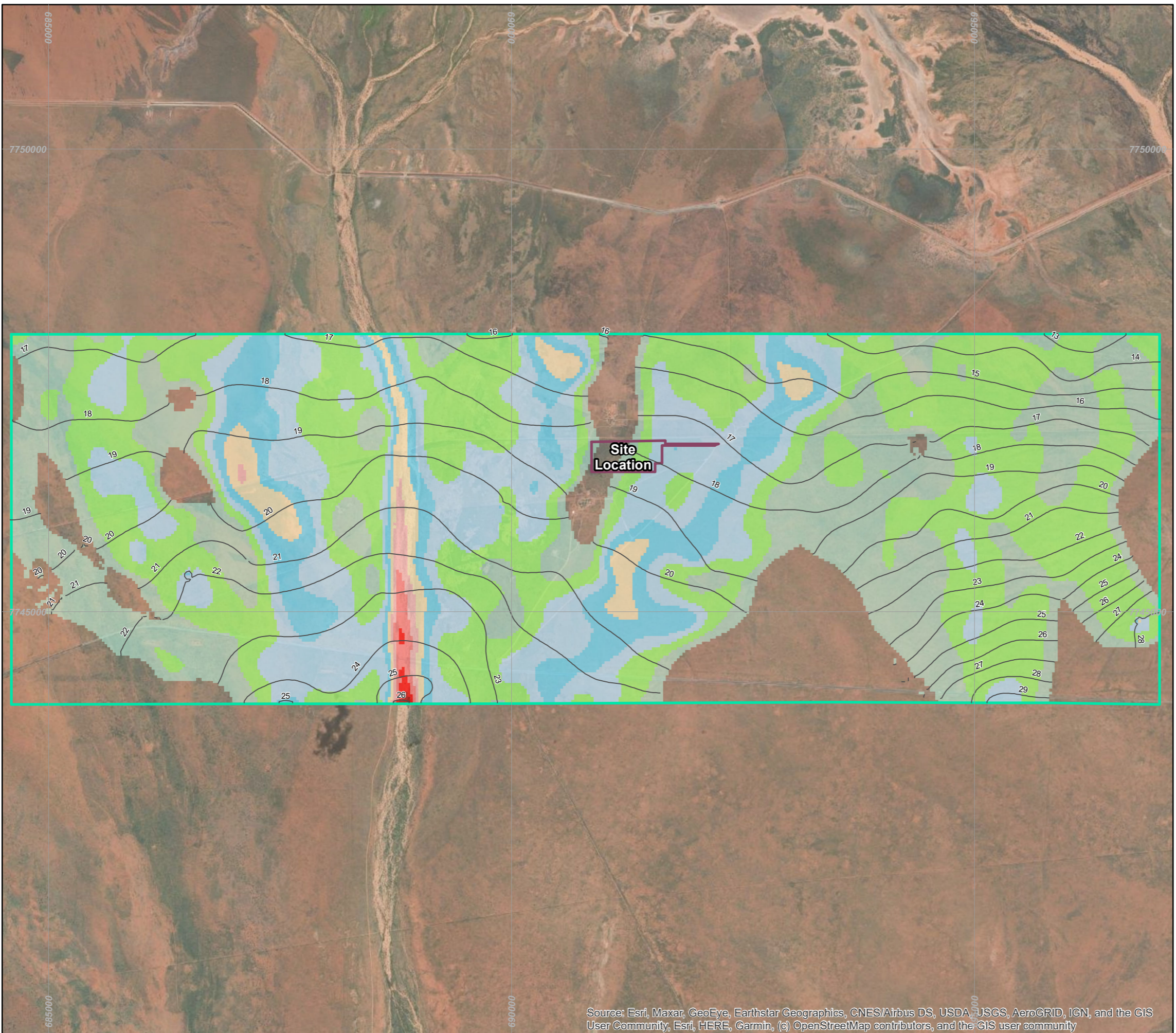


**Project: Junga Solar Farm –  
 Preliminary Flood Assessment  
 Job no: J0100100**

**Figure 3b  
 Predicted Flooding - Depth 1% AEP**

Additional Information

COMPILED: Gaia Resources	DATE: 18/05/2021	LOCN: PERTH	A3	SCALE 1:42,000
GDA 1994 MGA Zone 50		PLAN No: GR604-15_Junga_Fig3b.pdf		
DOCUMENT NAME: GR604-15_Junga_Fig3b.mxd				



Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community, Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community

### Legend

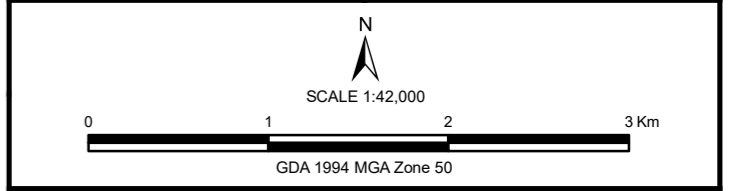
- 1m Water Level Contours
- ▭ Site Location
- ▭ Model Domain

#### Depth PMF (m)

- ▭ Above 5
- ▭ 4.5 - 5.0
- ▭ 4.0 - 4.5
- ▭ 3.5 - 4.0
- ▭ 3.0 - 3.5
- ▭ 2.5 - 3.0
- ▭ 2.0 - 2.5
- ▭ 1.5 - 2.0
- ▭ 1.0 - 1.5
- ▭ 0.5 - 1.0
- ▭ 0.0 - 0.5
- ▭ Below 0.0

Data Sources:  
 Image - ESRI, Site Location - NGH  
 Model Domain, Grids, Contours - Hydrologia

Location		1:100 000 Map Sheet Location				
			North Turtle 2658	Poissonnier 2758		
	Cossigny 2457	Thouin 2557	Port Hedland 2657	De Grey 2757	Pardoo 2857	
	Sherlock 2456	Yule 2556	Wallingara 2656	Carlindie 2756	Coongan 2856	



**Project: Junga Solar Farm – Preliminary Flood Assessment**  
**Job no: J0100100**

**Figure 3c**  
**Predicted Flooding - PMF Depth**

Additional Information

COMPILED: Gaia Resources	DATE: 18/05/2021	LOCN: PERTH	A3	SCALE 1:42,000
GDA 1994 MGA Zone 50		PLAN No: GR604-15_Junga_Fig3c.pdf		
DOCUMENT NAME: GR604-15_Junga_Fig3c.mxd				

## 4. Conclusions and recommendations

### 4.1 Conclusions

The modelling, based on the available data, indicates that the majority of the site is located across a low ridge line. The highest part of the ridgeline, through the centre of the site, is free of flooding even in the PMF event. Floodwater encroaches into the eastern and western edges of the site to varying degrees depending on the magnitude of the event. The narrow corridor extending to the east above the railway lines cuts intrudes into the eastern flow path.

Given the limited available data (particularly resolution of the SRTM topographic data and representation of the railway embankment) these results don't rule out inundation of the site nor define local flow paths or areas with elevated flow velocity that could interact with the site.

### 4.2 Recommendations

It is recommended that design of site infrastructure accounts for uncertainty in these model results. This should include collecting accurate topographic data for the site and surrounds and quantifying the risk of localised flow, particularly related to the railway embankment, on site infrastructure.

Design and construction of infrastructure should account for interaction with floodwaters.

## 5. References

Ball J, Babister M, Nathan R, Weeks W, Weinmann E, Retallick M, Testoni I, (Editors), 2016, Australian Rainfall and Runoff: A Guide to Flood Estimation, Commonwealth of Australia.

Cardno (2011). Port Hedland Coastal Vulnerability Study. Report prepared for Landcorp by Cardno (WA) Pty Ltd. Report number: Rep1022p.

DHI (2020). Mike software. <https://www.mikepoweredbydhi.com/products>. Mike powered by DHI.

GA (2011). 1 second SRTM.

<https://ecat.ga.gov.au/geonetwork/srv/eng/catalog.search?node=srv#/metadata/72759>.

Australian Government: Geoscience Australia.

RFFE (2016). Regional Flood Frequency Estimation Model. Version RFFE Model 2016 v1. <http://rffe.arr-software.org/>. Accessed 14 September 2020.

# Appendices

---

## Appendix A

### Model parameter values

#### Mike 21 hydraulic model

Software:

Mike 21 FM release 2020 Update 1.

Simulation specification:

Mike 21 flexible mesh.

The model domain covered the area around the site for a sufficient distance to allow upstream and downstream boundaries to be set. The model domain is shown on Figure 3.

The following key parameter values were adopted:

- Flexible mesh (500 m<sup>2</sup> maximum element size) derived from SRTM-H data;
- drying depth of 0.005 m and wetting depth of 0.1 m; and
- constant resistance (Manning  $M = 25$ , which is equivalent to a Manning's  $n$  of 0.04).

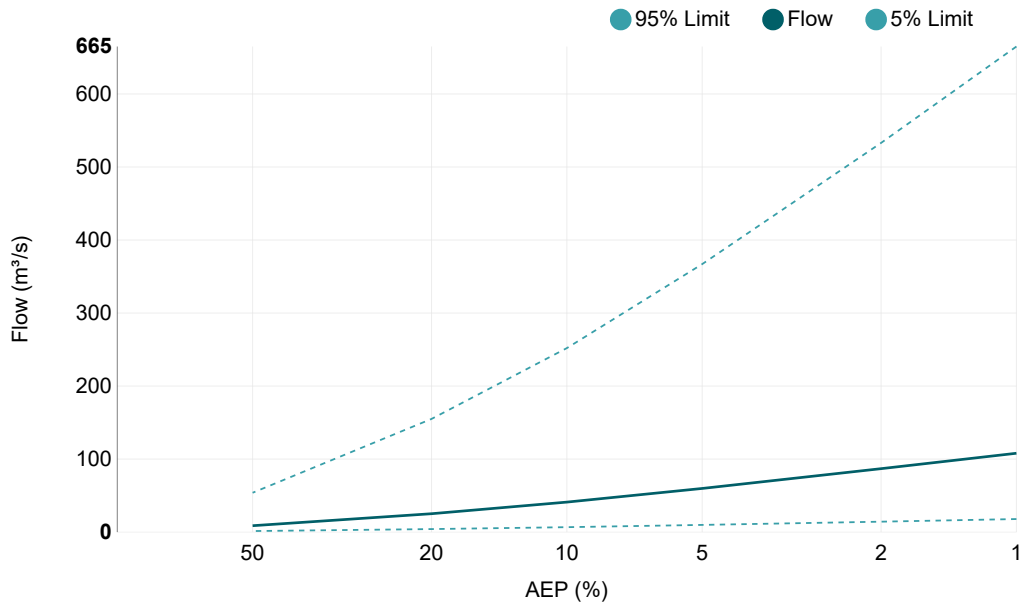
The model used steady state flows as the upstream boundary. Peak flows for catchments contributing to the model domain were derived using the RFFE tool for the 5% and 1% AEP events. PMF flows were extrapolated. Point source flows were also included within the model domain.

Constant velocity, varying with event magnitude, was used for the downstream boundary.



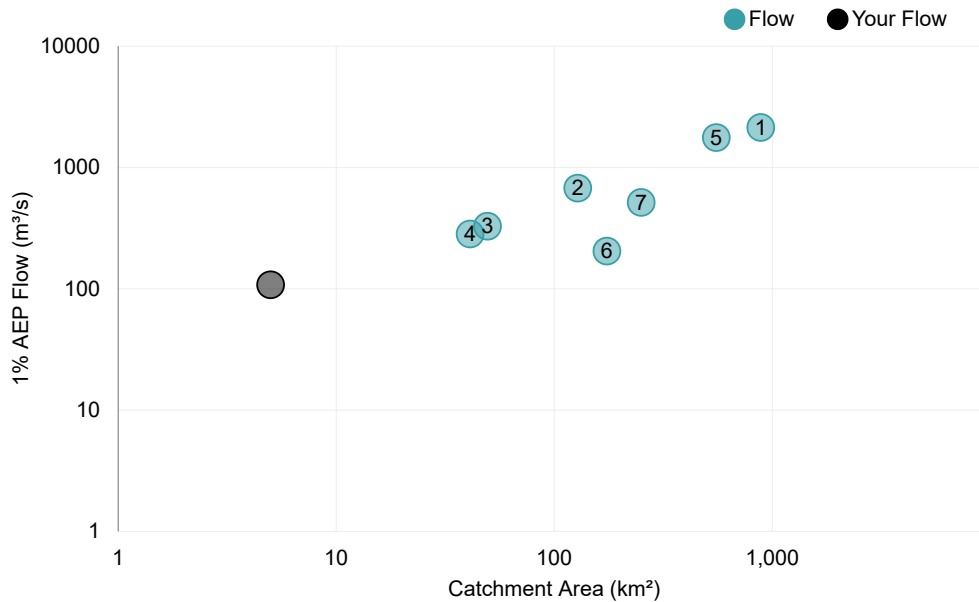
RFFE output

# Results | Regional Flood Frequency Estimation Model



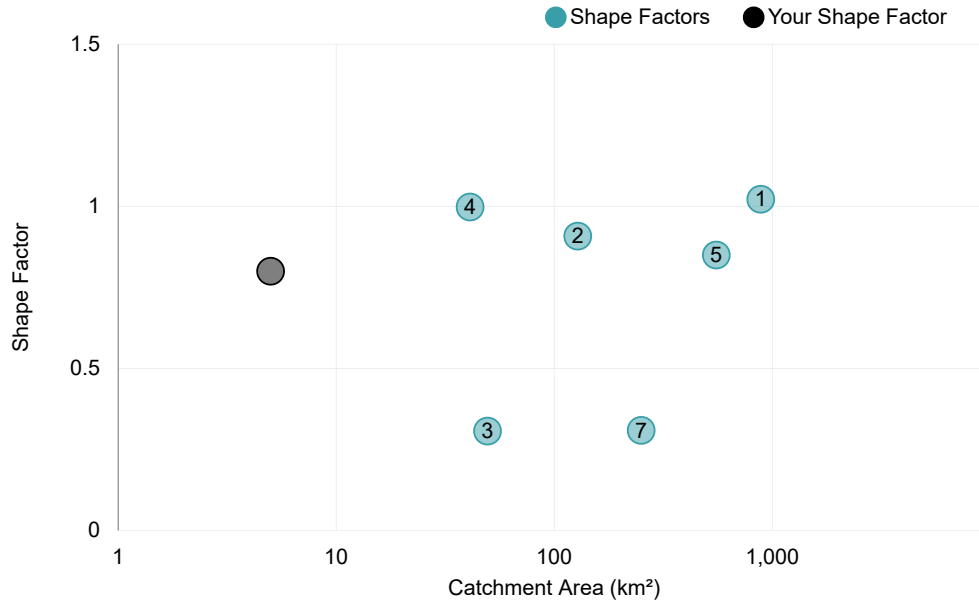
AEP (%)	Discharge (m³/s)	Lower Confidence Limit (5%) (m³/s)	Upper Confidence Limit (95%) (m³/s)
50	8.79	1.46	53.9
20	25.2	4.16	155
10	41.1	6.77	252
5	59.8	9.87	367
2	86.9	14.3	533
1	108	17.9	665

## 1% AEP Flow vs Catchment Area

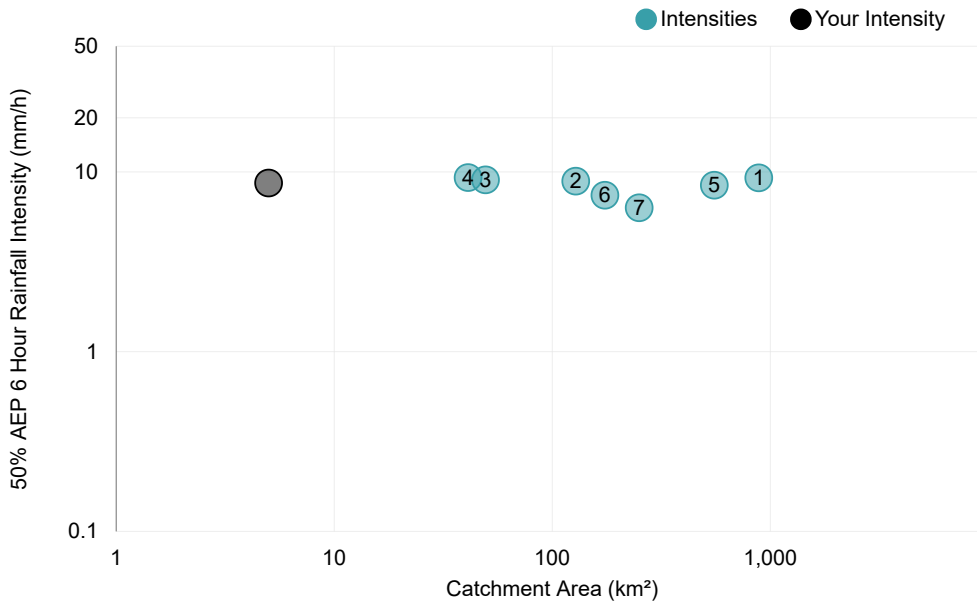


## Shape Factor vs Catchment Area

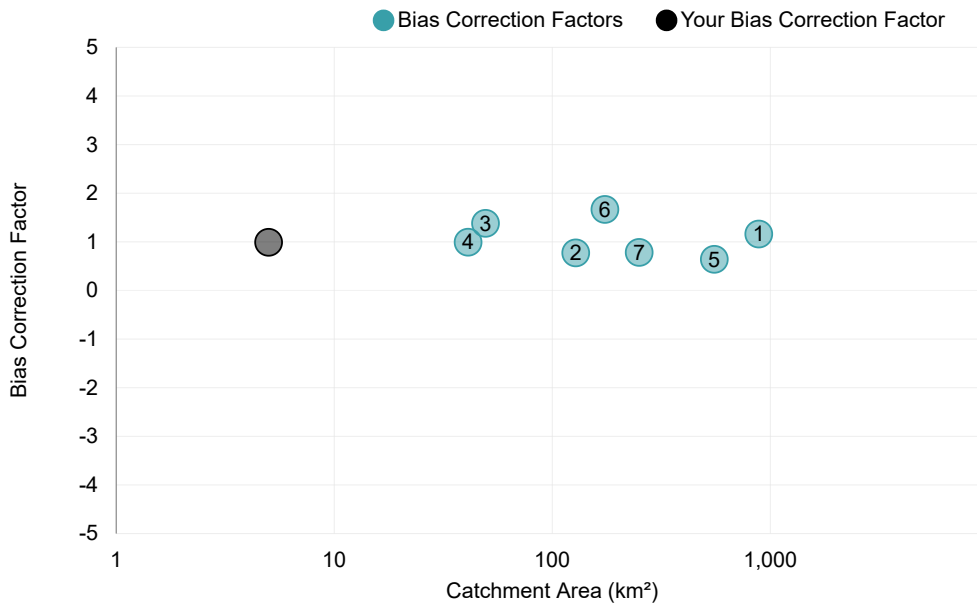
Note: This region does not use shape factors



## Intensity vs Catchment Area



## Bias Correction Factor vs Catchment Area

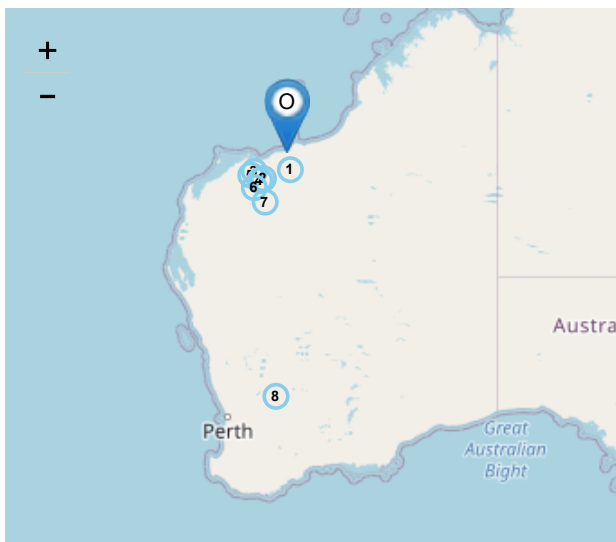


Download

- [TXT](#)
- [Nearby](#)
- [JSON](#)

**Input Data**

Date/Time	2020-09-14 17:28
Catchment Name	1
Latitude (Outlet)	-20.3571
Longitude (Outlet)	118.7803
Latitude (Centroid)	-20.3731
Longitude (Centroid)	118.7804
Catchment Area (km <sup>2</sup> )	5.0
Distance to Nearest Gauged Catchment (km)	97.2
50% AEP 6 Hour Rainfall Intensity (mm/h)	8.672955
2% AEP 6 Hour Rainfall Intensity (mm/h)	26.136791
Rainfall Intensity Source (User/Auto)	Auto
Region	Fringe - Pilbara & Arid and Semi-arid
Region Version	RFFE Model 2016 v1
Region Source (User/Auto)	Auto
Shape Factor	0.8
Interpolation Method	Natural Neighbour
Bias Correction Value	0.991

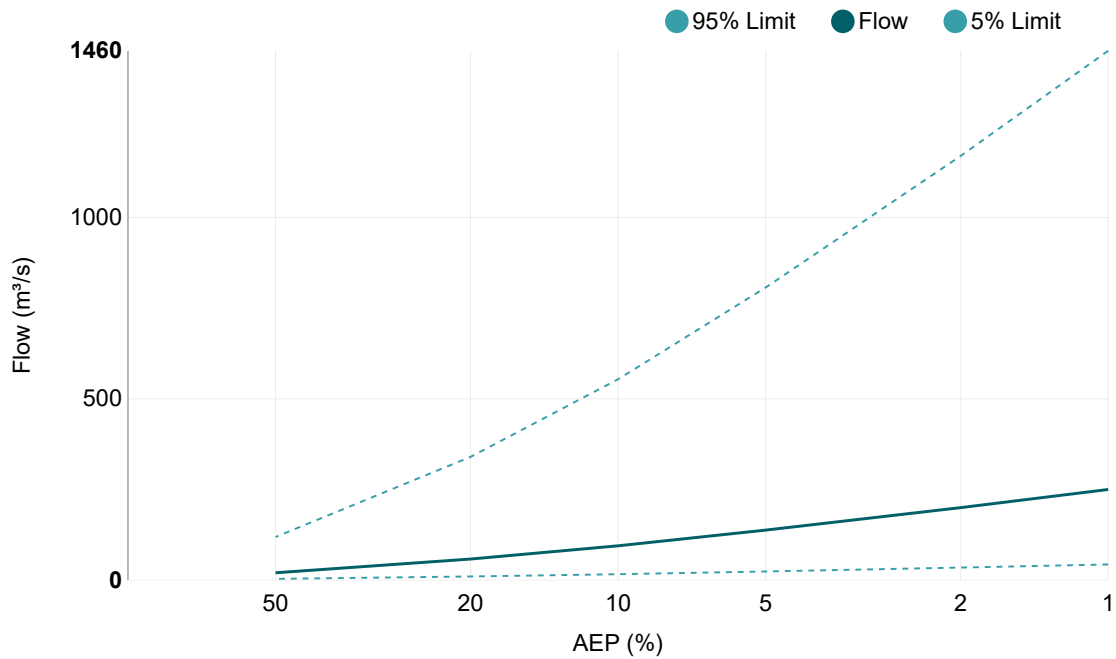


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Method by Dr Ataur Rahman and Dr Khaled Haddad from Western Sydney University for the Australian Rainfall and Runoff Project. Full description of the project can be found at the project page (<http://arr.ga.gov.au/revision-projects/project-list/projects/project-5>) on the ARR website. Send any questions regarding the method or project here (<mailto:admin@arr-software.org>).



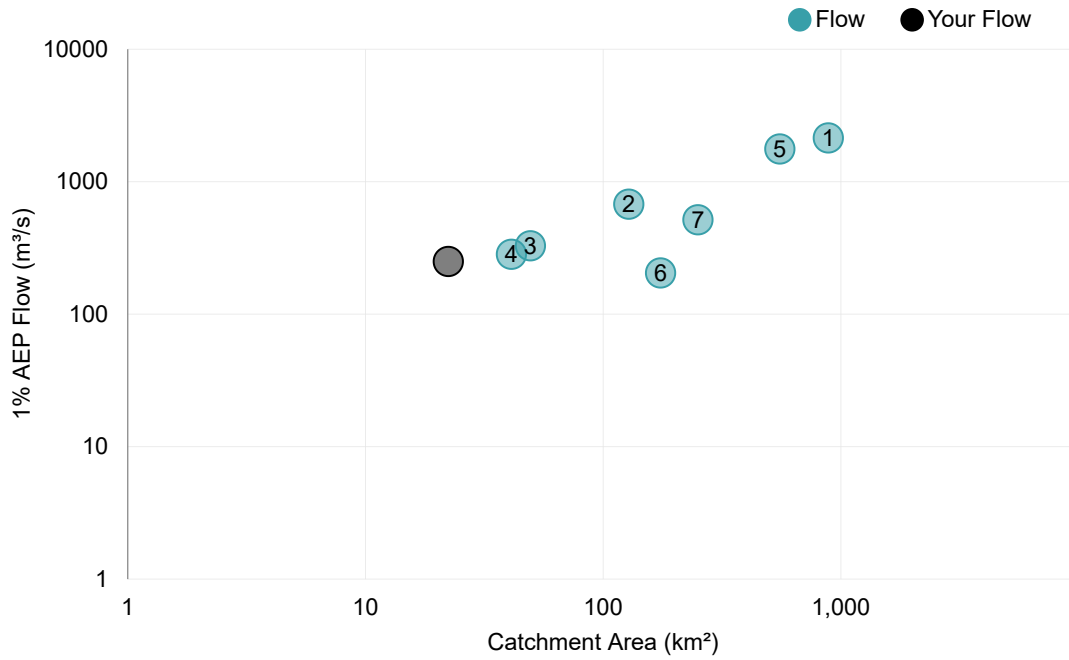
# Results | Regional Flood Frequency Estimation Model



\*The catchment has unusual shape. Results have lower accuracy and may not be directly applicable in practice.

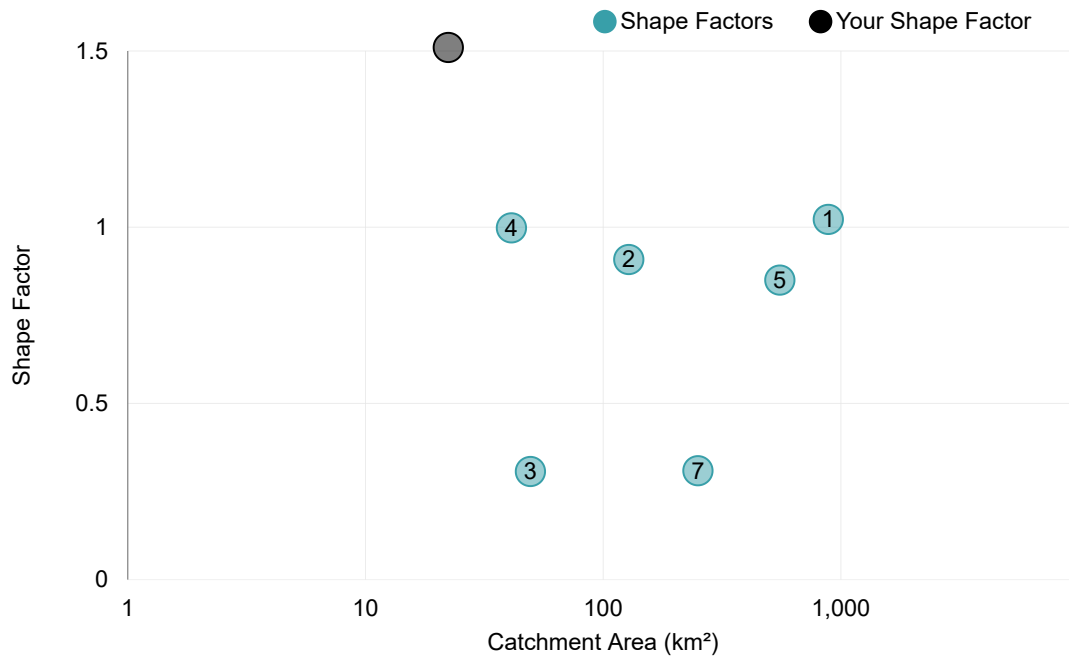
AEP (%)	Discharge (m³/s)	Lower Confidence Limit (5%) (m³/s)	Upper Confidence Limit (95%) (m³/s)
50	20.3	3.53	119
20	58.2	10.1	340
10	94.7	16.4	554
5	138	23.9	807
2	200	34.7	1170
1	250	43.3	1460

## 1% AEP Flow vs Catchment Area



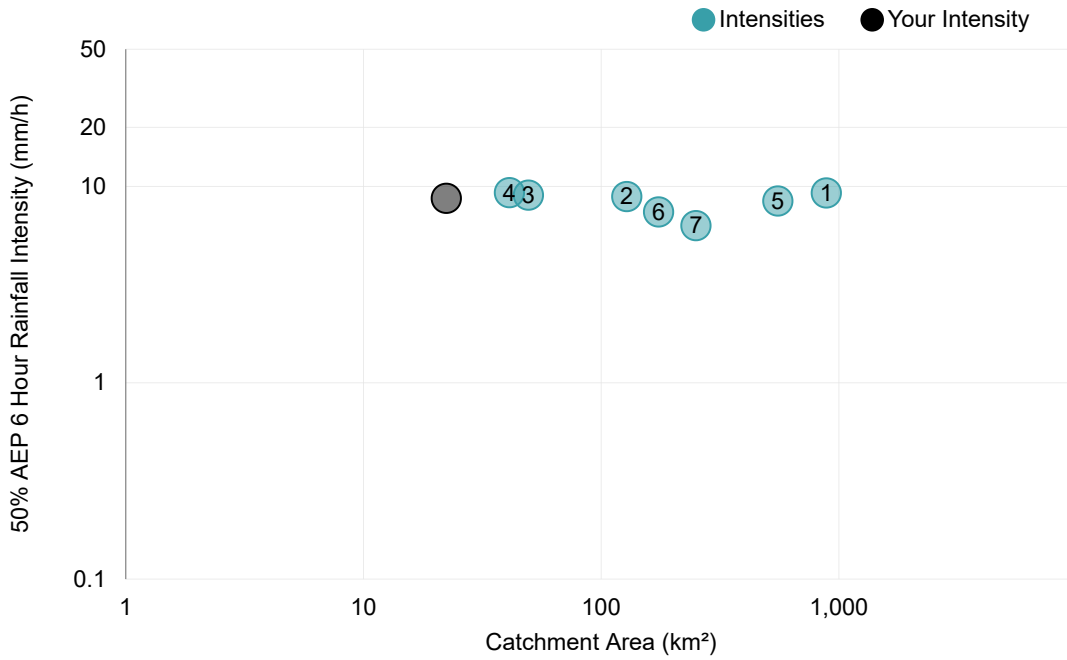
## Shape Factor vs Catchment Area

Note: This region does not use shape factors

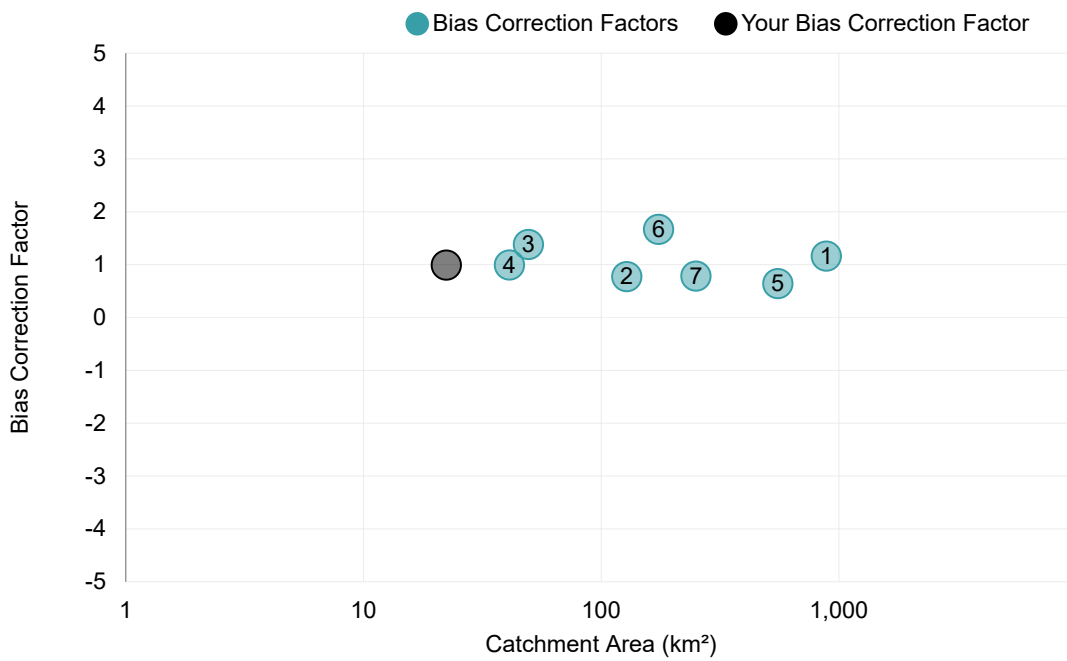


## Intensity vs Catchment Area





## Bias Correction Factor vs Catchment Area

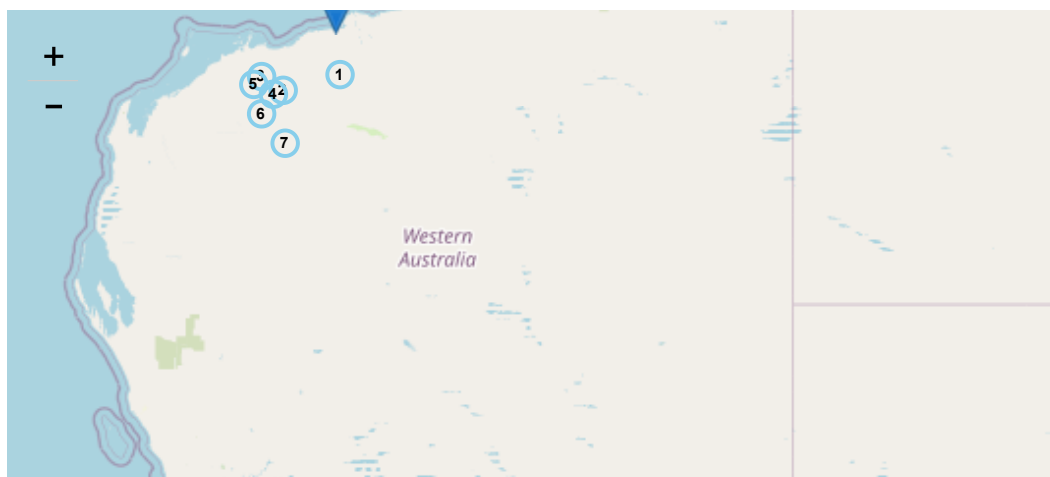


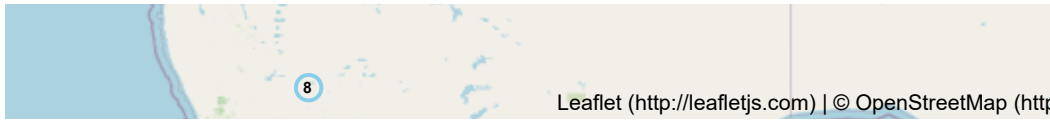
## Download

- [Download TXT](#)
- [Download Nearby](#)
- [Download JSON](#)

**Input Data**

Date/Time	2020-09-14 17:29
Catchment Name	2
Latitude (Outlet)	-20.3568
Longitude (Outlet)	118.7952
Latitude (Centroid)	-20.4206
Longitude (Centroid)	118.7995
Catchment Area (km <sup>2</sup> )	22.3
Distance to Nearest Gauged Catchment (km)	97.16
50% AEP 6 Hour Rainfall Intensity (mm/h)	8.702447
2% AEP 6 Hour Rainfall Intensity (mm/h)	26.257219
Rainfall Intensity Source (User/Auto)	Auto
Region	Fringe - Pilbara & Arid and Semi-arid
Region Version	RFFE Model 2016 v1
Region Source (User/Auto)	Auto
Shape Factor	1.51*
Interpolation Method	Natural Neighbour
Bias Correction Value	0.991



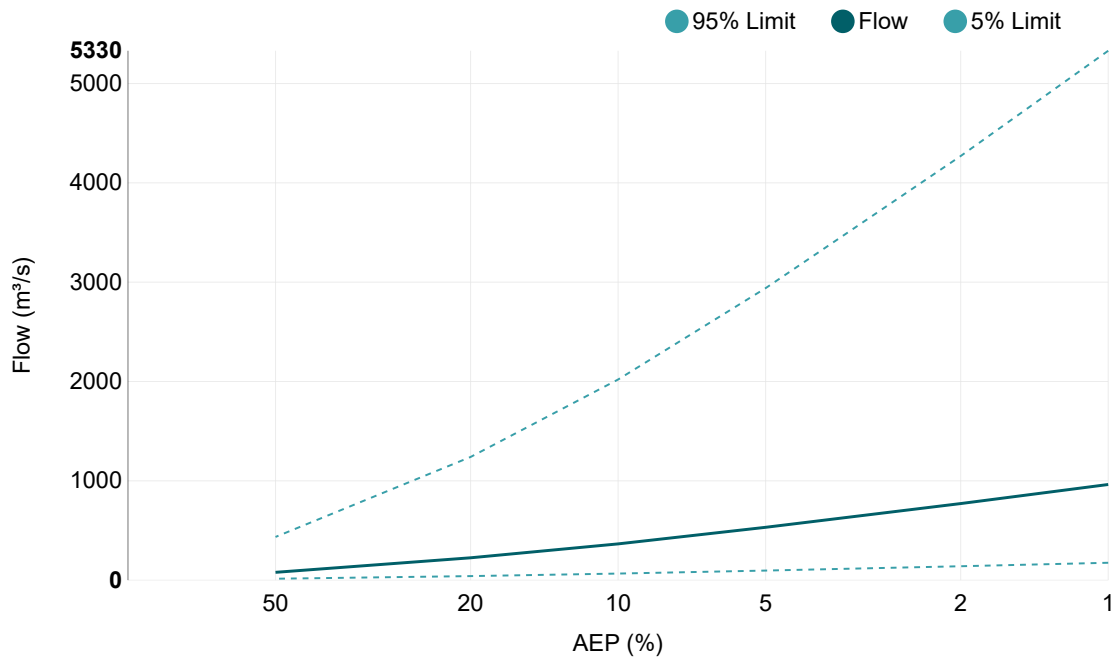


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Method by Dr Ataur Rahman and Dr Khaled Haddad from Western Sydney University for the Australian Rainfall and Runoff Project. Full description of the project can be found at the project page (<http://arr.ga.gov.au/revision-projects/project-list/projects/project-5>) on the ARR website. Send any questions regarding the method or project here (<mailto:admin@arr-software.org>).



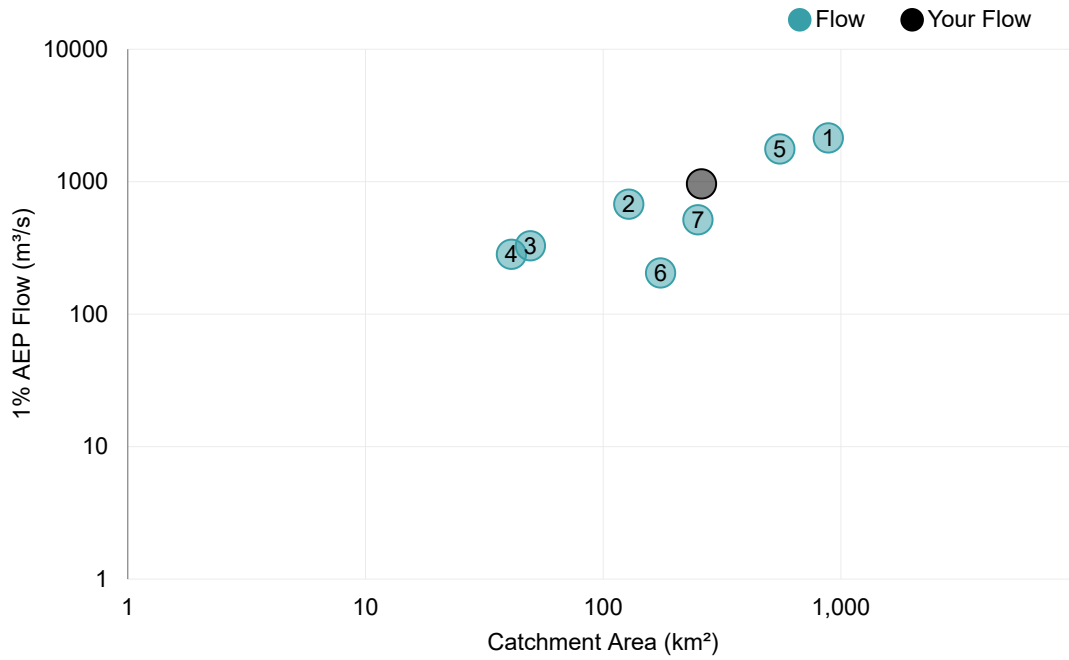
# Results | Regional Flood Frequency Estimation Model



\*The catchment has unusual shape. Results have lower accuracy and may not be directly applicable in practice.

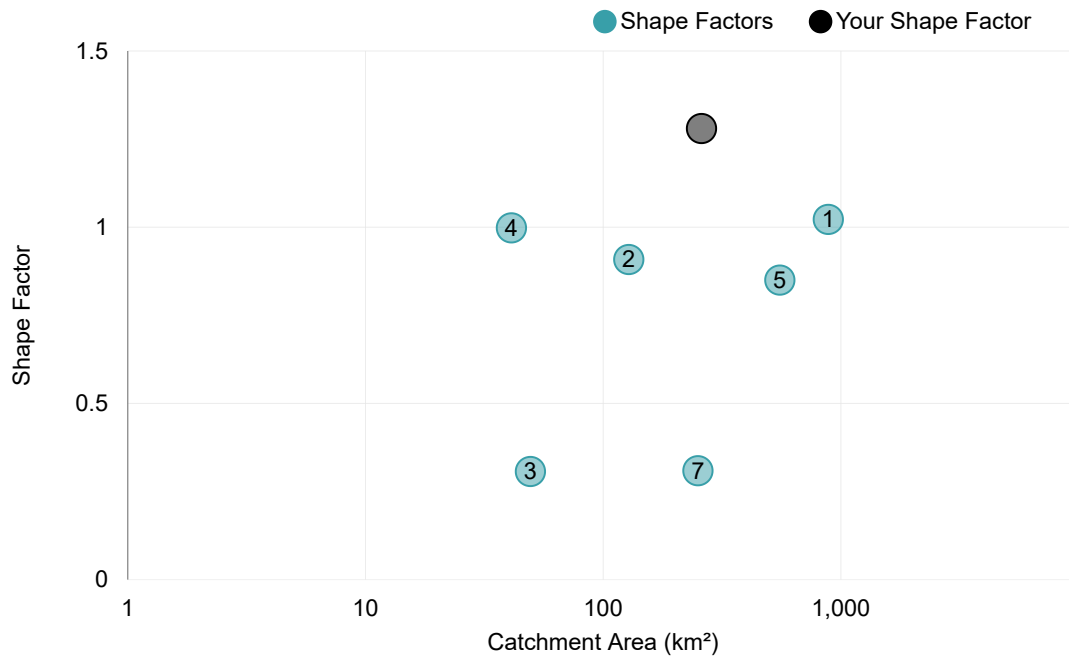
AEP (%)	Discharge (m³/s)	Lower Confidence Limit (5%) (m³/s)	Upper Confidence Limit (95%) (m³/s)
50	78.7	14.3	435
20	225	40.7	1240
10	365	66.2	2020
5	532	96.4	2940
2	771	140	4270
1	963	175	5330

## 1% AEP Flow vs Catchment Area

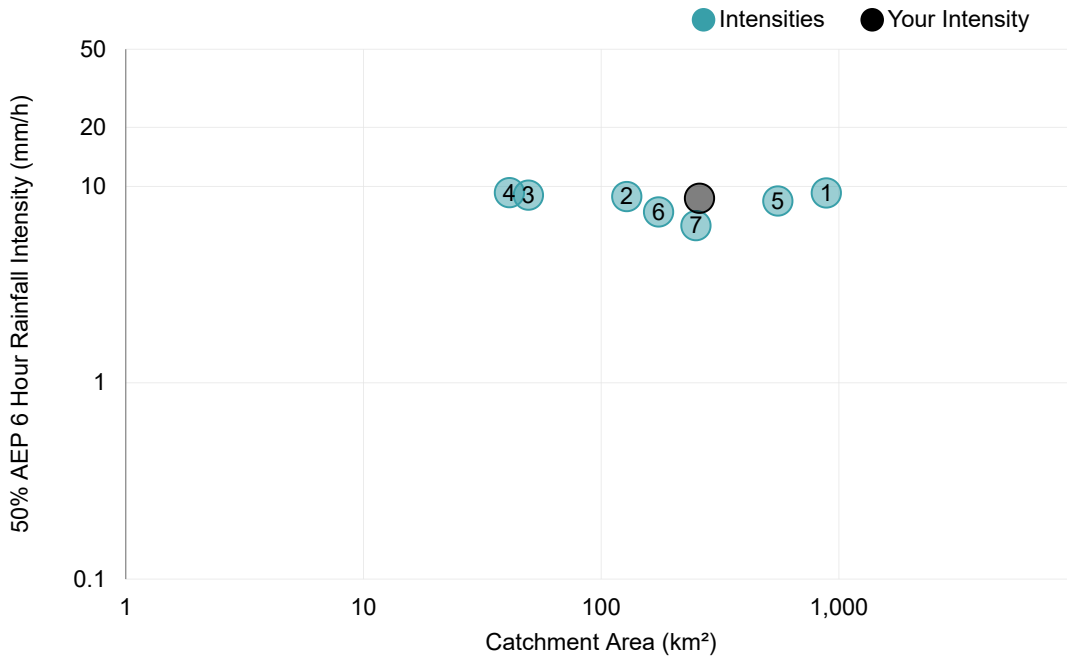


## Shape Factor vs Catchment Area

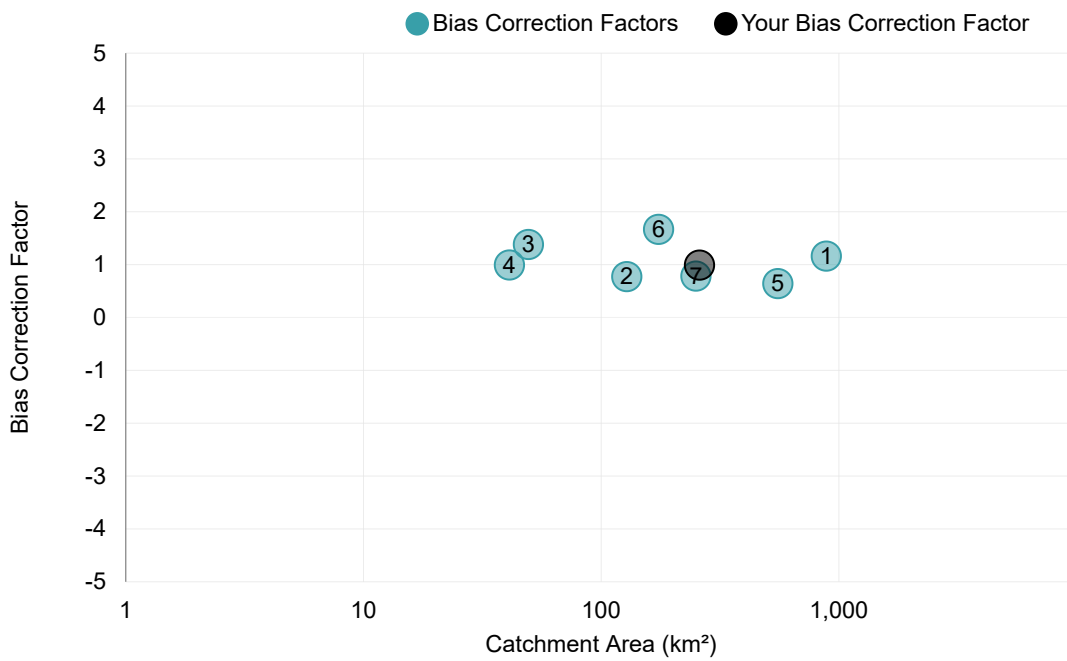
Note: This region does not use shape factors



## Intensity vs Catchment Area



## Bias Correction Factor vs Catchment Area

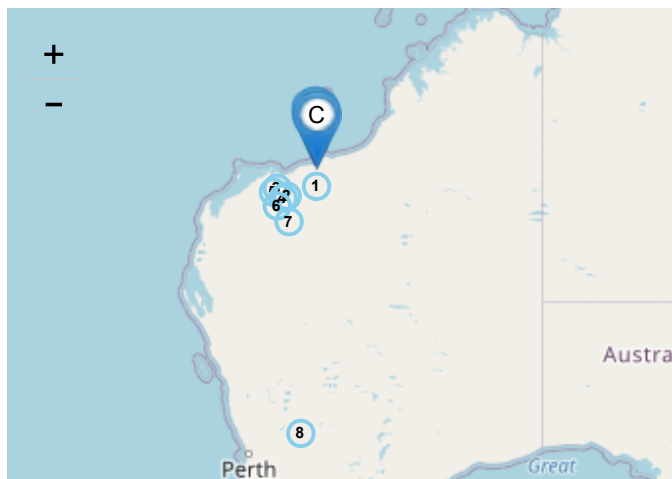


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**Input Data**

Date/Time	2020-09-14 17:30
Catchment Name	3
Latitude (Outlet)	-20.3566
Longitude (Outlet)	118.8055
Latitude (Centroid)	-20.5282
Longitude (Centroid)	118.8789
Catchment Area (km <sup>2</sup> )	259.1
Distance to Nearest Gauged Catchment (km)	97.15
50% AEP 6 Hour Rainfall Intensity (mm/h)	8.708389
2% AEP 6 Hour Rainfall Intensity (mm/h)	26.161826
Rainfall Intensity Source (User/Auto)	Auto
Region	Fringe - Pilbara & Arid and Semi-arid
Region Version	RFFE Model 2016 v1
Region Source (User/Auto)	Auto
Shape Factor	1.28*
Interpolation Method	Natural Neighbour
Bias Correction Value	0.991





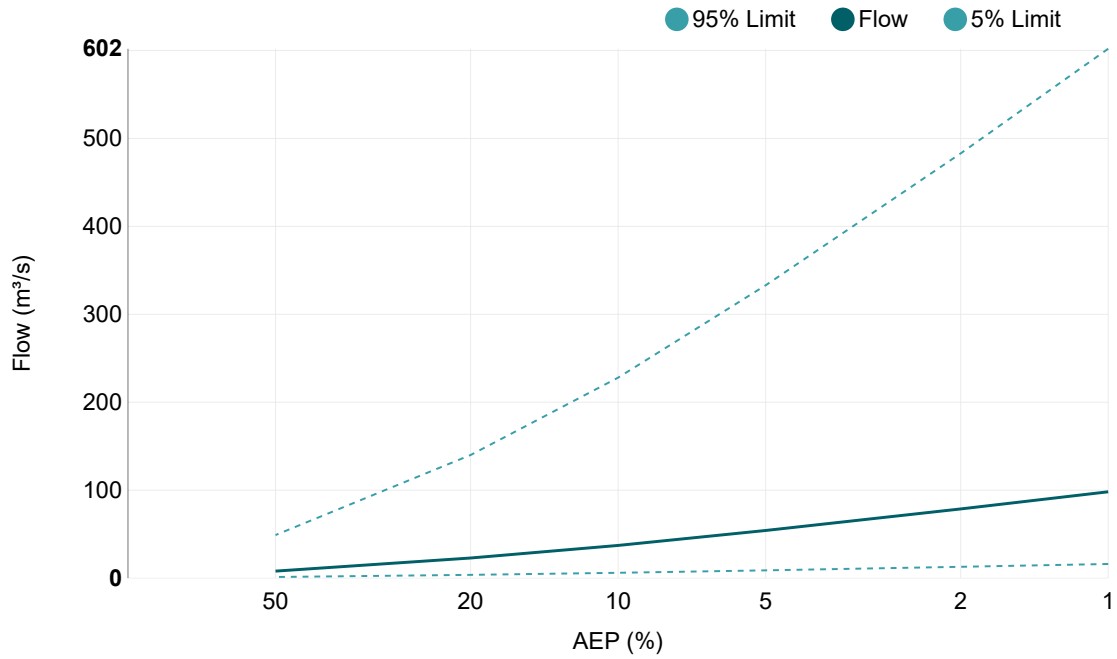
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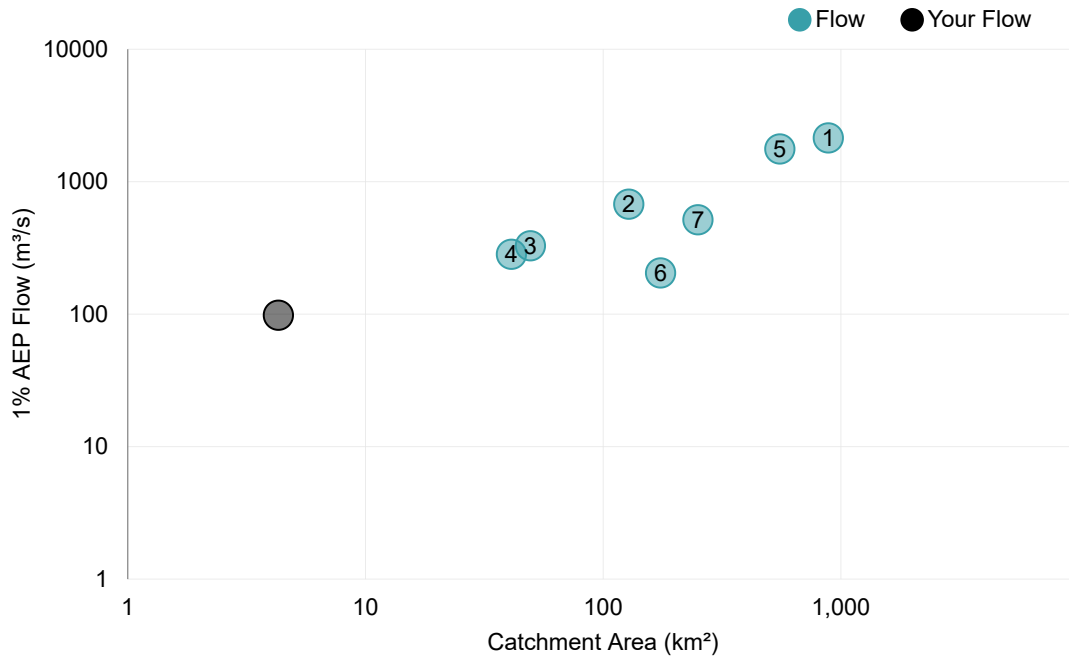


# Results | Regional Flood Frequency Estimation Model



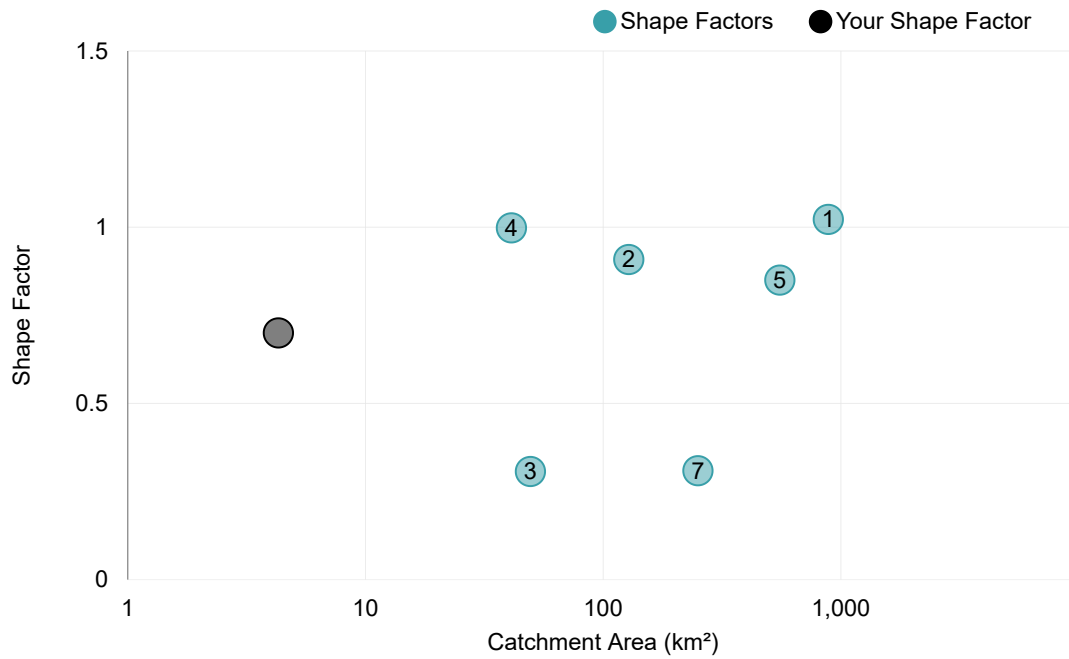
AEP (%)	Discharge (m³/s)	Lower Confidence Limit (5%) (m³/s)	Upper Confidence Limit (95%) (m³/s)
50	7.99	1.31	49.0
20	22.9	3.74	140
10	37.2	6.09	228
5	54.2	8.86	333
2	78.7	12.9	483
1	98.2	16.1	602

## 1% AEP Flow vs Catchment Area

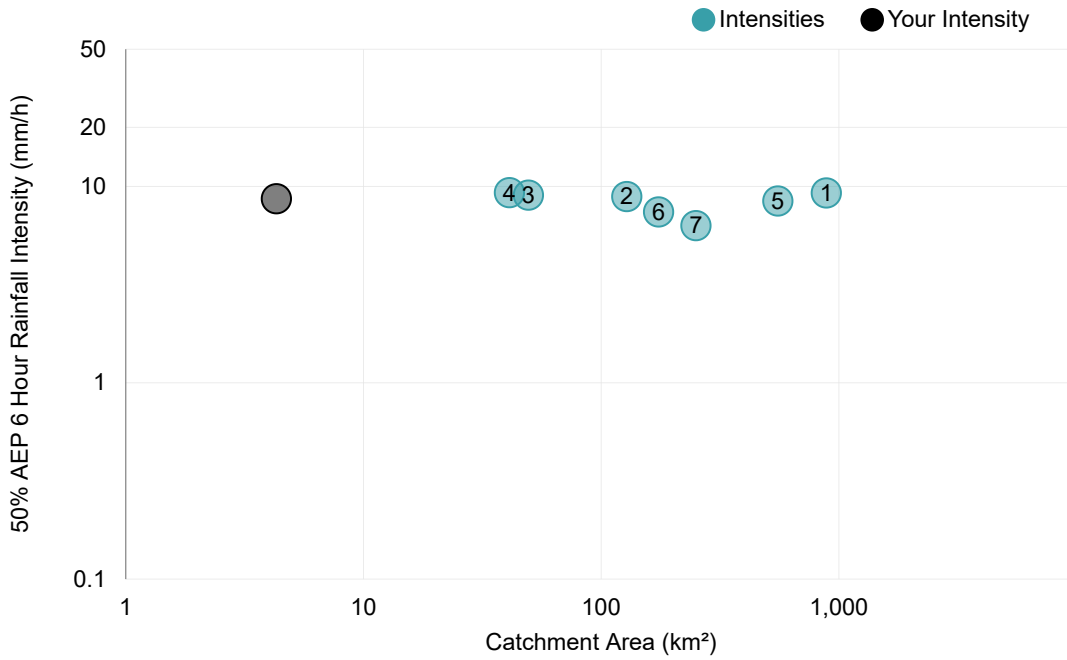


## Shape Factor vs Catchment Area

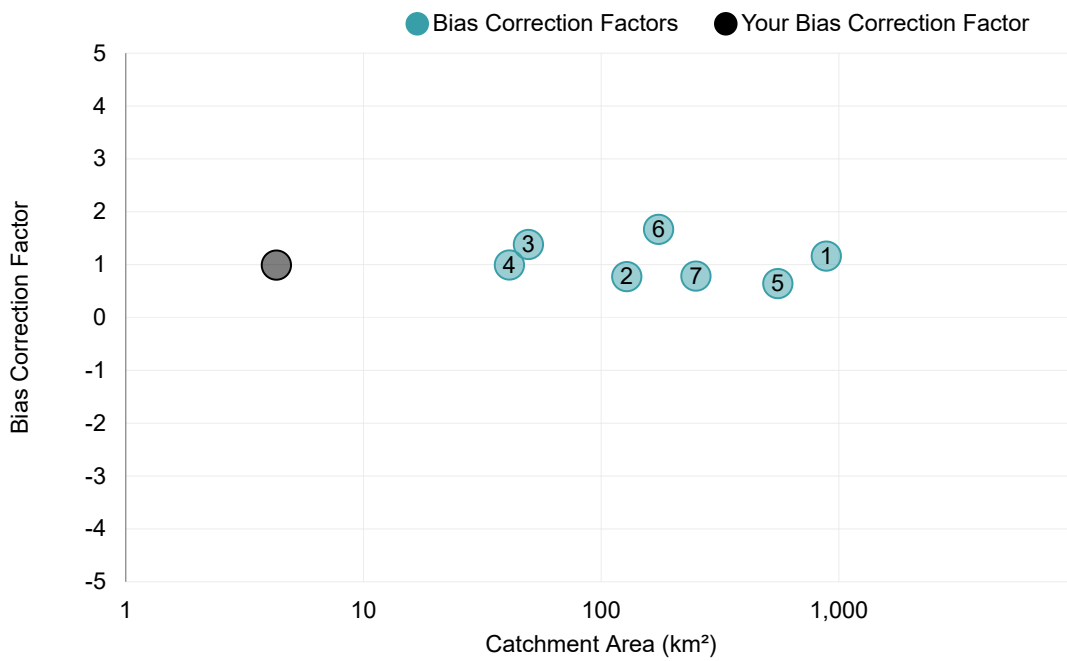
Note: This region does not use shape factors



## Intensity vs Catchment Area



## Bias Correction Factor vs Catchment Area

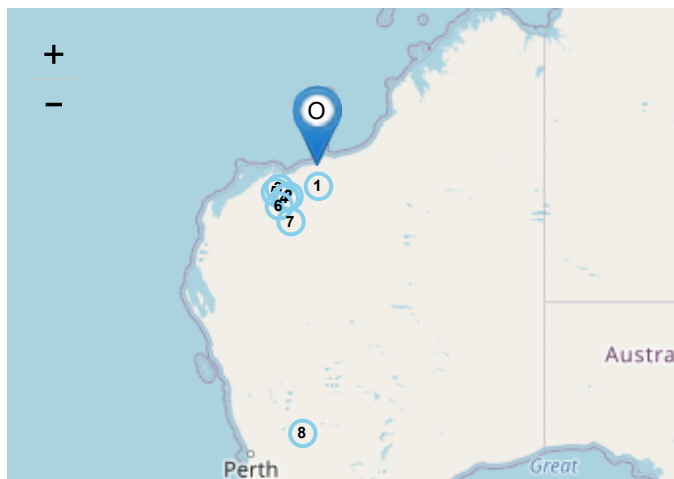


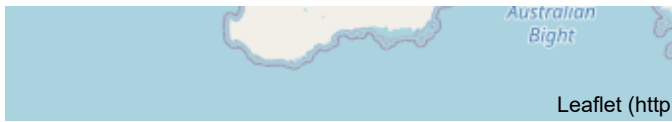
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**Input Data**

Date/Time	2020-09-14 17:32
Catchment Name	4
Latitude (Outlet)	-20.3568
Longitude (Outlet)	118.823
Latitude (Centroid)	-20.3697
Longitude (Centroid)	118.8216
Catchment Area (km <sup>2</sup> )	4.3
Distance to Nearest Gauged Catchment (km)	97.1
50% AEP 6 Hour Rainfall Intensity (mm/h)	8.659058
2% AEP 6 Hour Rainfall Intensity (mm/h)	26.054788
Rainfall Intensity Source (User/Auto)	Auto
Region	Fringe - Pilbara & Arid and Semi-arid
Region Version	RFFE Model 2016 v1
Region Source (User/Auto)	Auto
Shape Factor	0.7
Interpolation Method	Natural Neighbour
Bias Correction Value	0.991



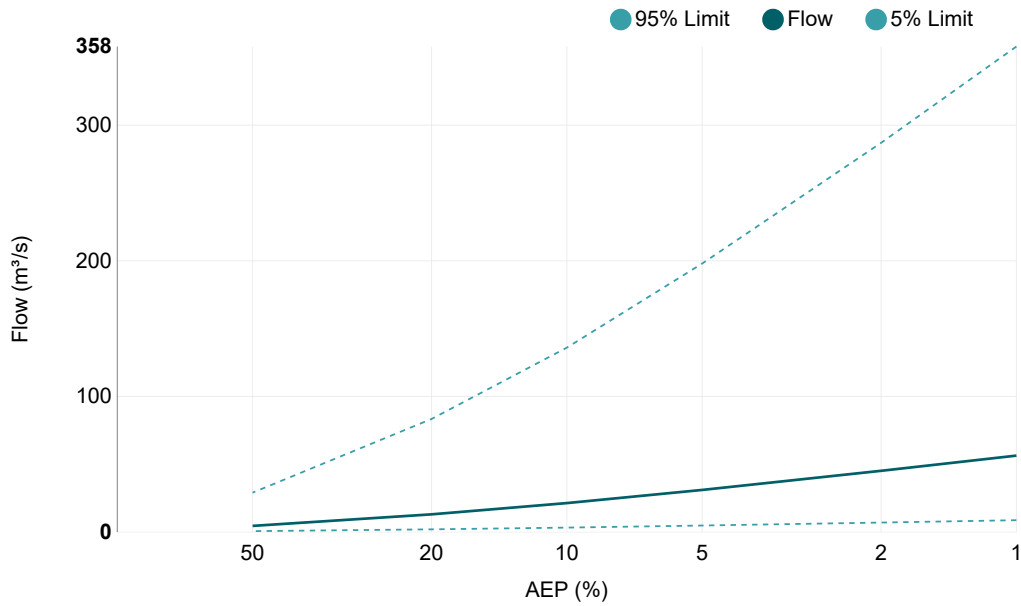


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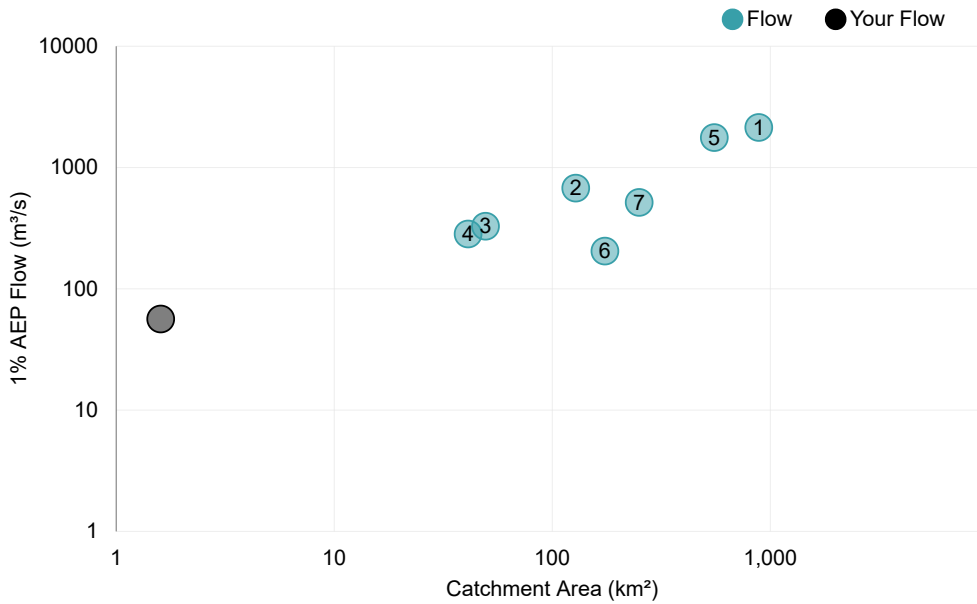


# Results | Regional Flood Frequency Estimation Model



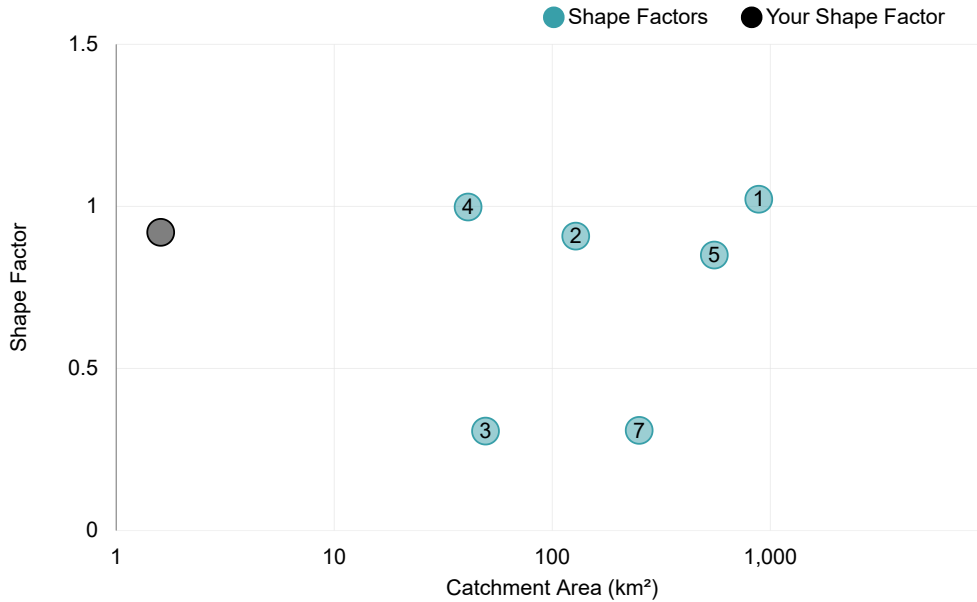
AEP (%)	Discharge (m³/s)	Lower Confidence Limit (5%) (m³/s)	Upper Confidence Limit (95%) (m³/s)
50	4.59	0.720	29.1
20	13.1	2.05	83.4
10	21.4	3.33	136
5	31.1	4.86	198
2	45.2	7.05	287
1	56.4	8.79	358

## 1% AEP Flow vs Catchment Area

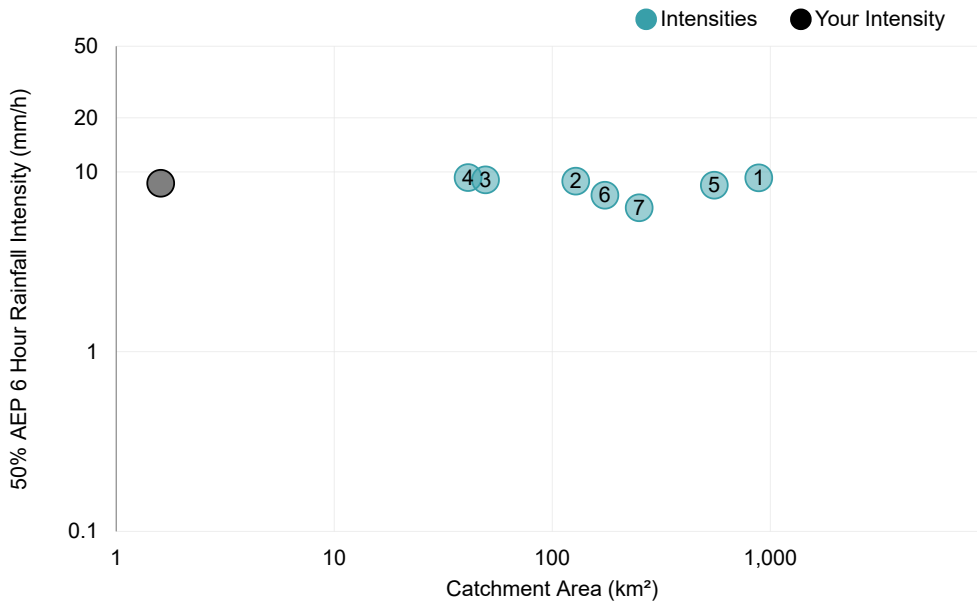


## Shape Factor vs Catchment Area

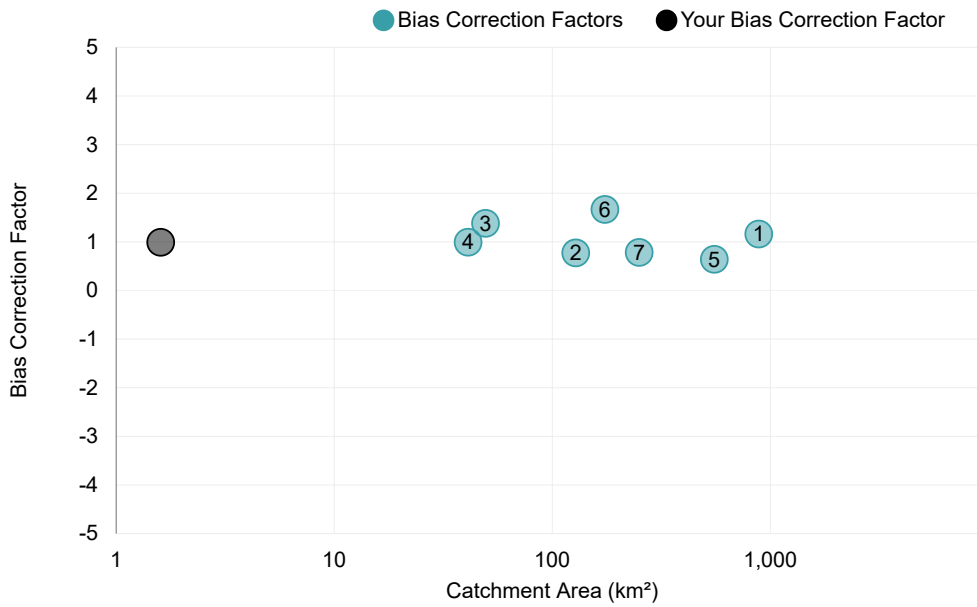
Note: This region does not use shape factors



## Intensity vs Catchment Area



## Bias Correction Factor vs Catchment Area



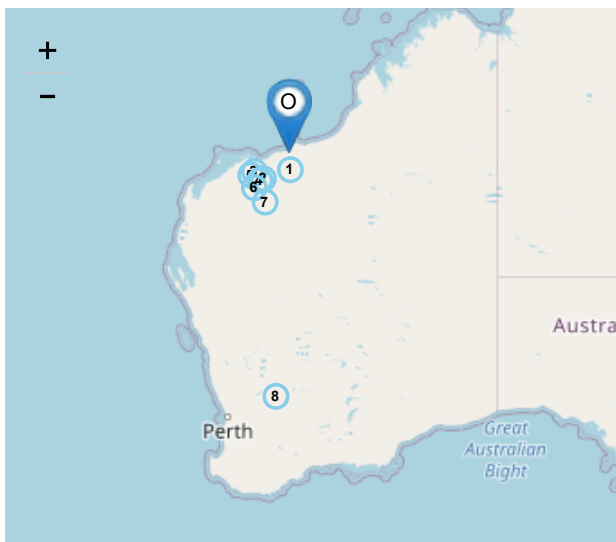
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**Input Data**

Date/Time	2020-09-14 17:33
Catchment Name	5
Latitude (Outlet)	-20.3563
Longitude (Outlet)	118.8361
Latitude (Centroid)	-20.3666
Longitude (Centroid)	118.8344
Catchment Area (km <sup>2</sup> )	1.6
Distance to Nearest Gauged Catchment (km)	97.15
50% AEP 6 Hour Rainfall Intensity (mm/h)	8.645855
2% AEP 6 Hour Rainfall Intensity (mm/h)	25.9872
Rainfall Intensity Source (User/Auto)	Auto
Region	Fringe - Pilbara & Arid and Semi-arid
Region Version	RFFE Model 2016 v1
Region Source (User/Auto)	Auto
Shape Factor	0.92
Interpolation Method	Natural Neighbour
Bias Correction Value	0.991

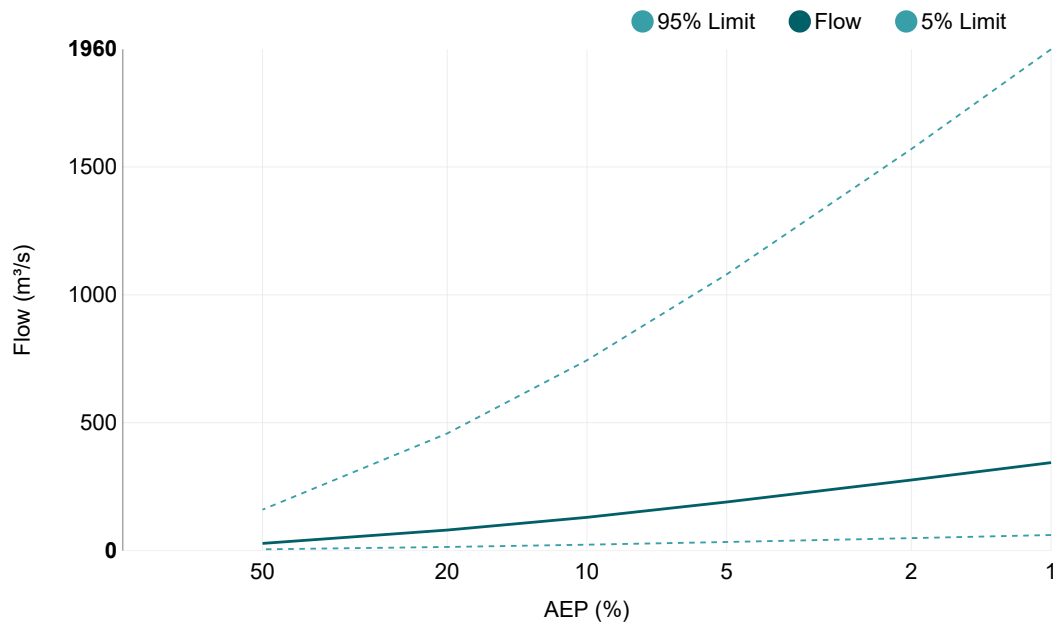


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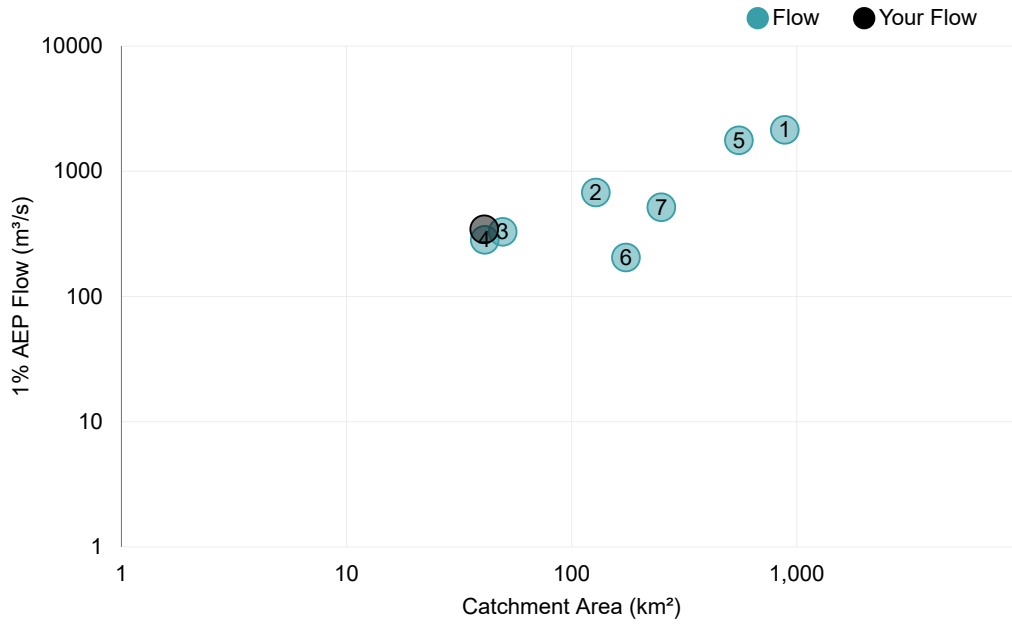


# Results | Regional Flood Frequency Estimation Model



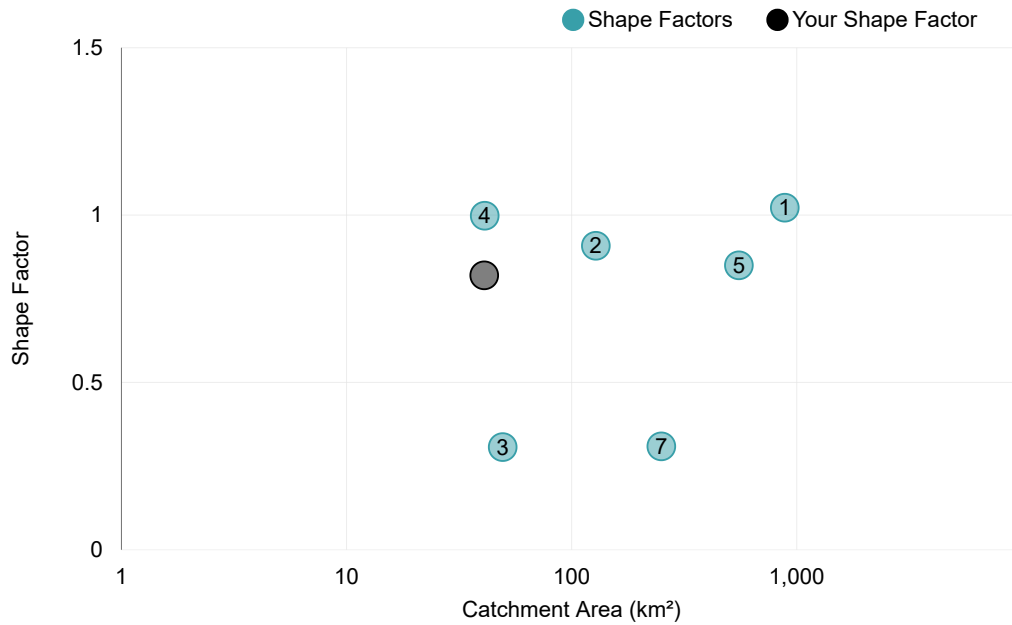
AEP (%)	Discharge (m³/s)	Lower Confidence Limit (5%) (m³/s)	Upper Confidence Limit (95%) (m³/s)
50	28.1	4.96	160
20	80.3	14.2	458
10	130	23.1	744
5	190	33.6	1080
2	276	48.7	1570
1	344	60.9	1960

## 1% AEP Flow vs Catchment Area

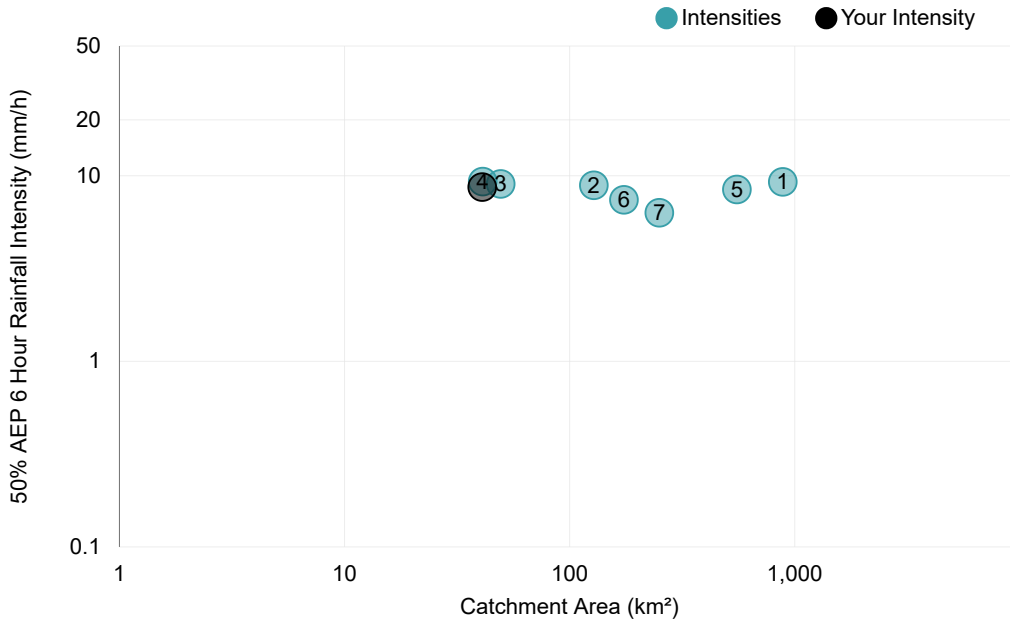


## Shape Factor vs Catchment Area

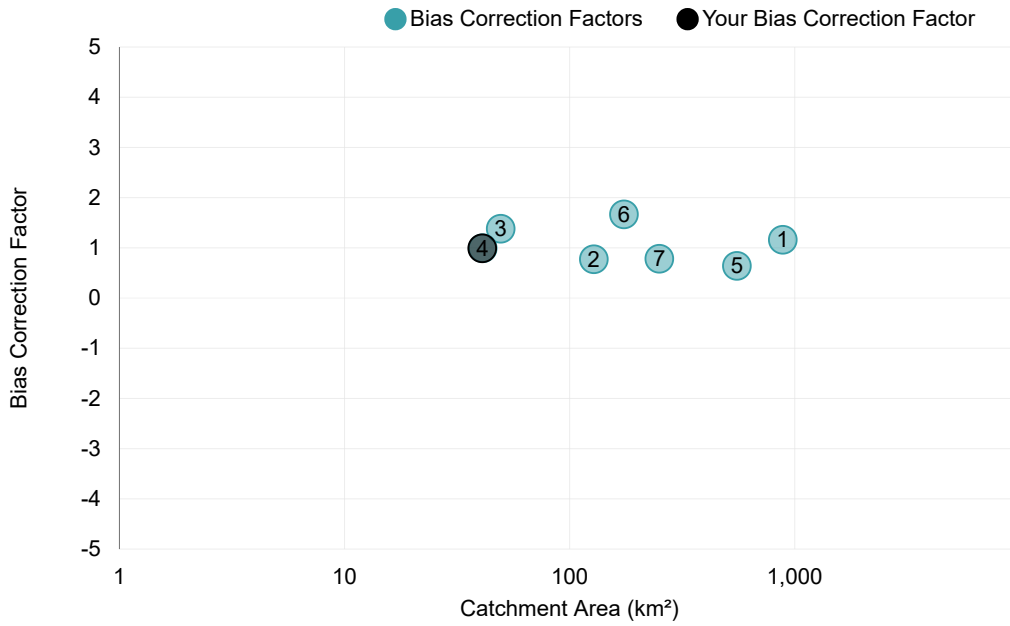
Note: This region does not use shape factors



## Intensity vs Catchment Area



## Bias Correction Factor vs Catchment Area

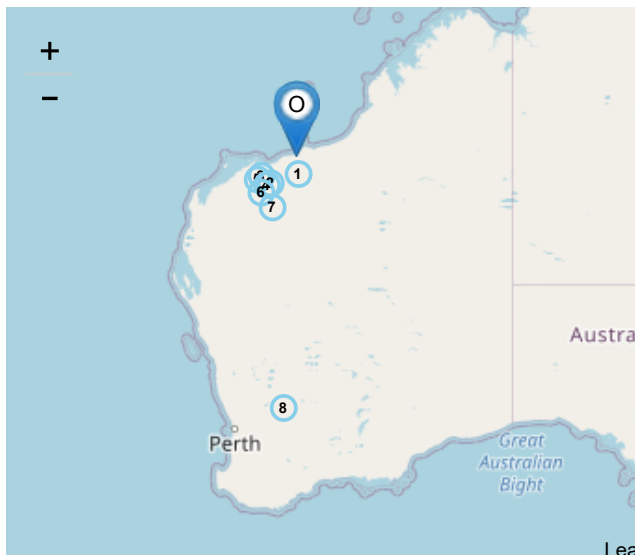


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**Input Data**

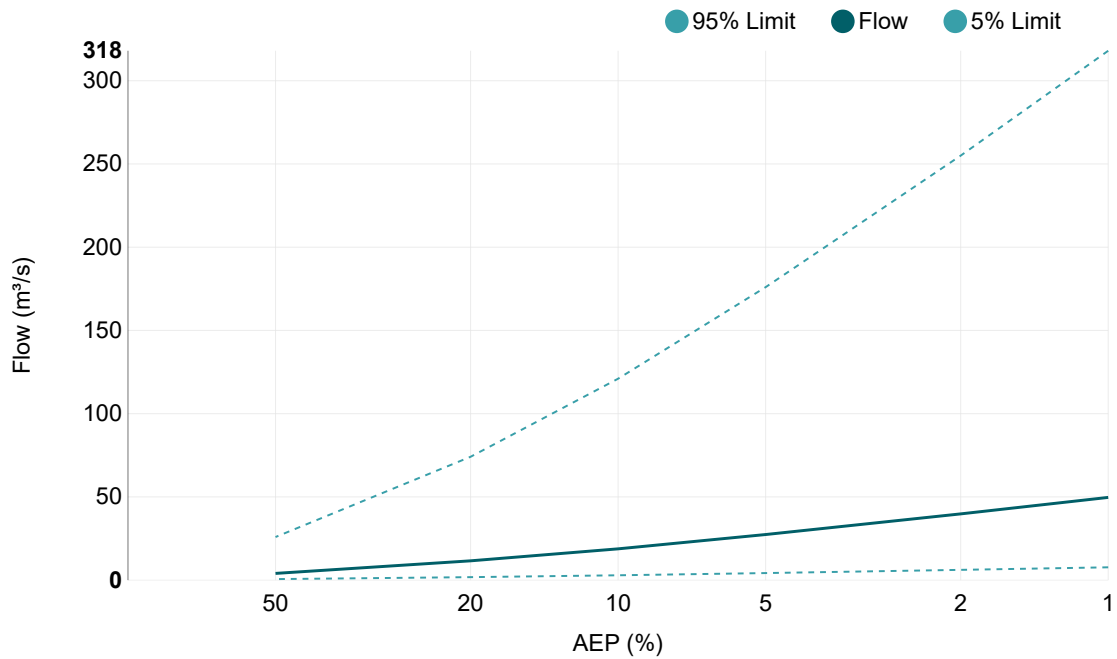
Date/Time	2020-09-14 17:37
Catchment Name	6
Latitude (Outlet)	-20.3563
Longitude (Outlet)	118.8476
Latitude (Centroid)	-20.4033
Longitude (Centroid)	118.8462
Catchment Area (km <sup>2</sup> )	40.9
Distance to Nearest Gauged Catchment (km)	97.17
50% AEP 6 Hour Rainfall Intensity (mm/h)	8.687174
2% AEP 6 Hour Rainfall Intensity (mm/h)	26.132093
Rainfall Intensity Source (User/Auto)	Auto
Region	Fringe - Pilbara & Arid and Semi-arid
Region Version	RFFE Model 2016 v1
Region Source (User/Auto)	Auto
Shape Factor	0.82
Interpolation Method	Natural Neighbour
Bias Correction Value	0.991



Method by Dr Ataur Rahman and Dr Khaled Haddad from Western Sydney University for the Australian Rainfall and Runoff Project. Full description of the project can be found at the project page (<http://arr.ga.gov.au/revision-projects/project-list/projects/project-5>) on the ARR website. Send any questions regarding the method or project here (<mailto:admin@arr-software.org>).



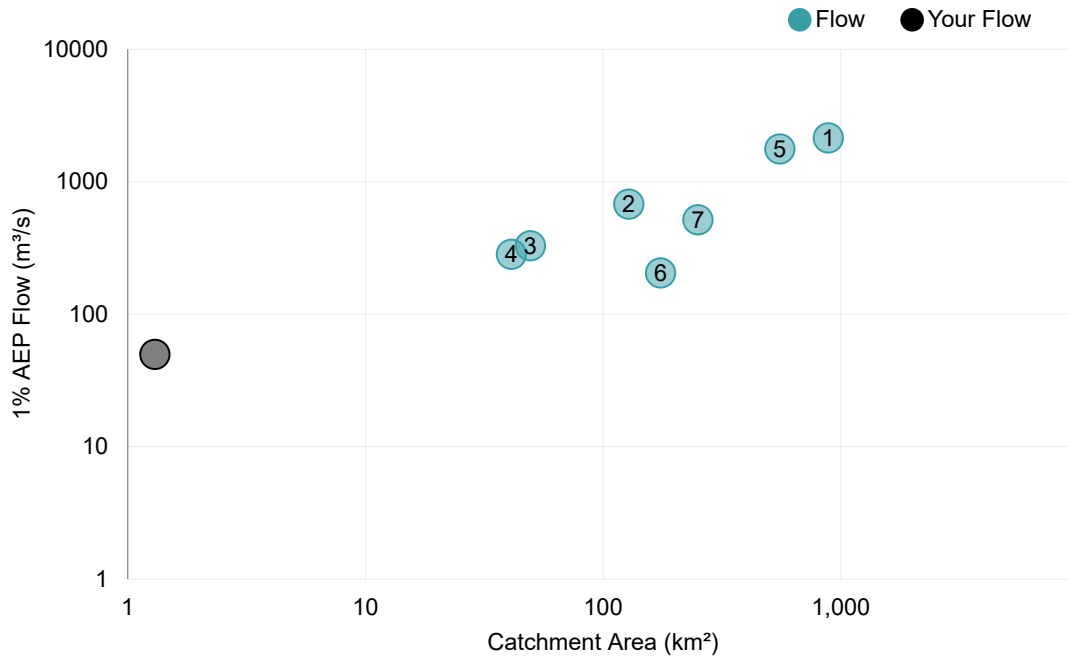
# Results | Regional Flood Frequency Estimation Model



AEP (%)	Discharge (m³/s)	Lower Confidence Limit (5%) (m³/s)	Upper Confidence Limit (95%) (m³/s)
50	4.05	0.630	25.9
20	11.6	1.80	74.1
10	18.8	2.92	121
5	27.4	4.25	176
2	39.8	6.18	255
1	49.7	7.71	318

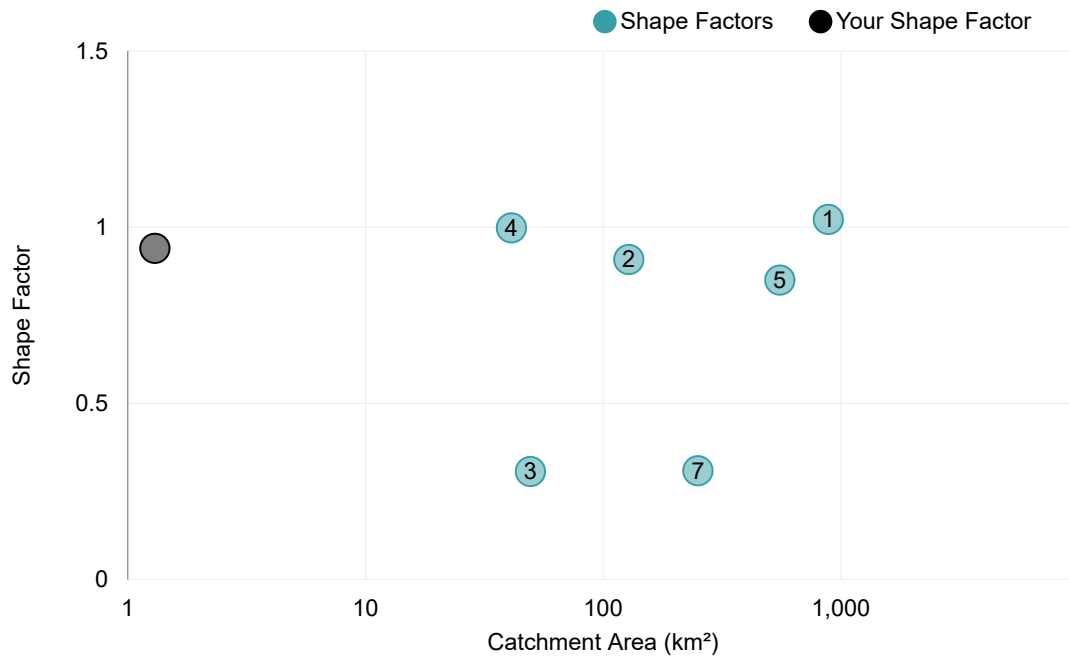
## 1% AEP Flow vs Catchment Area



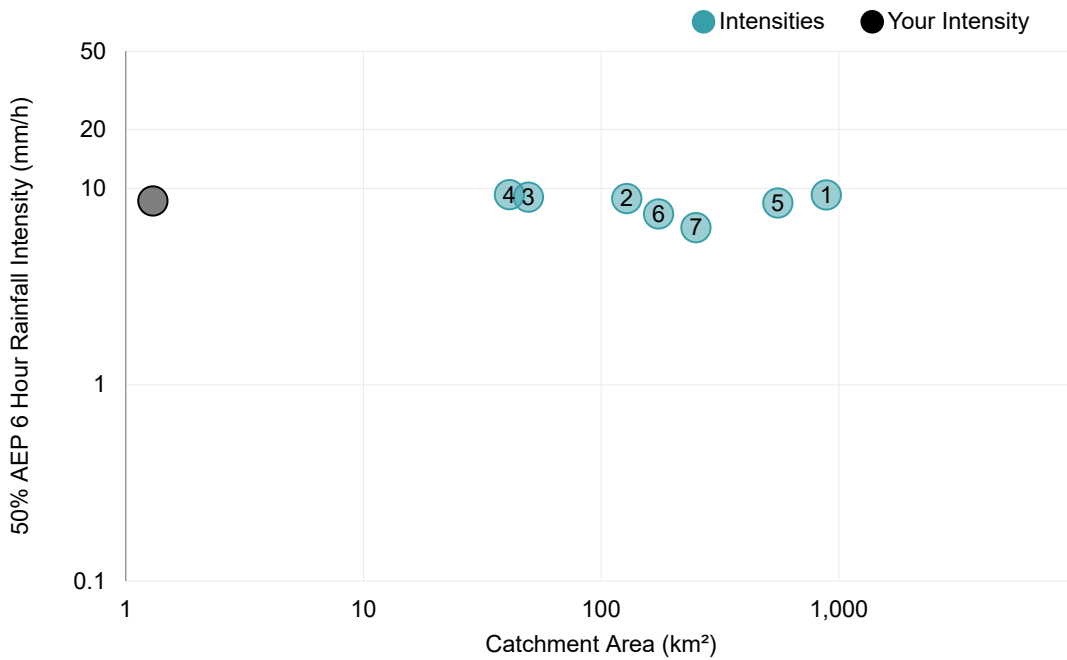


## Shape Factor vs Catchment Area

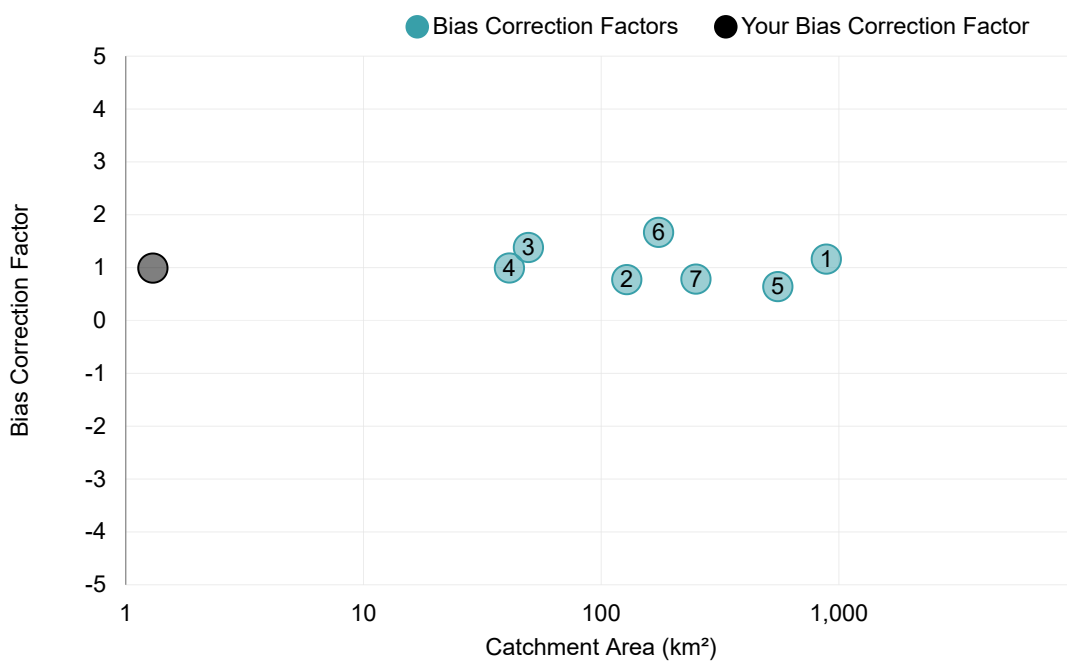
Note: This region does not use shape factors



## Intensity vs Catchment Area



## Bias Correction Factor vs Catchment Area

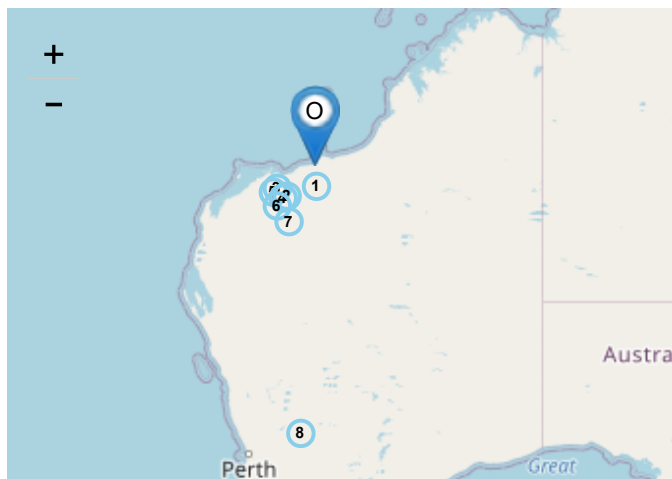


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**Input Data**

Date/Time	2020-09-14 17:39
Catchment Name	7
Latitude (Outlet)	-20.3561
Longitude (Outlet)	118.8582
Latitude (Centroid)	-20.3651
Longitude (Centroid)	118.862
Catchment Area (km <sup>2</sup> )	1.3
Distance to Nearest Gauged Catchment (km)	97.22
50% AEP 6 Hour Rainfall Intensity (mm/h)	8.6369
2% AEP 6 Hour Rainfall Intensity (mm/h)	25.917649
Rainfall Intensity Source (User/Auto)	Auto
Region	Fringe - Pilbara & Arid and Semi-arid
Region Version	RFFE Model 2016 v1
Region Source (User/Auto)	Auto
Shape Factor	0.94
Interpolation Method	Natural Neighbour
Bias Correction Value	0.991



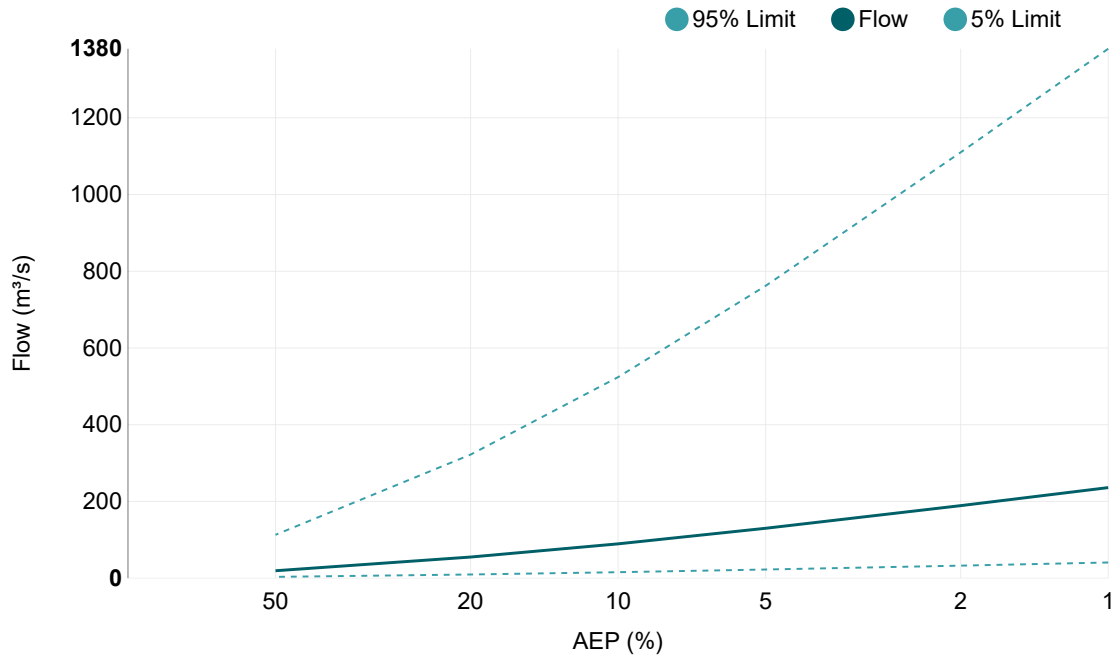


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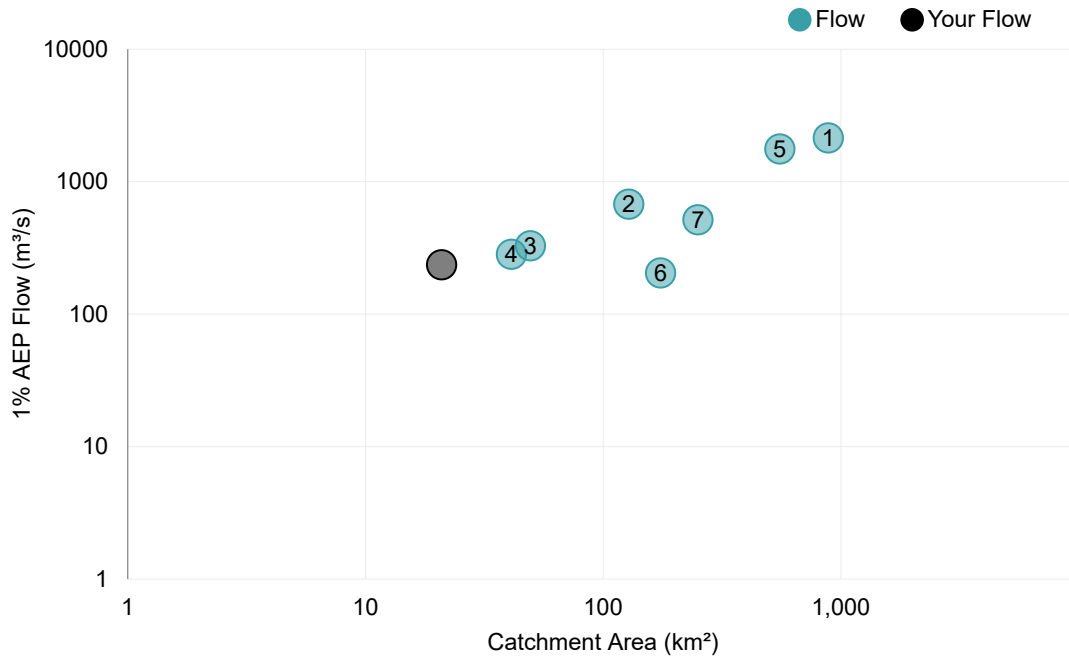
# Results | Regional Flood Frequency Estimation Model



\*The catchment has unusual shape. Results have lower accuracy and may not be directly applicable in practice.

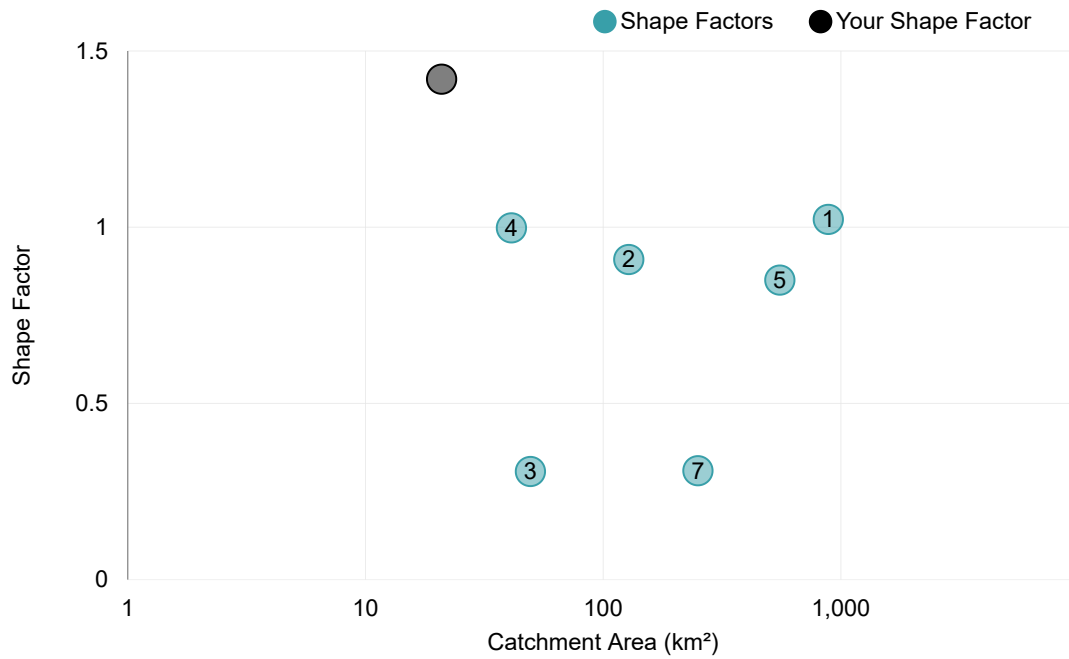
AEP (%)	Discharge (m³/s)	Lower Confidence Limit (5%) (m³/s)	Upper Confidence Limit (95%) (m³/s)
50	19.3	3.34	113
20	55.0	9.52	322
10	89.4	15.5	524
5	130	22.5	762
2	189	32.6	1110
1	236	40.8	1380

## 1% AEP Flow vs Catchment Area

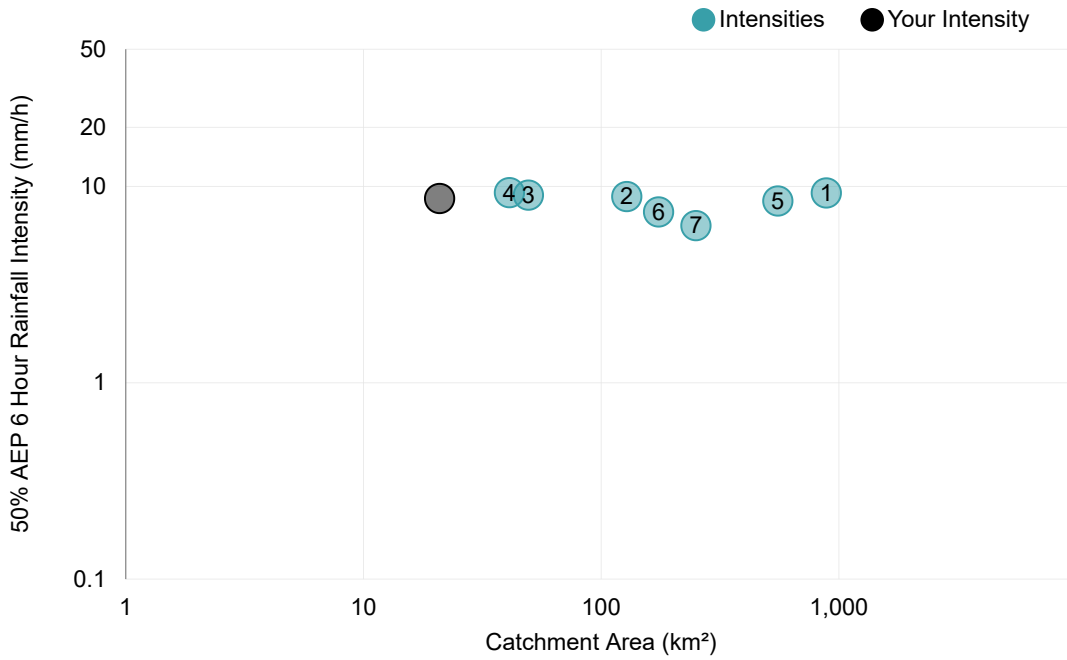


## Shape Factor vs Catchment Area

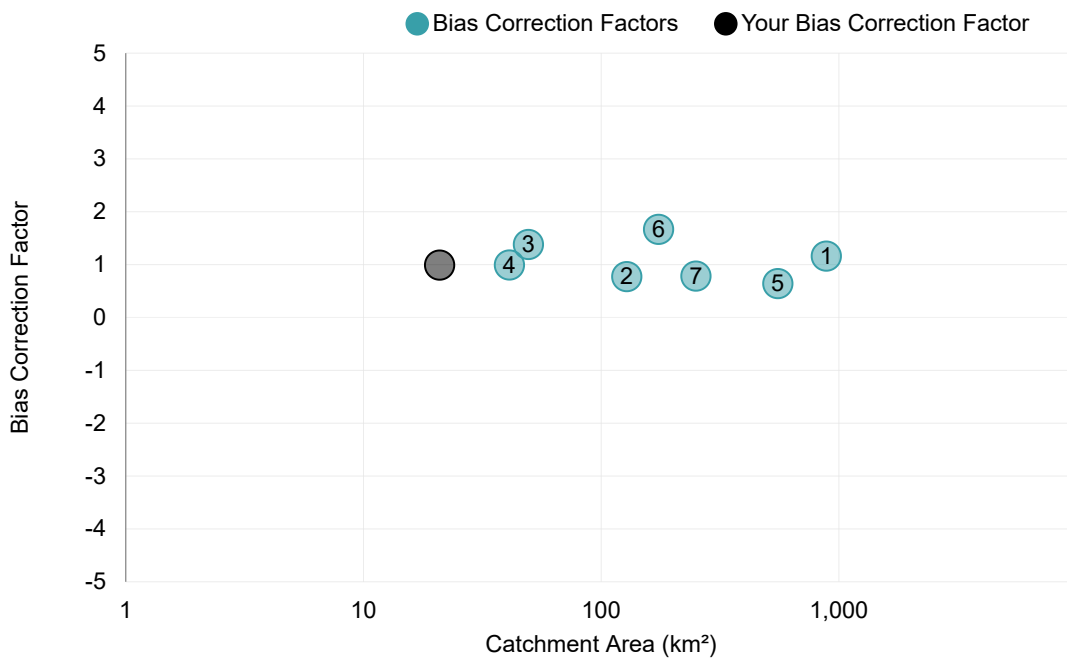
Note: This region does not use shape factors



## Intensity vs Catchment Area



## Bias Correction Factor vs Catchment Area

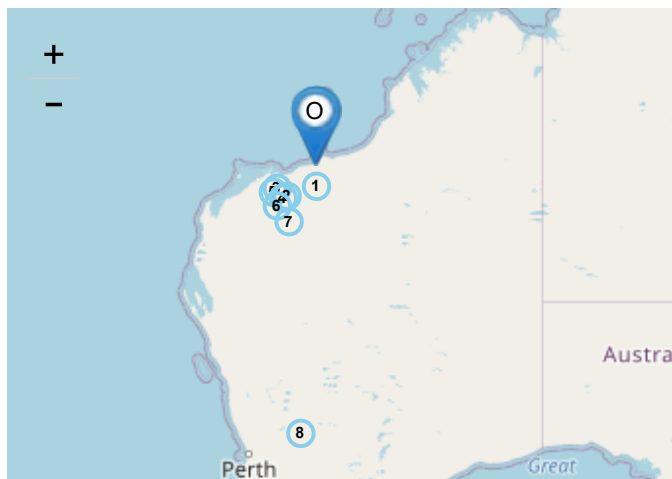


## Download

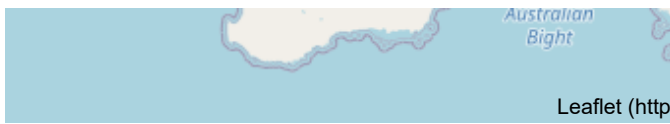
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**Input Data**

Date/Time	2020-09-14 17:39
Catchment Name	8
Latitude (Outlet)	-20.3563
Longitude (Outlet)	118.8691
Latitude (Centroid)	-20.4112
Longitude (Centroid)	118.8902
Catchment Area (km <sup>2</sup> )	20.9
Distance to Nearest Gauged Catchment (km)	97.24
50% AEP 6 Hour Rainfall Intensity (mm/h)	8.684369
2% AEP 6 Hour Rainfall Intensity (mm/h)	25.998121
Rainfall Intensity Source (User/Auto)	Auto
Region	Fringe - Pilbara & Arid and Semi-arid
Region Version	RFFE Model 2016 v1
Region Source (User/Auto)	Auto
Shape Factor	1.42*
Interpolation Method	Natural Neighbour
Bias Correction Value	0.991





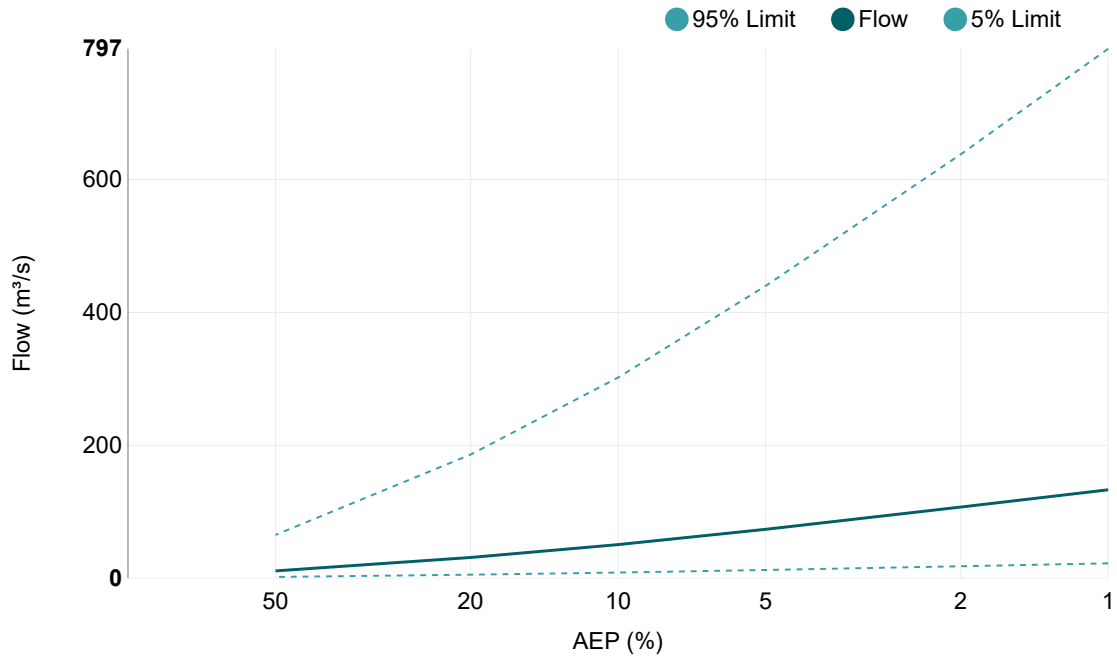


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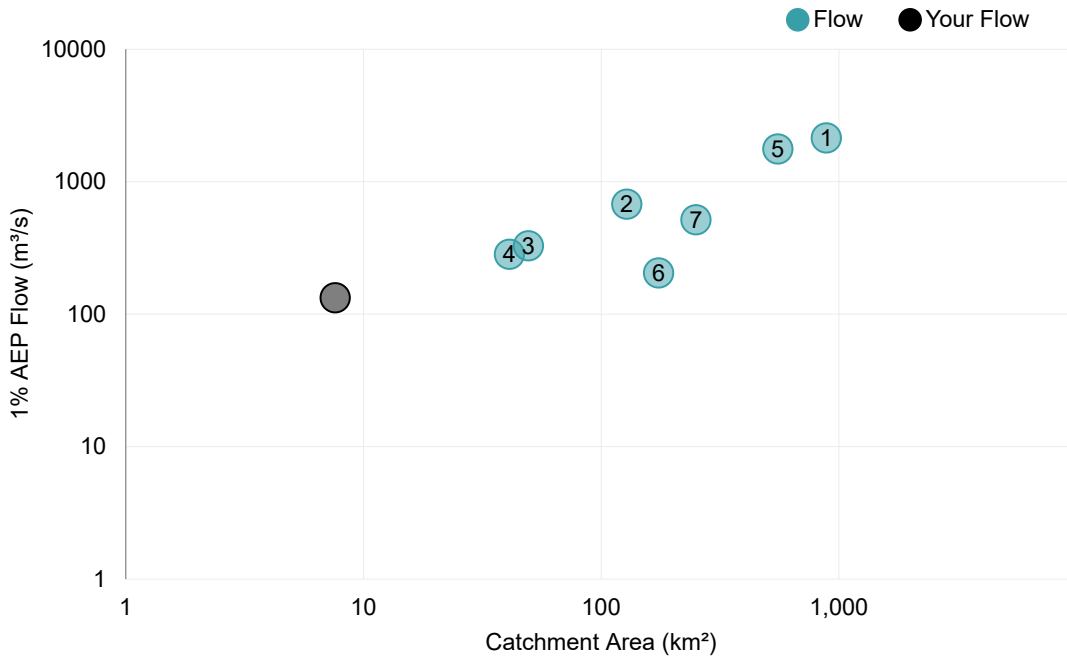
# Results | Regional Flood Frequency Estimation Model



\*The catchment has unusual shape. Results have lower accuracy and may not be directly applicable in practice.

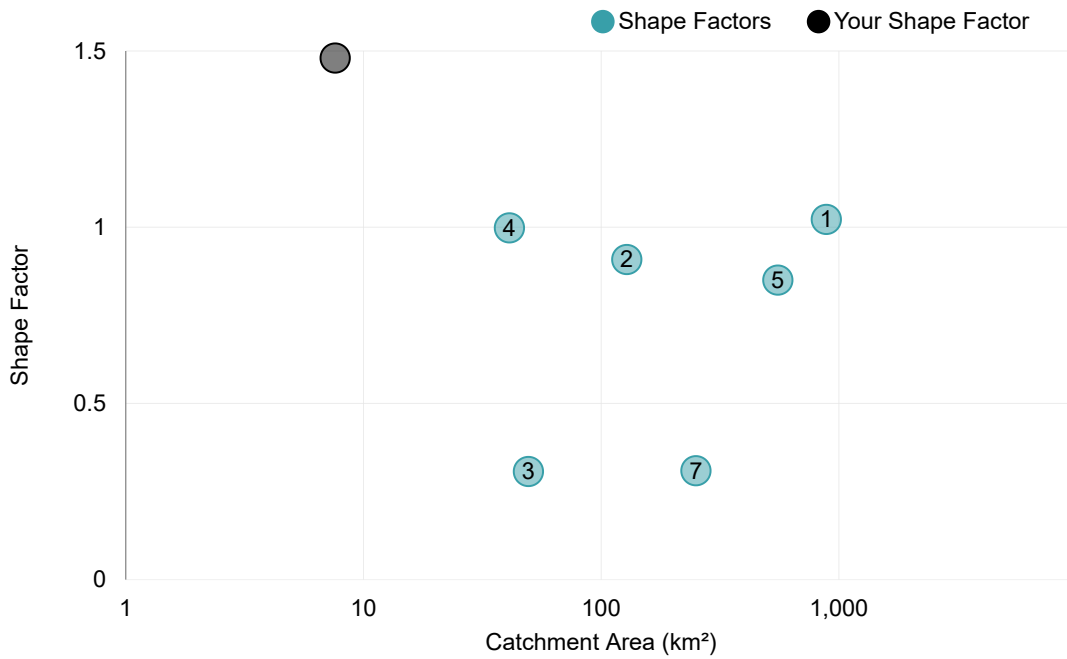
AEP (%)	Discharge (m³/s)	Lower Confidence Limit (5%) (m³/s)	Upper Confidence Limit (95%) (m³/s)
50	10.9	1.82	65.1
20	31.1	5.21	186
10	50.5	8.45	302
5	73.5	12.3	440
2	107	17.9	638
1	133	22.3	797

## 1% AEP Flow vs Catchment Area

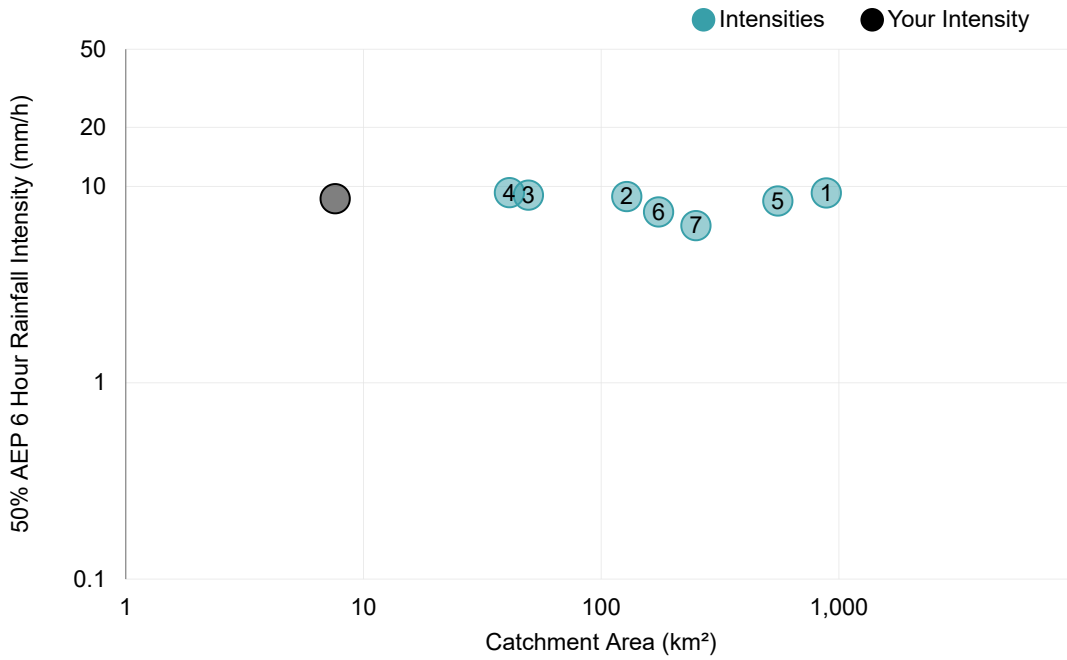


## Shape Factor vs Catchment Area

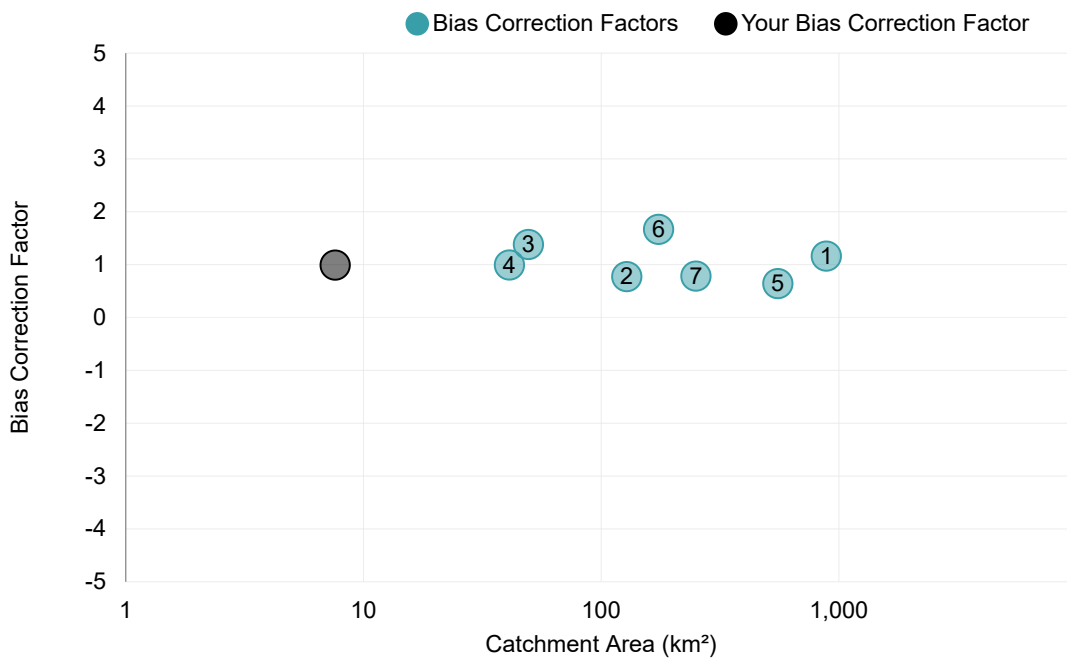
Note: This region does not use shape factors



## Intensity vs Catchment Area



## Bias Correction Factor vs Catchment Area

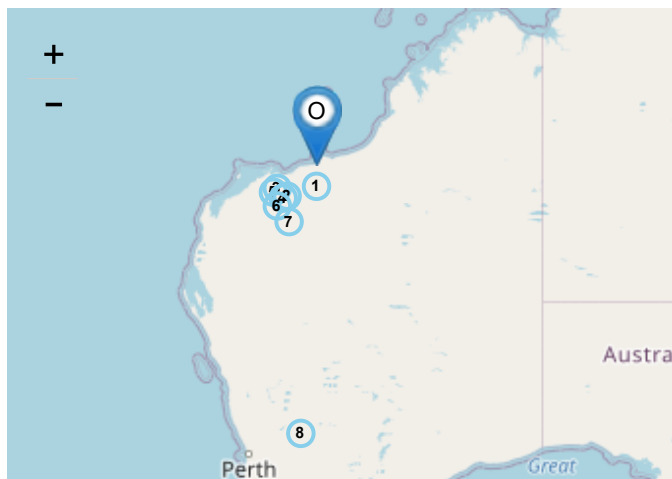


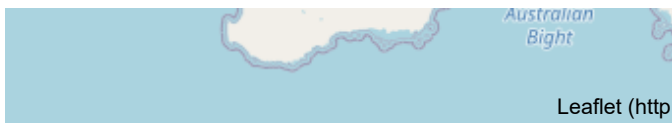
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**Input Data**

Date/Time	2020-09-14 17:41
Catchment Name	9
Latitude (Outlet)	-20.3561
Longitude (Outlet)	118.8815
Latitude (Centroid)	-20.3914
Longitude (Centroid)	118.892
Catchment Area (km <sup>2</sup> )	7.6
Distance to Nearest Gauged Catchment (km)	97.32
50% AEP 6 Hour Rainfall Intensity (mm/h)	8.662484
2% AEP 6 Hour Rainfall Intensity (mm/h)	25.929868
Rainfall Intensity Source (User/Auto)	Auto
Region	Fringe - Pilbara & Arid and Semi-arid
Region Version	RFFE Model 2016 v1
Region Source (User/Auto)	Auto
Shape Factor	1.48*
Interpolation Method	Natural Neighbour
Bias Correction Value	0.991





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# **APPENDIX E DUST MANAGEMENT PLAN**



**NGH**



## Dust Management Plan

August 2021

Project Number: 19-513





# DOCUMENT VERIFICATION

Project Title: Dust Management Plan

Project Number: 19-513

Project File Name: 19-513 Dust Management Plan Version 1.1

Revision	Date	Prepared by	Reviewed by	Approved by
Version 1	28/10/2020	B. Poulton	S. Priddle	Nick Graham-Higgs
Version 1.1	25/07/2021	B. Draper (minor edits)	Nicola Smith	Nick Graham-Higgs

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## **ACRONYMS AND ABBREVIATIONS**

ABS	Australian Bureau of Statistics
ASL	Above sea level
BoM	Bureau of Meteorology
DMP	Dust Management Plan
DPIRD	Department of Primary Industries and Regional Development
Dust Guideline	<i>A guideline for managing the impacts of dust and associated contaminants from land development sites, contaminated sites remediation and other related activities (DEC, 2011)</i>
DWER	Department of Water and Environmental Regulation
EP Act	<i>Environmental Protection Act 1986 (WA)</i>
EPA	Environmental Protection Authority
NEPC	National Environmental Protection Council
NEPC Act	<i>National Environment Protection Council (Western Australia) Act 1996 (WA)</i>
PM	Particulate Matter
ToPH	Town of Port Hedland
WA	Western Australia

# 1. INTRODUCTION

## 1.1. PURPOSE

This Dust Management Plan (DMP) has been provided by NGH, on behalf of Pilbara Solar, as a supplementary report to the development application (DA) for the Junja Solar Farm, a 10 megawatt (MW) alternating current (AC) photovoltaic (PV) solar farm approximately 26 km east of Port Hedland in the Pilbara Region of Western Australia (WA).

This DMP examines the potential for the proposal to generate dust that impacts any surrounding sensitive receivers, and to establish a program of management controls to maintain dust generation within acceptable levels, as defined in the *WA Environmental Protection Act 1986* (EP Act).

The development site is located well outside residential and commercial areas within the Town of Port Hedland local government area (over 10 km). The site is not presently used for any active rural purposes, one uninvolved Aboriginal community comprising clusters of residential dwellings is located approximately 180 m north of the development site boundary. The Jinparinya Aboriginal community is located approximately 250 m from the proposal and are associated with the proposal. No other sensitive receivers are located within 10 km of the proposal.

## 1.2. EPA OBJECTIVE

The environmental objective for air quality in WA is: "To maintain air quality and minimise emissions so that environmental values are protected" (EPA, 2016).

## 1.3. RELEVANT LEGISLATION, POLICY AND GUIDELINES

### 1.3.1. Legislation

#### ***Environmental Protection Act 1986 (EP Act)***

Dust emissions are only regulated under the EP Act, if they are of a magnitude to be considered 'pollution,' or the specific activity generating the dust is a regulated activity (covered by specific environmental protection regulations, or under a licence issued under Part V of the EP Act).

**Due to the size of the proposal and limited ground disturbance, the potential volume and concentration of dust generated would not be considered 'pollution' under the EP Act.**

#### ***National Environment Protection Council (Western Australia) Act 1996 (WA) (NEPC Act)***

The NEPC Act sets out national environmental protection standards and monitoring methods to achieve a desired environmental outcome defined as: "The desired environmental outcome of this Measure is ambient air quality that allows for the adequate protection of human health and well-being."

Table 1-1 Standards and goal for pollutants other than particles as PM<sub>2.5</sub>

Item	Pollutant	Averaging period	Maximum concentration	Goal within 10 years Maximum allowable exceedances
6	Particles as PM <sub>10</sub>	1 day	50 µg/m <sup>3</sup>	5 days a year

Table 1-2 Advisory reposting standards and goal for particles as PM<sub>2.5</sub>

Pollutant	Averaging period	Maximum concentration	Goal
Particles as PM <sub>2.5</sub>	1 day 1 year	25 µg/m <sup>3</sup> 8 µg/m <sup>3</sup>	Goal is to gather sufficient data nationally to facilitate a review of the Advisory Reporting Standards as part of the review of this Measure scheduled to commence in 2005

(Source: NEPC Act)

**This DMP is consistent with air quality standards and monitoring methods of the NEPC Act.**

### 1.3.2. Policy

The Town of Port Hedland (ToPH) currently has no local laws relating to dust management.

### 1.3.3. Guidelines

- *A Guideline for Managing the Impacts of Dust and Associated Contaminants from Land Development Sites, Contaminated Sites Remediation and Other Related Activities* (DEC, 2011) (Dust Guideline). Provides a method for assessing dust impacts and provides management and monitoring requirements for site classification categories.
- *Environmental Factor Guideline – Air Quality* (EPA, 2020). Defines air quality and air quality objectives.

## **2. EXISTING ENVIRONMENT**

### **2.1. SITE DESCRIPTION**

The development site is located approximately 26 km east of Port Hedland, on a portion of Lot 268 Great Northern Highway. Vehicle access to the site is via a private access track that runs from Great Northern Highway along the eastern boundary of Lot 268 (Figure 2-1).

The development site forms part of an area leased from the State Government by Jinparinya Aboriginal Community. Community dwellings are located approximately 250 m south of the development site boundary. A second uninhabited Aboriginal Community is located approximately 180 m north of the development site. A decommissioned railway owned by BHP Billiton lies directly north of the development site. A 66 kV Horizon Power electricity transmission line runs parallel along the railway line.

The Petermarer Creek runs approximately 1800 m to the eastern boundary. Like most rivers surrounding Port Hedland, Petermarer Creek is tidal, inundated for only a few hours each day, with its water washing back out to the Indian Ocean at low tide. The majority of the development site contains low-lying shrubland typical of the semi-arid Port Hedland area over relatively flat terrain (circa two metre relief).

**Junja Solar Farm**  
Dust Management Plan

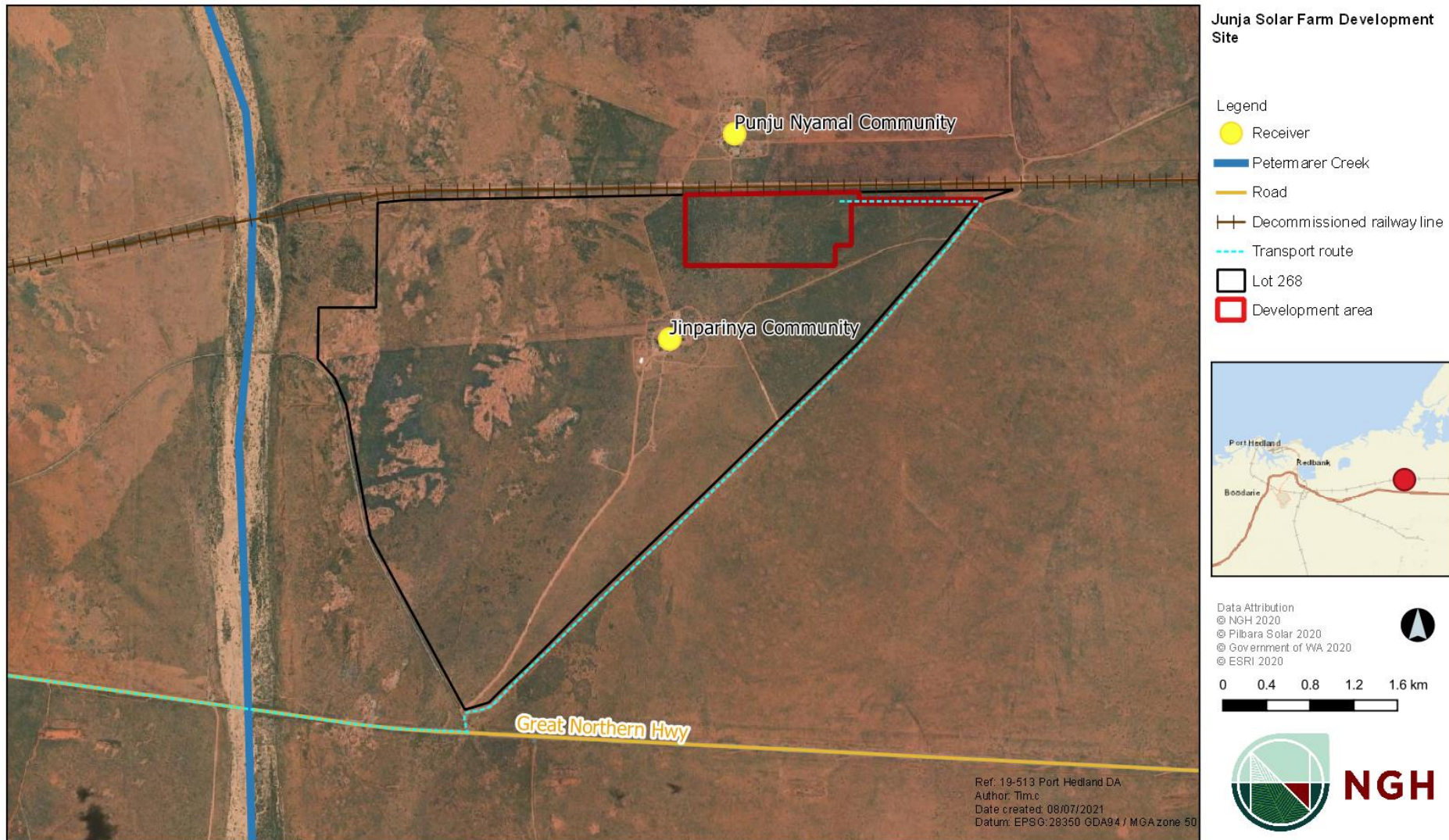


Figure 2-1 Junja Solar Farm development site



## 2.2. CLIMATE

Dust is reliant on climate for dispersal, particularly wind factors. Wind can cause dust to disperse into the surrounding environment and cause environmental and health impacts.

Port Hedland has a semi-arid climate with a tropical savanna climate influence. The BoM (2020) climate records available from the nearest climate station at Port Hedland Airport (station no. 004032, approximately 17 km southeast of the proposal) indicate a mean summer maximum of 36.8°C (March) and a mean winter minimum of 12.5°C (July) (Figure 2-2). Rainfall records from the same station show a mean annual rainfall of 319.3 mm, and that rainfall is generally greatest over summer, with the average monthly maximum occurring in February (88.9 mm).

Consideration of local climate is important in managing construction and operational impacts. For example, the semi-arid climate will affect soil and water management actions particularly, as well as the establishment of groundcover.

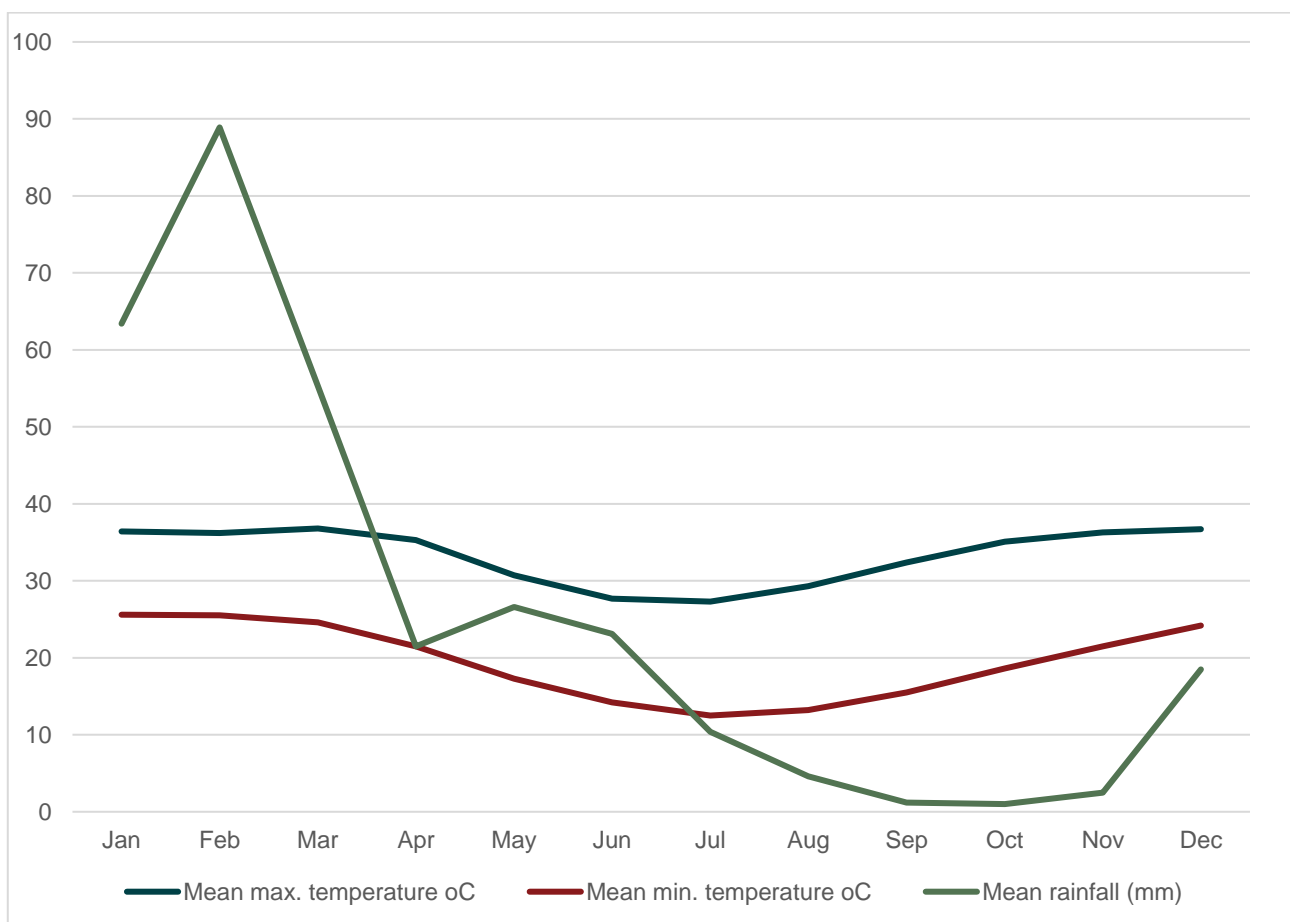


Figure 2-2 Climate statistics for weather station nearest to the proposal (Source: BoM 2020)

### 2.2.1. Local air quality

The air quality around the development site is generally expected to be good and typical of that found in a rural setting in the Pilbara region of WA. Existing sources of dust for the development site include:

- Agricultural activities including livestock movements across cattle stations.
- Dust from nearby unsealed roads.
- Strong winds moving across a flat landscape with naturally sparse groundcover.

Port Hedland Airport is the nearest BoM monitoring site with recorded wind rose data. The wind data from Port Hedland Airport demonstrates the differences in wind speed and direction during winter and summer.

Summer and winter wind roses were compiled from BoM data recorded during the period 1942 to 2020. The data presents morning (9am) and afternoon (3pm) wind conditions (Appendix A).

## **Summer**

Summer mornings (9am) generally have mild winds (<20 km/h in varying directions but slightly more in a north-westerly direction) (BoM, 2020).

Summer afternoons (3pm) generally have strong winds exceeding (>40 km/h) between 50 and 60% of the time in a north westerly direction. Northerly winds exceeding 40 km/h also infrequently. Summer afternoon winds almost never occur in southern or easterly directions (BoM, 2020).

## **Winter**

Winter mornings (9am) generally experience strong south easterly winds ranging from >10 km/h to >40 km/h. Winds moving west and north typically never occur during winter mornings (BoM, 2020).

Winter afternoons (3pm) generally experience winds in all directions except towards the southwest. The strongest, most regular winds are northerly winds, which persist approximately 30% of the time with a force up to between 30 km/h and 40 km/h (BoM, 2020).

## **2.3. SOILS**

The site is located on red deep sandy duplex according to available soil landscape mapping (CSIRO, 2020). Sandy duplexes are defined as 'soils with a sandy surface and a texture or permeability contrast at 3 to 80 cm,' (DAF, 2013). Red deep sandy duplex soils, characterised by the red appearance of the first 30 cm of the soil profile, mainly occur throughout the southern Pilbara Rangelands but are also scattered within the Southwestern Region of WA (DAF, 2013). Typical Australian Soil Classification of red deep sandy duplex soil are predominantly Red Chromosol/Red Sodosol overlaying loam, clay or rocky substrate. These soils are often hard setting and typically of neutral pH. Saline subsoils are common in this soil group (DAF, 2013).

## **2.4. DUST**

### **2.4.1. Air quality and health impacts**

The term dust refers to solid airborne particles generated and dispersed into the air by activities such as handling organic materials (such as grain), stockpiling of materials and soil disturbance resulting in windblown dust (DEC, 2011). Airborne particles are classified by size into three groups:

- Particulate matter (PM)<sub>10</sub>: Dust particles/particulate matter with an equivalent aerodynamic diameter of up to 10 µg/m<sup>3</sup>.
- PM<sub>2.5</sub>: Dust particles/particulate matter with an equivalent aerodynamic diameter of up to 2.5 µg/m<sup>3</sup>.
- TSP: All particles suspended in the atmosphere including fine, respirable particles (PM and PM) and larger size particles settling out of the air causing nuisance impacts, usually measured as having an aerodynamic diameter of 50 µg/m<sup>3</sup> (Source: EPA, 2008).

Dust has the potential to cause nuisance to surrounding land users and impact local amenity. Generally, nuisance dust has a larger particle size (>50µm (EPA 2008)), which causes it to settle out of the air, where it can form a layer of fine material on vehicles and infrastructure. Dust can impact human safety by limiting visibility for moving vehicles and reducing visual amenity. Dust can also impact the environment through

settling on flora, influencing the processes of photosynthesis, transpiration and respiration (Farmer, 1993). Exposure to large quantities of dust may alter nutrient concentrations within waterbodies, change the chemical composition of soils and alter the diversity of ecosystems (EPA, 2016).

Smaller particles, PM<sub>2.5</sub> to PM<sub>10</sub> are inhaled in the upmost part of the airways and lungs, causing irritation. PM<sub>2.5</sub> and smaller are articles of this size are considered 'respirable dust' and are inhaled more deeply where they can lodge in the alveolar region, directly impacting respiratory health.

Regulatory standards developed by the National Environmental Protection Council (NEPC) for pollutant particulate matter concentrations within the National Environmental Protection (Ambient Air Quality) Measure (NEPM) are provided below:

Table 2-1 NEPM exceedance criteria for PM<sub>10</sub> and PM<sub>2.5</sub>

Pollutant	Averaging period	Maximum concentration standard	Maximum allowable exceedances
PM <sub>10</sub>	1 day	50 µg/m <sup>3</sup>	None
	1 year	25 µg/m <sup>3</sup>	None
PM <sub>2.5</sub>	1 day	25 µg/m <sup>3</sup>	None
	1 year	8 µg/m <sup>3</sup>	None

(Source: Commonwealth of Australia, 2016)

### 2.4.2. Existing sources of dust

Primary existing sources of dust within the locality of the proposal include:

- Vehicle movements on unsealed tracks.
- Natural windblown dust as a result of the semi-arid climate and limited groundcover.

Dust and PM are sub-factor pollutants of air quality and require monitoring and management (EPA 2008).

## 2.5. TOPOGRAPHY

The site sits across a low ridge with an elevation of up to 18.5 – 19 m AHD (as indicated by the SRTM topographic data) (GA, 2011). The lowest parts of the site have ground elevations down to approximately 17 m AHD.

## 2.6. SENSITIVE RECEIVERS

The only uninvolved sensitive receiver within 10 km of the proposal is the Panju Nymal Aboriginal community, which currently comprises approximately 10 residents. The Panju Nymal community is located approximately 180 m north of the development site boundary and has been consulted in the preparation of the DA. Further details on community consultation are provided in section 6 of the Supplementary Report.

### 3. PROPOSED WORKS AND POTENTIAL IMPACTS

The proposal is consistent with the principle of waste management set out in section 4A of the EP Act and includes practical measures to minimise harmful dust emissions. Dust emissions generated by the proposal is a potential consequence of the following actions:

- Additional vehicle movement on unsealed tracks.
- Trenching to lay underground cables.
- Soil stockpiling.
- Limited vegetation removal for installation of inverter modules, transformer and storage shed.

Soils would be stockpiled onsite in low mounds under 2 metres in height, with concave tops to encourage plant growth.

Solar panels would be installed on frames installed by piling directly into the soil profile. No soil extraction and limited groundcover removal would be required by this process, thus the anticipated dust emission from solar panel installation is minimal.

Aspects and impacts for dust generating activities for the proposal are shown in Table 3-1. The duration of the activities were estimated based on the size of the proposal and NGH's experience with similar utility solar farm projects, confirmed with input from the EPC contractor. Risk ratings have been generated based on the Risk Matrix provided in Appendix B, taking into consideration the surrounding features such as vegetation, other land uses, topography and climate data.

Table 3-1 Aspects and impacts for dust construction generating activities

Activity	Duration	Aspect	Impact	Risk rating
<b>Vehicle movement</b>	6 months	Vehicle movement on unsealed tracks propel dust particles into the air. Approximately 1,000 light vehicle and 200 heavy vehicles movements (entering and leaving the site) over the construction phase.	Dust may become a nuisance and impact visual amenity of surrounding land uses.	Medium
<b>Trenching</b>	3 weeks	Excavating sand from its profile may cause airborne dust.	Dust may become a nuisance and impact visual amenity of surrounding land uses.	Low
<b>Soil stockpiles</b>	30 years	Increased soil exposure created by stockpiling may disperse dust into the air.	Dust may become a nuisance and impact visual amenity of surrounding land uses.	Low
<b>Vegetation removal and hardstand construction</b>	3 weeks	Removal of vegetation and topsoil exposes particles to the air and may increase wind erosion.	Increased wind erosion of exposed soil. Dust may become a nuisance and impact visual	Low

Activity	Duration	Aspect	Impact	Risk rating
			amenity of surrounding land uses.	
<b>Vegetation removal and track/firebreak construction</b>	30 years	Removal of vegetation and topsoil exposes particles to the air and may increase wind erosion.	Increased wind erosion of exposed soil. Dust may become a nuisance and impact visual amenity of surrounding land uses.	Low

### 3.1. IMPACT ASSESSMENT

A risk assessment for dust emissions from the proposal was completed using the site classification chart for uncontaminated dust (Appendix 1 of the Dust Guideline). The total scores from Table 3-2 and Table 3-3 give a site classification score (A x B) of 378 (**Classification 2**).

Table 3-2 Part A: Nature of site

Item	Score options				Allocated score
<b>1. Nuisance potential of soil, when disturbed</b>	Very low = 1	Low = 2	Medium = 4	High = 6	6
<b>2. Topography and protection provided by undisturbed vegetation</b>	Sheltered and screened = 1	Medium screening = 6	Little screening = 12	Exposed wind and prone = 18	6
<b>3. Area of site disturbed by the works</b>	Less than 1 ha = 1	Between 1 and 5 ha = 3	Between 5 and 10 ha = 6	More than 10 ha = 9	6
<b>4. Type of work being done</b>	Roads or shallow trenches = 1	Roads, drains and medium depth sewers = 3	Roads, drains, sewers, and partial earthworks = 6	Bult earthworks and deep trenches = 9	3
<b>Total score for Part A</b>					<b>21</b>

Table 3-3 Part B: Proximity for site to other land uses

Item	Score options				Allocated score
<b>1. Distance for other land uses from site</b>	More than 1 km = 1	Between 1 km and 500 m = 6	Between 100 m and 500 m = 12	Less than 100 m = 18	12
<b>2. Effect of prevailing wind direction (at time of construction) on other land uses</b>	Not affected = 1	Isolated land uses affected by one wind direction = 6	Dense land uses affected by one wind direction = 9	Dense/sensitive land uses affected by prevailing winds = 12	6
<b>Total score for Part B</b>					<b>18</b>

## **4. DUST MONITORING**

### **4.1. METHODS**

Activities that have the potential to cause emissions of PM10 and PM2.5 must be monitored, assessed and reported in accordance with relevant NEPM protocol. The methods proposed in this Dust Management Plan are based on the monitoring requirements for Classification 2 sites for uncontaminated dust (DEC, 2011).

The monitoring requirements for Classification 2 sites in Sheet 4 of the Dust Guideline include:

- Complaints management system in place (complaints recorded and acted on promptly).
- Notice to be erected at the site, providing contact details of the person to be contacted and works.

In addition to the above monitoring requirements, specific monitoring actions would be implemented for each phase of the proposal.

#### **4.1.1. Construction and decommissioning**

Visual monitoring will be completed by the EPC Contractor. When airborne dust has the potential to cause a nuisance by decreasing visibility on site, or clearly extending over the site boundary, the site manager would either cease works or implement more strenuous dust management methods depending on the severity of the dust incident.

The site manager would be responsible for recording details of all nuisance dust events in the Dust Incident Register located in the site office (example provided in Appendix C).

As meteorological conditions have a direct influence on dust generation, north facing winds and strength would be taken into consideration, in addition to temperature and rainfall conditions. If combined conditions look to be unfavourable for works, operations may cease for an agreed period of time in consultation with the Panju Nymal community.

#### **4.1.2. Operation**

As vehicle and staff movements at the site during operation would be limited to periodical inspections and maintenance works, dust emissions over this period are expected to be minimal and consistent with background levels. A notice providing contact details would continue to be displayed at the site entrance and a complaints register would be maintained by Pilbara Solar in accordance with the Dust Guideline.

## **5. DUST MANAGEMENT**

### **5.1. DUST MANAGEMENT CONTROLS**

In order to successfully mitigate onsite and offsite dust emissions, the following controls are required:

- Minimise and manage vehicle movements.
- Retain vegetation where possible.
- Limit areas of exposed soil.
- Schedule earthworks in relation to wind direction, wind strength, rainfall and temperature (daily and seasonally).
- Consideration of direction and strength of wind during excavating and filling trenches.
- Cover temporary soil stockpiles and excavations.
- Compact unsealed access track in consultation with landowners.
- Watercart on standby and used if required i.e. dust reached sensitive receivers.

Construction water would be obtained from a ToPH standpipe.

### **5.2. DUST MANAGEMENT ACTIONS**

By implementing a series of integrated dust management methods, the potential impacts of dust generated from the project would be minimised. A summary of the dust management controls, developed in accordance with the Dust Guideline, their associated risk and the roles and responsibilities of those employing them is in Table 5-1. Dust emissions during operation are not anticipated.



Table 5-1 Summary of dust management actions

Item	Risk	Control method	Responsibility	Revised risk matrix
<b>Construction and decommissioning</b>				
1	Vehicle movements on unsealed tracks	Compaction of unsealed sections of the transport route. 10km/hour speed limit throughout site, supported by signage. Speed limit conveyed to drivers and operatives at the site. Truck loads will be securely covered with canvas material to prevent any dust escaping Water cart on standby and used as required.	Contractor	Low
2	Clearing vegetation exposing topsoil to wind erosion	Where possible remaining vegetation would be retained. Compaction of unsealed tracks and hardstand areas. Watercart on standby for dust suppression.	Contractor	Low
3	Soil stockpiles causing airborne dust	Soil would be stockpiled into low mounds no higher than 2 metres using earthmoving equipment and covered to prevent wind dispersal. Retained stockpile stabilised with binder and/or planted vegetation, with concave tops to encourage plant growth.	Contractor	Low
4	Trenching for cable installation releasing soil	In the event of strong, north-facing winds, temporarily stop work and cover excavated areas and stockpiles until more favourable weather conditions resume. Watercart on standby and used if required.	Contractor	Low

Item	Risk	Control method	Responsibility	Revised risk matrix
<b>Construction and decommissioning</b>				
	particles as dust.			
5	Unloading fill material causing errant airborne dust	Unloading of fill material would be surrounded by a wind shield to contain dust, depending on weather conditions. In the event of strong, north-facing winds, temporarily stop work and cover excavated areas and stockpiles until more favourable weather conditions resume. Watercart on standby and used if required.	Contractor	Low
6	Loading excavated materials into trucks causing errant airborne dust	In the event of strong, north-facing winds, temporarily stop work and cover excavated areas and stockpiles until more favourable weather conditions resume.	Contractor	Low

### **5.3. RELEVANT STAKEHOLDERS**

Stakeholders are all parties who have an interest in the project. Department of Water and Environment Regulation (DWER) requires that proponents to carry out community engagement for sites that pose a risk to human health, the environment, environmental values, or potentially impact sensitive receptors (DER, 2014).

The relevant stakeholders of this project include:

- Sensitive receptors within 500 m of the proposal (Panju Nymal community (uninvolved) and Jinparinya community (involved)).
- Owners of Lot 268, Great Northern Highway (subject land).
- Horizon Power.
- Town of Port Hedland.
- Indirectly affected members of the public.
- Government Departments (e.g. DWER, Department of Health)

Stakeholder consultation for the proposal including dust emissions is further detailed in section 5 of the DA Supplementary Report.

### **5.4. ROLES AND RESPONSIBILITIES**

The roles and responsibilities associated with the implementation of this DMP are listed in Table 5-1.

### **5.5. COMPLAINTS MANAGEMENT**

A complaints management system would be implemented to include a feedback loop to the community and provide for corrective action when adverse impacts have occurred. All complaints would be logged and investigated with timely feedback provided to the complainant. Complaint forms would be kept at the Pilbara Solar office and made available to relevant authorities and community members upon request. An example Dust Incident Register is provided in Appendix C.

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# APPENDIX A WIND ROSES FOR PORT HEDLAND AIRPORT

## A.1 JANUARY 9AM

### Rose of Wind direction versus Wind speed in km/h (18 Jul 1942 to 13 Aug 2020)

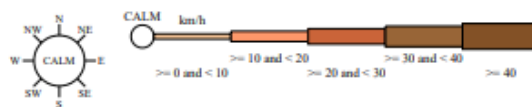
Custom times selected, refer to attached note for details

#### PORT HEDLAND AIRPORT

Site No: 004032 • Opened Jul 1942 • Still Open • Latitude: -20.3725° • Longitude: 118.6317° • Elevation 6.m

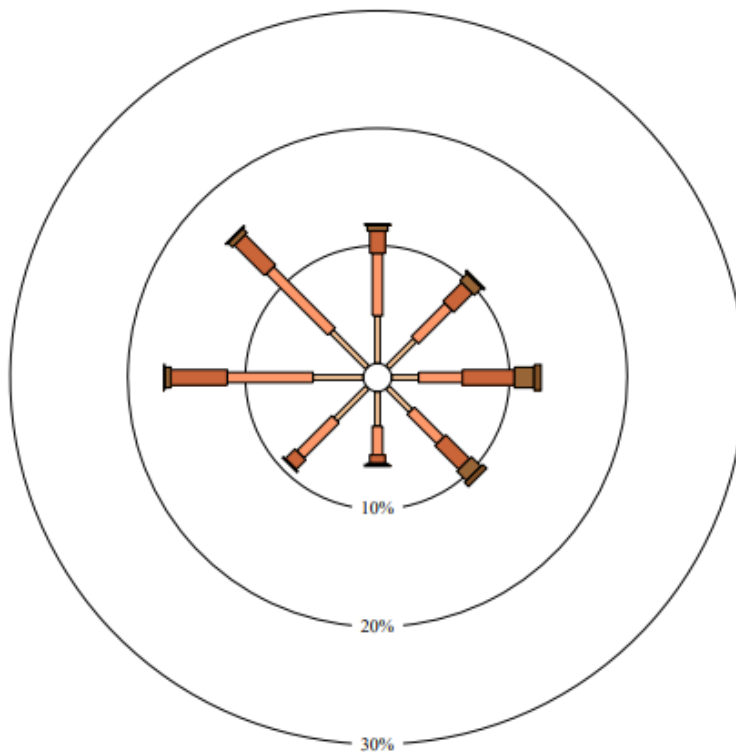
An asterisk (\*) indicates that calm is less than 0.5%.

Other important info about this analysis is available in the accompanying notes.



9 am Jan  
2413 Total Observations

Calm 6%



## A.2 JANUARY 3PM

### Rose of Wind direction versus Wind speed in km/h (18 Jul 1942 to 13 Aug 2020)

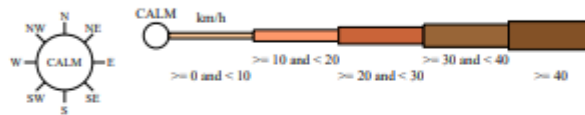
Custom times selected, refer to attached note for details

#### PORT HEDLAND AIRPORT

Site No: 004032 • Opened Jul 1942 • Still Open • Latitude: -20.3725° • Longitude: 118.6317° • Elevation 6.m

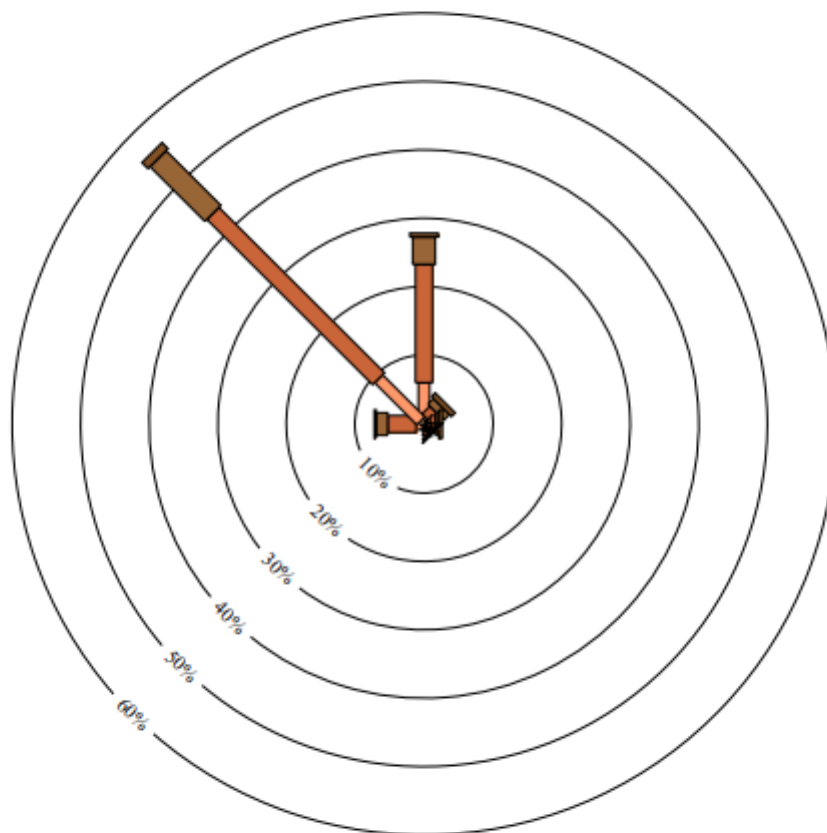
An asterisk (\*) indicates that calm is less than 0.5%.

Other important info about this analysis is available in the accompanying notes.



3 pm Jan  
2418 Total Observations

Calm \*



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### A.3 JULY 9AM

#### Rose of Wind direction versus Wind speed in km/h (18 Jul 1942 to 13 Aug 2020)

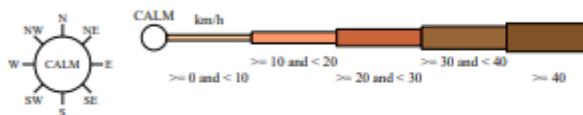
Custom times selected, refer to attached note for details

#### PORT HEDLAND AIRPORT

Site No: 004032 • Opened Jul 1942 • Still Open • Latitude: -20.3725° • Longitude: 118.6317° • Elevation 6.m

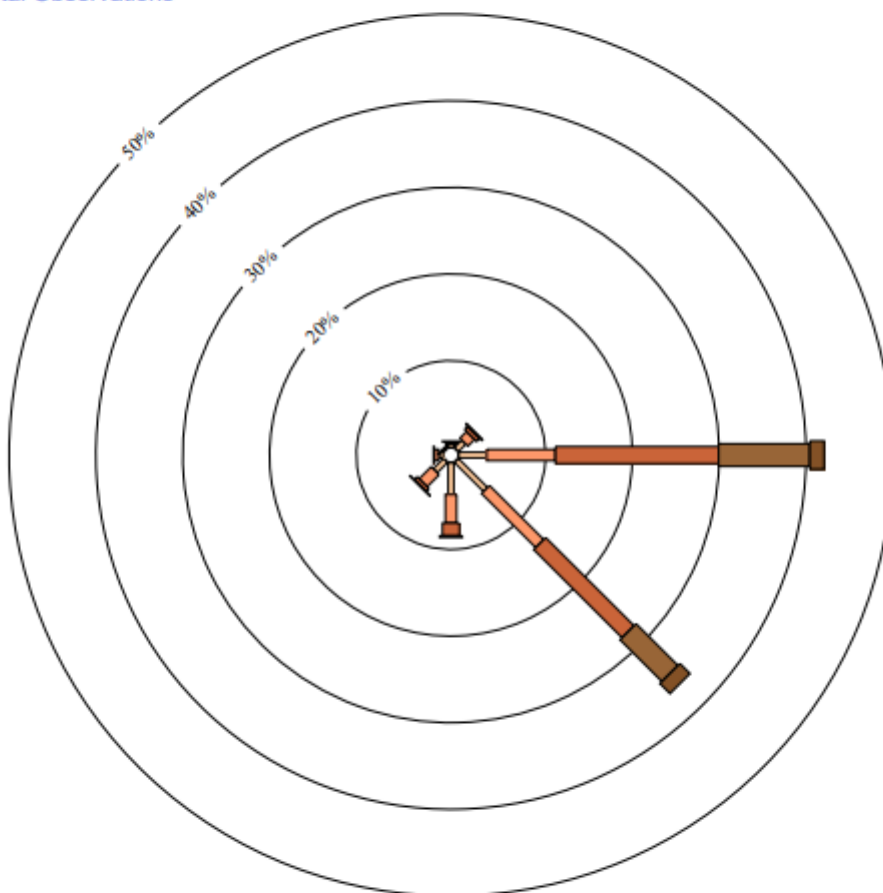
An asterisk (\*) indicates that calm is less than 0.5%.

Other important info about this analysis is available in the accompanying notes.



9 am Jul  
2415 Total Observations

Calm 4%



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## A.4 JULY 3PM

### Rose of Wind direction versus Wind speed in km/h (18 Jul 1942 to 13 Aug 2020)

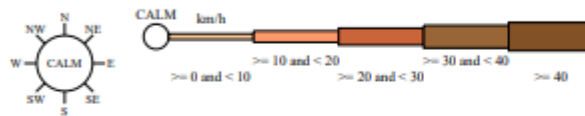
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#### PORT HEDLAND AIRPORT

Site No: 004032 • Opened Jul 1942 • Still Open • Latitude: -20.3725° • Longitude: 118.6317° • Elevation 6.m

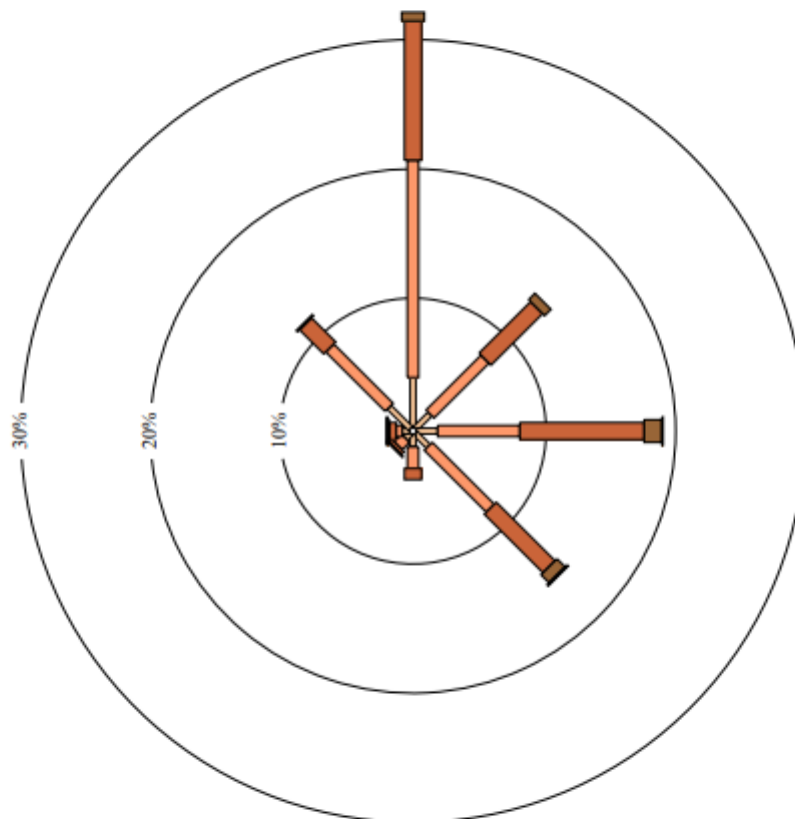
An asterisk (\*) indicates that calm is less than 0.5%.

Other important info about this analysis is available in the accompanying notes.



3 pm Jun  
2323 Total Observations

Calm 1%





## APPENDIX B RISK MATRIX

Likelihood	Consequence				
	Slight 1	Minor 2	Moderate 3	Major 4	Severe 5
Almost certain A	Medium	High	High	Extreme	Extreme
Likely B	Medium	Medium	High	High	Extreme
Possible C	Low	Medium	Medium	High	Extreme
Unlikely D	Low	Medium	Medium	Medium	High
Rare E	Low	Low	Medium	Medium	High

(Source: DER, 2017)

**RISK ACTION TABLE**

<b>Risk Rating</b>	<b>Acceptability</b>	<b>Action</b>
Extreme	Risk unacceptable.	Risks associated are impossible to manage.
High	Acceptable if control methods are outlined and implemented to remediate risks.	Multiple regulatory control methods are outlined and implemented to decrease associated emissions, outcome and management based conditions will be considered.
Medium	Acceptable if control methods are outlined and implemented to remediate risks, risks of this category are generally tolerable subject under general controls.	Regulatory controls outlined and implemented but risk is generally tolerable, outcome based controls are required for treatment.
Low	Acceptable.	No treatment required; risk is acceptable.

## APPENDIX C DUST INCIDENT REGISTER

Date / Time	Reported by?	Contact no.	Incident description	Location	Management controls implemented	Date implemented

# APPENDIX F NOISE MANAGEMENT PLAN



**NGH**



## Noise Management Plan

August 2021

Project Number: 19-513



# DOCUMENT VERIFICATION

Project Title: Noise Management Plan

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Project Number: 19-513

---

Project File Name: 19-513 Noise Management Plan Version 1.1

Revision	Date	Prepared by	Reviewed by	Approved by
Version 1	2/11/2020	B. Poulton	M Sutherland	Nick Graham-Higgs
Version 1.1	25/07/2021	B. Draper (minor edits)	Nicola Smith	Nick Graham-Higgs

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## **ACRONYMS AND ABBREVIATIONS**

ABS	Australian Bureau of Statistics
AS 2436-2010	<i>Australian Standard AS 2436-2010 Guide to noise and vibration control on construction, maintenance, and demolition sites</i>
ASL	Above sea level
Balance	Balance Services Group (Contractor)
BoM	Bureau of Meteorology
DAF	Department of Agriculture and Food
DEC	Department of Environment and Conservation (now DWER)
DPIRD	Department of Primary Industries and Regional Development
NMP	Noise Management Plan
DWER	Department of Water and Environmental Regulation
EP Act	<i>Environmental Protection Act 1986 (WA)</i>
EPA	Environmental Protection Authority
NEPC	National Environmental Protection Council
NEPC Act	<i>National Environment Protection Council (Western Australia) Act 1996 (WA)</i>
Noise Regulations	Environmental Protection (Noise) Regulations 1997
ToPH	Town of Port Hedland

# 1. INTRODUCTION

## 1.1. PURPOSE

This Noise Management Plan (NMP) has been prepared by NGH, on behalf of Pilbara Solar. The NMP is a supplementary report to the development application (DA) for the Junja Solar Farm. The Junja Solar Farm is a 10 megawatt (MW) alternating current (AC) photovoltaic (PV) solar farm located approximately 26 km east of Port Hedland in the Pilbara Region of Western Australia (WA).

This NMP examines the potential for the proposal to generate noise. It also examines the potential for noise from the project to impact surrounding sensitive receptors. Finally, the NMP establishes management controls to maintain noise generation within acceptable levels, as defined in the *Environmental Protection (Noise) Regulations 1997* (Noise Regulations).

The development site is located outside residential and commercial areas of the Town of Port Hedland (ToPH) local government area. The site is not presently used for active rural purposes. Two Aboriginal communities, comprising clusters of residential dwellings are located approximately 180 m north and approximately 250 m south of the development site. There are no other sensitive receptors within 10 km.

## 1.2. NOISE CONTROL OBJECTIVE

The objectives of the NMP are to comply with the Noise Regulations and prevent noise causing a nuisance for sensitive receptors near the proposal.

## 1.3. RELEVANT LEGISLATION, POLICY AND GUIDELINES

### 1.3.1. Legislation

#### ***Environmental Protection Act 1986 (EP Act)***

Assigned noise levels are the levels of noise allowed to be received at a premises at a particular time of the day or night.

The assigned levels form “prescribed standards” under sections 51, 62 (4), 65, 74 (3) and clause 22 of Schedule 4 of the EP Act. Causing or allowing noise emissions which exceed the prescribed standard is an offence and can also be regarded as “pollution” or “unreasonable noise” under Section 3 of the EP Act.

#### **Environmental Protection (Noise) Regulations 1997 (Noise Regulations)**

Regulation 8 defines three types of assigned levels:

- $LA_{max}$  assigned level means a noise level which is not to be exceeded at any time.
- $LA_1$  assigned level means a noise level which is not to be exceeded for more than 1% of the time, e.g. for more than one minute in 100 minutes.
- $LA_{10}$  assigned level means a noise level which is not to be exceeded for more than 10% of the time, e.g. for more than ten minutes in 100 minutes.

Assigned noise levels applicable to each sensitive receptor are calculated as directed by the Noise Regulations in section 2.5.3.

### **1.3.2. Policy**

ToPH currently has no local laws relating to noise management.

### **1.3.3. Guideline**

- Australian Standard *AS 2436-2010 Guide to noise and vibration control on construction, maintenance, and demolition sites (AS 2436-2010)*.

## **2. EXISTING ENVIRONMENT**

### **2.1. SITE DESCRIPTION**

The development site is located approximately 26 km east of Port Hedland, on a portion of Lot 268 DP 218421, Great Northern Highway. Vehicle access to the site is via a private access track that runs from the Great Northern Highway along the eastern boundary of Lot 268 (Figure 2-1).

The development site forms part of an area leased from the State Government by the Jinparinya Aboriginal Community. Residential dwellings within two Aboriginal communities are located approximately 180 m north and approximately 250 m south of the development site. A decommissioned railway owned by BHP Billiton Iron Ore lies directly north of the development site. A 66 kV Horizon Power electricity transmission line runs parallel to and along the railway line.

The Petermarer Creek runs approximately 1800 m to the eastern boundary. Like most watercourses surrounding Port Hedland, Petermarer Creek is tidal, inundated for only a few hours each day, with its water washing back out to the Indian Ocean at low tide. The majority of the development site contains low-lying shrubland typical of the semi-arid Port Hedland area.

**Junja Solar Farm**  
Noise Management Plan

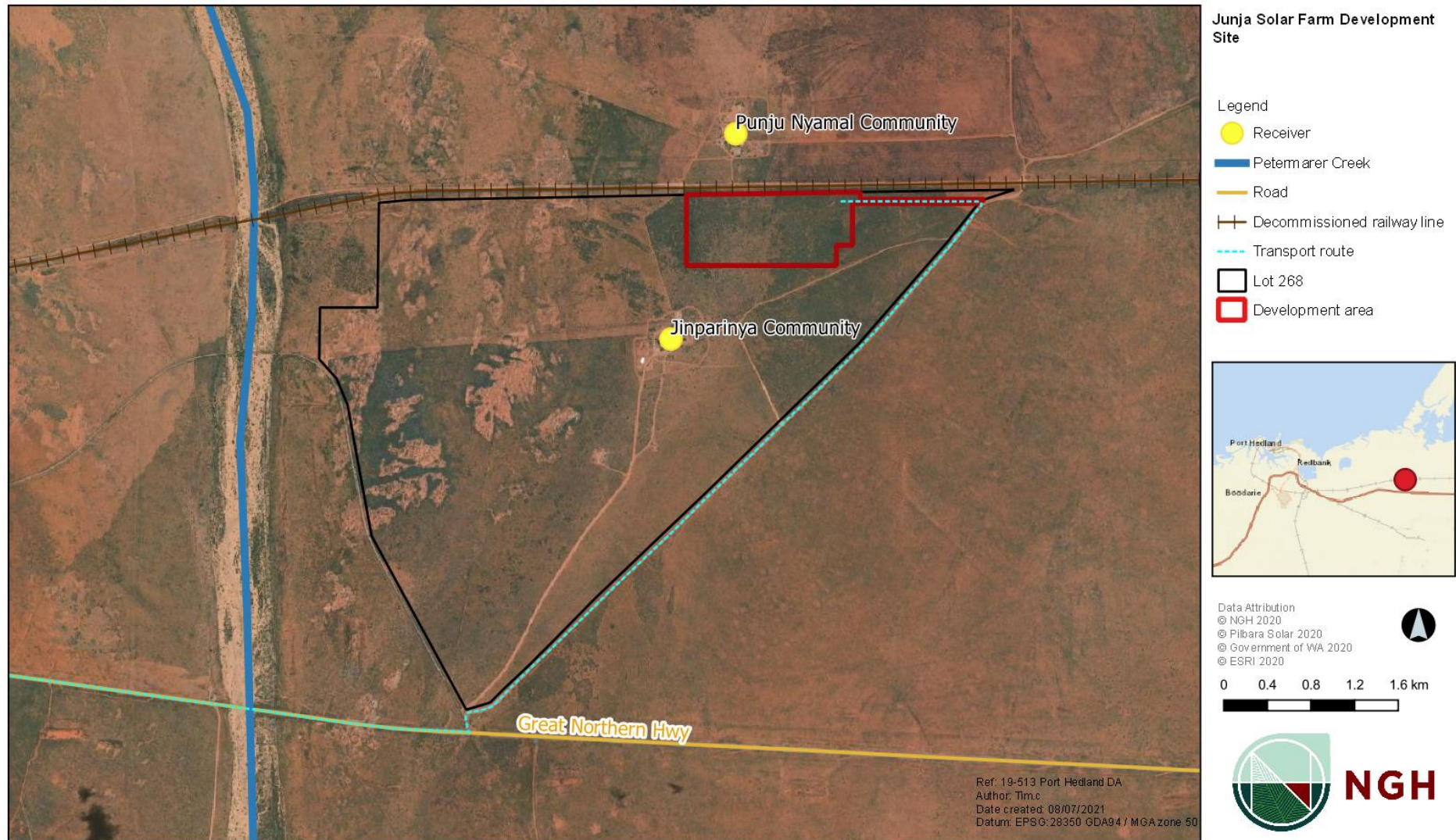


Figure 2-1 Junja Solar Farm development site

## 2.2. CLIMATE

Noise is reliant on climate for dispersal, particularly wind factors. Wind can cause noise to disperse further from its originating source. Weather impacts tend to decrease the accuracy of noise modelling as distance increased between the noise source and the receptor. This noise assessment is conservative in its assessment of noise impacts and represents the worst case scenario.

Port Hedland has a semi-arid climate with a tropical savanna climate influence. The BoM (2020) climate records available from the nearest climate station at Port Hedland Airport (station no. 004032, approximately 17 km southeast of the proposal) indicate a mean summer maximum of 36.8°C (March) and a mean winter minimum of 12.5°C (July) (Figure 2-2). Rainfall records from the same station show a mean annual rainfall of 319.3 mm, and that rainfall is generally greatest over summer, with the average monthly maximum occurring in February (88.9 mm).

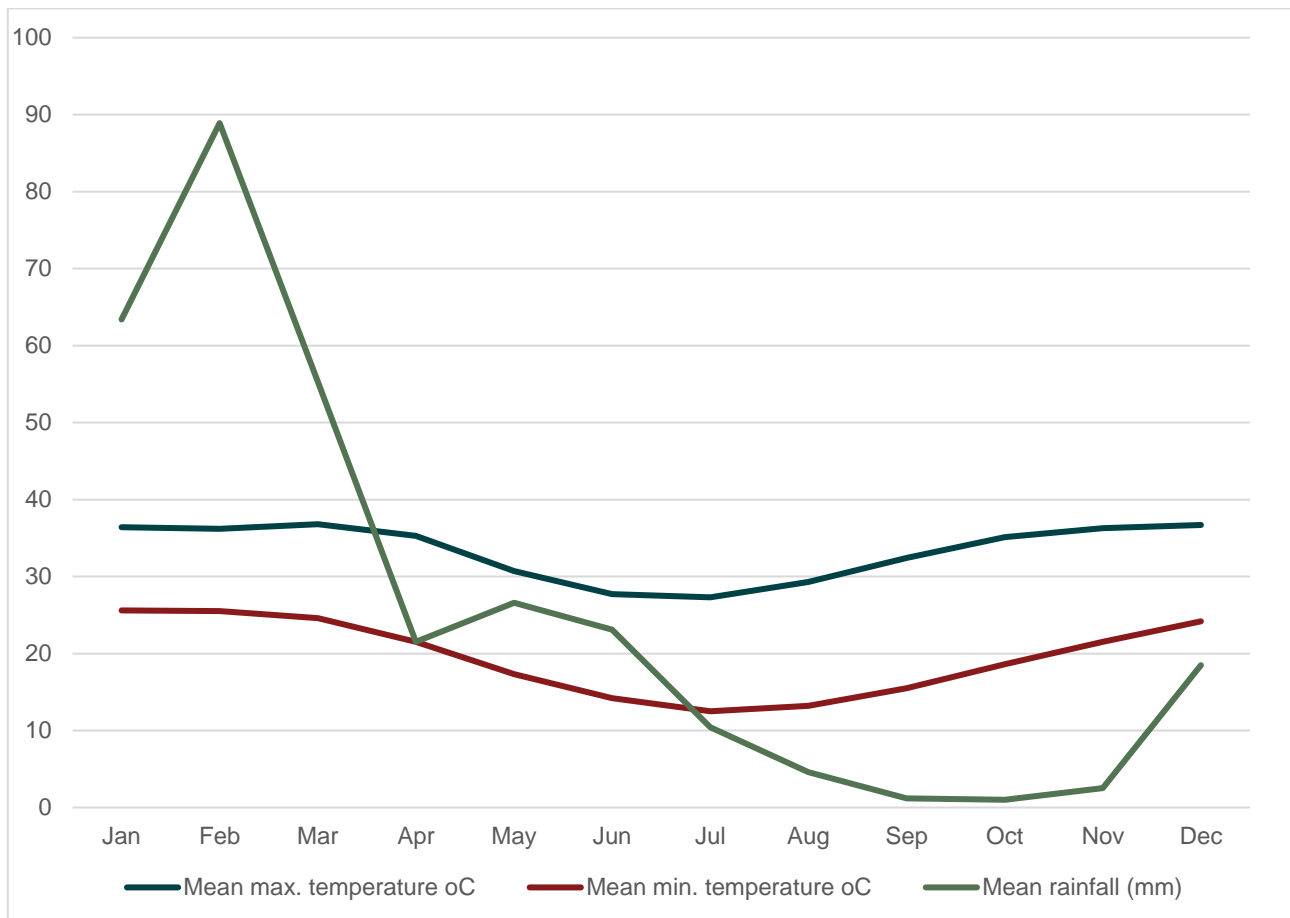


Figure 2-2 Climate statistics for weather station nearest to the proposal (Source: BoM 2020)

### 2.2.1. Local air quality

The air quality around the development site is generally expected to be good and typical of that found in a rural setting in the Pilbara region of WA. Existing sources of noise for the development site include:

- Noise from nearby sealed and unsealed roads.
- Strong winds moving across a flat landscape rustling vegetation.
- Domestic animals and wildlife such as dogs, insects and birds.

Port Hedland Airport is the nearest BoM monitoring site with recorded wind rose data. The wind data from Port Hedland Airport demonstrates the differences in wind speed and direction during winter and summer.

Summer and winter wind roses were compiled from BoM data recorded during the period 1942 to 2020. The data presents morning (9am) and afternoon (3pm) wind conditions (Appendix A).

## **Summer**

Summer mornings (9am) generally have mild winds (<20 km/h in varying directions but slightly more in a north-westerly direction (BoM, 2020).

Summer afternoons (3pm) generally have strong winds exceeding (>40 km/h) between 50 and 60% of the time in a north westerly direction. Northerly winds exceeding 40 km/h infrequently. Summer afternoon winds never occur in southern or easterly directions (BoM, 2020).

## **Winter**

Winter mornings (9am) generally experience strong south easterly winds ranging from >10 km/h to >40 km/h. Winds moving west and north rarely occur during winter mornings (BoM, 2020).

Winter afternoons (3pm) generally experience winds in all directions except towards the southwest. The strongest, most regular winds are northerly winds, which persist approximately 30% of the time with speeds between 30 km/h and 40 km/h (BoM, 2020).

## **2.3. TOPOGRAPHY AND OBSTACLES**

The site sits across a low ridge with an elevation of up to 18.5 – 19 m AHD (as measured by the SRTM topographic data). The lowest parts of the site have ground elevations down to approximately 17 m AHD. The area surrounding the development site is flat with few trees or built structures. The characteristics of the landscape will not hinder wind and noise travel.

## **2.4. SENSITIVE RECEPTORS**

Sensitive receptors within 10 km of the proposal are the Punju Nyamal Aboriginal community, which currently comprises approximately 10 residents and the Jinparinya community, which contains approximately 15 residents. The residents of both communities have been consulted in the preparation of the DA. Consultation details are provided in section 6 of the DA Supplementary Report.

## **2.5. NOISE**

### **2.5.1. Nuisance and health impacts**

Construction noise is one of the environmental considerations requiring assessment and management in the DA process. For the purpose of this noise assessment, construction noise also includes major refurbishment works and decommissioning. Construction can generate noise levels, that if not properly controlled can adversely affect a person's physical and mental health by limiting sleep, concentration and learning performance (DECC, 2009).

Construction can occur close to residences or other sensitive land uses. Construction noise typically varies in volume, longevity and type depending on the work activity(s). Construction noise by its nature is temporary, moves as construction progresses and is largely able to be managed with noise control measures.

Operational noise is ongoing and continuous over daylight hours. Operational noise is assessed in section 3.3.2 of this NMP.

## **2.5.2. Existing sources of noise**

Existing sources of noise within the locality of the proposal include:

- Vehicle movements on sealed and unsealed tracks.
- Small machines and hand tools such as chainsaws, generators, drills etc.
- Wind rustling vegetation.
- Domestic and native animals such as dogs, birds and insects.

It is anticipated that receptors within 1 km of the development site experience low levels of background noise consistent with remote largely natural areas and some road traffic noise.

## **2.5.3. Assigned noise levels**

Assigning levels for noise-sensitive receptors was carried out in accordance with the Noise Regulations. The influencing factor calculations for both communities are presented in Table 2-1 and the working zoning areas are shown in Figure 2-3. The assigned noise levels for both sensitive receptor communities are shown in Table 2-2.



Table 2-1 Influencing factors for noise level calculations

Receptor	(% Industrial in 100 m + % Industrial in 450 m) x 1/10	(% Commercial in 100 m + % Commercial in 450 m) x 1/20	Major road (more than 15,000 vehicles/day) in 100 m	Major road in 450 m	Secondar roads > 6000 vehicles/day in 100 m
Punju Nyamal community	0	0	0	0	0
Jinparinya community	0	0	0	0	0

**The influencing factor for both communities = 0**

Table 2-2 Assigned noise levels for both communities

Part of premises receiving noise	Time of day	Assigned level (dB)		
		L <sub>A10</sub>	L <sub>A1</sub>	L <sub>Amax</sub>
<b>Locations within 15 m of residential dwellings of each community</b>	7:00am to 7:00pm Monday to Saturday	45	55	65
	9:00am to 7:00pm Sunday and public holidays	40	50	65
	7:00pm to 10:00pm all days	40	50	55
	10:00pm to 7:00am Monday to Saturday and 10:00pm to 9:00am Sunday and public holidays	35	45	55

**Junja Solar Farm Noise Level Determination**

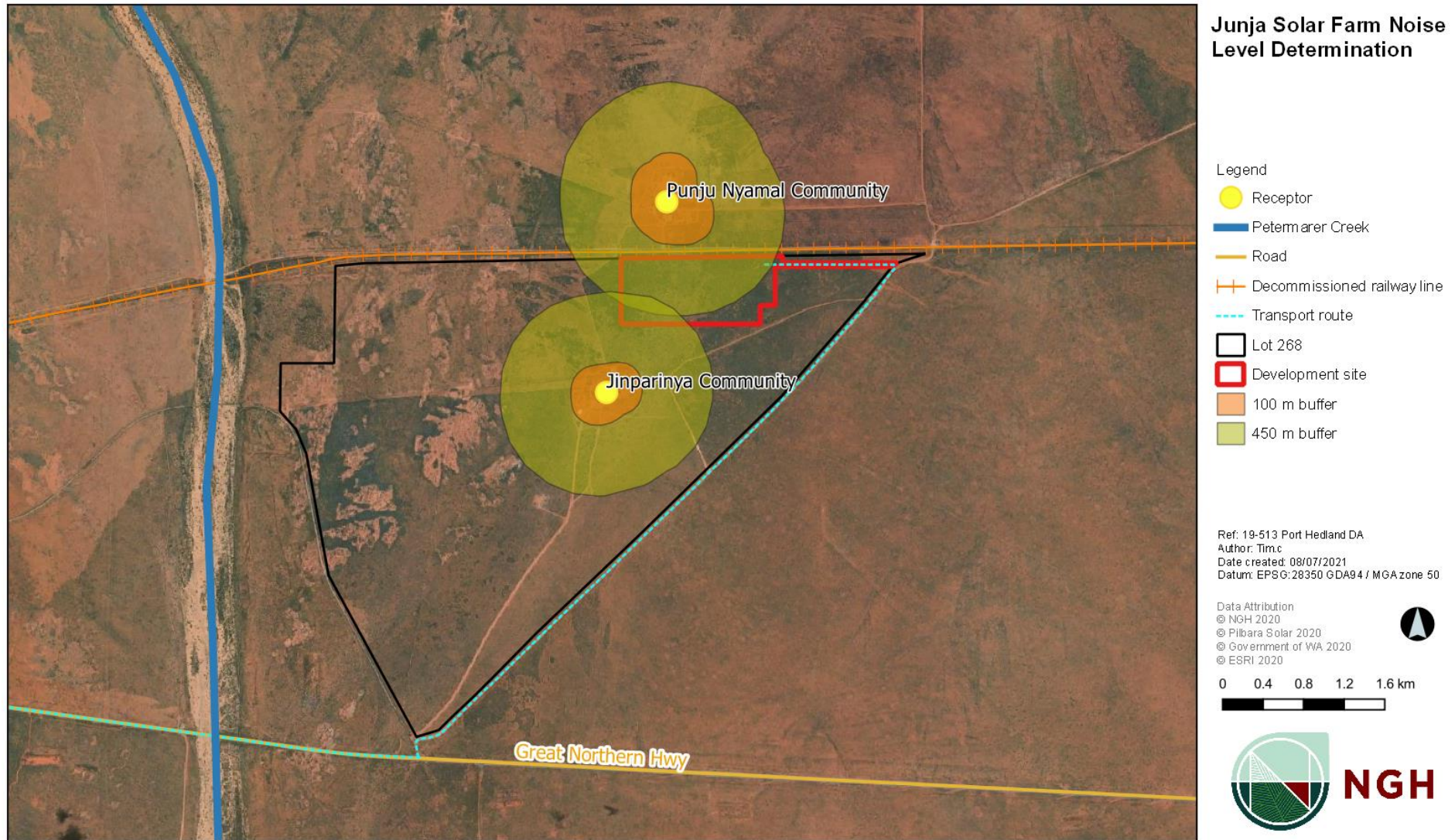


Figure 2-3 Noise level determination

## **3. PROPOSED WORKS AND POTENTIAL IMPACTS**

### **3.1. STANDARD WORKING HOURS**

Construction and decommissioning activities would occur within the hours of 7:00am to 7:00pm, which allow the highest noise levels over a 24 hour period. General site inspections and maintenance works during operation are not expected to generate noise above background levels and would therefore not impact surrounding land users.

### **3.2. PROPOSED WORKS**

The proposed development would occupy approximately 30 ha of Lot 268, Great Northern Highway, Pippingarra in the Town of Port Hedland local government area. The proposal would involve the construction of a ground-mounted photovoltaic (PV) solar farm with fixed or tracking arrays, generating around 10 megawatts (alternating current) of renewable energy. The power generated would be exported to the local electricity grid.

Key development and infrastructure components (shown in Appendix B) include:

- Single-axis fixed or tracking photovoltaic solar panels mounted on steel frames (approximately 30,000 PV solar panels).
- Underground electrical conduits and cabling to connect the arrays, inverters and transformers.
- Inverters, transformers and electrical conduits.
- Onsite substation / switching station.
- 66 kV electrical transmission line to connect the proposal to the existing Horizon Power transmission line.
- Site office, site compound, vehicle parking areas, access tracks and perimeter fencing.
- Site access from Great Northern Highway.

In total, the construction phase of the proposal is expected to take between three and six months, and the facility is expected to operate for around 30 years. Maintenance staff and service contractors would periodically attend the facility. At the end of its operational life, the solar farm would be decommissioned. All infrastructure would be removed, and the site returned to its existing agricultural land capability.

### **3.3. IMPACT ASSESSMENT**

The objective of this impact assessment is to predict whether noise emissions from construction and operation activities are likely to be within the assigned noise levels provided in Table 2-2 for each sensitive receptor. Where potential exists for the assigned noise levels to be exceeded, mitigation and control measures would be identified and implemented to reduce noise emissions where practicable.

As per the Noise Regulations:

*There will be genuine cases where the assigned levels cannot reasonably or practicably be met. In such cases, the person who believes they cannot reasonably or practicably meet the assigned levels can apply to the Environment Minister for approval to allow the noise emission to exceed or vary from the assigned level.*

In addition to the above, the Noise Regulations also recognise special cases which allow for reasonable amounts of construction noise at levels which may exceed the assigned levels but meet normal community expectations (DEP, 1997).

This noise impact assessment was completed by modelling noise generation by known construction and operation activities using the Transport for NSW (TfNSW) noise calculator. The calculator uses known noise

levels for individual plant, combines these to establish noise generation scenarios for noise generating activities and predicts the noise levels at receptor locations based on noise attenuation over distance under conditions ideal for noise transmission.

The TfNSW noise calculator models the probable noise level (LAeq (15 minute) experienced at a set distance. Where the range of noise emitted is between 60 and 90 dB (A), a simple calculation can be applied:  $L_{10} = L_{eq} +3$  (Burgess, 1978). Calculator worksheets are shown in Appendix C.

### 3.3.1. Construction noise impact assessment

Construction noise impacts would likely be from the operation of construction equipment. Several key activities on the site that are likely to produce the most noise include:

- Earth works for the construction of accesses roads, compounds, and hard stands.
- Pile driving for solar panel frames and trenching for the installation of cabling.
- The delivery and movement of vehicles transporting materials on site.

It is common for the road work and compound construction activities to precede the installation of solar panel frames and cabling. The activities above rarely occur in the same location at the same time due to safety and logistics. As such, predictive modelling of the noise impacts during construction examines three scenarios, deemed to have the highest noise impact. It was envisaged that these scenarios would occur across the site, sequentially. Generally, earthworks for roads and hardstands (scenario one) would precede scenario two (cable installation and panel framing) and scenario two would precede scenario three (panel assembly). Noise predictions were modelled for a worst-case scenario at each step of the construction phase. Noisy plant expected to operate at the development site simultaneously are shown in Table 3-1 below.

Table 3-1 Plant used in construction noise scenarios

Scenario 1		Scenario 2		Scenario 3	
Earthworks and road construction	Sound power level ((dB)A) at 7 m	Panel framing and cabling equipment	Sound power level ((dB)A) at 7 m	Assembly of frames and panels	Sound power level ((dB)A) at 7 m
Grader (x 1)	88	Flatbed truck (x 1)	85	Front end loader/telehandler (x 2)	66
Water cart (x 1)	82	Piling rig (x 1)	87	Power generator (x 1)	78
Vibratory roller (1)	84	Light vehicle (x 2)	63	Power hand tools (x 2)	60

Note: Equipment sound power levels (Table 3-1) are sourced from AS 2436 – 2010.

The LA10 values were calculated for both communities, from the closest wall of the closest dwelling, for each of the three noise scenario (see Table 3-2) and the perimeter of the assigned LA10 value (45 dB) is mapped in Figure 3-1 showing exceedances under Scenarios 1 and 2 for both communities. LA10 exceedances under Scenario 3 are anticipated only for the closest dwellings of the Punju Nyamal community. The mapped LA10 noise levels represent the largest area radius impacted under each scenario; thus, noise levels would not be exceeded at any time by the proposal outside these zones.

Table 3-2 Noise level zones for each construction noise scenario

	Scenario 1		Scenario 2		Scenario 3	
	LA10	LAeq	LA10	LAeq	LA10	LAeq
<b>Assigned noise level (dB)</b>	45	42	45	42	45	42
<b>Punju Nyamal community</b>	59	56	58	55	47	44
<b>Jinparinya community</b>	54	51	54	51	43	40
<b>Compliance distance (m)</b>	500	500	470	470	220	220

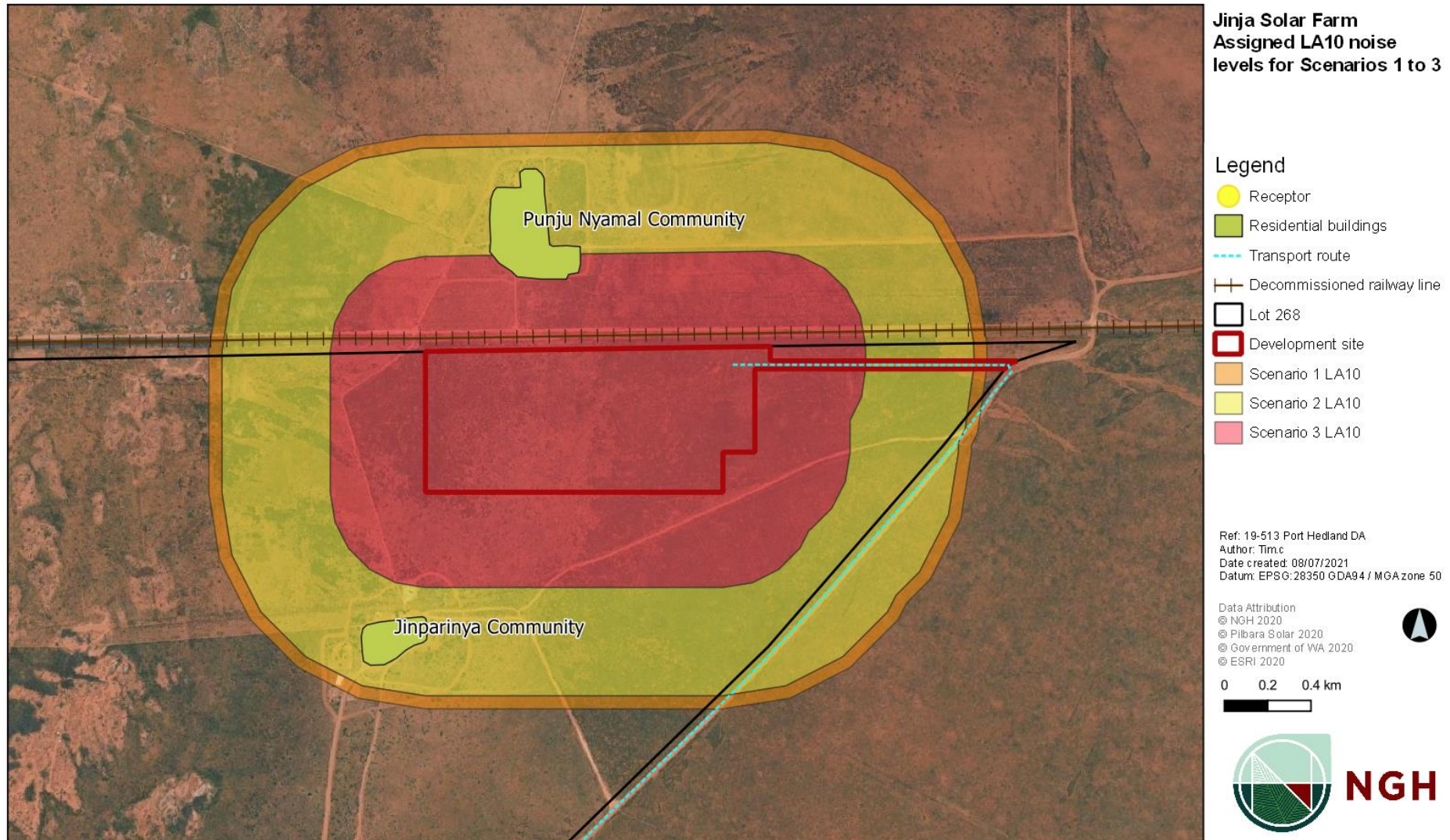


Figure 3-1 Assigned LA10 noise levels under construction noise Scenarios 1 to 3

## Special case regulations

The Noise Regulations recognise that there are certain economic, social and cultural cases, which may exceed the assigned levels but are within normal community expectations (DEP, 1997). This includes construction noise.

While the  $L_{A10}$  at both sensitive receptors would be exceeded during construction, the anticipated worst case scenario would produce approximate noise levels of  $L_{Aeq}$  of 58 dB(A) for the Punju Nyamal community and 54 dB(A) for Jinparinya community. For reference, these anticipated noise levels are 2 dB to 4 dB lower than the daytime  $L_{A10}$  noise levels acceptable for commercial premises.

The construction period would be between three and six months, meaning that construction noise impacts would be of short duration.

### 3.3.2. Operational noise impact assessment

The assigned noise levels for both the Punju Nyamal and Jinparinya communities (see Table 2-2) were used to assess operational noise impacts.

Overall noise levels from operation of the solar farm are demonstrably low due to the low level of noise generating equipment used during operation. Noise from the operation of the solar farm would be generated by:

1. Two inverter modules located in the centre of the solar array.
2. Tracking motors and movement of the solar panels – if panels are rotating (to be confirmed at detailed design).
3. One substation transformer.
4. Maintenance activities such as light vehicle use for inspections and general maintenance (e.g., electrical repairs, replacing panels), slashing and cleaning of panels.
5. Site inspection – the solar farm would be unmanned but one vehicle would visit the site for short periods during the day.

Predicted operational noise levels were calculated for each receptor community for each noise scenario. The predictions were prepared based on their distance from the operational equipment, refer to Table 3-3. The assessment uses the distance between the receptor and the substation transformers, tracking motors and inverters. The modular inverters and tracking motors would be distributed across the development site. Due to their distribution across the site, for any one receptor, it is expected that only one inverter and 1 tracking motor would be close enough to affect the noise scenario outcome. Accordingly, only one inverter and 1 tracking motor has been used to calculate the noise impacts for each receptor. It is worth noting here that Pilbara Solar have yet to confirm whether fixed panels or rotating panels would be used for the proposal.

Table 3-3 Operational noise scenario equipment and distance

Equipment	Quantity per receptor	Sound power level (dB (A)) at 7 m per item	Distance (m)	
			Punju Nyamal community	Jinparinya community
<b>Substation transformer</b>	1	72	180	610
<b>Tracking motors</b>	1	65	190	260
<b>Modular inverters</b>	2	70	340	530

The operational noise predictions are based on noise attenuation with distance from source. They do not consider any obstacles between the source or weather conditions which can influence the level of noise perceived. While the wind is directed away from each receptor, noise emitted from the proposal would be less perceptible at that receptor.

The predicted noise levels for the 'worst case scenario' based on concurrent operation all plant and equipment (Table 3-3) have been calculated and tabulated (Table 3-4).

Table 3-4 Predicted operational noise levels at residential receptors

Assigned noise level (dB)	Punju Nyamal		Jinparinya community	
	L <sub>A10</sub>	L <sub>Aeq</sub>	L <sub>A10</sub>	L <sub>Aeq</sub>
7:00 am to 7:00pm Monday to Saturday (dB)	45	42	45	42
9:00am to 7:00pm Sunday and public holidays (dB)	40	37	40	37
7:00pm to 10:00pm all days (dB)	40	37	40	37
10:00pm to 7:00am Monday to Saturday and 10:00pm to 9:00pm Sunday and public holidays (dB)	35	32	35	32
<b>Predicted operational noise (dB(A))</b>	<b>42</b>	<b>39</b>	<b>32</b>	<b>29</b>
<b>Comments</b> Clearly audible = < 10 dB (A) assigned noise level Moderately intrusive = >10 dB (A) assigned noise level Intrusive = > 60 dB (A)	Below assigned noise levels during standard working hours. Above assigned noise levels are other times. An exceedance of 2 dB is not discernible to the human ear.		Below assigned noise levels for all periods except between 10:00pm to 7:00am Sundays and public holidays.	

The current footprint of the development is within 300 m of both community receptors. The noise levels predicted in Table 3-4 represent the worst case scenario for operational noise and incorporate the use of one light vehicle and vehicle trackers, which would not be used at night. As such it is assumed that the assigned noise levels for these timeframes would be met.

Noise modelling undertaken for the operational phase of the proposal predicts that operational noise for the proposal would comply with daytime assigned noise levels, however a 2 dB exceedance was predicted for sunlight hours before 7:00am Monday to Friday and 7 dB before 9:00 am on Sundays and public holidays for the Punju Nyamal community. It is worth noting here that a 2 dB difference is not discernible to the human ear.

Other activities that would occur occasionally during operation of the solar farm such as slashing to maintain firebreaks and panel washing. These activities would only to occur once or twice a year. These activities may generate additional noise; however, they would be temporary and short term (and therefore have not been considered as part of this assessment).



## **4. NOISE MONITORING**

### **4.1. METHODS**

Noise emissions during construction are predicted to exceed the assigned noise levels (Table 2-2) for both communities. Construction noise levels during would be clearly audible at both community receptors but is not expected to be highly intrusive. Construction noise would remain within assigned noise levels for commercial premises.

The Noise Regulations accept that construction is an unavoidably noisy process and therefore considers construction activities allowable between the standard working hours of 7:00am and 7:00pm Monday to Saturday. Pilbara Solar and the construction contractor would comply with this requirement and as such noise monitoring during the construction phase is not proposed.

The predicted noise levels for operation (Table 3-4) show that assigned noise levels would not be exceeded during 7:00am to 7:00pm Monday to Saturday or during the hours of darkness (as the solar farm would not operate without sunlight). Assigned noise levels, may however be exceeded early morning on all days for the Punju Nyamal community and on Sundays and public holidays for the Jinparinya community. Though, unless weather conditions favour noise dispersion, it is unlikely that noise from the operational solar farm would be noticeable. As a due diligence measure, Pilbara Solar may undertake operational noise monitoring in consultation with the sensitive receptors.

Pilbara Solar would ensure that sensitive receptors are able to contact site personal during all phases of the proposal to report incidents of nuisance noise and these reports would be investigated addressed in a timely manner.

## **5. NOISE MANAGEMENT**

### **5.1. NOISE MANAGEMENT CONTROLS**

#### **5.1.1. Construction noise controls**

In accordance with the Noise Regulations, construction activities would be carried out between 7:00am and 7:00pm hours Monday to Saturday:

1. The construction work must be carried out in accordance with AS 2436-2010.
2. The equipment used for the construction work must be the quietest reasonably available.
3. The EPA may request a noise management plan (this NMP) may be submitted for construction at any time (DEP, 1997).

As the noise assessment for the proposal (section 3.3) indicates that assigned noise levels would not be reached at either sensitive receptor at any time, additional voluntary noise management actions are not considered necessary. However, in compliance with point two above, measures for minimising the noise emissions from construction plant are listed in Table 5-1.

#### **5.1.2. Operation noise controls**

The predicted operational noise levels for the proposed solar farm are described in 3.3.2. Exceedances with assigned noise levels are possible in the early mornings before 7:00am Monday to Saturday and before 9:00am Sundays and public holidays for the Punju Nymal receptor and before 9:00am on Sundays and public holidays for the Jinparinya community. The operational noise modelling represents the worst case scenario including light vehicle movements and tracking panels, which may not be undertaken outside standard work hours. Controls for operation noise include restricting certain activities to occur between the standard working hours of 7:00am to 7:00pm in response to community consultation and noise monitoring results.

## **5.2. RELEVANT STAKEHOLDERS**

Stakeholders are all parties who have an interest in the project. Department of Water and Environment Regulation (DWER) requires that proponents carry out community engagement for sites that pose a risk to human health, the environment, environmental values, or have the potential to impact sensitive receptors (DER, 2014).

The relevant stakeholders of this project include:

- Sensitive receptors within 500 m of the proposal (Punju Nymal community).
- Owners of Lot 268 DP218421, Great Northern Highway (subject land).
- Horizon Power.
- Town of Port Hedland.
- Government Departments (e.g., EPA, DWER, Department of Health).

Stakeholder consultation for the proposal including noise emissions is further detailed in section 5 of the DA Supplementary Report.

## 5.3. ROLES AND RESPONSIBILITIES

### 5.3.1. The construction contractor

The construction contractor for the proposal is Balance Services Group (Balance). Balance is an Australian owned company established in 2012 and currently has AUD\$186 million in solar projects either completed or under construction.

### 5.3.2. Roles and responsibilities

The roles and responsibilities associated with the implementation of this NMP are listed in Table 5-1.

Table 5-1 Roles and responsibilities

Safeguards	Persons responsible	Evidence of action
<b>During construction</b>		
<p><i>Plant and vehicle</i></p> <ul style="list-style-type: none"> <li>• Plant and equipment will be turned off when not in use.</li> <li>• Minimise annoyance from reversing noise by fitting non-tonal alarms or deploying spotters to oversee reversing movements.</li> <li>• Regularly maintain and monitor plant and equipment to ensure noise emissions do not exceed standard levels.</li> <li>• All plant and equipment including contractor vehicles used on this job are operated by appropriately trained staff in accordance with regulations and are regularly maintained and serviced.</li> <li>• Pre-start checklists on all plant/equipment/vehicles will be conducted before their use.</li> </ul>	Contractor	Plant/Vehicle Inspection Checklist
No works will be undertaken outside of standard working hours (Section 3.1)	Contractor	Noise Incident Register

## 5.4. COMPLAINTS MANAGEMENT

A complaints management system would be implemented to include a feedback loop to the community and provide for corrective action when adverse impacts have occurred. All complaints would be logged and investigated with timely feedback provided to the complainant. A Noise Incident Register would be kept at the Pilbara Solar office and made available to relevant authorities and community members upon request. An example Noise Incident Register is provided in Appendix C.2.

## 6. REFERENCES

Australian Standards. 2010. *Australian Standard AS 2436-2010 Guide to noise and vibration control on construction, maintenance, and demolition sites.*

Burgess, M. 1978. 'Relationship between L10 and Leq for noise from road traffic' in *Australian Road Research*, 8(3): 15-18.

Bureau of Meteorology (BoM). 2020. 'Climate statistics for Australian locations: Port Hedland Airport.' [http://www.bom.gov.au/climate/averages/tables/cw\\_004032.shtml](http://www.bom.gov.au/climate/averages/tables/cw_004032.shtml)

Department of Environment and Climate Change (NSW) (DECC). 2009. Interim Construction Noise Guideline. <https://www.environment.nsw.gov.au/resources/noise/09265cng.pdf>

Department of Environmental Protection. n.d. *Environmental Protection (Noise) Regulations 1997: Summary of the Regulations.*

# APPENDIX A WIND ROSES FOR PORT HEDLAND AIRPORT

## A.1 JANUARY 9AM

### Rose of Wind direction versus Wind speed in km/h (18 Jul 1942 to 13 Aug 2020)

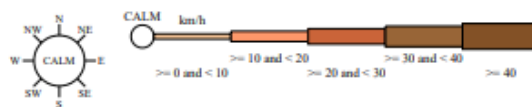
Custom times selected, refer to attached note for details

#### PORT HEDLAND AIRPORT

Site No: 004032 • Opened Jul 1942 • Still Open • Latitude: -20.3725° • Longitude: 118.6317° • Elevation 6.m

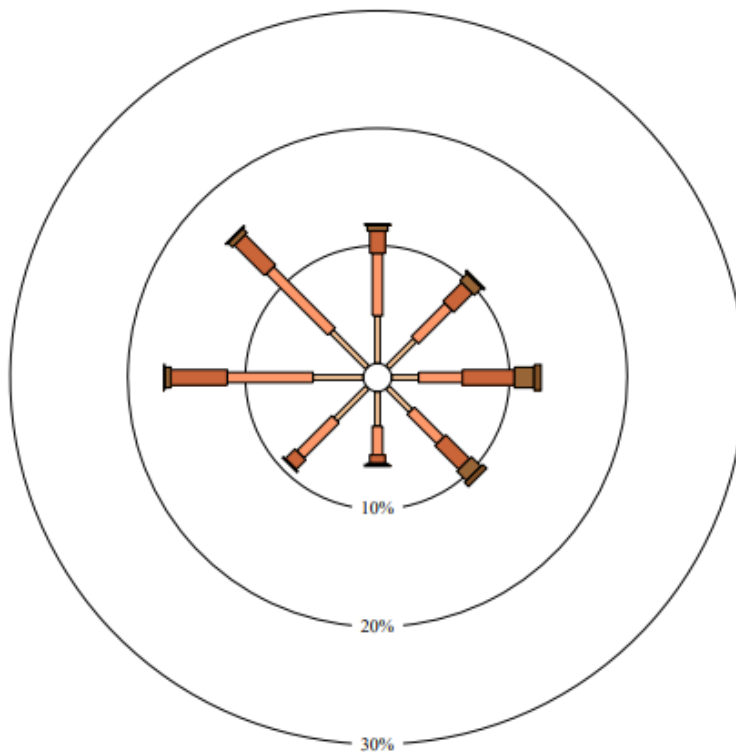
An asterisk (\*) indicates that calm is less than 0.5%.

Other important info about this analysis is available in the accompanying notes.



9 am Jan  
2413 Total Observations

Calm 6%



## A.2 JANUARY 3PM

### Rose of Wind direction versus Wind speed in km/h (18 Jul 1942 to 13 Aug 2020)

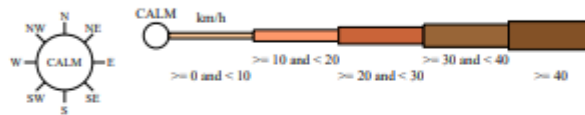
Custom times selected, refer to attached note for details

#### PORT HEDLAND AIRPORT

Site No: 004032 • Opened Jul 1942 • Still Open • Latitude: -20.3725° • Longitude: 118.6317° • Elevation 6.m

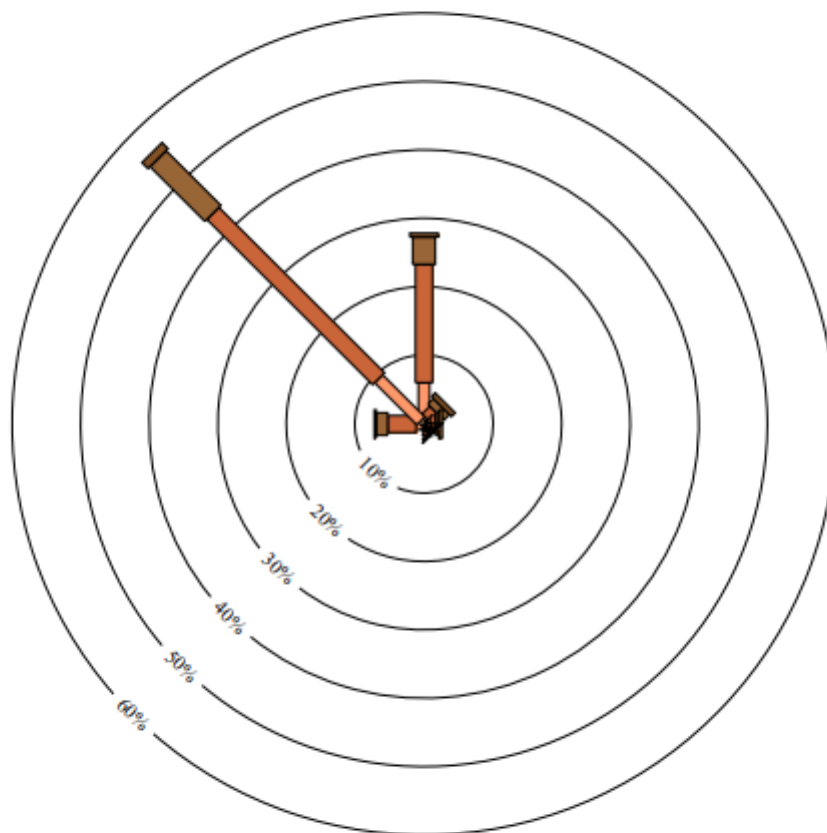
An asterisk (\*) indicates that calm is less than 0.5%.

Other important info about this analysis is available in the accompanying notes.



3 pm Jan  
2418 Total Observations

Calm \*



## A.3 JULY 9AM

### Rose of Wind direction versus Wind speed in km/h (18 Jul 1942 to 13 Aug 2020)

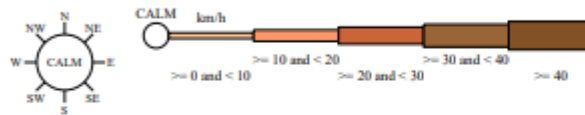
Custom times selected, refer to attached note for details

#### PORT HEDLAND AIRPORT

Site No: 004032 • Opened Jul 1942 • Still Open • Latitude: -20.3725° • Longitude: 118.6317° • Elevation 6.m

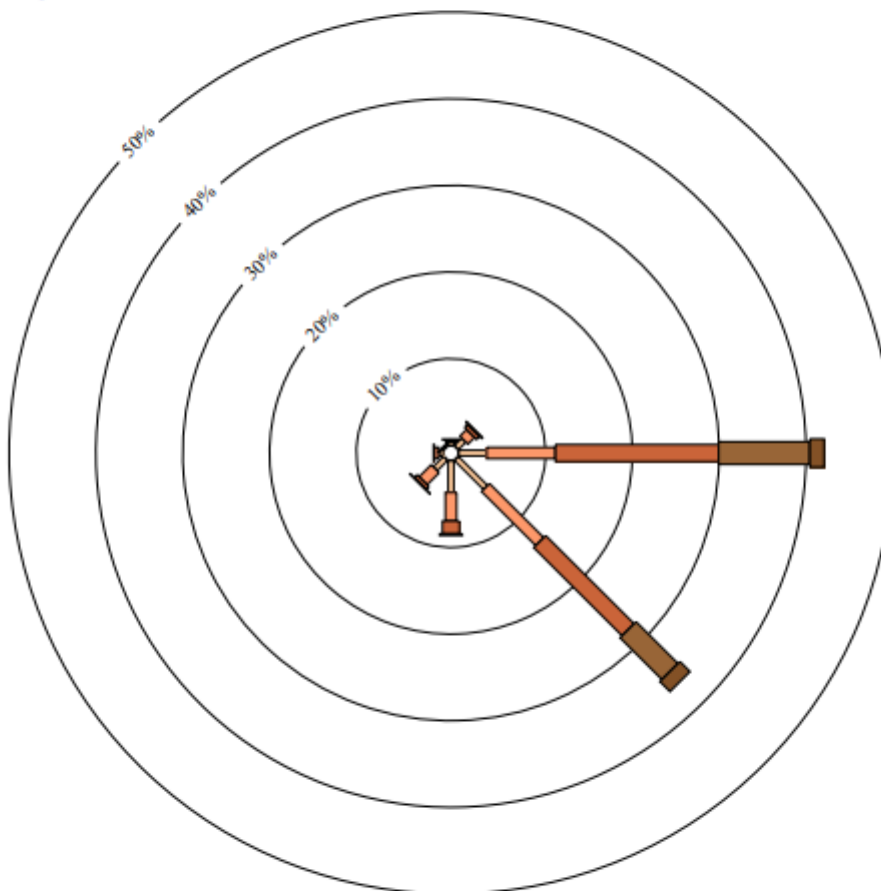
An asterisk (\*) indicates that calm is less than 0.5%.

Other important info about this analysis is available in the accompanying notes.



9 am Jul  
2415 Total Observations

Calm 4%



## A.4 JULY 3PM

### Rose of Wind direction versus Wind speed in km/h (18 Jul 1942 to 13 Aug 2020)

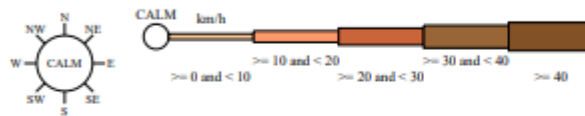
Custom times selected, refer to attached note for details

#### PORT HEDLAND AIRPORT

Site No: 004032 • Opened Jul 1942 • Still Open • Latitude: -20.3725° • Longitude: 118.6317° • Elevation 6.m

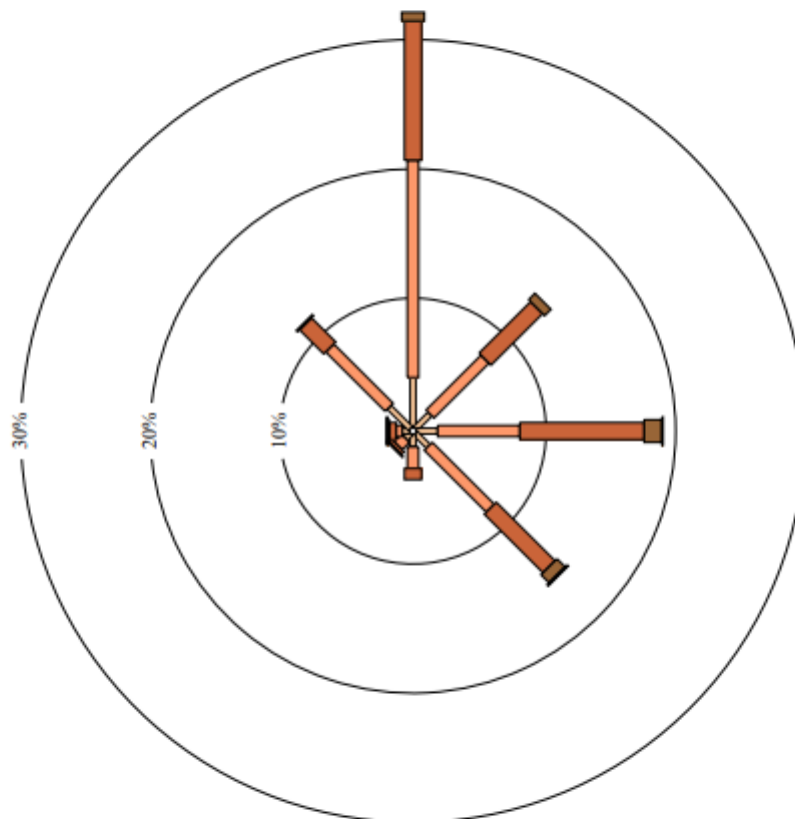
An asterisk (\*) indicates that calm is less than 0.5%.

Other important info about this analysis is available in the accompanying notes.



3 pm Jun  
2323 Total Observations

Calm 1%





# APPENDIX B DESIGN DRAWINGS

# APPENDIX C NOISE CALCULATOR WORKSHEETS

## C.1 SCENARIO 1 EARTHWORKS AND ROAD CONSTRUCTION



### Construction Noise Estimator

Please input information into yellow cells  
Please pick from drop-down list in orange cells

Project name	Jinparinya Solar Farm
Scenario name	Earthworks and road construction
Receiver address	Lot 268 Great Northern Highway
Select area ground type	Rural
Select type of background noise level input	Representative Noise Environment

		Representative Noise Environment	User Input
Noise area category		p	
RBL or LA90 Background level (dB(A))	Day	#N/A	
	Evening	#N/A	
	Night	#N/A	
LAeq(15minute) Noise mangement level (dB(A))	Day	#N/A	
	Day (OOHW)	#N/A	
	Evening	#N/A	
	Night	#N/A	

Is all plant at the same representative distance to the receiver? Y/N	Y
Representative distance (m)	500 <i>All at Representative Distance</i>

**Steps:**  
 1. Enter project name (cell C9).  
 2. Enter scenario name (cell C10).  
 3. Enter receiver address (cell C11).  
 4. Select area ground type (cell C12) - hard ground (for a conservative assessment or across the river/valley), urban or rural.  
 5. Select the type of background noise level input - Representative noise environment (to make assumptions) or user input (where noise monitoring data is available):  
     (a) where representative noise environment is selected - select the appropriate noise area category (cell C16). The worksheet titled "Representative Noise Environ." provides a number of examples to help select the noise area category.  
     (b) where user input is selected - enter the measured background noise level for each time period (cells D17 to D19).  
 6. Is all plant at the same representative distance to the receiver? Select Y or N (cell C24):  
     (a) where Y is selected - enter the representative distance in cell C25.  
     (b) where N is selected - go to step #7  
 7. For the scenario (e.g. shallow excavation), select plant from the drop-down list in cells A28 to A47 (e.g. dump trucks + excavator).  
     (a) enter quantity for each selected plant in cells D28 to D47.  
     (b) where N is selected from step #6 - enter the distance to receiver for each individual plant in cells E28 to E47.  
     (c) is there line of sight to receiver? select from drop down list in cells F28 to F47.  
 8. Identify the level above background and/or noise mangement level (see rows 57 to 62).  
 9. Identify and implement the relevant additional mitigation measures (see rows 63 to 65).  
 9. Document a summary report detailing:  
     (a) project description (including location, duration, hours of work, construction methodology, plant, potentially impacted receivers, etc.).  
     (b) background noise levels.  
     (c) noise management levels.  
     (d) predicted noise levels for each time period.  
     (e) sleep disturbance mitigation distance for night works.  
     (f) mitigation measures.  
     (g) Team member responsible for implementing mitigation measures and managing noise and vibration.

(Note that suitable noise management levels for other noise-sensitive businesses not identified in the Construction Noise Estimator should be investigated on a project-by-project basis. Please contact a Roads and Maritime noise specialist for more information)

Type/ model plant (See Sources Sheet)	SWL LAeq (dB(A))	SPL @7m (dB(A))	Quantity	Individual distance to receiver (m)	Is there line of sight to receiver? Y/N	Quantity correction (dBA)	Shielding correction (dBA)	Distance used in calculation (m)	Contribution SPL (dB(A))
Grader	113	88	1	80	Yes	0	0	500	40
Water truck	107	82	1	80	Yes	0	0	500	34
Vibratory roller	109	84	1	80	Yes	0	0	500	36
					Yes	0	0		-888
					Yes	0	0		-888
					Yes	0	0		-888
					Yes	0	0		-888
					Yes	0	0		-888
					Yes	0	0		-888
					Yes	0	0		-888
					Yes	0	0		-888
					Yes	0	0		-888
					Yes	0	0		-888
					Yes	0	0		-888
					Yes	0	0		-888
					Yes	0	0		-888
					Yes	0	0		-888

Total SPL LAeq(15minute) (dB(A))	42
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## C.2 SCENARIO 2 PANEL FRAMING AND CABLING EQUIPMENT



### Construction Noise Estimator

Please input information into yellow cells  
Please pick from drop-down list in orange cells

Project name	Jinparinya Solar Farm
Scenario name	Panel framing and cabling equipment
Receiver address	Lot 268 Great Northern Highway
Select area ground type	Rural
Select type of background noise level input	Representative Noise Environment

Noise area category		Representative Noise Environment	User Input
RBL or LA90 Background level (dB(A))	Day	p	
	Evening	#N/A	
	Night	#N/A	
LAeq(15minute) Noise management level (dB(A))	Day	#N/A	
	Day (OOHW)	#N/A	
	Evening	#N/A	
	Night	#N/A	

Is all plant at the same representative distance to the receiver? Y/N	Y	
Representative distance (m)	470	All at Representative Distance

Type/ model plant (See Sources Sheet)	SWL LAeq (dB(A))	SPL @7m (dB(A))	Quantity	Individual distance to receiver (m)	Is there line of sight to receiver? Y/N	Quantity correction (dBA)	Shielding correction (dBA)	Distance used in calculation (m)	Contribution SPL (dB(A))
Flatbed truck	110	85	1	80	Yes	0	0	470	38
Piling rig	112	87	1	80	Yes	0	0	470	40
Light vehicle	88	63	2	80	Yes	3	0	470	19
					Yes	0	0		-888
					Yes	0	0		-888
					Yes	0	0		-888
					Yes	0	0		-888
					Yes	0	0		-888
					Yes	0	0		-888
					Yes	0	0		-888
					Yes	0	0		-888
					Yes	0	0		-888
					Yes	0	0		-888
					Yes	0	0		-888
					Yes	0	0		-888
					Yes	0	0		-888
					Yes	0	0		-888
					Yes	0	0		-888
					Yes	0	0		-888
					Yes	0	0		-888

Total SPL LAeq(15minute) (dB(A))	42
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**Steps:**

- Enter project name (cell C9).
- Enter scenario name (cell C10).
- Enter receiver address (cell C11).
- Select area ground type (cell C12) - hard ground (for a conservative assessment or across the river/valley), urban or rural.
- Select the type of background noise level input - Representative noise environment (to make assumptions) or user input (where noise monitoring data is available):
  - where representative noise environment is selected - select the appropriate noise area category (cell C16). The worksheet titled 'Representative Noise Environ.' provides a number of examples to help select the noise area category.
  - where user input is selected - enter the measured background noise level for each time period (cells D17 to D19).
- Is all plant at the same representative distance to the receiver? Select Y or N (cell C24):
  - where Y is selected - enter the representative distance in cell C25.
  - where N is selected - go to step #7.
- For the scenario (e.g. shallow excavation), select plant from the drop-down list in cells A28 to A47 (e.g. dump trucks + excavator).
  - enter quantity for each selected plant in cells D28 to D47.
  - where N is selected from step #6 - enter the distance to receiver for each individual plant in cells E28 to E47.
  - is there line of sight to receiver? select from drop down list in cells F28 to F47.
- Identify the level above background and/or noise management level (see rows 57 to 62).
- Identify and implement the relevant additional mitigation measures (see rows 63 to 65).
- Document a summary report detailing:
  - project description (including location, duration, hours of work, construction methodology, plant, potentially impacted receivers, etc.).
  - background noise levels.
  - noise management levels.
  - predicted noise levels for each time period.
  - sleep disturbance mitigation distance for night works.
  - mitigation measures.
  - Team member responsible for implementing mitigation measures and managing noise and vibration.

(Note that suitable noise management levels for other noise-sensitive businesses not identified in the Construction Noise Estimator should be investigated on a project-by-project basis. Please contact a Roads and Maritime noise specialist for more information)

### C.3 SCENARIO 3 ASSEMBLY OF FRAMES AND PANELS



#### Construction Noise Estimator

Please input information into yellow cells  
Please pick from drop-down list in orange cells

Project name	Jinparinya Solar Farm
Scenario name	Assembly of frames and panels
Receiver address	Lot 268 Great Northern Highway
Select area ground type	Rural
Select type of background noise level input	Representative Noise Environment

Noise area category		Representative Noise Environment	User Input
RBL or LA90 Background level (dB(A))	Day	#N/A	
	Evening	#N/A	
	Night	#N/A	
LAeq(15minute) Noise management level (dB(A))	Day	#N/A	
	Day (OOHW)	#N/A	
	Evening	#N/A	
	Night	#N/A	

Is all plant at the same representative distance to the receiver? Y/N	Y	
Representative distance (m)	220	All at Representative Distance

Steps:

1. Enter project name (cell C9).
2. Enter scenario name (cell C10).
3. Enter receiver address (cell C11).
4. Select area ground type (cell C12) - hard ground (for a conservative assessment or across the river/valley), urban or rural.
5. Select the type of background noise level input - Representative noise environment (to make assumptions) or user input (where noise monitoring data is available):
  - (a) where representative noise environment is selected - select the appropriate noise area category (cell C16). The worksheet titled 'Representative Noise Environ.' provides a number of examples to help select the noise area category.
  - (b) where user input is selected - enter the measured background noise level for each time period (cells D17 to D19).
6. Is all plant at the same representative distance to the receiver? Select Y or N (cell C24):
  - (a) where Y is selected - enter the representative distance in cell C25.
  - (b) where N is selected - go to step #7.
7. For the scenario (e.g. shallow excavation), select plant from the drop-down list in cells A28 to A47 (e.g. dump trucks + excavator).
  - (a) enter quantity for each selected plant in cells D28 to D47.
  - (b) where N is selected from step #6 - enter the distance to receiver for each individual plant in cells E28 to E47.
  - (c) is there line of sight to receiver? select from drop down list in cells F28 to F47.
8. Identify the level above background and/or noise management level (see rows 57 to 62).
9. Identify and implement the relevant additional mitigation measures (see rows 63 to 65).
9. Document a summary report detailing:
  - (a) project description (including location, duration, hours of work, construction methodology, plant, potentially impacted receivers, etc.).
  - (b) background noise levels.
  - (c) noise management levels.
  - (d) predicted noise levels for each time period.
  - (e) sleep disturbance mitigation distance for night works.
  - (f) mitigation measures.
  - (g) Team member responsible for implementing mitigation measures and managing noise and vibration.

(Note that suitable noise management levels for other noise-sensitive businesses not identified in the Construction Noise Estimator should be investigated on a project-by-project basis. Please contact a Roads and Maritime noise specialist for more information)

Type/ model plant (See Sources Sheet)	SWL LAeq (dB(A))	SPL @7m (dB(A))	Quantity	Individual distance to receiver (m)	Is there line of sight to receiver? Y/N	Quantity correction (dBA)	Shielding correction (dBA)	Distance used in calculation (m)	Contribution SPL (dB(A))
Front end loader	91	66	2	80	Yes	3	0	220	32
Power generator	103	78	1	80	Yes	0	0	220	41
Power hand tools	85	60	2	80	Yes	3	0	220	28
					Yes	0	0		-888
					Yes	0	0		-888
					Yes	0	0		-888
					Yes	0	0		-888
					Yes	0	0		-888
					Yes	0	0		-888
					Yes	0	0		-888
					Yes	0	0		-888
					Yes	0	0		-888
					Yes	0	0		-888
					Yes	0	0		-888
					Yes	0	0		-888
					Yes	0	0		-888
					Yes	0	0		-888
					Yes	0	0		-888
					Yes	0	0		-888
					Yes	0	0		-888
					Yes	0	0		-888
					Yes	0	0		-888

Total SPL LAeq(15minute) (dB(A))	42
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## C.4 OPERATIONAL NOISE SCENARIO FOR PUNJU NYAMAL COMMUNITY



### Construction Noise Estimator

Please input information into yellow cells

Please pick from drop-down list in orange cells

Project name	Jinparinya Solar Farm
Scenario name	Operational noise
Receiver address	Lot 268 Great Northern Highway
Select area ground type	Rural
Select type of background noise level input	Representative Noise Environment

Noise area category		Representative Noise Environment	User Input
		p	
RBL or LA90 Background level (dB(A))	Day	#N/A	
	Evening	#N/A	
	Night	#N/A	
LAeq(15minute) Noise management level (dB(A))	Day	#N/A	
	Day (OOHW)	#N/A	
	Evening	#N/A	
	Night	#N/A	

Is all plant at the same representative distance to the receiver? Y/N	N
Representative distance (m)	180 <i>Using Individual Distances!</i>

Type/ model plant (See Sources Sheet)	SWL LAeq (dB(A))	SPL @7m (dB(A))	Quantity	Individual distance to receiver (m)	Is there line of sight to receiver? Y/N	Quantity correction (dBA)	Shielding correction (dBA)	Distance used in calculation (m)	Contribution SPL (dB(A))
Sunstation transformer	97	72	1	180	Yes	0	0	180	38
Tracking motor	90	65	1	190	Yes	0	0	190	30
Modular inverters	95	70	2	340	Yes	3	0	340	30
Light vehicle	103	78	1	180	Yes	0	0	180	44
					Yes	0	0		-888
					Yes	0	0		-888
					Yes	0	0		-888
					Yes	0	0		-888
					Yes	0	0		-888
					Yes	0	0		-888
					Yes	0	0		-888
					Yes	0	0		-888
					Yes	0	0		-888
					Yes	0	0		-888
					Yes	0	0		-888
					Yes	0	0		-888
					Yes	0	0		-888
					Yes	0	0		-888

<b>Total SPL LAeq(15minute) (dB(A))</b>	<b>45</b>
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**Steps:**

1. Enter project name (cell C9).
2. Enter scenario name (cell C10).
3. Enter receiver address (cell C11).
4. Select area ground type (cell C12) - hard ground (for a conservative assessment or across the river/valley), urban or rural.
5. Select the type of background noise level input - Representative noise environment (to make assumptions) or user input (where noise monitoring data is available):
  - (a) where representative noise environment is selected - select the appropriate noise area category (cell C16). The worksheet titled 'Representative Noise Environ.' provides a number of examples to help select the noise area category.
  - (b) where user input is selected - enter the measured background noise level for each time period (cells D17 to D19).
6. Is all plant at the same representative distance to the receiver? Select Y or N (cell C24):
  - (a) where Y is selected - enter the representative distance in cell C25.
  - (b) where N is selected - go to step #7
7. For the scenario (e.g. shallow excavation), select plant from the drop-down list in cells A28 to A47 (e.g. dump trucks + excavator).
  - (a) enter quantity for each selected plant in cells D28 to D47.
  - (b) where N is selected from step #6 - enter the distance to receiver for each individual plant in cells E28 to E47.
  - (c) is there line of sight to receiver? select from drop down list in cells F28 to F47.
8. Identify the level above background and/or noise management level (see rows 57 to 62).
9. Identify and implement the relevant additional mitigation measures (see rows 63 to 65).
9. Document a summary report detailing:
  - (a) project description (including location, duration, hours of work, construction methodology, plant, potentially impacted receivers, etc.).
  - (b) background noise levels.
  - (c) noise management levels.
  - (d) predicted noise levels for each time period.
  - (e) sleep disturbance mitigation distance for night works.
  - (f) mitigation measures.
  - (g) Team member responsible for implementing mitigation measures and managing noise and vibration.

(Note that suitable noise management levels for other noise-sensitive businesses not identified in the Construction Noise Estimator should be investigated on a project-by-project basis. Please contact a Roads and Maritime noise specialist for more information)

# C.5 OPERATIONAL NOISE SCENARIO FOR JINPARINYA COMMUNITY



## Construction Noise Estimator

Please input information into yellow cells  
Please pick from drop-down list in orange cells

Project name	Jinparinya Solar Farm
Scenario name	Operational noise
Receiver address	Lot 268 Great Northern Highway
Select area ground type	Rural
Select type of background noise level input	Representative Noise Environment

Noise area category	Representative Noise Environment	User Input
	p	
RBL or LA90 Background level (dB(A))	Day	#N/A
	Evening	#N/A
	Night	#N/A
LAeq(15minute) Noise management level (dB(A))	Day	#N/A
	Day (OOHW)	#N/A
	Evening	#N/A
	Night	#N/A

Is all plant at the same representative distance to the receiver? Y/N	N	
Representative distance (m)	250	Using Individual Distances!

- Steps:**
1. Enter project name (cell C9).
  2. Enter scenario name (cell C10).
  3. Enter receiver address (cell C11).
  4. Select area ground type (cell C12) - hard ground (for a conservative assessment or across the river/valley), urban or rural.
  5. Select the type of background noise level input - Representative noise environment (to make assumptions) or user input (where noise monitoring data is available):
    - (a) where representative noise environment is selected - select the appropriate noise area category (cell C16). The worksheet titled 'Representative Noise Environment' provides a number of examples to help select the noise area category.
    - (b) where user input is selected - enter the measured background noise level for each time period (cells D17 to D19).
  6. Is all plant at the same representative distance to the receiver? Select Y or N (cell C24):
    - (a) where Y is selected - enter the representative distance in cell C25.
    - (b) where N is selected - go to step #7
  7. For the scenario (e.g. shallow excavation), select plant from the drop-down list in cells A28 to A47 (e.g. dump trucks + excavator):
    - (a) enter quantity for each selected plant in cells D28 to D47.
    - (b) where N is selected from step #6 - enter the distance to receiver for each individual plant in cells E28 to E47.
    - (c) is there line of sight to receiver? select from drop down list in cells F28 to F47.
  8. Identify the level above background and/or noise management level (see rows 57 to 62).
  9. Identify and implement the relevant additional mitigation measures (see rows 63 to 65).
  9. Document a summary report detailing:
    - (a) project description (including location, duration, hours of work, construction methodology, plant, potentially impacted receivers, etc.).
    - (b) background noise levels.
    - (c) noise management levels.
    - (d) predicted noise levels for each time period.
    - (e) sleep disturbance mitigation distance for night works.
    - (f) mitigation measures.
    - (g) Team member responsible for implementing mitigation measures and managing noise and vibration.

(Note that suitable noise management levels for other noise-sensitive businesses not identified in the Construction Noise Estimator should be investigated on a project-by-project basis. Please contact a Roads and Maritime noise specialist for more information)

Type/model plant (See Sources Sheet)	SWL LAeq (dB(A))	SPL @7m (dB(A))	Quantity	Individual distance to receiver (m)	Is there line of sight to receiver? Y/N	Quantity correction (dBA)	Shielding correction (dBA)	Distance used in calculation (m)	Contribution SPL (dB(A))
Sunstation transformer	97	72	1	180	Yes	0	0	180	38
Tracking motor	90	65	1	190	Yes	0	0	190	30
Modular inverters	95	70	2	340	Yes	3	0	340	30
					Yes	0	0		-888
					Yes	0	0		-888
					Yes	0	0		-888
					Yes	0	0		-888
					Yes	0	0		-888
					Yes	0	0		-888
					Yes	0	0		-888
					Yes	0	0		-888
					Yes	0	0		-888
					Yes	0	0		-888
					Yes	0	0		-888
					Yes	0	0		-888
					Yes	0	0		-888
					Yes	0	0		-888
					Yes	0	0		-888
					Yes	0	0		-888
					Yes	0	0		-888

Total SPL LAeq(15minute) (dB(A))	39
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## APPENDIX D NOISE INCIDENT REGISTER

Date / Time	Reported by?	Contact no.	Incident description	Location	Management controls implemented	Date implemented

# **APPENDIX G CONSULTATION FACT SHEET**





**PILBARA  
SOLAR**



# Junja Solar Farm



## About Pilbara Solar

**Pilbara Solar (PS) develops commercial renewable energy projects in which Aboriginal people have the opportunity to own equity. We strive for sustainable economic development that benefits Aboriginal people, business, government and the community.**

We aim to set a standard of high Corporate Social Responsibility and develop projects to lower businesses carbon footprint. Pilbara Solar is currently developing a range of utility-scale renewable energy projects in Western Australia to provide power to industry and the community.

We support the development of sustainable local supply chains and wherever possible, we engage local and Aboriginal businesses.

### The Solar project

Pilbara Solar is proposing the development of a 10 megawatt (MW) solar farm on land leased to Jinparinya Aboriginal Corporation. This fact sheet includes an introduction to the project and discusses the process of the Development Application and how you might be affected during the construction phase of the project. Due to Jinparinya and Punju Njamal's close proximity to the development site (within 500 metres) it's important to us that you are aware of how you might be affected.

### Size, capacity & location

The solar farm will be approximately 25 hectares of the Jinparinya Aboriginal Corporation lease (in the form of a sublease). The production capacity of the solar farm is 10MW. The map on following page shows the proposed location of the solar project. This location was chosen mainly for security reasons, as there is less likelihood of vandalism if it can't be seen from the highway. The solar farm will be approximately 250 metres from Jinparinya housing and 180 metres from Punju Njamal housing.

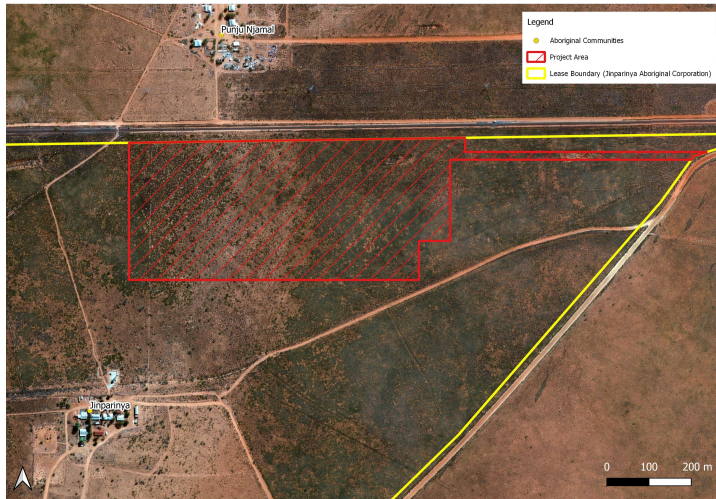
Access to the site would be via an existing access track east and south to Great Northern Highway. Pilbara Solar anticipates that approximately 10 to 12 light vehicles, and one to two heavy vehicles would access the site each day during the construction phase. Once operational, the solar farm would be unmanned except for periodical site inspections and maintenance.

During construction, the project would employ approximately 60 full time equivalent (FTE) workers and once operational, 4 fulltime employees working out of the Pilbara Solar office in Wedgefield, Hedland. Employment will occur closer to the beginning of construction with the aim to employ suitably qualified local people.

## Anticipated project schedule

**Construction timing** – approximately six months starting in the 4th quarter 2021.

**Construction hours** – generally 7am to 7pm Monday to Saturday. No construction activities would be undertaken on Sundays or public holidays.



## Project infrastructure

Solar (PV) panels (approx 22,000) – height not exceeding three metres above ground level. The mounting structure would comprise steel posts driven 1.2 to 2.5 metres into the ground using a pile driver.

- **Inverters** – proposal to include three inverters within the solar panels each up to 3 metres in height.
- **Substation** (location to be determined).
- **Cabling** – majority of cabling would be below ground of depths between 0.3 to 1.5 metres.
- **Storage shed** (20 foot container) – operations and maintenance shed.
- **Security fencing** – at a height of approximately 2.4 metres would be installed around the site
- **Firebreak** – installed around the security fence and maintained.
- **Access tracks** – internal access tracks would be approximately five metres wide.
- **Construction laydown area** – within fenced area.

## Development application process

Planning approval is required for the project, and there is a requirement to submit a Development Application (DA) to the Town of Port Hedland for consultation with the final application to be determined by the Department of Planning, Lands and Heritage. The purpose of the DA is to:

- Establish an earthworks strategy that coordinates access and construction of the solar farm.
- Undertake required environmental investigations, including an Aboriginal heritage survey of the development site and threatened flora, fauna and vegetation community assessments.
- Resolve high-level matters that require management in response to development of the proposed solar farm, including access, stormwater, bushfire, environmental constraints, and infrastructure servicing.

Confirm the likely conditions that will be imposed on this application in order to construct the proposal.

The planned submission date for development application is July 2021, with determination expected around September 2021.

## Contact Us

Pilbara Solar welcomes your feedback on the proposal. If you have any comments or questions please do not hesitate to contact us.

### Pilbara Solar Contact

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