APPENDIX G BIODIVERSITY DEVELOPMENT ASSESSMENT REPORT

PREPARED FOR

The Plains Wind Farm

Biodiversity Development Assessment Report

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The Plains Wind Farm

Biodiversity Development Assessment Report

0667692



Lorena Boyle
Ecologist / BAM Accredited Assessor



Mark Aitkens
Principal Ecologist / BAM Accredited Assessor



Joanne Woodhouse
Project Manager



Mark Davey
Partner

Environmental Resources Management
Australia Pty Ltd
Level 14, 207 Kent St
Sydney NSW 2000

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ACRONYMS AND ABBREVIATIONS

Acronyms	Description
APZ	Asset protection zone
BAM	Biodiversity Assessment Method
BAM-C	Biodiversity Assessment Method Calculator
BC Act	Biodiversity Conservation Act 2016 (NSW)
BC Regulation	Biodiversity Conservation Regulation 2017 (NSW)
BDAR	Biodiversity Development Assessment Report
BOAMS	Biodiversity Offsets and Agreement Management System
BOS	Biodiversity Offsets Scheme
CEEC	Critically endangered ecological community
DBH	Diameter at breast height over bark
EC	Ecological community listed under the EPBC Act
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999 (Cwlth)
EP&A Act	Environmental Planning and Assessment Act 1979 (NSW)
EEC	Endangered Ecological Community
HTW	High Threat Weed
LLS Act	Local Land Services Act 2013 (NSW)
MNES	Matters of National Environmental Significance
IBRA	Interim Biogeographic Regionalisation for Australia
NPW Act	National Parks and Wildlife Act 1974 (NSW)
NSW	New South Wales
PCT	Plant community type
SAII	Serious and Irreversible Impact
SEARs	Secretary's Environmental Assessment Requirements
TBDC	Threatened Biodiversity Data Collection
TEC	Threatened ecological community
VEC	Vulnerable ecological community
Vegetation SEPP	State Environmental Planning Policy (Vegetation in Non-Rural Areas) 2017 (NSW)

DECLARATIONS

Certification under clause 6.15 Biodiversity Conservation Act 2016

I, Lorena Boyle, certify that this report has been prepared based on the requirements of, and information provided under, the Biodiversity Assessment Method and clause 6.15 of the ***Biodiversity Conservation Act 2016*** (BC Act).

Signature:	
Date:	23 April 2024

BAM Assessor Accreditation Number: BAAS23027

Details and experience of Author's and contributors.

AUTHORS AND CONTRIBUTORS

Name	BAM Assessor Accreditation no (if relevant)	Position/Role	Tasks performed	Relevant qualifications
Mark Aitkens	BAAS17034	ERM – Principal Ecologist/Technical Lead	• Technical review • BAM Accredited Assessor	• Bachelor of Science (Environmental Biology) • BAM Accredited Assessor
Matt Davis	BAAS18090	ERM - Principal Ecologist/Technical Lead	• Technical review • BAM Accredited Assessor	• Bachelor Science Ecology and Conservation Biology • Master of Environmental Management, Conservation Biology • BAM accredited assessor
Lorena Boyle	BAAS23027	ERM – Ecologist/Field Lead	• BAM plot surveys • Targeted threatened flora surveys • Targeted threatened fauna surveys • Report preparation	• Bachelor of Zoology • BAM Accredited Assessor
Joanne Woodhouse	-	ERM - Project Manager	• Technical and QA Review	• Bachelor of Env Science • Diploma in Bushfire Protection • Diploma in Indigenous Archaeology
Bart Schiebaan	BAAS18033	Hunter Ecology - Principal Ecologist	• BAM plot surveys • Targeted threatened flora surveys	• B.Ap.Sc. Adv. Dip. Business Mgt. • Cert II Conservation & Land Mgt. • BAM Accredited Assessor
Lizzie Bowman	BAAS18112	Hunter Ecology - Principal Ecologist	• BAM plot surveys • Targeted threatened flora surveys	• B.Sc., GradCert.Env.Mng&Sus • BAM Accredited Assessor

Name	BAM Assessor Accreditation no (if relevant)	Position/Role	Tasks performed	Relevant qualifications
Damian Wall	BAAS18081	Red-gum Environmental Consulting - Principal Ecologist	• BAM plot surveys • Targeted threatened flora surveys	• BAppS, MEnvMgt, GradCert CHM, MEIANZ, CENVP
Olivia Hynam	-	Red-gum Environmental Consulting - Ecologist	• BAM plot surveys • Targeted threatened flora surveys	• N/A
Gabrielle Rose	-	Mango Green Consulting – Senior Ecologist	• BAM plot surveys • Targeted threatened flora surveys	• BAM Accredited Assessor
Ned Bowden	-	ERM - Ecologist	• Targeted threatened fauna surveys	• Bachelor of Environmental Management (Hons) • Graduate Certificate of Ornithology
Jaimie Soper	-	ERM - Ecologist	• Targeted threatened flora surveys • Targeted threatened fauna surveys	• Bachelor of Zoology • Graduate certificate of environmental science
Michael Thompson	-	ERM - Ecologist	• Targeted threatened fauna surveys	• Bachelor of Science (zoology) • Graduate Certificate of Environmental Management
Robert Ashworth	-	ERM - Ecologist	• Targeted threatened flora surveys • Targeted threatened fauna surveys • Report Preparation	• Bachelor of Science (Ecology and Conservation Biology) • Masters of Environment, restoration and Conservation
Freya Robinson	-	ERM - Ecologist	• Report Preparation	• Bachelor of Biological Science - Majors in Botany and Ecology • Graduate Certificate of Agriculture & Environment
Milan Bartusek	-	ERM - GIS Consultant	• GIS mapping and calculations • Figure preparation	• Masters in geoinformatics and applied cartography

Conflict of interest.

I, Lorena Boyle, declare that I have considered the circumstances and there is no actual, perceived or potential conflict of interest.

This declaration has been made in the interest of full disclosure to the decision-maker. Full disclosure has also been provided to the client.

Signature:	
Date:	23 April 2024

BAM Assessor Accreditation Number: BAAS23027

EXECUTIVE SUMMARY

OVERVIEW

ENGIE Australia Pty Ltd ('ENGIE' or 'Applicant') proposes to construct, operate, maintain and decommission The Plains Wind Farm (the Project) within the rural locality of Hay, New South Wales (NSW). The Applicant is seeking development approval under Part 4 of the *Environmental Planning & Assessment Act 1979* (EP&A Act) (State Significant Development or SSD) requiring preparation of a Biodiversity Development Assessment Report (BDAR) as the Project is deemed to have a significant impact on biodiversity values (s7.14 of the Biodiversity Conservation Act 2016 (BC Act)). This Project will form a component of the Plains Renewable Energy Park (PREP).

THE PROJECT

The Project is situated on Mungadal Station and neighbouring properties to the east and west of the Cobb Highway in the Riverina Murray Region of NSW. The Subject Land is lands to which the Biodiversity Assessment Method (BAM) is applied, and represents a 100 m buffer applied to the Development Footprint. The Development Footprint represents the maximum extent of potential direct impacts associated with the construction and operation of the Project.

The Subject Land extends over 314 freehold land parcels (and 6 parcels of Crown Land/ 'Road Casement'), in the Hay Shire Local Government Area (LGA). The Project is about 15 kilometres (km) (by road) south of Hay town centre and 10 km (by road) north of Booroooban village, via the Cobb Highway. The Project is located on land predominately used for agricultural activities.

The Project involves the construction, operation and where relevant decommissioning of:

- 188 wind turbine generators (WTGs), with each having a hub height of up to 180 metres (m), blade length of up to 90m, and tip height of up to 270m, and a total maximum capacity of up to 1,350 megawatts (MW);
- Up to 10 x Met Masts;
- Electrical reticulation; and
- Associated and ancillary facilities.

The Project will connect to either an existing 220 kV transmission line or the under construction 330 kV Project EnergyConnect, both owned by TransGrid and located along the southern boundary of the Project.

A Haul Route is proposed for the delivery of Project components from the Port of Adelaide, South Australia (SA), to the Subject Land. The area of impact for this component of the Project is delineated separately to the Subject Land and Development Footprint. The area of disturbance as a result of the Haul Route, and required to be assessed under the BAM, is herein referred to as the 'Haul Route Disturbance Footprint' (Haul Route DF). The Haul Route DF is assessed independently to the Subject Land, in accordance with the BAM streamlined assessment module for small area developments.

METHODS

Impacts to biodiversity values have been assessed in accordance with the Biodiversity Assessment Method 2020 (BAM) (DPIE 2020). Field surveys were undertaken over eight (8) events as follows:

- 26th October – 12th November 2021: Surveys included a general habitat assessment, paddock tree assessments, targeted flora surveys, nocturnal avian driven transects, bird utilisation surveys (BUS), BAM plots, targeted avian area searches and nocturnal call playback and spotlighting;
- 14th February – 25th February 2022: Surveys included a general habitat assessment, paddock tree assessments, BAM plots, anabat deployment, amphibian aural-visual survey, diurnal avian driven transects and BUS;
- 16th May – 20th May 2022: Surveys included a general habitat assessment, paddock tree assessments and BUS;
- 8th August – 18th August 2022: Surveys included a general habitat assessment, paddock tree assessments, BUS and nocturnal call playback.
- 21st February – 3rd March 2023: Surveys included a general habitat assessment, paddock tree assessments, BAM plots, targeted flora surveys, anabat deployment, Koala tree assessment, amphibian aural-visual survey, diurnal avian driven transects, nocturnal call playback and spotlighting and bird census;
- 23rd March 2023 – 13th May 2023: Anabat device deployed at height on a Met Mast;
- 17th July – 21st July 2023: Haul Route assessment including rapid vegetation assessments, habitat assessments and targeted flora transects;
- 18th September – 29th September 2023: Surveys included threatened flora transects;
- 13th November – 16th November 2023: Surveys included BUS; and
- 5th December 2023: Surveys included BAM plots.

The planned Spring 2022 surveys for threatened flora were abandoned due to weather events and flood conditions resulting in survey effort shortfalls (i.e., the project site was inaccessible for surveys). Engie have consulted with BCS on 25th October 2022 and 28th June 2023 and commit to undertaking additional targeted threatened flora surveys. Further surveys will also be conducted to inform assessment of the EPBC Act listed Grey Snake (*Hemiaspis damelii*) and Plains-wanderer (*Pedionomus torquatus*) habitat in accordance with the controlled actions assessment approach. These surveys will be completed during the response to submissions phase and in response to detailed project design.

BIODIVERSITY VALUES

The Subject Land comprises the following naturally occurring plant community types (PCTs):

- PCT 13 Black Box - Lignum woodland wetland of the inner floodplains in the semi-arid (warm) climate zone (mainly Riverina Bioregion and Murray Darling Depression Bioregion);
- PCT 17 Lignum shrubland wetland of the semi-arid (warm) plains (mainly Riverina Bioregion and Murray Darling Depression Bioregion);
- PCT 24 Canegrass swamp tall grassland wetland of drainage depressions, lakes and pans of the inland plains;

- PCT 28 White Cypress Pine open woodland of sand plains, prior streams and dunes mainly of the semi-arid (warm) climate zone;
- PCT 44 Forb-rich Speargrass – Windmill Grass – White Top grassland of the Riverina Bioregion;
- PCT 46 Curly Windmill Grass - speargrass - wallaby grass grassland on alluvial clay and loam on the Hay Plain, Riverina Bioregion;
- PCT 153 Black Bluebush low open shrubland of the alluvial plains and sandplains of the arid and semi-arid zones;
- PCT 157 Bladder Saltbush shrubland on alluvial plains in the semi-arid (warm) zone including Riverina Bioregion;
- PCT 163 Dillon Bush (Nitre Bush) shrubland of the semi-arid and arid zones; and
- PCT 164 Cotton Bush open shrubland of the semi-arid (warm) zone.

A single vegetation zone was established for each PCT within the Development Footprint for the purposes of calculating vegetation integrity scores (VIS) via the BAM Calculator (BAM-C). This was developed for each of the above PCTs except for PCT 46, which is situated outside the Development Footprint.

The Haul Route DF comprises four (4) PCTs, including the following:

- PCT 128 Neila tall open shrubland of semi-arid shrublands;
- PCT 136 Prickly Wattle open shrubland of drainage lines on stony rises and plains of the arid climate zone;
- PCT 139 Prickly Wattle tall open shrubland of dunes and sandplains of semi-arid and arid regions; and
- PCT 155 Bluebush shrubland on stony rises and downs in the arid and semi-arid zones.

Of these, PCT 155 is considered the dominant PCT and subsequently the only PCT to be incorporated into the BAM-C for the Haul Route DF under the streamlined assessment module for small area developments. A single vegetation zone was established for the PCT.

Alignment with threatened ecological communities (TECs) was also analysed resulting in the confirmation of presence of one (1) TEC within the Subject Land:

- Sandhill Pine Woodland in the Riverina, Murray-Darling Depression and NSW Southwestern Slopes bioregions TEC (Sandhill Pine Woodland TEC), listed as ‘Endangered’ under the BC Act .

No TECs are known within the Haul Route DF.

Four (4) ecosystem credit species have been recorded within the Subject Land, including:

- Black Falcon (*Falco subniger*);
- Spotted Harrier (*Circus assimilis*);
- Yellow-bellied Sheath-tailed Bat (*Saccolaimus flaviventris*); and
- White-fronted Chat (*Epthianura albifrons*).

Four (4) ecosystem credit species have been recorded in proximity to the Haul Route DF based on BioNet records, including:

- Redthroat (*Pyrrholaemus brunneus*);

- White-fronted Chat (*Epthianura albifrons*);
- Southern Whiteface (*Aphelocephala leucopsis*); and
- Black Falcon (*Falco subniger*).

A species polygon was developed for eight (8) species credit species within the Subject Land, including:

- Plains-wanderer (*Pedionomus torquatus*)*;
- A Spear-grass (*Austrostipa wakoolica*);
- Winged Pepper-cress (*Lepidium monoplocoides*);
- Chariot Wheels (*Maireana cheelii*);
- Mossgiel Daisy (*Brachyscome papillosa*);
- A burr-daisy (*Calotis moorei*)*;
- Slender Darling Pea (*Swainsona murrayana*); and
- Small Scurf Pea (*Cullen parvum*).

A species polygon was developed for a single species credit species within the Haul Route DF, being:

- Creeping Darling Pea (Swainsona *viridis*)*

Serious and Irreversible Impact (SAII) entities were identified for the purposes of further assessment under the BAM (identified with an asterisk above).

There are four (4) named waterways situated within the Subject Land, with the Project intersecting the ephemeral creeks, including:

- Telegraph Creek;
- Abercrombie Creek;
- Curtains Creek; and
- Nyangay Creek.

No key fish habitat is present. It is considered unlikely that any listed aquatic species under the *Fisheries Management Act 1994* would be impacted by the Project.

PRESCRIBED IMPACTS

The Project is anticipated to have prescribed impacts as outlined below:

- Increased risk of mammal predatory species;
- Risk of Turbine Strike; and
- Increased risk of vehicle strike.

Measures to mitigate these impacts will be implemented through a Construction Environmental Management Plan (CEMP), Bird and Bat Adaptive Management Plan (BBAMP), and Pest Management Control Programs.

CUMULATIVE IMPACTS

It is anticipated that the Project will remove native vegetation thus contributing to the cumulative loss of vegetation in the region. The Project involves direct impacts to 1,965.33 ha of native vegetation across the Development Footprint, and 0.67 ha of native vegetation across the Haul Route DF. A review against publicly available information regarding nearby relevant projects found the Project will likely form part of cumulative impacts to biodiversity values in the region.

AVOID, MINIMISE AND MITIGATE

The Project design has evolved through the course of preparing the BDAR to minimise impact on biodiversity features, including minimising impacts to Important Mapped Areas for the Plains-wanderer, using existing access tracks to reduce habitat clearing, largely avoiding areas of remnant woodland and TECs, and avoiding identified Little Eagle nest and remaining mapped resident raptor nests.

Mitigation measures proposed to be undertaken as part of the Project include a CEMP, BBAMP and Pest Management Control Programs. The CEMP will make provisions for clearing protocols, construction timing, and include measures to minimise soil disturbance, runoff and sediment transfer, noise, dust, and vibrations because of the Project. The Pest Management Control Programs will be developed and implemented to minimise the impacts of introduced predators on existing native fauna, with a particular focus on the Plains-wanderer. The BBAMP will intend to enable the implementation of a long-term approach to the mitigation and management of potential impacts on listed threatened and migratory species as a result of turbine strike. Monitoring will also be incorporated into the BBAMP to identify any potential changes to the species' utilisation of the Subject Land and the surrounding landscape.

SERIOUS AND IRREVERSIBLE IMPACTS (SAII)

Three (3) species were identified at risk of SAII, thus requiring assessment under Section 9.1 of the BAM 2020. These are:

- Plains-wanderer (*Pedionomus torquatus*);
- A burr-daisy (*Calotis moorei*); and
- Creeping Darling Pea (Swainsona viridis).

This assessment took into consideration the impacts of the Project and avoidance, minimisation and mitigation measures proposed, and concluded that the severity of the Projects impact is not of a kind that would contribute to an increase in the decline of the species such that it would become extinct. It is anticipated that these species would likely respond to the management proposed (e.g., micrositing to avoid *Calotis moorei* and *Swainsona viridis* during detailed design, weed control).

RESIDUAL IMPACTS AND BIODIVERSITY OFFSET LIABILITY

The Project has been calculated to have a direct impact on the PCTs as outlined in the following table.

Table E 1 Impacts that require offsets - ecosystem credits

Vegetation Zone	PCT	Condition	TEC/EC	Impact area (ha)	Number of ecosystem credits required
1	13	Moderate	-	2.01	45
2	17	Moderate	-	87.09	3016
3	24	Moderate	-	57.33	1028
4	28	Low	Yes	0.69	12
5	44	Moderate	-	73.63	3119
6	153	Moderate	-	18.48	586
7	157	Moderate	-	48.41	1254
8	163	Moderate	-	392.68	11320
9	164	Moderate	-	1,285.02	41766
10*	155	High	-	0.67	29

**Vegetation Zone 10 is related to the Haul Route DF only.*

Table E 2 Impacts that require offset - species credits

Common Name	Scientific Name	Loss of habitat (ha)	Number of species credits required
Plains-wanderer	*Pedionomus torquatus*	5.35	305
A Spear-grass	*Austrostipa wakoolica*	87.78	3,447
Winged Pepper-cress	*Lepidium monoplocoides*	367.42	13,441
Chariot Wheels	*Maireana cheelii*	1,036.75	44,233
Mossgiel Daisy	*Brachyscome papillosa*	1,376.57	56,517
A burr-daisy	*Calotis moorei*	46.29	2,176
Small Scurf-pea	*Cullen parvum*	72.81	3,084
Slender Darling Pea	*Sclerolaena napiformis*	1,331.03	55,536
Creeping Darling Pea*	*Swainsona viridis*	0.53	40

**The Creeping Darling Pea is related to the Haul Route DF only*

OFFSET STRATEGY

The no net loss standard involves the retirement of ecosystem and species credits for Project related direct impacts in accordance with the NSW Biodiversity Offsets Scheme (BOS). The BOS requires all direct impacts on biodiversity to be calculated using the BAM-C, which provides an output determining the final Species credit and Ecosystem credit obligations for the Project. Typically, the final credit obligations are to be 'retired' prior to construction or in accordance with an approved staged approach.

The Applicant is developing a biodiversity offset strategy in parallel with the BDAR. This strategy will detail the offset approach to be undertaken to retire credit obligations and will be achieved by:

- Retiring 'like for like' credits as specified in Sections 7.1 and 7.2 to the amount and from the regions indicated;
- Funding a biodiversity conservation action instead of, or in combination with, the retirement of species credits; or
- Payment into the Biodiversity Conservation Trust (BCT) in lieu of satisfying the offset liability specified in Section 7.1 and 7.2.

The fee associated with the latter option is to be determined through formal consultation with the Biodiversity Conservation Trust (BCT).

PREFACE

1. ASSESSMENT OVERVIEW

ERM has been contracted by ENGIE Australia Pty Ltd ('ENGIE' or 'Applicant') to develop a Biodiversity Development Assessment Report (BDAR) for The Plains Wind Farm (the 'Project'). This Project will form a component of the Plains Renewable Energy Park (PREP).

The Project involves the construction, operation, maintenance and, where relevant, decommissioning of:

- 188 wind turbine generators (WTGs), with each having a hub height of up to 180 metres (m), blade length up to 90 m, and tip height of up to 270 m, and a total maximum capacity of up to 1,350 megawatts (MW);
- Up to 10 x Met Masts;
- Electrical reticulation network, onsite substations and switchyard; and
- Associated and ancillary infrastructure.

The Project will connect to the existing 220 kV line or approved project EnergyConnect 330 kV transmission line Eastern Section (EnergyConnect), both owned by TransGrid and located along the southern boundary of the Subject Land.

The Project is to be assessed under Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act) as State Significant Development (SSD). This BDAR is prepared in accordance with the Biodiversity Offset Scheme (BOS) and addresses the project-specific Secretary's Environmental Assessment Requirements (SEARs) issued by the Department of Planning and Environment (DPE) (SSD-50629707, dated 16th December 2022). This BDAR will be submitted with the Environmental Impact Statement (EIS) prepared as part of the SSD process.

This BDAR also considers proposed works along the Haul Route for the delivery of Project components to the Subject Land from the Port of Adelaide, SA. The impacts to biodiversity values across the Haul Route DF are assessed independently throughout this BDAR, using the streamlined assessment module for small area developments in accordance with Appendix C of the BAM.

This BDAR addresses Stage 1 (Biodiversity Assessment) and Stage 2 (Impact Assessment) of the BAM and omits Stage 3 (Improving Biodiversity Values) as this is only required for Biodiversity Stewardship Site Assessment Reports. The BDAR also addresses the assessment requirements of the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and relevant State Environmental Planning Policies (SEPPs).

1.1 RELEVANT LEGISLATION AND POLICIES

1.1.1 ASSESSMENT FRAMEWORK

The Project requires approval under Part 4 of the EP&A Act. Section 1.7 of the EP&A Act specifies that Act has effect subject to the provisions of Part 7 of *Biodiversity Conservation Act 2016* (BC Act). Part 7 of the BC Act mandates the application of the Biodiversity Assessment Methodology 2020 (BAM) (DPIE 2020a) where the Project exceeds a biodiversity offsets

scheme threshold (i.e., Section 7.2 of the BC Act) and/ or is "likely to significantly affect threatened species" upon application of the test (Section 7.3 of the BC Act). In this case, these thresholds do not apply as the Project is declared SSD thus mandating the preparation of a BDAR (s7.14) in the absence of a successful BDAR waiver. The Minister for Planning is to take into consideration impacts on SAIIs and determine if any additional measures are required to minimise impacts on those entities (s7.16(3)).

1.1.2 NEED FOR A BDAR

The BOS applies to the Project as it has been declared SSD (s7.14 of the BC Act). The Applicant (ENGIE) has engaged an accredited assessor to apply the BAM to assess the impacts of the proposal on biodiversity values.

1.1.3 APPLICATION OF THE BAM

This BDAR has been prepared in accordance with the relevant parts of the BAM, as required under the BC Act for development identified as "likely to significantly affect threatened species". The streamlined assessment module for small area developments was applied to the Haul Route component of the Project in preparing this BDAR.

The Haul Route component of the proposal includes disturbance to native vegetation within the Haul Route DF. The Haul Route DF meets the area limits criteria for the streamlined assessment module for small area developments, on the bases that the area of native vegetation to be disturbed is below the maximum clearing area threshold set out in the BAM. In this regard the minimum lot size associated with the disturbance for the Haul Route is 2 ha and the proposed activity would involve clearing/disturbance to less than 2 ha (0.67 ha) of native vegetation.

The minimum information supplied in this BDAR is in accordance with the relevant details specified in Table 24 of Appendix K of the BAM.

The BDAR is certified by the accredited assessor indicated on Page (i) of this document as of the date corresponding with the signature. The BAM Calculator (BAM-C) reports associated with this BDAR were finalised within 14 days of the date of submission of this BDAR.

1.1.4 MATTERS OF NATIONAL ENVIRONMENTAL SIGNIFICANCE

The EPBC Act provides a legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities, and heritage places – defined as matters of national environmental significance (MNES).

A referral was submitted by the Applicant to the Commonwealth Department of Climate Change, Energy, the Environment and Water (DCCEEW), (EPBC 2022/09404). The referral identified potential for significant impacts to EPBC Act listed MNES, which are likely to occur or use habitat within the Project area and be impacted by the project.

The Commonwealth Minister for the Environment and Water determined that the Project is likely to have a significant impact on MNES and therefore is a 'controlled action' under Part 7 of the EPBC Act. Consequently, the Project will be assessed under an Assessment Bilateral Agreement, allowing a single environmental impact assessment process for both the Commonwealth and NSW government. Requirements under the bilateral agreement are presented in Table 1.1.

TABLE 1-1 SEARS COMMENTS AND RESPONSE

SEARs Comment	Response
Department of Planning and Environment	
1. Biodiversity impacts related to the proposed development are to be assessed in accordance with Section 7.9 of the Biodiversity Conservation Act 2016 using the Biodiversity Assessment Method (BAM) 2020 and documented in a Biodiversity Development Assessment Report (BDAR). The BDAR must include information in the form detailed in the Biodiversity Conservation Act 2016 (s6.12), Biodiversity Conservation Regulation 2017 (s6.8) and the BAM, unless DPE determines that the proposed development is not likely to have any significant impact on biodiversity values.	Section 1.1.3
2. The BDAR must document the application of the avoid, minimise and offset framework including assessing all direct, indirect, uncertain and prescribed impacts in accordance with the BAM.	Section 7
3. The BDAR must include details of the measures proposed to address the offset obligation as follows; a. The total number and classes of biodiversity credits required to be retired for the development/project; b. The number and classes of like-for-like biodiversity credits proposed to be retired; c. The number and classes of biodiversity credits proposed to be retired in accordance with the variation rules; d. Any proposal to fund a biodiversity conservation action; e. Any proposal to make a payment to the Biodiversity Conservation Fund. If seeking approval to use the variation rules, the BDAR must contain details of the reasonable steps that have been taken to obtain requisite like-for-like biodiversity credits.	Section 10
4. The EIS must assess the impact of wind turbine strikes on protected animals including; a) Predict the likelihood of impact on aerial species resident in, or likely to fly over, the project area, including but not limited to bat/bird strike and barotrauma. b) Predict the rate of impact per turbine per year for species likely to be affected. c) Justify predictions of likelihood of impact and rates of impact with reference to relevant literature and other published sources of information. d) Predict the consequences of impacts for the persistence of bioregional populations, with reference to relevant literature and other published sources of information. e) Predict and map the likely zone of disturbance around wind turbines for aerial species resident in, or likely to fly over, the project area, with reference to relevant literature and other published sources of information. f) Map significant landscape and habitat features within the zone of disturbance for species likely to be affected, including but not limited to hollow bearing trees, nest trees, microbat habitat and important habitat for migratory species. g) Predict the likelihood and describe the nature of indirect impacts on aerial species resident in, or likely to fly over, the project area including but not limited to barriers to migratory pathways and breeding, feeding and resting resources. h) For migratory species, predict the impact of avoidance behaviour relative to migration distances and the availability of suitable habitat for breeding, feeding and resting over the migration route, with reference to relevant literature and other sources of published information.	Section 7.2.2

SEARs Comment	Response
i) Justify prediction of likelihood and nature of impact, with reference to relevant literature and other published sources of information. j) Predict the cumulative impact of the project together with existing wind farms with respect to movement patterns and the use of adjacent habitat and provide justification for these predictions.	
Department of Primary Industries (Fisheries)	
A clear description of the location of works, including identification of the waterways present and all relevant plans.	Section 2.1
Identification and classification of key fish habitat in the area, according to section 3.2 of DPI Policy.	Section 3.1.1
A clear description of the works to be undertaken, including timing and duration of the works and all relevant plans. This includes detail on the: • location and design of any proposed or upgraded waterway crossings over key fish habitat. • the methodology (e.g. trenching or underboring) for any underground cabling or transmission lines that pass through key fish habitat.	Section 2.1 *Note: No Key Fish Habitat present*
Description of aquatic and riparian vegetation and instream aquatic vegetation in the vicinity of the development, particularly the extent and condition of riparian vegetation and instream aquatic vegetation, water depth, permanence of water flow and snags (large woody debris) within the footprint of the proposal area.	Section 3.1.1
Details on the location and design of proposed or upgraded waterway crossings of key fish habitat.	*Note: No Key Fish Habitat present*
An assessment of all potential impacts to key fish habitat and riparian zones. The extent of aquatic habitat removal and riparian vegetation removal, modification or improvement that may result from the development is to be clearly defined. Potential impacts to water quality and fish passage must be clearly defined.	Section 3.1.1
An assessment of significance for any threatened species matters listed under the FM Act. Guidelines can be found at: Threatened Species Assessment Guidelines - Assessment of Significance.	Section 3.1.1
A clear description of all proposed safeguards to mitigate impacts on aquatic habitats, water quality and riparian buffer zones. This can include, but not be limited to: • A clear map showing the riparian buffer zone width. • A description of any riparian buffer zone revegetation or erosion control works. • Details regarding how fish passage will be provided for. • A description of proposed erosion and sediment control techniques to be used during construction. • Detail on any onsite design measures to mitigate water quality and flow impacts to within and downstream of the site.	Section 3.1.1

SEARs Comment	Response
DCCEEW Bilateral Assessment	
1. *Background and description of action* The EIS / BDAR must include: a. Descriptions and maps of the operational and construction footprints of the project that relate to MNES. b. Descriptions and maps of staging and timing of the action that may impact on MNES. c. Maps of the subject land boundary showing the final proposal and disturbance footprint with regards to MNES	Section 2.1
2. *Landscape context of the MNES* Ensure that the 'Establishing the site context' of BAM 2020 (Section 3) have been fully met in the BDAR in relation to MNES	Section 3
3. *EPBC Act listed threatened species and communities* The EIS / BDAR must include the following: a. Demonstration that field-based survey effort meets BCD survey guidelines and, where available, Commonwealth survey guidelines. b. Demonstration of access and use of supporting databases (e.g. NSW BioNet Vegetation Classification, NSW BiaNet Threatened Biodiversity Data Collection, NSW BioNet Atlas, Commonwealth Species Profile and Threats Database search results). c. Demonstration of access and use of published peer-reviewed literature. d. Demonstration of access and use of local data (if relevant). e. Demonstration of appropriate mapping of all EPBC Act-listed threatened species and communities in accordance with the relevant Commonwealth listing advice. f. Demonstration of consideration of important populations and critical habitat as defined in Approved Listing Advice, Approved Conservation Advice and Recovery Action Plans. g. A list of all EPBC Act listed threatened species and communities that occur on the subject land, or in the vicinity (including species that are 'ecosystem credits' in BAM). h. A discussion, with data and analysis where any species and communities identified by the Department of Climate Change, Energy, the Environment and Water (DCCEEW) referral documents have been ruled out as occurring on or near the subject site.	Section 2.2, Section 1.4, Section 4.1.6, Section 5.1.3
4. *Avoidance, minimisation, mitigation and management.* The EIS / BDAR must include: a. The demonstration of all feasible alternatives and efforts to avoid and minimise impacts on EPBC Act listed threatened species and communities (including direct, indirect and prescribed impacts) including an analysis of alternative: • designs and engineering solutions • modes or technologies • routes and locations of facilities • sites within the subject site • the identification of any other site constraints in determining the location and design of the proposal (such as bushfire protection requirements, flood planning levels, servicing constraints, etc). b. A discussion and justification of all feasible measures to avoid, mitigate and/or manage impacts on EPBC Act listed threatened species and communities (including direct, indirect and prescribed impacts) including: • techniques, timing, frequency and responsibility	Section 7, Section 8.5

SEARs Comment	Response
• identify measures for which there is risk of failure • evaluate the risk and consequence of any residual impacts • any adaptive management strategy proposed to monitor and respond to impacts.	
5. *Impact assessment* The EIS / BDAR must include the following: a. Identification of the residual adverse impacts likely to occur to each EPBC Act listed threatened species and/or community after the proposed avoidance and mitigation measures are taken into account. b. Justification and evidence for the predicted level of impact, with reference to the Commonwealth's Significant Impact Guidelines 1.1 - Matters of National Environmental Significance'' and DPIE's 'Guidance to Assist a Decision- Maker to Determine a Serious and Irreversible Impact 2 c. Provide a table detailing listed EPBC Act entities, nature of impact (direct, indirect), duration/timing of impact, quantum of impact, consequence , offsetting requirements. d. Provide data and justification where any EPBC Act-listed threatened species or communities to be considered in the BDAR are considered to be at low risk of impact during the assessment.	Section 9.3, Section 8.1 and Section 8.2.
6. *Offsets* The EIS / BDAR must include the following: a. The identification of any MNES that have not been offset using the BAM. b. Details of how impacts requiring offset correlate to the MNES impacts. c. Details of the PCTs that require offsetting and the number and type of ecosystem credits required for impacts to MNES. d. Details of threatened species requiring offset and the number of species credits required for impacts to MNES. e. A demonstration of the correct uses the BAM (and BAM calculator) to identify the number and class of biodiversity credits that need to be offset to achieve a standard of no net loss of biodiversity f. Any details of ecological rehabilitation and/or biodiversity conservation actions proposed for offsetting g. The identification of any other offsetting approach proposed, such as land-based offsets, retiring credits by payment into the Biodiversity Conservation Fund and/or through supplementary measures. h. Provide threatened entity, PCT association, area of impact, credits required, offsetting approach, reference (EIS, BDAR)	Section 5.1.2, Section 10.1, Section 10.2
7. *Other considerations*. The EIS / BDAR must include the following: a. Consideration of all relevant Commonwealth guidelines and policy statements that are appliable to the action and listed threatened species and/or communities, including but not limited to: • International environmental obligations • Recovery Plans • Approved Conservation Advice • Threat Abatement Plans b. An assessment for each EPBC Act listed threatened species and/or community, that has been adequately informed by applicable Commonwealth guidelines and/or policy statements. For example, the interaction between the proposed action and important populations or critical habitat identified in policy documents and/or the interaction between the proposed action and threatening processes or recommended conservation actions outlined in Commonwealth policies and plans.	Throughout

1.2 BIODIVERSITY CREDITS AND CLASSES

The BAM uses biodiversity credits to measure:

- The residual impacts of a proposal on biodiversity values; or
- Gains in biodiversity values at biodiversity stewardship sites.

In this application, the BDAR is measuring the direct impacts of the Project on biodiversity values using two kinds of credits, being 'ecosystem credits' and 'species credits'.

Each ecosystem credit is assigned up to seven attributes that are used to distinguish the type of biodiversity values represented by the credit and to determine whether a credit within a class is 'like' another credit.

Each species credit is assigned four attributes. Matching of attributes is used to apply the 'like-for-like' rules and variation rules as set out in the BC Regulation.

1.3 ACCREDITED PERSON

A BDAR, which documents the assessment and 'No Net Loss' outcomes, must be prepared by a person accredited under Section 6.10 of the BC Act. An accredited person is referred to as an assessor.

This BDAR was authored by Lorena Boyle (Accredited BAM Assessor – BAAS23027) with contributions from Robert Ashworth, Freya Robinson and Samantha Maher. The BDAR was reviewed by Mark Aitkens (Accredited BAM Assessor – BAAS17034). The assessment provided in the report is based on the BAM-C (version 1.4.0.00) with BAM data last updated on 22/06/2023 and linked to two (2) Development Assessment Cases created in the BAM-C as required. Separate Development Assessment Cases are established for the following:

- Case 00034483 – SSD under Part 4: The Project, with exception of the Haul Route DF
- Case 00046788 – SSD under Part 4 (small area): The Haul Route DF

1.4 DATA AND INFORMATION USED

The full list of information sources referred to in this report is provided in Section 12. Digital shapefiles for all maps and spatial data have been submitted with this report. Information sources included (but were not necessarily limited to) the following:

- Proposal layers and concept designs provided by the Applicant;
- Land Surveys Aerial LiDAR Survey Imagery and Ground Control Survey 2023;
- Department of Planning, Industry and Environment (DPIE) Threatened Species Database Collection (http://www.environment.nsw.gov.au/threatenedspeciesapp/; Accessed June 2021);
- DPE State Vegetation Type Mapping Version C1.1.M1.1 (https://datasets.seed.nsw.gov.au/dataset/nsw-state-vegetation-type-map Accessed 15 January 2022);
- NSW Biodiversity Values Map (https://www.lmbc.nsw.gov.au/Maps/index.html?viewer=BVMap; Accessed 2 July 2023);
- BAM 2020 (DPIE 2020);

- Interim Biogeographical Regionalisation for Australia (IBRA) and IBRA sub-regions v7 (http://www.environment.gov.au/land/nrs/science/ibra);
- NSW Mitchell Landscapes map and descriptions (NPWS 2003);
- Department of Environment Energy Climate Change and Water (DEECCW) Australian Government's Species Profiles and Threats (SPRAT) database (http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl) (Accessed 3 April 2023; DEECCW 2023a);
- DEECCWs EPBC Act Protected Matters Search Tool (http://www.environment.gov.au/epbc/protectedmatters- search-tool; Accessed April 12, 2023; DEECCW 2023b);
- Department of Planning, Industry and Environment (DPIE) (2019) Guidance to assist a decision-maker to determine a serious and irreversible impact;
- Biodiversity Assessment Method (BAM) 2020;
- NSW OEH BAM Calculator (BAM-C) (https://www.lmbc.nsw.gov.au/bamcalc);
- 'Species credit' threatened bats and their habitats NSW survey guide for the Biodiversity Assessment Method (OEH, 2018);
- Surveying threatened plants and their habitats - NSW survey guide for the Biodiversity Assessment Method (NSW DPIE, 2020);
- Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities (Department of Environment and Conservation (DEC), 2004);
- Survey Guidelines for Australia's Threatened Mammals (Department of Sustainability, Environment, Water, Population & Communities (DSWP&C), 2011);
- NSW Survey Guide for Threatened Frogs: A guide for the survey of threatened frogs and their habitats for the Biodiversity Assessment Method (DPIE, 2020a); and
- Koala (Phascolarctos cinereus) Biodiversity Assessment Method Survey Guide (DPE 2022).

1.5 BIODIVERSITY VALUES NOT ASSESSED

The BAM does not assess biodiversity values for:

- Marine mammals;
- Wandering seabirds;
- Biodiversity that is endemic to Lord Howe Island; and/ or
- Native vegetation and loss of habitat on category 1-exempt land (within the meaning of Part 5A of the LLS Act 2013), other than the additional biodiversity impacts under clause 6.1 of the BC Regulation (referred to as prescribed impacts in the BAM).

This BDAR does not include an assessment of these matters. The extent of Category 1 - Exempt Land is outlined in the following section.

1.6 CATEGORY 1- EXEMPT LANDS

The Subject Land comprises rural zoned land and is thus regulated under the *Local Land Services Act 2013* (LLS Act). Under the LLS Act, three land categories are defined relating to vegetation clearing:

- Category 1 – 'Exempt land', land not subject to clearing approval;

- Category 2 – 'Regulated Land', land on which clearing of native vegetation may be carried out with or without approval in accordance with an 'allowable activity' or 'code' under the LLS Act; and
- 'Excluded Land' – Land not categorised in the Regulatory Maps and to which the LLS Act does not apply.

The Draft Native Vegetation Regulatory (NVR) Map (accessed 24th November 2023) identifies the Subject Land as containing Category 1 – Exempt Lands and Category 2 - Regulated Lands. No map review has been sought as part of this BDAR. Clearing of Category-1 Exempt Lands is not subject to consideration in this assessment and is represented as PCT 0 (non-native) on report figures. Clearing of vegetation classified as Category 2 – Regulated Lands across the Subject Land will be subject to approval and have been considered throughout this BDAR in accordance with the BAM.

The Haul Route DF comprises areas of rural zoned land, however no Category 1 – Exempt Lands are identified via the Draft NVR Map.

1.7 STRUCTURE OF THE BDAR

A BDAR requires completion of Stages 1 and 2 of the BAM (DPIE 2020a). These stages are outlined below.

- Stage 1 establishes a consistent approach to assessing the biodiversity values of land; and
- Stage 2 outlines the guidance and requirements to apply the hierarchy of avoid, minimise and offset for assessing direct, indirect or prescribed impacts on biodiversity values arising from the proposed development, activity, clearing or biodiversity certification. Stage 2 also provides guidance on the use of mitigation measures where there is uncertainty on the timing or extent of impacts.

Section structuring in this BDAR follows the corresponding BAM sections to assist readability for compliance with the BAM. Thus, in omitting the Stage 3 assessment, the BDAR section structuring ends with the last section in Stage 2 (Section 10 Applying the no net loss standard).

Documents appended to this BDAR include:

- Bat Call Analysis Report (Summer 2022) – Green Tape Solutions;
- Bat Call Analysis Report (Summer 2023) – Green Tape Solutions;
- Microbat Call Analysis Report (February 2024) – Lachlan McRae Fauna Services;
- The Plains Wind Farm – Haul Route Assessment: SA Biodiversity Due Diligence – ERM; and
- The Plains Wind Farm – Haul Route Assessment: NSW Biodiversity Due Diligence – ERM.

It is noted 'Bat Call Analysis Report (Summer 2022)' includes a possible recording of the Eastern Long-eared Bat (*Nyctophilus bifax*). The Project is situated substantially outside the species distribution, therefore this possible recording is discounted and not further discussed.

1.8 BDAR VERSION HISTORY

This BDAR has been prepared in accordance with the BAM 2020 through contributions made by accredited and non-accredited persons since 2020. Contributors to the preparation of the BDAR are listed on Page 2 of this BDAR.

Version 1 (current version) assesses the impact of the Project by way of:

- Proposal design: The Project involves the construction, operation, maintenance and decommissioning of a wind farm, with up to 188 WTGs, together with associated and ancillary infrastructure. This BDAR additionally assesses upgrades required along the preferred Haul Route between Port Adelaide and the Project; and
- Mitigation: Mitigation measures proposed to be undertaken as part of the Project include a:
    - Bird and Bat Adaptive Management Plan (BBAMP);
    - Construction Environmental Management Plan (CEMP); and
    - Pest Management Control Programs.

The BBAMP will intend to enable the implementation of a long-term approach to the mitigation and management of potential impacts on listed threatened and migratory species as a result of turbine strike. Monitoring will also be incorporated into the BBAMP to identify any potential changes to the species' utilisation of the Subject Land and the surrounding landscape.

The CEMP will make provisions for clearing protocols, construction timing, and include measures to minimise soil disturbance, runoff and sediment transfer, artificial light, noise, dust, and vibrations as a result of the Project.

The Pest Management Control Programs will be developed and implemented to minimise the impacts of introduced predators on existing native fauna, with a particular focus on the Plains-wanderer.

Amendments to Version 1 have potential to affect the offset liability generated.

STAGE 1: BIODIVERSITY ASSESSMENT

2. INTRODUCTION

ERM has prepared this BDAR on behalf of the 'Applicant' to inform the EIS for the proposed Project. The Project is in the Riverina Murray region of New South Wales (NSW), within the Hay Shire Council Local Government Area (LGA) and is approximately 15 kilometres (km) (by road) south of the town of Hay. The Project is situated on Mungadal Station and neighbouring properties to the east and west of the Cobb Highway.

For the purposes of the BDAR, the term 'Development Footprint' is used hereafter to refer to the maximum area of potentital direct impacts during the construction and operational phases of the Project, with the 'Subject Land' used to refer to the Development footprint with a 100 m buffer applied.

This BDAR further addresses potential biodiversity impacts as a result of upgrades and modifications at three (3) Haul Route pinch points (PPs). 'Haul Route' is used hereafter to refer to the entirety of the route. 'Haul Route Disturbance Footprint' (Haul Route DF) is used to refer to the sole area of mapped native vegetation to be directly impacted by these upgrades and modifications and subsequently subject to assessment under the BAM.

2.1 PROPOSED DEVELOPMENT

2.1.1 OVERVIEW

The Applicant is seeking SSD Consent under Division 4.7, Part 4 of the EP&A Act for the construction and operation of the Project. The Project involves the construction, operation, maintenance and decommissioning of a wind farm, with up to 188 WTGs, together with associated and ancillary infrastructure. This Project will form a component of the PREP, and is situated within The Plains Wind Farm Project Area.

The blade and tower components of the wind turbines for the Project will require transport between the Port of Adelaide and the Subject Land, via Broken Hill, NSW. The proposed haul route will head north from Port Adelaide passing through several towns along the way before turning right towards Broken Hill and Wilcannia in NSW, where the route will then proceed south through Ivanhoe, Boogal, and finish at the Subject Land.

The Applicant proposes to undertake upgrades and modifications as required to 11 identified pinch points along the proposed haul route between the Port of Adelaide to the Subject Land. Three pinch points are situated in NSW and are discussed within the appended NSW Haul Route Due Diligence Assessment (Appendix B). The remaining eight pinch points are in SA, discussed within the appended SA Haul Route Due Diligence Assessment (Appendix A).

This BDAR includes assessment of the three (3) Haul Route PPs located in NSW only. Impacts associated within the Haul Route DF, associated with one identified PP (PP09A), requires assessment under the BOS.

2.1.2 LOCATION

The Subject Land is land to which the BAM is applied and includes the area of direct impacts and any additional areas where the proposal is likely to have indirect impacts. In this assessment, the Subject Land is described as the proposed area of disturbance as a result of the wind farm (the 'Development Footprint') with a 100 m buffer applied. The Subject Land is contained within the Project Area, Lot and DP Details listed in Table 2-1, and has an area of approximately 8,178.68 ha. A recent aerial photograph of the Subject Land is provided in Figure 2-5.

Additional areas of impact are assessed throughout this BDAR, associated with the Haul Route, locations of which are detailed in Table 2-1 and presented in Figure 2-3 and Figure 2-4.

The Assessment Area for a linear development, such as the Wind Farm, is all lands within a 500 m radius of the Subject Land as shown in Figure 2-2. The Assessment Area comprises areas of agricultural land, local West Burrabogie Road, and the Cobb Highway. It is situated approximately 20 km west of the Oolambeyan National Park. The Assessment Area does not extend into residential or commercial areas.

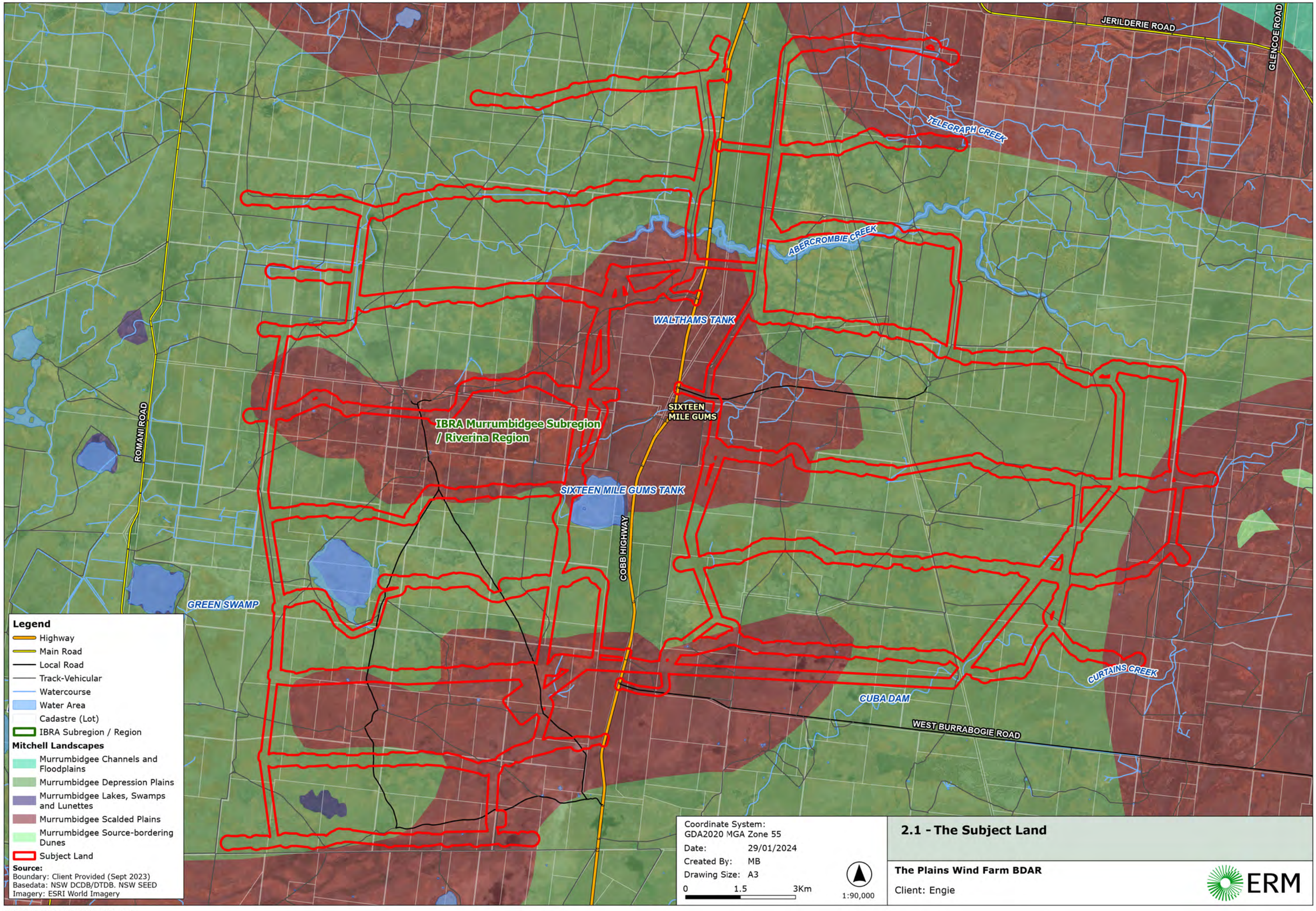
Major transport corridors in proximity to the Project include:

- Cobb Highway located through the centre of the project that connects Hay to Echuca;
- Sturt highway which connects Hay to Adelaide, as well as Sydney and Melbourne via the Hume Highway; and
- Mid-Western highway that connects Hay to West Wyalong.

TABLE 2-1 LOT AND DP DETAILS

Lot	DP	Title
Project Area		
1, 2	126222	Freehold
1, 2	126223	Freehold
1, 2	529796	Freehold
2	703764	Freehold
38	722043	Freehold
1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 20, 21, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 38, 115, 116, 117, 118, 119	756732	Freehold
2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 49, 50, 119	756737	Freehold
1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 13, 14, 15, 18, 19, 20, 21, 22, 23, 24, 25, 30	756745	Freehold
1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 19, 20, 21, 23, 24, 25, 26, 27, 28, 29, 30, 31, 44	756770	Freehold
1, 2, 3, 4, 5, 7, 11, 12, 17, 18, 19, 24, 25, 26, 27, 28, 29, 35, 36, 37, 38, 40, 41, 42	756771	Freehold
36, 42, 43, 44, 45, 46, 50, 72, 73, 74, 76, 77, 78, 94, 95	756774	Freehold

Lot	DP	Title
1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43	756778	Freehold
3, 4, 6, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 30, 31, 32, 33, 34, 35, 36, 37	756779	Freehold
3, 4, 5, 7, 8, 9, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 41, 42, 48, 51, 55, 56, 57, 58, 59, 60, 61, 62, 63, 65, 66, 67, 68, 69	756785	Freehold
1, 23, 24, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47	756797	Freehold
86, 87	756809	Freehold
21, 22	831180	Freehold
1	954661	Freehold
1	1015117	Freehold
1, 2, 3, 4	1091853	Freehold
1	1101148	Freehold
1	1218600	Freehold
7002	1056492	Crown
1	1123124	Crown
7300, 7301, 7303, 7304	1149704	Crown
Haul Route		
PP09A / Haul Route DF		
7401	DP1179151	CROWN
7400	DP1179151	CROWN
100	DP1136508	FREEHOLD
301	DP1242250	LOCAL GOVERNMENT AUTHORITY
302	DP1242250	FREEHOLD
17	DP39679	FREEHOLD
7307	DP1179131	CROWN
6667	DP822054	CROWN
PP10A		
7313	DP1185108	CROWN
PP10B		
5834	DP757298	CROWN
PP11		
Within road easement	-	-



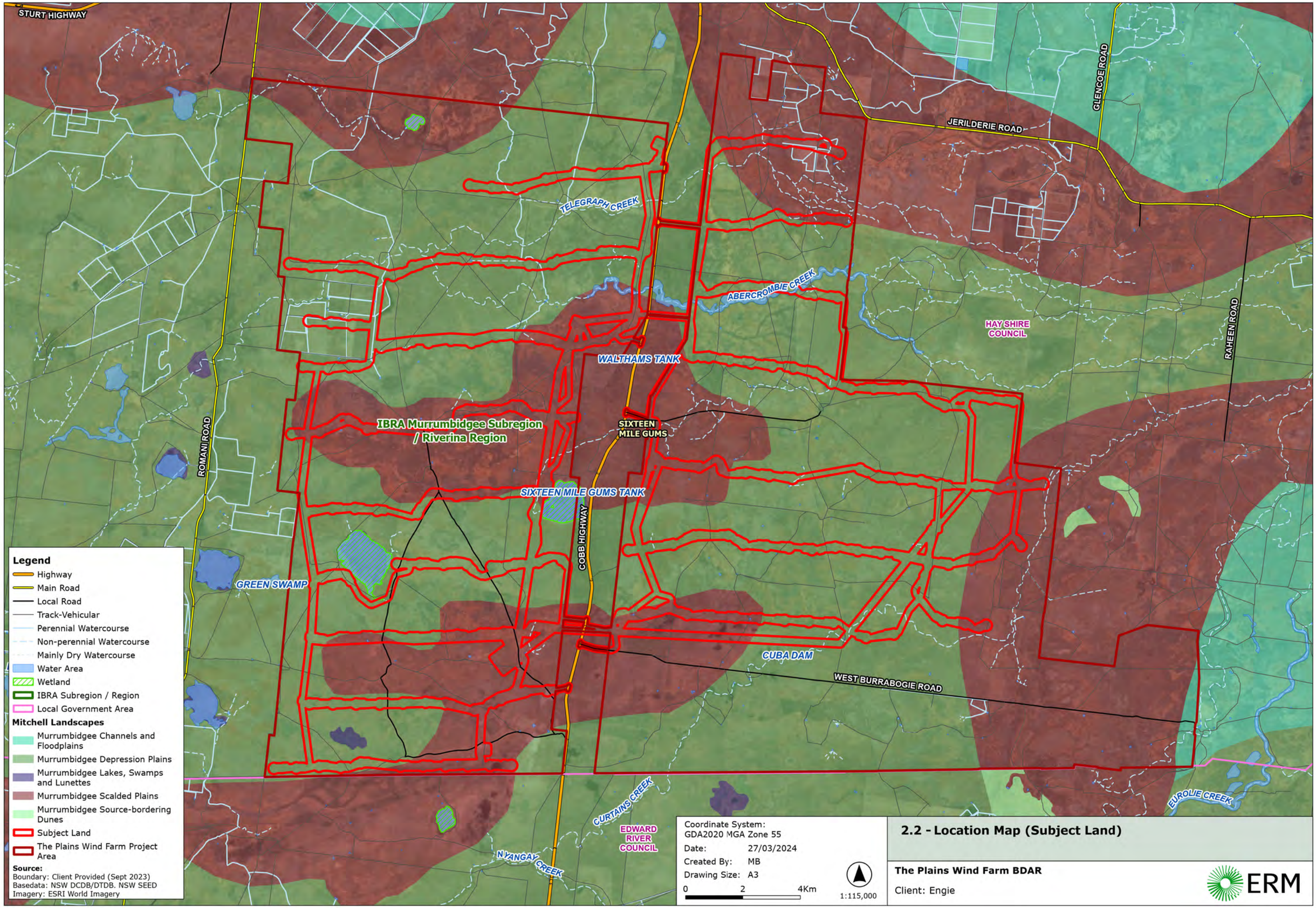
2.1 - The Subject Land

The Plains Wind Farm BDAR

Client: Engie

ERM

0667692_PlainsWF_BDAR_R01.aprx



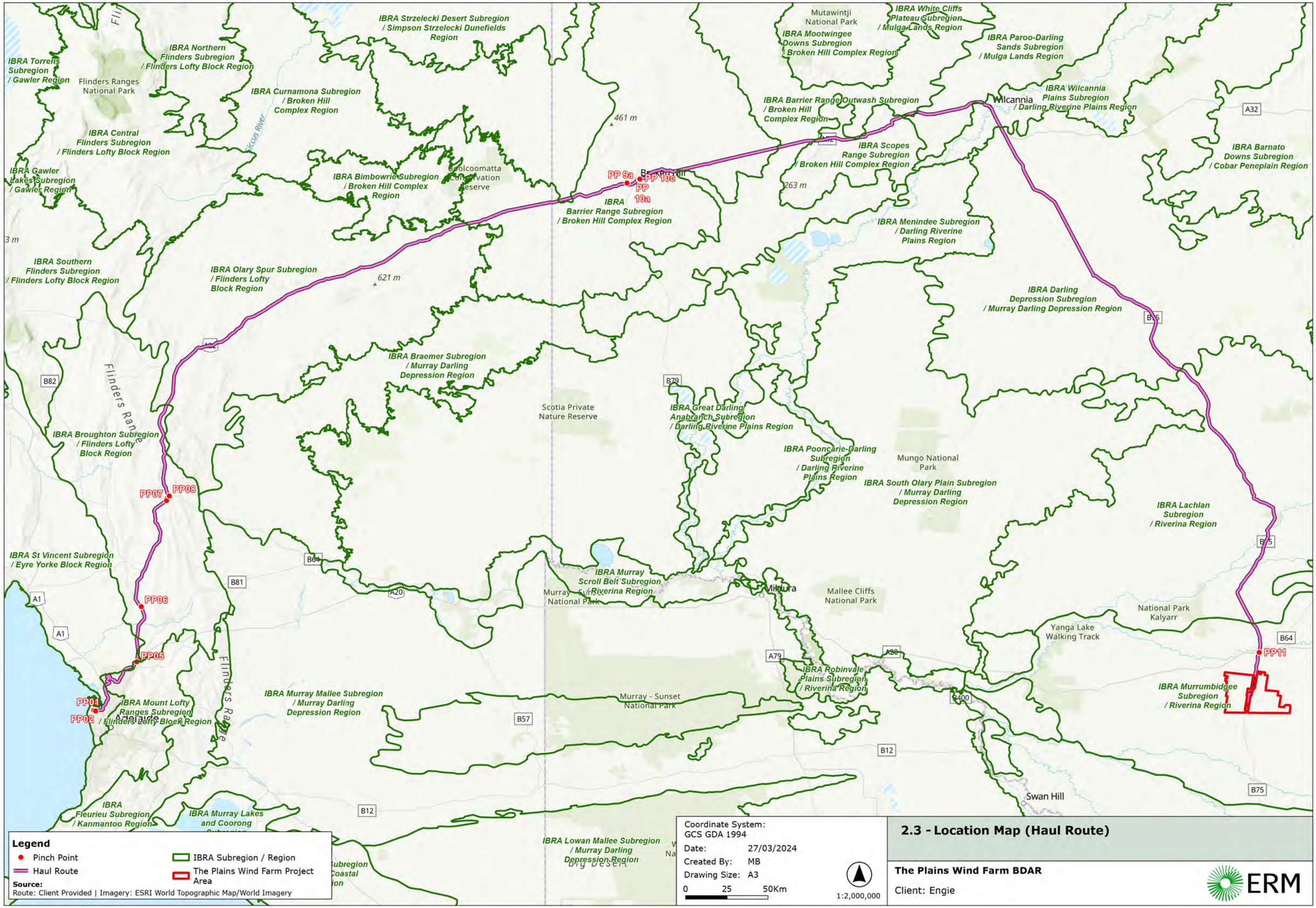
2.2 - Location Map (Subject Land)

The Plains Wind Farm BDAR

Client: Engie

ERM

0667692_PlainsWF_BDAR_R02.aprx



0667692_PlainsWF_BDAR_R02.aprx

Barrier Highway
A32
A32
A32
Unincorporated
- Far West Area
PP 9a
Regeneration
Reserve
Depot Road
Wills Lane
Burke Street
Ryan
Creedon Street
Wills Street
IBRA Barrier Range Subregion
/ Broken Hill Complex Region
Broken Hill City Council
Kanandah Road

Legend

- Pinch Point
- Railway
- Watercourse
- Local Government Area
- IBRA Subregion / Region

Mitchell Landscapes

- Barrier Downs
- Adelaide to Hay Route
- Haul Route Disturbance Footprint

Source:
Route: Client Provided
Basedata: NSW DCDB/DTDB. NSW SEED
Imagery: ESRI World Imagery

Coordinate System:
GCS GDA 1994
Date: 27/03/2024
Created By: MB
Drawing Size: A3
0 200 400m
1:10,000

2.4 - Haul Route Disturbance Footprint

The Plains Wind Farm BDAR

Client: Engie

ERM

0667692_PlainsWF_BDAR_R02.aprx

2.1.3 DEVELOPMENT FOOTPRINT AND THE SUBJECT LAND

The Development Footprint has an area of 1,997.03 ha and is nested within the Subject Land, which covers a total area of 8,178.68 ha. The Development Footprint represents the potential maximum area of impact associated with the construction and operation of the Project and is presented in Figure 2-5.

The Project assessed will involve the construction and operation of up to 188 WTGs. The WTG model selected for the Project is the Vestas 172 7.2MW. Each WTG consists typically of composite metals and individual flanged sections which are bolted together. The WTGs consist of a concrete foundation, tower, nacelle, rotor hub and blades. The Project layout for which approval is sought is shown in Figure 2-5 with components further discussed in Table 2-2 .

TABLE 2-2 PROJECT COMPONENTS

Component	Specification
Wind Turbine Generators	
Foundations	The exact size and type of tower foundation will be based on subsurface soil conditions and the results of geotechnical surveys undertaken during the detailed design phase, prior to commencement of construction.
Tower	Each WTG tower is assembled onsite and anchored to a concrete foundation. The towers include an internal ladder and service personnel lift and support the WTG nacelle, rotor hub and blades.
Hardstands	The total area of the hardstand during construction will be approximately 3.6 ha, subject to the topography of the surrounding land and will include a minimum of 10 m bushfire APZ around the perimeter of the hardstand area. A portion of the hardstand will be maintained during Project operations to allow for maintenance and future decommissioning of the WTGs, there may be an opportunity to revegetate the assembly portions of the hardstand to allow grazing activities to resume in these areas if not required for Project operations.
Nacelle	The nacelle is the housing that sits on the top of the turbine tower and accommodates the generator, gearbox, transformer, control systems, and pitch and yaw drives. The nacelle structure consists of a cast iron base frame and a rear girder structure. The base frame is the foundation for the drive train and transmits forces from the rotor to the tower through the yaw system. The bottom surface is machined and connected to the yaw bearing and the yaw gears are bolted to the base frame. The crane girders are attached to the rear structure.
Rotor Hub and Blades	The rotor includes the three blades and the hub which connects the blades to the gearbox. Blade length of up to 90 m, rotor hub height up to 180 m and tip height up to 270 m.
Electrical Reticulation and Grid Connection	
Substation	One 330 kV main substation and two 132 kV collector substations will be constructed in the Project Area to transform the 33 kV received from the internal electrical reticulation network to the 330 kV transmission voltage. The main substation would occupy a maximum expected area of 59 ha and each collector substation an area of 4.5 ha.

Component	Specification
Medium Voltage Reticulation	The internal electrical reticulation network, which connects the WTGs to the collector substations, will comprise approximately 222.6 km of underground and 81 km of overhead 33 kV cables. WTGs are connected in strings, which are then connected to the onsite substations. Where possible the cabling will be in underground trenches running parallel to access tracks. Where deviation from the access track is required due to geotechnical or other constraints, or to reduce overall cable length, these deviations will be positioned to minimise impact to ecological and heritage areas of high significance. The trenching for underground electrical cabling will be approximately 0.6 m wide per circuit by 1.0 m deep, located within a works area of approximately 5 m to accommodate the mobile plant and stockpiling of spoil and bedding sand. Trenches will be progressively backfilled during the construction works.
High Voltage Transmission Line	A 330 kV single or double circuit, three phase, twin conductor bundles overhead transmission line connection. The construction of approximately 28 km of a new 330 kV overhead transmission line will be required to connect the collector substations to main substation, and then approximately another 85 m to connect to the switchyard. The 330 Kv overhead transmission line is approximately 50 m high, single circuit lattice steel tower, spaced approximately 500 m apart, subject to final design. The transmission line will include a 60 m wide easement with unformed access tracks up to 4 m wide (equivalent to a farm track) to facilitate operational access by TransGrid (for maintenance, repair and hazard reduction).
Switchyard	A switchyard with approximate dimensions of 320 m by 180 m for physical electrical components including required earth works will be located within a site with a maximum expected area of 6 ha. A 10 m APZ will surround the switchyard. The switchyard will connect the Project to the existing transmission line and/ or Project EnergyConnect currently under construction.
Other components	
Internal Access Tracks	Access to the east and west portions of the Subject Land during construction and operations is proposed via up to 4 access points off Cobb Highway. The ongoing maintenance of the Project will be accessed through the construction of approximately 237 km of new private access tracks. The internal access tracks will be connected to existing public roads. Where practicable, the internal access road network will be aligned along the route of existing farm tracks to reduce impacts to biodiversity and to provide upgraded access for ongoing agricultural activities. The internal access tracks will be up to 6 m trafficable width, with localised widening on curves and where required to support transportation of the over-dimensional component vehicles. The internal access tracks will be constructed with dirt, sand, gravel or sealed pavement with the final design based on material in proximity to site.
Meteorological Monitoring Masts	Up to 10 permanent met masts will be installed in proximity to a WTG and will have a maximum height of approximately 150 m AGL. Permanent met masts will assist in verifying the performance of WTGs during operation of the Project. Each met mast each will include sensors and concrete foundation and will be designed and constructed to the appropriate aviation safety specifications.

Component	Specification
Micro-siting	The layout presented in this BDAR may require refinement based on detailed geotechnical investigations and selection of the final WTG model. As such, the Applicant requires the ability to micro-site Project infrastructure. This will allow the design to be adjusted to, for example, avoid unnecessary excavation, vegetation clearing, or to benefit constructability, plant and equipment access.
Lighting	The requirements for night lighting of ancillary infrastructure for this Project is generally limited to security lighting to the substation, and within the construction compound. The light sources are limited to low-level lighting for security, night time maintenance and emergency purposes. There will be no permanently illuminated lighting installed.
Landscaping	The landscape strategy for the Project will include vegetation planting in specific locations at non-associated dwellings, which will provide a visual buffer and assist in fragmenting views to turbines.

Additional infrastructure will generally be constructed and utilised within the Subject Land including visual enhancement plantings, fencing, creek crossings, drainage systems, sediment and erosion control structures and access roads.

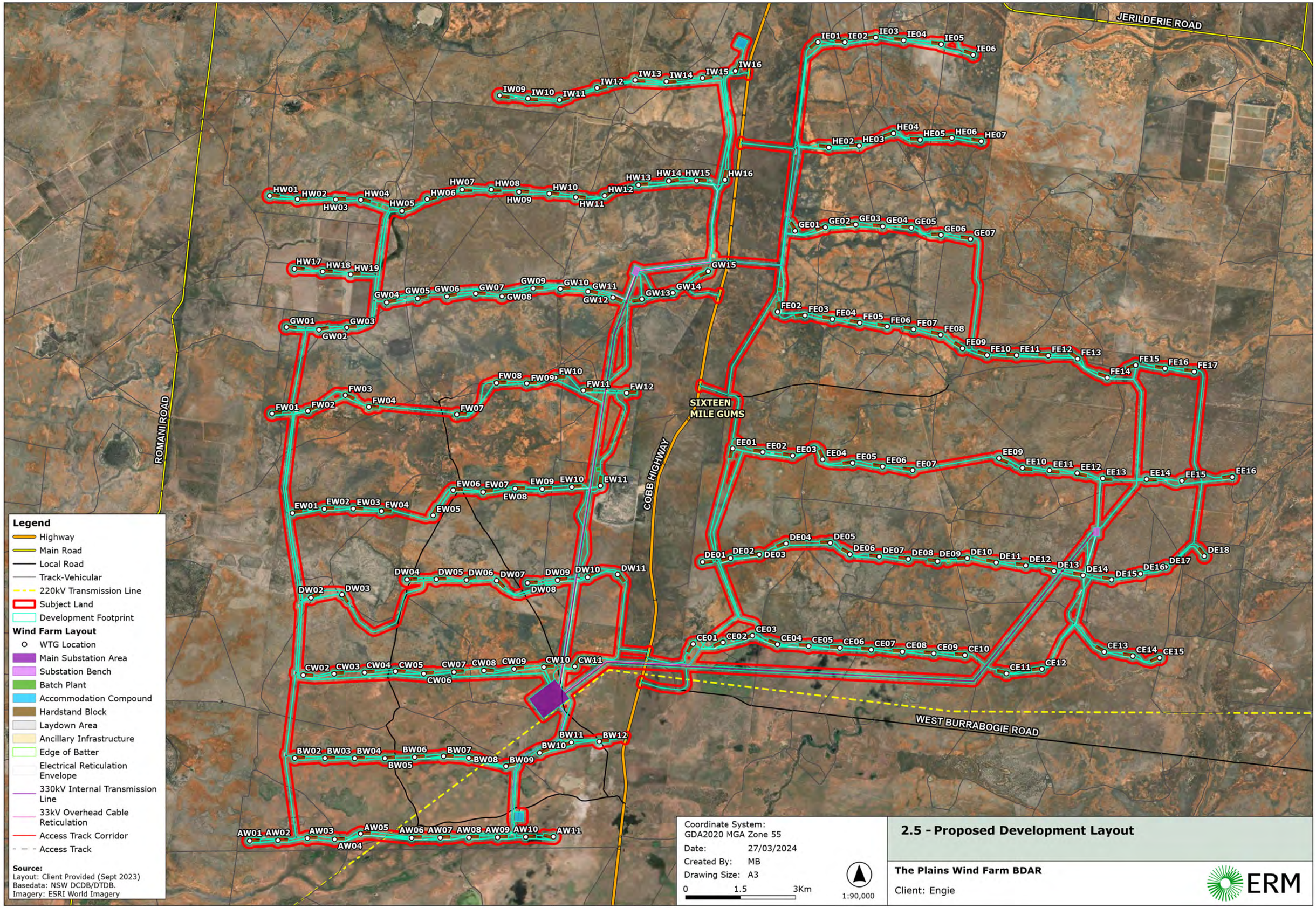
The proposed Haul Route is delineated separately to the Subject Land and Development Footprint, as presented in Figure 2-3 and Figure 2-4. The Haul Route DF, located in association with PP09A, represents the expected impacts associated with the proposed works.

The works proposed for the Haul Route are provided in Table 2-3 and are further discussed in Appendix B.

TABLE 2-3 HAUL ROUTE PROPOSED WORKS

Pinch Point	Proposed Works
09	Pinch Point 09 is located in the town of Broken Hill, cargo will arrive from the south-west via the Barrier Hwy and needs to exit via the Silver City and Barrier Hwys to the north-east. *09A) Right hand turn from Barrier Hwy into Crown Lands, crossing of Kanandah Rd, straight onto Gaffney St.* The proposed bypass makes use of existing tracks which come off the Barrier Hwy at around 2.4km west of Broken Hill town. There is no existing intersection, and a new one will have to be designed and constructed. A temporary track will need to be built to link the entry into Barrier Hwy to the exit point toward Gaffney St. This will pass through Crown land near the Broken Hill Community Recycling Centre.
10	Pinch Point 10 is located in the town of Broken Hill, cargo will arrive from the south-west via the Barrier Hwy and needs to exit via the Silver City and Barrier Hwys to the north-east. 10A) Right turn: Crystal St & Sturt St • The blades will require a temporary track to link the end of Crystal St with Sturt St across Menindee Rd. This will pass through Crown land and will require a moderate amount of civil works to make the surface suitable for a road base. • There is a power pole which can be avoided, but a tree will need to be removed along with a few road signs being made removeable. 10B) Right turn: Chettle St & Barrier Hwy • A temporary track will need to be built to link the end of Chettle St to the Barrier Hwy/Argent St. This will pass through Crown land near the Junction Mine, which is non-operational. • A new gate will have to be put in at the exit point into Barrier Hwy/Argent St An alternative option to PP10B (PP10C) is discussed within Appendix B

Pinch Point	Proposed Works
11	Pinch Point 11 is located in the town of Hay, cargo will arrive from the north via the Cobb Hwy and needs to exit via the Cobb Hwy, intersecting the Cobb Hwy & Sturt Hwy. *Roundabout: Cobb Hwy & Sturt Hwy* The roundabout south of Hay will require a moderate amount of work prior to blade transport. • Three light poles will need to be removed or relocated, and a number of signs made removeable. • A hard stand will be required of approximately 300m^2 • The blade swing passes over the private property to the east which is a proposed service station currently under development. ARES reviewed the development plans and the blade tip should miss the 12m high signboard indicated on the plans.



Legend

- Highway
- Main Road
- Local Road
- Track-Vehicular
- 220kV Transmission Line
- Subject Land
- Development Footprint

Wind Farm Layout

- WTG Location
- Main Substation Area
- Substation Bench
- Batch Plant
- Accommodation Compound
- Hardstand Block
- Laydown Area
- Ancillary Infrastructure
- Edge of Batter
- Electrical Reticulation Envelope
- 330kV Internal Transmission Line
- 33kV Overhead Cable Reticulation
- Access Track Corridor
- Access Track

Source:
Layout: Client Provided (Sept 2023)
Basedata: NSW DCDB/DTDB.
Imagery: ESRI World Imagery

Coordinate System:
GDA2020 MGA Zone 55
Date: 27/03/2024
Created By: MB
Drawing Size: A3
0 1.5 3Km
1:90,000

2.5 - Proposed Development Layout

The Plains Wind Farm BDAR

Client: Engie

ERM

2.2 METHODOLOGY

2.2.1 SITE CONTEXT METHODS

2.2.1.1 LANDSCAPE FEATURES

Landscape features requiring consideration were initially determined via desktop assessment. Field surveys undertaken between October 2021 and September 2023 across The Plains Wind Farm Project Area, and during July 2023 across the Haul Route, sought to verify the following landscape features (in accordance with Sections 4.2 and 4.3 of the BAM):

- IBRA bioregions and subregions, NSW landscape region and area (ha);
- Native vegetation extent and cleared areas within the buffer area;
- Rivers and streams (classified according to stream order);
- Wetlands within, adjacent to and downstream of the site;
- Connectivity features;
- Areas of geological significance and soil hazard features; and
- Site context components, including:
  - Identification of method applied (i.e. linear or site-based); and
  - Percent native vegetation cover in the landscape (development site and biodiversity stewardship site).

Unmapped wetland habitat was observed within The Plains Wind Farm Project Area during field survey events. These landscape features were subsequently mapped and considered throughout the preparation of this BDAR. No further amendments were required to be made to any remaining landscape features following field surveys.

2.2.1.2 NATIVE VEGETATION COVER

A desktop assessment was initially conducted to determine the extent (ha) of vegetation cover on the Subject Land, the Assessment Area (500 m buffer of the Subject Land) and across the Haul Route. The following resources were used:

- Land Surveys Aerial LiDAR Survey Imagery and Ground Control Survey 2023;
- Historic imagery (Historical Imagery (nsw.gov.au)); and
- SEED (Geocortex Viewer for HTML5 (nsw.gov.au)).

Surveys conducted between 2021 and 2023 confirmed the extent and condition of native vegetation cover on the Subject Land.

Native vegetation in the Assessment Area and Haul Route situated outside of the Subject Land was not ground-truthed and relies on state vegetation mapping that may be outdated and/or inaccurate. Consequently, there may be some minor additions or omissions to the actual extent of native vegetation as defined in the BAM.

2.2.2 NATIVE VEGETATION, THREATENED ECOLOGICAL COMMUNITIES AND VEGETATION INTEGRITY

2.2.2.1 EXISTING INFORMATION

The State Vegetation Type Map (SVTM) (DPE, 2022a) and BioNet Vegetation Classification (BioNet VIS) system were reviewed to identify plant community types (PCTs) and threatened ecological communities (TECs) likely to be present within the Subject Land, and across the Haul Route. This was used as the basis for more detailed site specific vegetation mapping.

2.2.2.2 MAPPING NATIVE VEGETATION EXTENT

Native vegetation and vegetation community delineation and mapping across the Subject Land involved review and field validation of the SVTM over several field survey events throughout 2021 and 2023. Field survey efforts were initially undertaken at a higher scale across the broader Plains Wind Farm Project Area prior to site selection followed by a refined survey design in 2023.

Each field event detailed above included plot-based vegetation integrity surveys (BAM Plots) and/or rapid survey of vegetation at locations where distinct PCTs could be observed within the Subject Land, noting the extent and structure of the existing vegetation, and dominant species within each stratum. Signs of disturbance, such as clearing, fire damage, grazing and weed invasion, were also noted where applicable.

Vegetation survey events are provided below:

- Spring 2021 – 26th October to 12th November 2021;
- Summer 2022 – 14th February to 25th February 2022;
- Summer 2023 – 21st February to 3rd March 2023; and
- Summer 2023 - 2nd to 5th December 2023.

Areas of native vegetation which could be validated as a PCT were identified and delineated in the field, and their condition determined. Identification of PCTs within the Subject Land was confirmed with reference to the community profile descriptors identified within the DPE mapping and the NSW BioNet VIS.

Haul Route

A five-day survey was undertaken between 17th and 21st of July 2023 by one ecologist to assess the haul route between the Port of Adelaide and the Subject Land. The NSW portion was assessed between the 18th and 21st July 2023.

Surveys were undertaken via a meander of the pinch point sites. Survey methodologies were designed to rapidly assess biodiversity value. Vegetation at these survey locations was assessed via rapid vegetation assessment only, with no BAM Plots undertaken, nor vegetation zones delineated.

Under the streamlined assessment module for small area developments, applied to the Haul Route DF, the dominant PCT on the site can be identified either by:

a. use of existing information, or
b. collection of plot-based survey data as required by Box 1 of the BAM (2020) and choosing the PCT based on analysis of the plot data.

The existing SVTM (2022a) has been used to determine the dominant PCT classification and extent.

2.2.2.3 VEGETATION ZONES

A vegetation zone (VZ) is an area of native vegetation that is the same PCT and has a similar broad condition state. The VZs were defined during field assessments across the Subject Land in Spring 2021, Summer 2022, and Summer 2023. Table 2-4 summarises the plot requirements based on the size and number of vegetation zones within the Subject Land.

TABLE 2-4 BAM PLOT DETAILS

Vegetation Zone	PCT	Condition	Code	Area (ha) within Development Footprint	Minimum Plots Required	Plots Used in Assessment
VZ1	13	Moderate	PCT13_Moderate	2.01	2	2
VZ2	17	Moderate	PCT17_Moderate	87.09	5	7
VZ3	24	Moderate	PCT24_Moderate	57.33	5	6
VZ4	28	Low	PCT28_Low	0.69	1	1
VZ5	44	Moderate	PCT44_Moderate	73.63	5	5
VZ6	153	Moderate	PCT153_Moderate	18.48	3	3
VZ7	157	Moderate	PCT157_Moderate	48.41	3	4
VZ8	163	Moderate	PCT163_Moderate	392.68	6	7
VZ9	164	Moderate	PCT164_Moderate	1,285.02	8	10

BAM plots were located within the Development Footprint as much as practicable. However, due to refinements of the development footprint, there are instances where plots are no longer located within the Development Footprint. Where BAM plots were not located within the development footprint, they were located within a contiguous/ representative patch of vegetation suitable for collection of data commensurate with the impacted vegetation zones. This allows for the vegetation integrity scores to be included in the BAM-C to provide consistency with the area impacted in the development footprint.

The existing SVTM (DPE, 2022a) was used to determine the dominant PCT present for the Haul Route DF. As such, a single VZ of high condition has been assigned to the dominant PCT, as presented in Table 2.5. Additional PCTs are delineated on the SVTM (DPE, 2022a) and are discussed in Section 4.1.4.

TABLE 2-5 HAUL ROUTE VEGETATION ZONES

Vegetation Zone	PCT	Condition	Code	Area (ha)
VZ10	155	High	PCT155_High	0.67

2.2.2.4 PLOT-BASED VEGETATION SURVEY

Method

BAM Plots were conducted across the Subject Land in accordance with s.4.2.1 of the BAM. BAM plots were established by walking a random distance into the vegetation zone and establishing the plot on a random bearing. The plot-based vegetation integrity surveys were used to calculate the vegetation integrity score (VIS) of the VZ. Each BAM Plot was established around a central 50 m transect and each included:

- A 20 m x 20 m plot sampled for the presence of flora species. The plots were carefully examined to identify all flora species present. This search continued until it was confident that all flora species within the plot were detected. Data collected for each species included:

  - Stratum and layers in which each species occurs;
  - Growth form for each species;
  - Scientific and common name for each species;
  - Percentage foliage cover (PFC) across the plot, of each species rooted in or overhanging the plot;
- Abundance rating for each species;
- One 1000 m² (20 m x 50 m) plot to assess the function attributes: number of large trees, stem size class, tree regeneration and length of logs; and
- Five 1 m² sub-plots to assess average litter cover (and other groundcover components).

BAM Plot location data is shown in Figure 2-6.

BAM Plot Classification

Floristic plot data obtained from BAM plots was quantitatively assessed using the Bray-Curtis similarity (dissimilarity) index (Bray-Curtis Index). This analysis was performed using the percent cover values for each species in each plot. The Bray-Curtis Index is bounded between 0 and 1. Where 0 is assigned it means the two sites have the same species composition and where 1 is assigned it means the two sites do not share any species. A pairwise Bray-Curtis index matrix was generated from PRIMER Version 7 with PERMANOVA Version 1.0.3 (Plymouth Marine Laboratory, Plymouth United Kingdom, Clarke and Gorley 2006). A dummy variable was added (value 0.2) following a square root transformation of percent cover values.

An agglomerative hierarchical clustering analysis (CLUSTER analysis) was performed to classify plot data into groups of similarity at the 5% significance level (i.e., SIMPROF groups). SIMPROF analyses of a priori unstructured (Single sample from each of several sites) were also performed to test for statistical evidence of genuine clusters (plot data groupings).

A one-way Analysis of Similarities (ANOSIM) was subsequently performed to calculate the sample statistic (Global R) of the SIMPROF groups. The Global R value was reviewed to determine if the CLUSTER analysis was biologically significant. A Global R value > 0.5 is generally considered significant. If the value is determined to be significant a group of pairwise tests are examined to further interrogate the results.

A SIMPER analysis of the SIMPROF groups was performed to identify the characteristic species of those groups in preparation of PCT assignment. Characteristic species were reported for each group and related to PCT descriptions to assign the best fit PCT. A non-metric multidimensional scaling (nMDS) plot was produced to geographically represent plot data similarity with similarity contours to aid interpretation.

2.2.3 THREATENED FLORA SURVEY METHODS

2.2.3.1 REVIEW OF EXISTING INFORMATION

Consultation of the BAM-C, BioNet Atlas Database and Atlas of Living Australia (ALA) were performed prior to the flora surveys conducted for this BDAR. Threatened flora sightings recorded within the Subject Land and Haul Route were further investigated and considered throughout this BDAR.

Desktop review and field surveys within the Subject Land and across the Haul Route included the assessment of habitat constraints and microhabitats and their suitability for predicted species credit flora species.

2.2.3.2 HABITAT CONSTRAINTS ASSESSMENT

Desktop review and field surveys within the Subject Land and across the Haul Route included the assessment of habitat constraints and microhabitats and their suitability for predicted species credit flora species.

2.2.3.3 FIELD SURVEYS

The BAM-C identifies candidate species that require seasonal targeted searches to be undertaken across the Subject Land and Haul Route DF in accordance with the BAM and relevant guidelines.

Under Section 5.2.2 of the BAM 2020, species credit species can be excluded from further assessment, and therefore targeted surveys, if it is determined that none of the species-specific habitat constraints are present within the Subject Land or Haul Route DF. Furthermore, under Section 5.2.3 of the BAM, a candidate species credit species can be considered unlikely to occur on the Subject Land or Haul Route DF (or within specific vegetation zones) if after carrying out a field assessment, the assessor determines that the habitat is substantially degraded such that the species is unlikely to utilise the Subject Land or Haul Route DF (or specific vegetation zone).

Targeted field surveys were undertaken in habitat throughout The Plains Wind Farm Project Area prior to refinement of the current Subject Land.

The following targeted flora survey events were completed across The Plains Wind Farm Project Area and Subject Land:

- Spring 2021: 26th October – 12th November
- Summer 2023: 21st February – 3rd March
- Spring 2023: 18th September – 29th September

During these survey events, targeted parallel transect searches were performed on foot in accordance with the method described in *Surveying threatened plants and their habitats - NSW survey guide for the Biodiversity Assessment Method* (DPIE, 2020c). This involved the walking of parallel lines spaced 15 m apart assuming at least 7.5 m visual coverage either side of the walked line, traversing a total of 439.95 km. Table 2-6 provides a summary of the flora species credit species surveyed for within the Subject Land.

TABLE 2-6 SUBJECT LAND THREATENED FLORA SURVEY EFFORT

Scientific Name	Common name	Associated PCTs	Recommended Survey Period	Survey Method
Austrostipa wakoolica	A Spear Grass	-	October – December	-
Brachyscome papillosa	Mossgiel Daisy	13, 24, 44, 46, 157, 163, 164	September - November	Parallel field traverse in associated PCTs within Subject Land

Scientific Name	Common name	Associated PCTs	Recommended Survey Period	Survey Method
Calotis moorei	A burr-daisy	153, 157	September - November	Parallel field traverse in associated PCTs within Subject Land
Cullen parvum	Small Scurf-pea	44	December – January	Parallel field traverse in associated PCTs within Subject Land
Eucalyptus leucoxylon	Yellow Gum	13	All year	Parallel field traverse in associated PCTs within Subject Land
Lepidium monoplocoides	Winged Peppercress	13, 24, 46, 153	September - December	Parallel field traverse in associated PCTs within Subject Land
Leptorhynchos orientalis	Lanky Buttons	24, 44, 46	September – November	Parallel field traverse in associated PCTs within Subject Land
Maireana cheelii	Chariot Wheels	44, 46, 157, 164	September - December	Parallel field traverse in associated PCTs within Subject Land
Sclerolaena napiformis	Turnip Copperburr	44, 46	September - December	Parallel field traverse in associated PCTs within Subject Land
Swainsona murrayana	Slender Darling Pea	44, 46, 157, 163, 164	September	Parallel field traverse in associated PCTs within Subject Land
Swainsona plagiotropis	Red Darling Pea	44, 46	September	Parallel field traverse in associated PCTs within Subject Land
Swainsona sericea	Silky Swainson-pea	44,46	September - November	Parallel field traverse in associated PCTs within Subject Land

The Summer 2023 survey event was completed outside the recommended survey months for Winged Peppercress and Chariot Wheels; however, both species were observed fruiting within the site and subsequently included in the survey effort.

Threatened flora survey effort was not met for three (3) flora candidate species, including:

- A Spear-grass (*Austrostipa wakoolica*);
- Mossgiel Daisy (*Brachyscome papillosa*); and
- Small Scurf-pea (*Cullen parvum*).

These species have subsequently been assumed to be present within remaining areas of suitable habitat. The Mossgiel Daisy has been recorded within the Plains Wind Farm Project Area, in the far southern portion east of the Cobb Hwy, outside the Subject Land.

The Applicant consulted with BCS on 25th October 2022 and 28th June 2023 and commit to undertaking additional targeted surveys during the response to submissions phase and in response to detailed project design. This will be presented in a revised BDAR and will address any final design or layout changes made in response to the public exhibition and agency comments.

Haul Route

Under the streamlined assessment module for small area developments, applied only to the Haul Route DF, determination of the suite of threatened species likely to occur on or use the site is required according to Section 5.2.1 and 5.2.2 of the BAM. However, further assessment and survey in accordance with Section 5.2.3, 5.2.4, 5.2.5 and 5.2.6 is only required for candidate species credit species identified for the proposal at risk of an SAII.

A single transect along the midline of the Haul Route DF (largely 5.5 m wide) was walked by an ecologist during the July 2023 field survey event, targeting the threatened flora species detailed in Table 2-7.

TABLE 2-7 HAUL ROUTE THREATENED FLORA SURVEY EFFORT

Scientific Name	Common name	Associated PCTs	Recommended Survey Period	Survey Method
Swainsona flavicarinata -	Yellow-Keeled Swainsona	139, 150, 155	June - Oct	Field traverse in associated PCTs in July 2023

The July 2023 field survey was undertaken outside the recommended survey period for the Creeping Darling Pea (*Swainsona viridis*).

The Applicant commits to undertaking additional targeted surveys during the response to submissions phase and in response to detailed project design. This will be presented in a revised BDAR and will address any final design or layout changes made in response to the public exhibition and agency comments.



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2.2.4 THREATENED FAUNA SURVEY METHODS

2.2.4.1 REVIEW OF EXISTING INFORMATION

The BAM-C, BioNet Atlas Database and ALA were reviewed prior to the fauna surveys conducted for this BDAR. All threatened fauna sightings recorded over the Subject Land and Haul Route were further investigated and considered throughout this BDAR.

2.2.4.2 HABITAT CONTRAINTS ASSESSMENT

Desktop assessments and field surveys within the Subject Land and Haul Route included assessment of habitat constraints and microhabitats and their suitability for predicted species credit fauna species. This included desktop assessment of the Assessment Area for features such as caves and waterways and field inspection of microhabitats including leaf litter, stick nests and hollowing-bearing trees within the Subject Land.

2.2.4.3 FIELD SURVEYS

Targeted field surveys were undertaken in habitat throughout the broader The Plains Wind Farm Project Area prior to refinement of the current Subject Land.

The following targeted fauna survey events were completed across the The Plains Wind Farm Project Area and Subject Land:

- Spring 2021: 26th October – 12th November;
- Summer 2022: 14th February – 25th February;
- Autumn 2022: 16th May – 20th May;
- Winter 2022: 8th August – 18th August;
- Summer 2023: 21st February – 3rd March; and
- Spring 2023: 13th November – 16th November.

Requirements for targeted surveys include the survey months specified in the BAM-C, as well as the survey effort and methods described in the TBDC and relevant survey guidelines. Relevant survey guidelines considered include the following:

- BAM 2020 (DPIE, 2020a);
- 'Species credit' threatened bats and their habitats NSW survey guide for the Biodiversity Assessment Method (OEH, 2018);
- Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities (Department of Environment and Conservation (DEC), 2004);
- Survey Guidelines for Australia's Threatened Mammals (Department of Sustainability, Environment, Water, Population & Communities (DSWP&C), 2011);
- NSW Survey Guide for Threatened Frogs: A guide for the survey of threatened frogs and their habitats for the Biodiversity Assessment Method (DPIE, 2020b); and
- Koala (*Phascolarctos cinereus*) Biodiversity Assessment Method Survey Guide (DPE 2022b).

Survey effort across the Subject Land and areas of The Plains Wind Farm Project Area are shown in Figure 2-7 and detailed in Table 2-8.

It is noted that no threatened fauna surveys were required in accordance with the BAM across the Haul Route.

TABLE 2-8 FAUNA FIELD SURVEY EFFORT SUMMARY

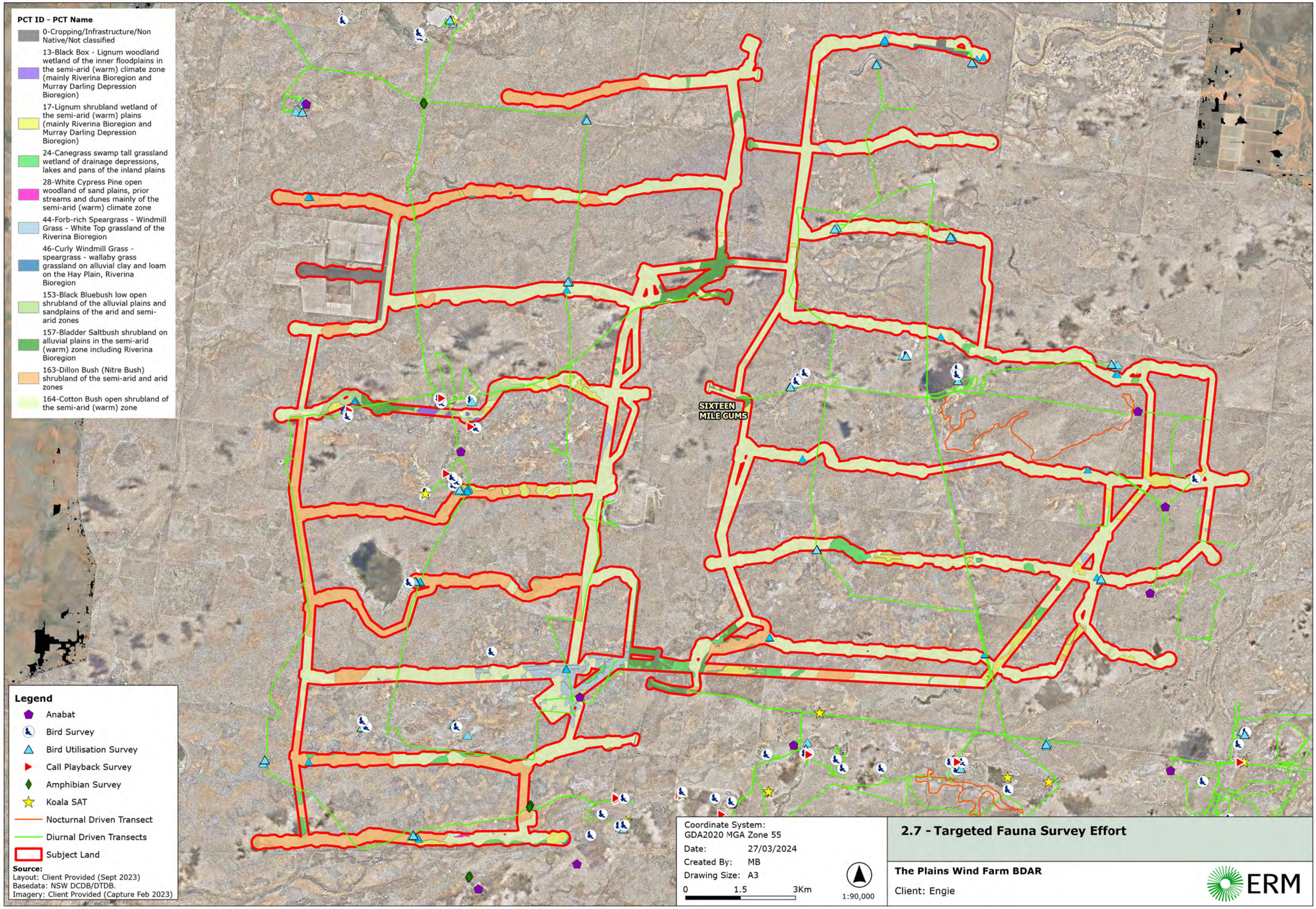
Target Species	Method	The Plains Wind Farm Project Area Effort	Subject Land Effort
Australian Bustard	**Diurnal Driven Transects:** Diurnal driven transects were conducted for avian species due to the expansive study area. Diurnal transects were completed by a slow-moving vehicle (<40 km per hour) while looking for the Australian Bustard, in addition to threatened raptor species flying or perched across the study area. It is noted these species were searched for during all traversing of the site across five survey events by teams of two - eight ecologists.	26.5 person hours during Summer 2022 15 person hours during Summer 2023	26.5 person hours during Summer 2022, and 15 person hours or diurnal driven transects during Summer 2023. Additionally, teams of up to six ecologists traversed the Subject Land and surrounds over six (6) survey events, making opportunistic species records. No Australian Bustard observations made.
Bush-stone curlew	**General Habitat Assessment:** Opportunistic observations were taken, noting the presence of various habitat features with consideration of candidate listed species microhabitats. This included searches for hollow bearing trees, raptor nests, roosts, fallen logs, bush rocks, rocky outcrops, caves and crevices, man-made structures, riparian areas, wetlands and waterbodies.	Habitat assessments completed noting areas of suitable habitat opportunistic throughout.	Habitat assessments completed in areas of PCT 13 and PCT 28, noting PCT 28 does not present as suitable habitat for the species (lacking fallen logs/timber).
	Targeted Avian Area Searches: Targeted area searches for detection of a range of threatened avian species by sight or call was conducted in suitable habitat. Observations of signs of species presence (bark stripping, scratches, pellets), suitable roosting and nesting sites recorded within each survey site location. Flushing for Bush Stone-curlew conducted at each survey location.	43 hours during the spring 2021 survey event at 21 sites undertaken by two to four ecologists.	Two (2) replicates (approx. 30min per survey) completed within patch of suitable habitat, PCT 13.

Target Species	Method	The Plains Wind Farm Project Area Effort	Subject Land Effort
	Nocturnal Call Playback and Spotlighting: Nocturnal call playback and spotlighting was conducted for the Bush Stone-curlew and Koala in *Eucalyptus largiflorens* woodland. Spotlighting was conducted using handheld LedLenser P7r Core torches (1400 lumens), and call playback conducted broadcasting calls via Ultimate Ears Wonderboom 2 with outdoor mode. At each survey location, species call was played for 30 seconds, followed by 4.5 minutes of listening and spotlighting. This was repeated in 5-minute cycles 3 times.	12 sites visited one night each during Spring 2021, by three ecologists 3 sites visited one night each during Summer 2023, by two ecologists	One site of call playback surveys conducted within patch of suitable habitat, PCT 13.
Major-mitchell Cockatoo	**Paddock Tree Assessment:** Paddock trees across the Subject Land were recorded taking note of tree species, height, diameter at breast height (DBH), presence of hollows, stick nests, and signs of fauna usage.	Completed opportunistically throughout	Completed opportunistically throughout
	General Habitat Assessment: Opportunistic observations were taken, noting the presence of various habitat features with consideration of candidate listed species microhabitats. This included searches for hollow bearing trees, raptor nests, roosts, fallen logs, bush rocks, rocky outcrops, caves and crevices, man-made structures, riparian areas, wetlands and waterbodies.	Habitat assessments completed noting areas of suitable habitat opportunistic throughout.	Habitat assessments completed in areas of PCT 13 and PCT 28, noting PCT 28 does not present as suitable habitat for the species. Suitable hollow bearing trees observed within PCT13.
	Targeted Avian Area Searches: Targeted area searches for detection of a range of threatened avian species by sight or call was conducted in suitable habitat. Observations of signs of species presence (bark stripping, scratches, pellets), suitable roosting and nesting sites recorded within each survey site location. Flushing for Bush Stone-curlew conducted at each survey location.	43 hours during the spring 2021 survey event at 21 sites undertaken by two to four ecologists.	Two (2) replicates (approx. 30min per survey) completed within patch of suitable habitat, PCT 13.

Target Species	Method	The Plains Wind Farm Project Area Effort	Subject Land Effort
	Bird Utilisation Surveys (BUS): The BUS method involved observers stationed at a fixed survey point for 20 minutes, recording abundance of all large bird species observed within 800m and all small birds within 100m. For each observation, flight height was documented. All birds are identified to the species level, either through direct observation or identification of calls**.**	28 established BUS sites, visited during each survey event; Spring 2021, Summer 2022, Autumn 2022 and Winter 2022.	One (1) BUS location is situated within the small patch of remnant PCT 13, with the 2 x spring survey efforts supplementing threatened avian species effort. Noting the species was not recorded across The Plains Wind Farm Project Area during any survey event, or during general site traversing over 5 survey events.
Plains-wanderer	**Nocturnal Driven Transects:** Nocturnal driven transects were conducted in suitable habitat from a slow-moving vehicle (<5km per hour) using hand-held spotlights and vehicle headlights. **Noting surveys for this species are not required under the BAM, presence determined by Important Mapped Areas (as listed by the TBDC).*	Two nights of survey undertaken by four ecologists in a single vehicle.	Survey effort overlaps Subject Land in areas.
Koala	**General Habitat Assessment:** Opportunistic observations were taken, noting the presence of various habitat features with consideration of candidate listed species microhabitats. This included searches for hollow bearing trees, raptor nests, roosts, fallen logs, bush rocks, rocky outcrops, caves and crevices, man-made structures, riparian areas, wetlands and waterbodies.	Habitat assessments completed noting areas of suitable habitat opportunistic throughout.	Habitat assessments completed in areas of PCT 13 and PCT 28. Large areas of the Subject Land are grassland and chenopod shrublands, with low levels of scattered trees and connectivity, as discussed in Section 3.1. The Subject Land is unlikely to constitute dispersal or foraging/breeding habitat for the species.
	Koala Spot Assessment Technique (Koala SAT): At each survey location, a center tree was recorded and flagged, with the 29 nearest trees also flagged for assessment. At each of the 30 flagged trees, a search for Koala presence and markings was conducted, along with faecal pellet search within 1 m of tree bases.	31 Koala SAT sites.	One (1) Koala SAT site within PCT 13.

Target Species	Method	The Plains Wind Farm Project Area Effort	Subject Land Effort
	Nocturnal Call Playback and Spotlighting: Nocturnal call playback and spotlighting was conducted for the Bush Stone-curlew and Koala in Eucalyptus largiflorens woodland. Spotlighting was conducted using handheld LedLenser P7r Core torches (1400 lumens), and call playback conducted broadcasting calls via Ultimate Ears Wonderboom 2 with outdoor mode. At each survey location, species call was played for 30 seconds, followed by 4.5 minutes of listening and spotlighting. This was repeated in 5-minute cycles 3 times.	12 sites visited one night each during Spring 2021, by three ecologists.	One site of call playback surveys conducted in PCT 13.
	Paddock Tree Assessment: Paddock trees across the Subject Land were recorded taking note of tree species, height, diameter at breast height (DBH), presence of hollows, stick nests, and signs of fauna usage.	Completed opportunistically throughout	Completed opportunistically throughout
Barking Owl and Masked Owl	**General Habitat Assessment:** Opportunistic observations were taken, noting the presence of various habitat features with consideration of candidate listed species microhabitats. This included searches for hollow bearing trees, raptor nests, roosts, fallen logs, bush rocks, rocky outcrops, caves and crevices, man-made structures, riparian areas, wetlands and waterbodies.	Habitat assessments completed noting areas of suitable habitat opportunistic throughout.	Habitat assessments completed in areas of PCT 13.
	Winter Nocturnal Call Playback: During the winter survey event, call playback surveys were conducted targeting the Masked Owl and Barking Owl at six identified suitable owl hollows, greater than 2 km apart. Survey sites were visited over eight nights, with the exception of four sites visited seven nights due to weather restrictions. The survey involved a five-minute listening period, followed by call playback session of five minutes of intermittent calls for each of the targeted species, followed by 20-minute period of listening during which spotlighting is conducted.	Two sites visited over eight nights Four sites visited over seven nights in Winter 2022 by two ecologists.	One site visited over eight nights situated within 2 km of the Subject Land.

Target Species	Method	The Plains Wind Farm Project Area Effort	Subject Land Effort
Microbats	**Echolocation Call Detectors:** Titley Anabat echolocation call detection devices were placed in proximity to water sources, or beside a 'flyway', pointing toward microbat expected flight path and programmed to record from dusk to dawn. Bat call analysis was completed by Green Tape Solutions, with results presented in Appendix E, Appendix F and Appendix G.	8 devices deployed in Summer 2022 6 devices deployed in Summer 2023; 1 device deployed at height on a met mast from 23rd March – 13th May 2023,	2 devices deployed in Summer 2022 (Anabat 11 and Anabat 10), 2 devices deployed in Summer 2023 1 device deployed at height on a met mast from 23rd March – 13th May 2023. The Applicant currently has an additional at height device deployed, and is committed to installing additional at height echolocation call detector on further Met Masts as they are erected.
Resident Raptors and Migratory species	**Bird Utilisation Surveys (BUS):** The BUS method involved observers stationed at a fixed survey point for 20 minutes, recording abundance of all large bird species observed within 800m and all small birds within 100m. For each observation, flight height was documented. All birds are identified to the species level, either through direct observation or identification of calls.	28 established BUS sites, visited during each survey event; Spring 2021, Summer 2022, Autumn 2022 and Winter 2022.	28 established BUS sites, visited during each survey event; Spring 2021, Summer 2022, Autumn 2022 and Winter 2022. Additional BUS are scheduled to be undertaken to further inform the BBAMP.
Amphibians	**Amphibian Aural-visual Survey:** Aural visual surveys were completed along the edge of suitable habitat for the Growling Grass Frog (*Litoria raniformis*), which consists of waterbodies with emergent vegetation. These were completed at water tank locations with water overflow resulting in pooling with emergent vegetation, and inundated Nitre Goosefoot swamps. An aural search for the species was undertaken at each survey location, followed by the broadcasting of the species call via loudspeaker for 2 minutes to elicit a response. A subsequent two-minute listening period was employed to detect any response.	Summer 2022, two sites visited over four nights by two ecologists. Each survey event conducted for 30 minutes. Summer 2023, three sites visited over four nights by two ecologists. Each survey event conducted for 30 minutes.	Suitable habitat not present within Subject and.



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2.2.5 WEATHER CONDITIONS

Weather conditions during the field survey events were appropriate for detection of target flora and fauna. A summary of the recorded conditions on the Subject Land during the survey periods is provided in Table 2-9, with Haul Route survey conditions provided in Table 2-10.

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TABLE 2-9 WEATHER CONDITIONS DURING SURVEY PERIODS (SUBJECT LAND)

Date	Min Temperature (°C)	Max Temperature (°C)	Rainfall (mm)
Spring 2021			
26/10/2021	3.2	25.9	0
27/10/2021	7.8	32.9	0
28/10/2021	4.4	31.1	0.2
29/10/2021	3.5	22.7	0
30/10/2021	3.5	20.6	0
31/10/2021	3.7	24.6	0
01/11/2021	8.4	28.3	0
02/11/2021	9.7	33.2	0
03/11/2021	21.6	24.2	0
04/11/2021	4.8	28.7	4.2
05/11/2021	4.0	29.7	0
06/112021	17.2	33.1	0
07/11/2021	14.0	29.2	2.8
08/11/2021	0.5	26.4	0.2
09/11/2021	7.2	28.3	0
10/11/2021	17.4	24.6	0
11/11/2021	7.5	19.5	0
12/11/2021	10.7	14.6	24.8
Summer 2022			
14/02/2022	21.9	37.5	0
15/02/2022	20.4	38.9	0
16/02/2022	22.0	39.5	0
17/02/2022	20.7	30.8	0
18/02/2022	14.7	29.1	0
19/02/2022	11.2	31.5	0
20/02/2022	13.9	33.5	0
21/02/2022	13.0	29.0	0
22/02/2022	11.8	34.1	0

Date	Min Temperature (°C)	Max Temperature (°C)	Rainfall (mm)
23/02/2022	17.7	34.6	0.6
24/02/2022	24.3	32.8	0
25/02/2022	22.6	34.6	0
Autumn 2022			
08/08/2022	0.5	16.4	4.8
09/08/2022	-1.1	16.3	0.2
10/08/2022	-2.2	17.0	0
11/08/2022	7.4	12.4	0.2
12/08/2022	7.1	18.9	2.6
13/08/2022	8.1	14.9	0.2
14/08/2022	4.1	17.1	0
05/08/2022	4.1	15.0	0
16/08/2022	5.0	16.9	7.2
17/08/2022	1.2	18.3	0.6
18/08/2022	8.0	19.9	0
Summer 2023			
21/02/2023	17.3	37.7	0
22/02/2023	17.9	34	0
23/02/2023	17.7	32.4	0
24/02/2023	17.4	34.6	0
25/02/2023	20	36.6	0
26/02/2023	17.6	31.1	0
27/02/2023	12.8	30.1	0
28/02/2023	12.4	31.4	0
01/03/2023	13.8	29	0
02/03/2023	10.6	30.3	0
03/03/2023	12.7	32.5	0
Spring 2023			
18/09/2023	14.4	37.4	0
19/09/2023	14.8	35.6	0
20/09/2023	11.4	25.4	0
21/09/2023	4.6	20.4	0
22/09/2023	2.3	22.9	0
23/09/2023	3.3	25	0
24/09/2023	4.5	29.2	0

Date	Min Temperature (°C)	Max Temperature (°C)	Rainfall (mm)
25/09/2023	13.5	29.1	0
26/09/2023	8.7	29.6	0
27/09/2023	5.8	25.4	0
28/09/2023	3.7	27.9	0
29/09/2023	3.6	29.7	0
13/11/2023	8.7	28.6	0
14/11/2023	12.1	25.3	0
15/11/2023	11.1	29.6	0.4
16/11/2023	11.1	27.7	0
17/11/20223	6.2	27.4	0

Source: Bureau of Meteorology - Hay, NSW Daily Weather Observations. Online resource: http://www.bom.gov.au/climate/dwo/202311/html/IDCJDW2058.202311.shtml

TABLE 2-10 WEATHER CONDITIONS DURING SURVEY PERIODS (HAUL ROUTE)

Date	Min Temperature (°C)	Max Temperature (°C)	Rainfall (mm)
Broken Hill, NSW			
18/07/2023	4.3	17.8	0
19/07/2023	2.3	16.0	0
Hay, NSW			
21/07/2023	2.1	14.7	0.6

Source: Bureau of Meteorology - Hay, NSW Daily Weather Observations. Online resource: http://www.bom.gov.au/climate/dwo/202311/html/IDCJDW2058.202311.shtml; Bureau of Meteorology - Broken Hill Airport, NSW Daily Weather Observations. Online resource: http://www.bom.gov.au/climate/dwo/202307/html/IDCJDW2168.202307.shtml

2.2.6 LIMITATIONS

The field and desktop assessments undertaken to inform this report provide a detailed overview of the biodiversity values that exist within the Subject Land; however, results are potentially limited by the inherent nature of native vegetation communities present and targeted species.

Variation in flora composition and structure has been observed during survey events completed over the Subject Land, likely due to natural seasonal variation, severe weather/ climatic events (e.g., drought and floods), land use history, pest vertebrate/ invertebrate impacts and any associated interaction effects.

The classification of native vegetation within the Subject Land has been assigned the best fit PCT by using a quantitative analysis of BAM plot data comparative analysis with the BioNet Vegetation Classification database. This process has involved the reconciliation of broad ecotones generated from several environmental and anthropogenic influences, with PCT boundary definition determined from floristic surveys, field observations and analysis of aerial imagery.

Fauna and flora diversity within the Subject Land should not be seen to be comprehensive, but rather a representation of sampling effort at the time of survey events. The potential for false negatives (i.e., not seeing a species that is actually present), was limited by utilization of industry published guidelines applicable to the assessment. The inclusion of seasonal and multiple year sampling has reduced the likelihood of not detecting species relevant to this assessment.

Targeted field surveys for threatened flora and fauna have been conducted in habitat throughout The Plains Wind Farm Project Area, prior to refinement of the current Subject Land. The Plains Wind Farm Project Area includes the Subject Land. A period of several seasons or years is often needed to identify all the species present in an area, especially as some species are only apparent at certain times of the year (orchids or migratory birds) and require specific weather conditions for optimum detection.

It is noted that Spring 2022 surveys were planned for, however due to weather events and flood conditions, unable to access the project site for surveys. Engie have consulted with BCS on 25 October 2022 and 28 June 2023 and commit to undertaking additional targeted spring surveys during the response to submissions phase and in response to detailed project design.

These potential limitations have been addressed by the application of the precautionary principle (assumed presence), applied where habitat was identified, or species were predicted to utilise habitat components at some stage during their life cycle.

2.2.7 LICENCING

Regarding the flora and fauna surveys conducted in this BDAR, ERM operated under the Scientific Licence of SL100196 and Animal Ethics Accreditation number 53055.

3. SITE CONTEXT

3.1 LANDSCAPE FEATURES

The following site context features have been identified from an inspection of the Subject Land (Table 3-1) and Haul Route DF (Table 3-2) along with GIS assessment of available relevant digital mapping layers and aerial imagery.

TABLE 3-1 LANDSCAPE FEATURES (SUBJECT LAND)

Landscape feature	Description
IBRA Bioregions and Subregions	The Subject Land and Assessment Area occur within the Murrumbidgee IBRA subregion (RIV02), of the Riverina IBRA Bioregion (RIV) (Figure 2-1).
NSW Landscape Regions (Mitchell)	The Subject Land is situated across two NSW Landscape Regions (Figure 2-2): • Murrumbidgee Scalded Plains; and • Murrumbidgee Depression Plains. Murrumbidgee Depression Plains has been applied to the BAM-C as it covers a greater portion of the Subject Land.
Rivers, streams, estuaries and wetlands	The Subject Land is located south of the Murrumbidgee River and north of the Coleambally Outfall Drain. NSW Hydrography mapping (Figure 2-2) shows that four (4) ephemeral creeks intersect the Subject Land: • Telegraph Creek – first order • Abercrombie Creek – first order • Curtains Creek – first order • Nyangay Creek – first order Aquatic habitat associated with these Creeklines is assessed in Section 3.1.1. There are no Ramsar Wetlands or Important Wetlands as listed in the Directory of Important Wetlands of Australia located within the Subject Land. Large ephemeral wetlands largely associated with PCT13 are present across The Plains Wind Farm Project Area, particularly within the western area of the site, these wetlands have been mapped in Figure 2-2 and avoided by the Project. Other wetland PCTs are mapped across the Subject Land, including: • Canegrass swamp tall grassland wetland of drainage depressions, lakes and pans of the inland plains; and • Lignum shrubland wetland of the semi-arid (warm) plains (mainly Riverina Bioregion and Murray Darling Depression Bioregion). This vegetation, along with majority of the Subject Land, is likely to have been inundated during Spring 2022 heavy rainfall events; however, the grassland and shrubland wetlands have not been observed inundated during survey events. Farm dams occur throughout the Subject Land (Water Area on Figure 2-2). These artificial features possess relatively low vegetation quality with limited emergent or submerged vegetation, however, still provide a valuable resource for fauna.
Habitat connectivity	The Subject Land is predominantly present in a modified condition following a long history of clearing and grazing. Treed vegetation is present in low densities, largely restricted to natural drainage lines, with woodlands also scattered on sandy rises. The extent of this woody vegetation cover has been dramatically reduced by land clearing for agriculture. Native shrubland and grasslands are present in high densities, largely lacking canopy and shrub layers >1m. Connectivity across this open landscape is considered substantially low, with only remnant isolated patches of treed habitat identified.

Landscape feature	Description
Karst, caves, crevices, cliffs, rocks or other geological features of significance	The presence of habitat features including karst, caves, crevices and cliffs of other areas of geological significance were assessed throughout the Subject Land during detailed field surveys. There are no karsts, caves, crevices, cliffs or other geological features of significance within the Subject Land.
Soil hazard features	A search of the eSPADE database found that there are no known significant soil hazard features within the Subject Land. A search of the ASC Soil Type Map reveals that the Vertosol soil type dominates the Subject Land. Vertosols are categorised as clay soils with shrink-swell properties that exhibit strong cracking when dry and at depth have slickensides and/or lenticular peds. Although many soils exhibit gilgai microrelief, this feature is not used in their definition. A search of the NSW EPA Contaminated Sites Register, identified the closest sites recorded to the Subject Land. There is one site within the Hay Shire Council LGA and one site within Edward River Council LGA with former Declarations of Significantly Contaminated Land. All located in the town of Deniliquin over 60km from the Subject Land.
Areas of outstanding biodiversity value	The Subject Land is not identified as an area of outstanding biodiversity value, as identified under the BC Act.
Additional landscape features identified in SEARs	No additional landscape features were identified in the SEARs.

TABLE 3-2 LANDSCAPE FEATURES (HAUL ROUTE DF)

Landscape feature	Description for the Haul Route DF
IBRA Bioregions and Subregions	The Haul Route DF occurs within the Barrier Range IBRA subregion of the Broken Hill Complex IBRA Bioregion (Figure 2-4).
NSW Landscape Regions (Mitchell)	The Haul Route DF occurs within the Barrier Downs NSW Landscape Region (Figure 2-4).
Rivers, streams, estuaries and wetlands	No rivers, streams, estuaries or wetlands are present.
Habitat connectivity	The Haul Route DF is largely situated along existing tracks, bounded by acacia and chenopod shrublands. This vegetation is considered to provide low levels of connectivity.
Karst, caves, crevices, cliffs, rocks or other geological features of significance	No Karst, caves, crevices, cliffs, rocks or other geological features of significance are present.
Soil hazard features	A review of the ASC Soil Type Map reveals Sodosols occur across the Pinch Point. Sodosols are texture-contrast soils with impermeable subsoils due to the concentration of sodium. These soils occupy a large area of inland Queensland. Generally, Sodosols have a low-nutrient status and are very vulnerable to erosion and dryland salinity when vegetation is removed.
Areas of outstanding biodiversity value	Not applicable.

3.1.1 AQUATIC HABITAT

The Subject Land is located south of the Murrumbidgee River and north of the Coleambally Outfall Drain. NSW Hydrography mapping (Figure 2-2) shows that four (4) creeks intersect the Subject Land:

- Telegraph Creek;
- Abercrombie Creek;
- Curtains Creek; and
- Nyangay Creek.

All mapped creeklines are ephemeral, first order waterways. During field survey events across 2021, 2022 and 2023 all natural creeklines were observed to be dry, presenting as minor depressions no greater than 1 m in relief. The creekline vegetation presents at times dominated by Lignum (*Muehlenbeckia florulenta*), Canegrass (*Eragrostis australasica*) and Nitre Goosefoot (*Chenopodium nitrariaceum*), common of low-lying depressions of the Hay Plains, with chenopod shrublands also occurring. These features are ephemeral, likely to only form water passage during and post heavy rainfall events.

Substantial rainfall and flooding events occurred across the Hay Plains, inclusive of the Subject Land, during late Spring 2022. Assessment of the site during and following the flood event was heavily limited, with planned surveys abandoned due to access restrictions. The site was accessed during February 2023, during which time mapped wetlands across The Plains Wind Farm Project Area were observed to be inundated with water, however creeklines remained clear. It is noted that no woody debris nor instream aquatic vegetation was observed across the creeklines within the Subject Land.

The NSW DPI Fisheries Spatial Data Portal (accessed 11 October 2023) was reviewed to determine aquatic values and potential presence of threatened species in the Subject Land. As a result, the Subject Land is not considered to consist of mapped Key Fish Habitat; however, Abercrombie Creek running through the northern portion of the Subject Land is mapped as providing habitat for the following:

- Flathead Galaxias (*Galaxias rostratus*) listed as critically endangered under the EPBC Act and BC Act; and
- Silver Perch (*Bidyanus bidyanus*) listed as critically endangered under the PEBC Act and Vulnerable under the BC Act.

These listed species have been assessed in Section 3.1.1.1. The Subject Land is situated within the distribution of the Endangered Ecological Community (EEC) of the Lower Murray River. All native fish and aquatic invertebrates in natural creeks within this distribution form part of the EEC. This EEC is further discussed in Section 3.1.1.2.

No aquatic habitat is present within the Haul Route DF, nor with potential to be impacted by the remaining areas of the Haul Route.

3.1.1.1 AQUIATIC THREATENED SPECIES LIKELIHOOD OF OCCURANCE ASSESSMENT

A likelihood of occurrence assessment was undertaken for threatened aquatic entities across the Subject Land, informed by desktop sources (PMST and BioNet search results within 10 km) and the field survey results. Desktop sources identified several aquatic threatened species listed under the EPBC Act and BC Act that have been recorded previously or are predicted to occur within a 10 km buffer of the Subject Land. The likelihood of occurrence approach refines the desktop generated list using site-specific and species-specific habitat information.

The assessment ranks the likelihood of the species occurring within the Subject Land through analysis of species distribution information and the presence of specific habitat attributes as identified through the desktop analysis and field survey.

The criteria applied are outlined in Table 3-3. The likelihood of occurrence assessment is provided in Table 3-4 .

TABLE 3-3 AQUIATIC THREATENED SPECIES LIKELIHOOD OF OCCURANCE CRITERIA

Factor	Preferred habitat exists	Suitable habitat exists[1]	Habitat does not exist[2]
Records within Subject Land	Known	Known	Known
Records in the locality[3]	Likely	Potential	Unlikely
No records in the locality, but Subject Land is within known distribution	Potential	Unlikely	Unlikely
No records in the locality, and Subject Land is outside of distribution	Unlikely	Unlikely	Unlikely

1. *Habitat may be considered suitable, but not preferred.*
2. *Based on sources reviewed and/or field survey results.*
3. *'Locality' refers to a 10 km buffer of the Subject Land.*

TABLE 3-4 AQUIATIC THREATENED SPECIES LIKELIHOOD OF OCCURANCE ASSESSMENT

Habitat	ALA/BioNet Records	Distribution	Likelihood within the Subject Land
Flathead Galaxias			
Flathead Galaxias are found in still or slow-moving water bodies such as wetlands and lowland streams. They have been associated with a range of habitats including rock and sandy bottoms and aquatic vegetation.	No records within the Subject Land or Locality. Historical ALA records along the Murrumbidgee River.	The Flathead Galaxias is only known from the southern half of the Murray-Darling Basin system. They have not been recorded and are considered locally extinct in the lower Murray, Murrumbidgee, Macquarie and Lachlan River catchments.	The Flathead Galaxias is considered **unlikely** to occur within the Subject Land as the suitable habitat in the form of slow-moving waterbodies is not present and there are a lack of records in the locality.

Habitat	ALA/BioNet Records	Distribution	Likelihood within the Subject Land
Silver Perch			
Silver Perch formerly utilised a diversity of habitats within the Murray-Darling system. The species were consistently reported by anglers and researchers to show a general preference for faster-flowing water, including rapids and races, and more open sections of river, throughout the Murray-Darling Basin.	No records within the Subject Land or Locality	Current core habitat is defined as the Murray River, from the base of Mulwala Weir through to Torrumbarry Weir, through to Euston Weir, and then through to the South Australian border; the lower reaches of the Darling River, from the base of the Menindee Lake weirs through to its junction with the Murray River; and the Edwards/Wakool anabranch system. Silver perch occurrences outside of this core habitat in the Border Rivers and in the Namoi and Lachlan catchments are in wholly and mostly stocked impoundments which do not recruit.	The Silver Perch is considered **unlikely** to occur within the Subject Land as the suitable habitat in the form of fast-flowing waterbodies is not present and there are a lack of records in the locality.

No threatened aquatic species are considered known or likely to occur within the Subject Land. As such, in accordance with *the threatened species assessment guidelines: the assessment of significance* (DPI 2008), an assessment of significance for threatened species matters listed under the FM Act is not required.

3.1.1.2 THREATENED AQUATIC ECOLOGICAL COMMUNITIES

The Lower Murray River EEC is a community that includes all native fish and aquatic invertebrates within all natural creeks, rivers, and associated lagoons, billabongs and lakes of the regulated portions of the Murray River downstream of Hume Weir, the Murrumbidgee River downstream of Burrinjuck Dam, the Tumut River downstream of Blowering Dam and all their tributaries anabranches. Excluded from this recommendation are the Lachlan River and the Darling River and their tributaries, and artificial canals, water distribution and drainage works, farm dams and off-stream reservoirs.

The Lower Murray River EEC occurs in a lowland riverine environment, characterised by meandering channels and wide floodplains. The land is generally flat to gently sloping. In their natural state, these lowland rivers experienced extremely variable water flows, ranging from floods to droughts. The EECs drainage system has been greatly modified since European settlement, through activities such as river regulation, agricultural practices and the introduction of non-native species.

The Creeklines across the Subject Land as presented in Figure 2-2 are within the distribution of the EEC; however, largely present as degraded, dried creekbeds with a lack of native fish and aquatic invertebrates. This EEC is likely to occur in the event the ephemeral creeklines are inundated post heavy rainfall events. Measures to avoid impact to this habitat will be undertaken in accordance with the Department's Policy and Guidelines for Fish Habitat Conservation and Management (Update 2013) and Why Do fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings (2003).

3.2 NATIVE VEGETATION COVER AND PATCH SIZE

The assessment of site context involved the application of the site-based method. The following landscape attributes were assessed in the following sections:

- Percent native vegetation cover in the landscape; and
- Patch size.

3.2.1 NATIVE VEGETATION COVER

The extent of native vegetation across the Subject Land is provided in Figure 3-1 and summarised in Table 3-5, with the extent of native vegetation within the Haul Route DF provided in Figure 3-2 and summarised in Table 3-6.

TABLE 3-5 NATIVE VEGETATION COVER (SUBJECT LAND)

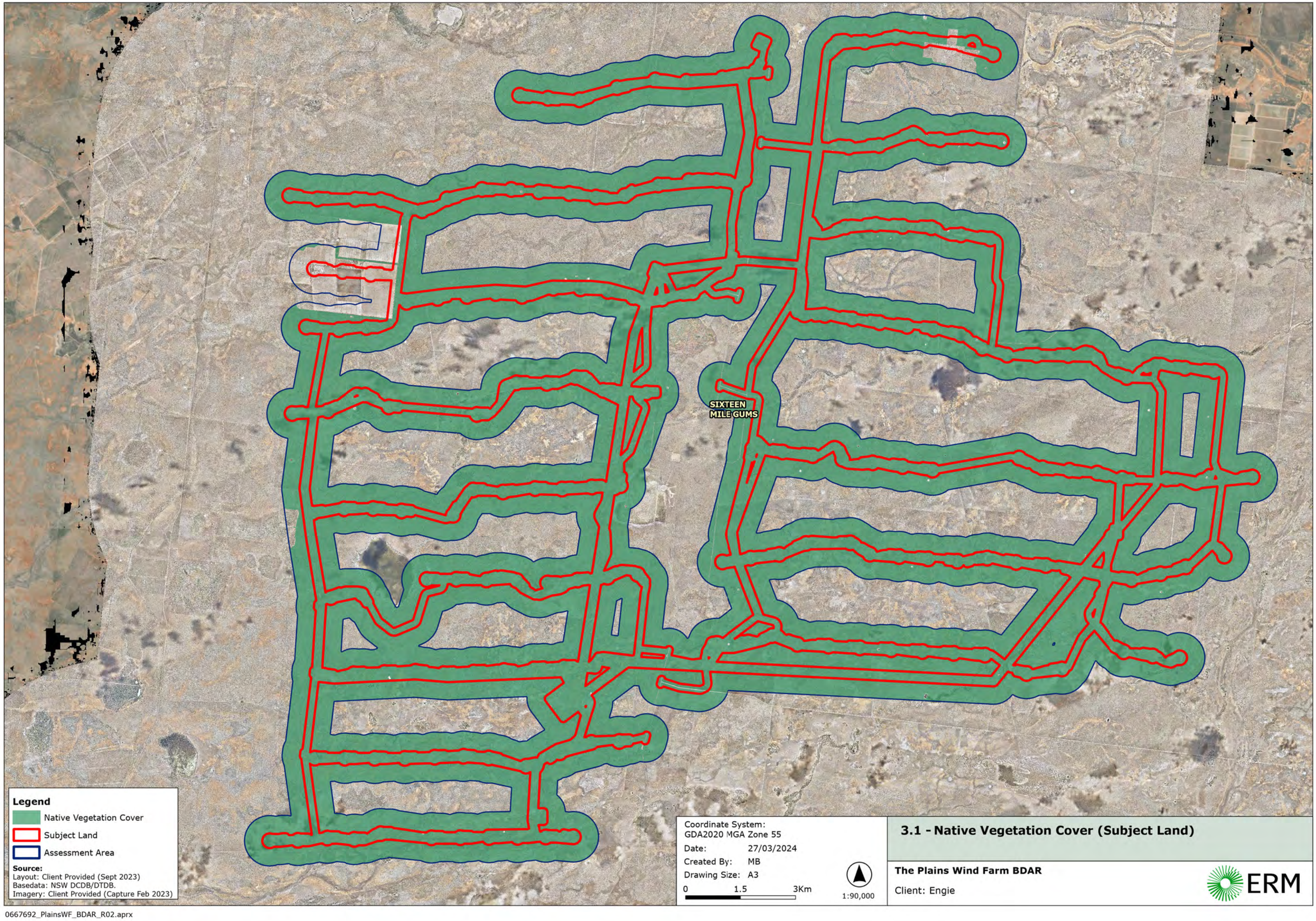
Description	Value
Subject Land	8,178.43 ha
Total area of native vegetation cover	8,038.78 ha
Percentage of native vegetation cover	98%
Class (0-10, >10-30, >30-70 or >70%)	>70%

TABLE 3-6 NATIVE VEGETATION COVER (HAUL ROUTE DF)

Description	Value
Haul Route DF	2.2 ha
Total area of native vegetation cover	0.67 ha
Percentage of native vegetation cover	31%
Class (0-10, >10-30, >30-70 or >70%)	>10-30

3.2.2 PATCH SIZE

Patch size is defined in the BAM as an area of intact native vegetation that occurs on the development site and includes native vegetation that has a gap of less than 100 m from the next area of moderate to good condition native vegetation (or ≤ 30 m for non-woody ecosystems). Patch size may extend onto adjoining land that is not part of the development site. The patch size of the native vegetation on the Subject Land and for the Haul Route DF has been calculated as >100 ha.



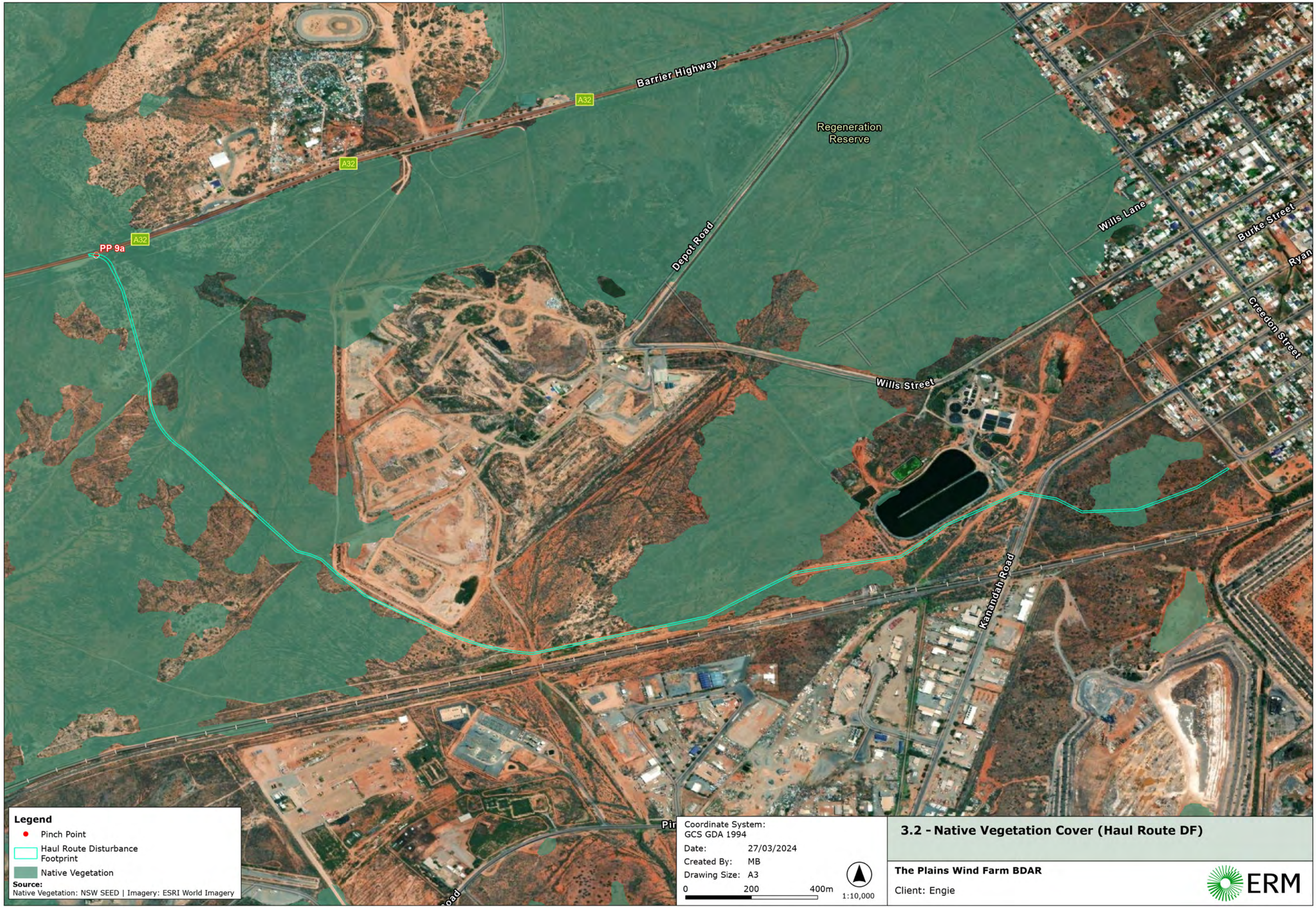
3.1 - Native Vegetation Cover (Subject Land)

The Plains Wind Farm BDAR

Client: Engie

ERM

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3.2 - Native Vegetation Cover (Haul Route DF)

The Plains Wind Farm BDAR

Client: Engie

ERM

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4. NATIVE VEGETATION, THREATENED ECOLOGICAL COMMUNITIES AND VEGETATION INTEGRITY

4.1 NATIVE VEGETATION EXTENT

This section of the BDAR identifies native vegetation occurring on the Subject Land (Figure 3-1) in accordance with the requirements of Section 5 of the BAM, and occurring along the Haul Route (Figure 3-2) in accordance with Appendix C of the BAM.

This section describes PCTs on the Subject Land, including:

- Vegetation formation and class;
- Area (ha) for each vegetation type (PCT);
- Species relied upon for identification of vegetation type;
- Justification of evidence used to identify a PCT (as outlined in Paragraph 5.2.1.12 of the BAM);
- TEC status (as outlined in Paragraphs 5.2.1.14 – 5.2.1.15 of the BAM); and
- Estimate of percent cleared value of PCT (as outlined in Paragraph 5.2.1.16 of the BAM).

This section also includes the results of vegetation integrity assessments completed on the Subject Land, including:

- Mapping vegetation zones (in accordance with Subsection 5.3.1 of the BAM);
- Patch size;
- Assessing vegetation integrity using benchmark data (in accordance with Subsection 5.3.3 of the BAM);
- Survey effort (as described in Subsection 5.3.4 of the BAM); and
- Determining the current vegetation integrity score (in accordance with Appendix 6 of the BAM) including:
  - Composition condition score;
  - Structure condition score;
  - Function condition score; and
  - VI score.

4.1.1 MAPPED NATIVE VEGETATION

Ground-verified vegetation mapping was conducted over the Subject Land and for most of the Assessment Area. Changes were made to the SVTM (DPE, 2022a), including the reassignment and reshaping of polygons to better fit the occurrence of PCTs across the Subject Land.

4.1.2 AREAS THAT ARE NOT NATIVE VEGETATION

No areas were re-allocated to non-native vegetation across the Assessment Area.

A small area of the Haul Route, situated at PP11 in Hay NSW, was re-allocated to non-native vegetation. PCT 164 is mapped on the SVTM (DPE, 2022a), occurring within a median strip to the east of the Sturt Hwy and Cobb Hwy roundabout; however, presents dominated (>50% cover) by non-native species. This vegetation will not be impacted by the passing of Project components. This is further discussed in Appendix B.

4.1.3 VEGETATION CLASSIFICATION

The 46 BAM plots used in this assessment were classified using the Bray-Curtis similarity index to produce a resemblance matrix used to aid in PCT identification within the Subject Land. Various analytical routines used included:

- A hierarchical cluster analysis (CLUSTER analysis) incorporating a SIMPROF analysis to identify statistically similar BAM plot groups;
- A non-metric multidimensional scaling plot (nMDS) (to graphically show BAM plot relatedness); and
- An Analysis of Similarities to calculate the Global R Statistic and test for differences between unordered SIMPROF groups.

The analysis produced a dendrogram (Chart 4-1) displaying four SIMPROF groups at the 5% significance level (red lines denoting SIMPROF groups).

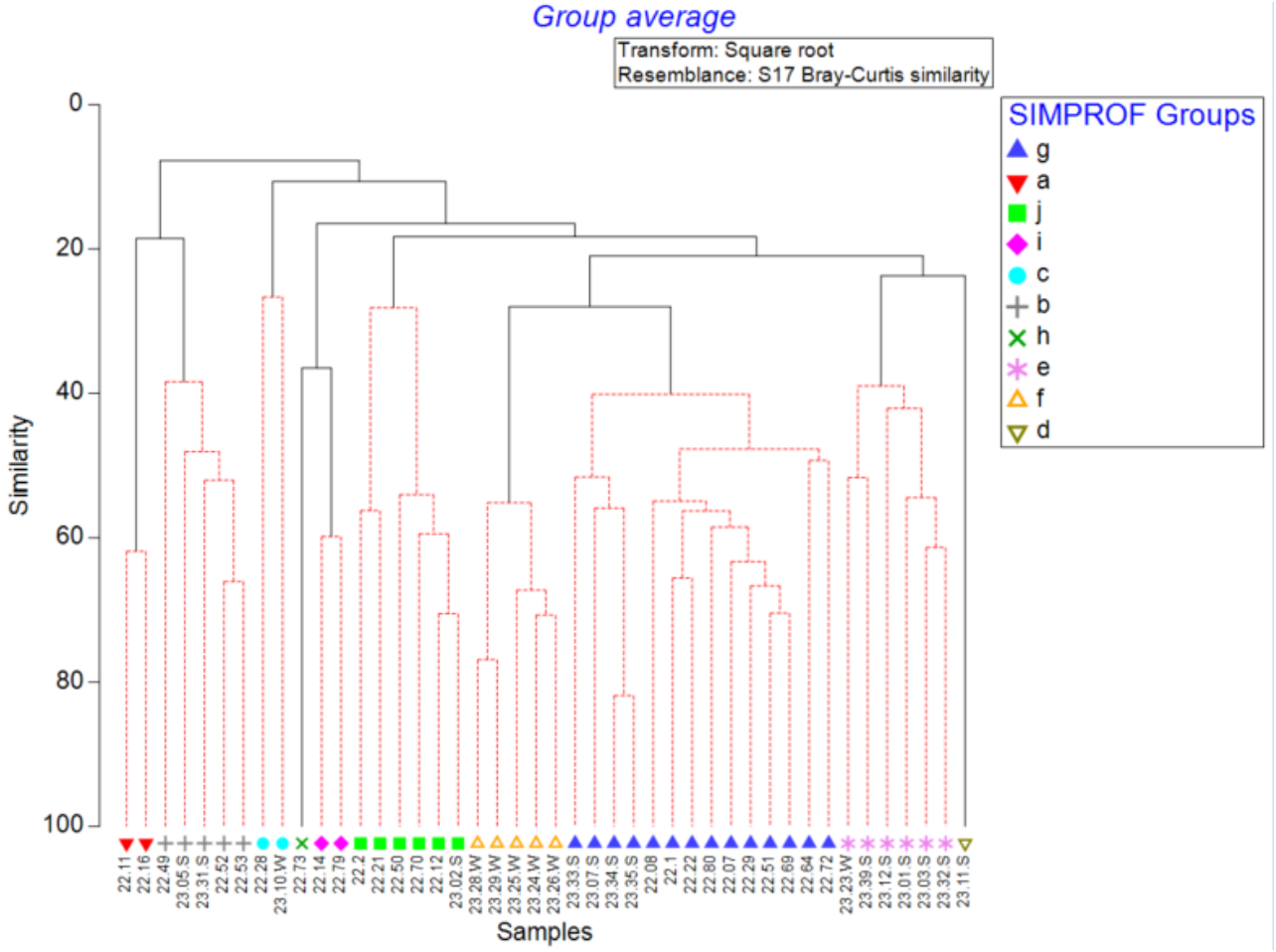


CHART 4-1 DENDOGRAM OF THE BAM PLOT DATA BY SIMPROF GROUP

The nMDS plot showing the SIMPROF groups shown in Chart 4-2.

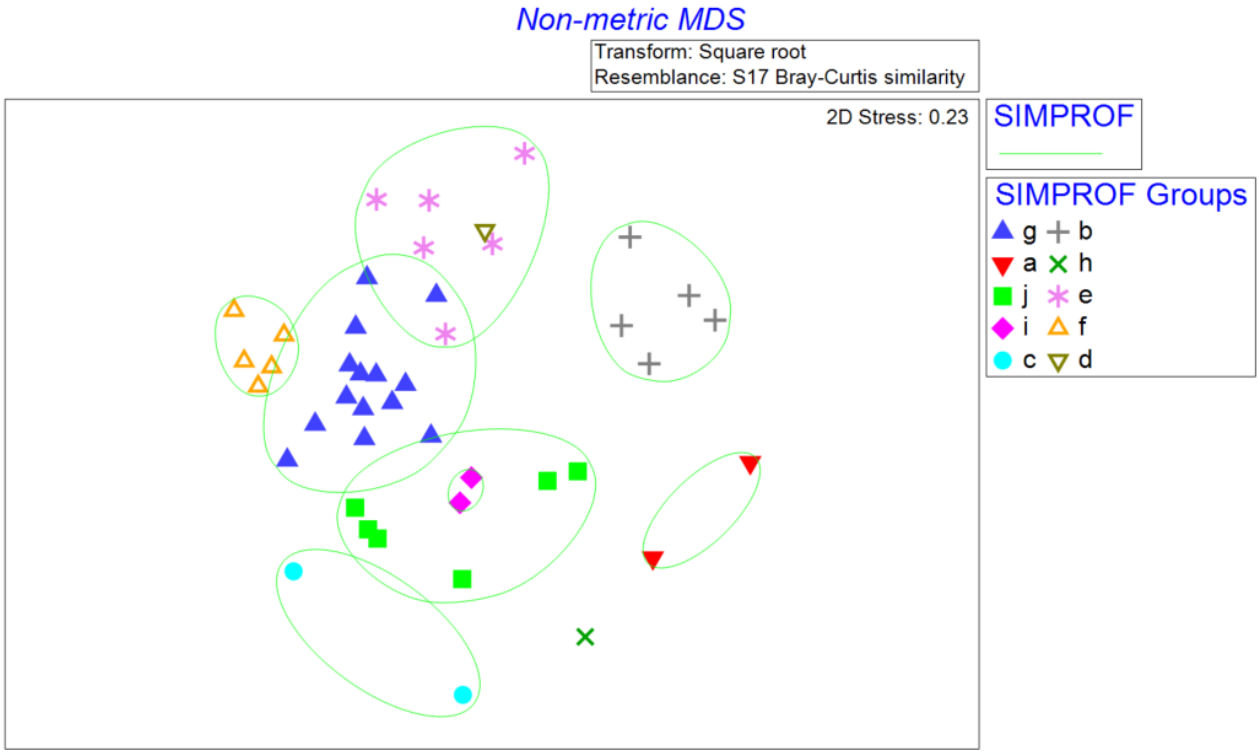


CHART 4-2 NMDS PLOT OF BAM PLOTS BY CLUSTER GROUPS

SIMPROF Group G has the highest number of member BAM plots with an average similarity of 61.32%. The dendrogram indicates that this likely represents a vegetation continuum influenced by an interaction between factors such as anthropogenic landuse (i.e., grazing/ cropping impacts), climatic events such as drought and historic pest plagues (e.g., European rabbit). This vegetation is not likely representative of a pre-European vegetation community, rather a derived plant community type that no longer holds characteristic diagnostic species.

SIMPROF Group G and E separate into two subgroups at approximately 40% similarity, this separation indicates a split between two vegetation communities.

The SIMPER output for each CLUSTER group with two or more plots is provided in Table 4-1. This table lists the flora species that characterise each of the SIMPROF groups and has been used as the basis for discerning PCTs on the Subject Land.

TABLE 4-1 SIMPER ANALYSIS OF CLUSTER GROUPS

Species	Average Abundance	Average Similarity	Sim/SD	Contribution %	Cumulative %
Group a: Average similarity 61.88					
Atriplex nummularia	5.48	26.09	SD=0!	42.16	42.16
Eucalyptus largiflorens	4.74	21.3	SD=0!	34.42	76.59
Lycium ferocissimum	1.41	6.74	SD=0!	10.89	87.47

Species	Average Abundance	Average Similarity	Sim/SD	Contribution %	Cumulative %
Groub b: Average similarity 46.80					
Chenopodium nitrariaceum	4.68	24.08	8.82	51.44	51.44
Muehlenbeckia florulenta	3.01	13.16	1.52	28.11	79.56
Sclerolaena muricata	0.56	1.95	8.74	4.16	83.72
Heliotropium europaeum	0.34	1.88	9.13	4.02	87.74
Group c: Average similarity 26.65					
Austrostipa scabra	3.35	8.76	SD=0!	32.86	32.86
Enteropogon acicularis	2.44	3.92	SD=0!	14.7	47.56
Rhagodia spinescens	2.44	3.92	SD=0!	14.7	62.25
Enchylaena tomentosa	1.47	2.77	SD=0!	10.39	72.64
Heliotropium europaeum	0.85	2.77	SD=0!	10.39	83.04
Rytidosperma spp.	1.47	2.77	SD=0!	10.39	93.43
Group e: Average similarity 59.84					
maireana pyramidata	3.87	30.6	SD=0!	51.14	51.14
Maireana pentagona	1.22	9.68	SD=0!	16.17	67.31
Austrostipa scabra	0.93	3.53	SD=0!	5.91	73.22
Maireana aphylla	0.93	3.53	SD=0!	5.91	79.12
Atriplex vesicaria	0.43	2.5	SD=0!	4.18	83.3
Enteropogon acicularis	0.51	2.5	SD=0!	4.18	87.47
Group f: Average similarity 42.19					
Atriplex vesicaria	4.42	25.77	1.5	61.09	61.09
Sporobolus caroli	1.96	6.86	0.8	16.26	77.35
Nitraria billardierei	1.66	3.35	0.36	7.94	85.29

Species	Average Abundance	Average Similarity	Sim/SD	Contribution %	Cumulative %
Group g: Average similarity 61.32					
Rytidosperma caespitosum	4.14	18.08	2.94	29.49	29.49
Austrostipa scabra	3.95	17.13	3.96	27.94	57.42
Sporobolus caroli	1.85	7.42	3.21	12.1	69.53
Maireana pentagona	1.39	5.09	1.14	8.3	77.83
Salsola australis	0.47	2.49	15.35	4.06	81.88
Sclerolaena bicornis	0.66	1.76	0.98	2.87	84.75
sida trichopoda	0.63	1.67	0.99	2.73	87.48
Group h: Average similarity 48.42					
Maireana aphylla	4.64	24.36	2.18	50.31	50.31
Sporobolus caroli	2.19	7.51	1.26	15.52	65.83
Rytidosperma caespitosum	1.66	4.98	1.16	10.28	76.11
Nitraria billardierei	1.57	3.85	0.75	7.95	84.06
Maireana pentagona	0.71	1.6	0.87	3.3	87.36
Group j: Average similarity 44.01					
Marsilea drummondii	3.77	15.19	5.79	34.53	34.53
Eragrostis australasica	3.15	10.47	2.05	23.79	58.32
Panicum laevinode	1.88	5.58	1.08	12.69	71
Maireana aphylla	1.09	2.9	1.02	6.59	77.59
Rytidosperma caespitosum	1.85	2.4	0.43	5.45	83.05
Alternanthera denticulata	0.66	1.21	0.66	2.75	85.8

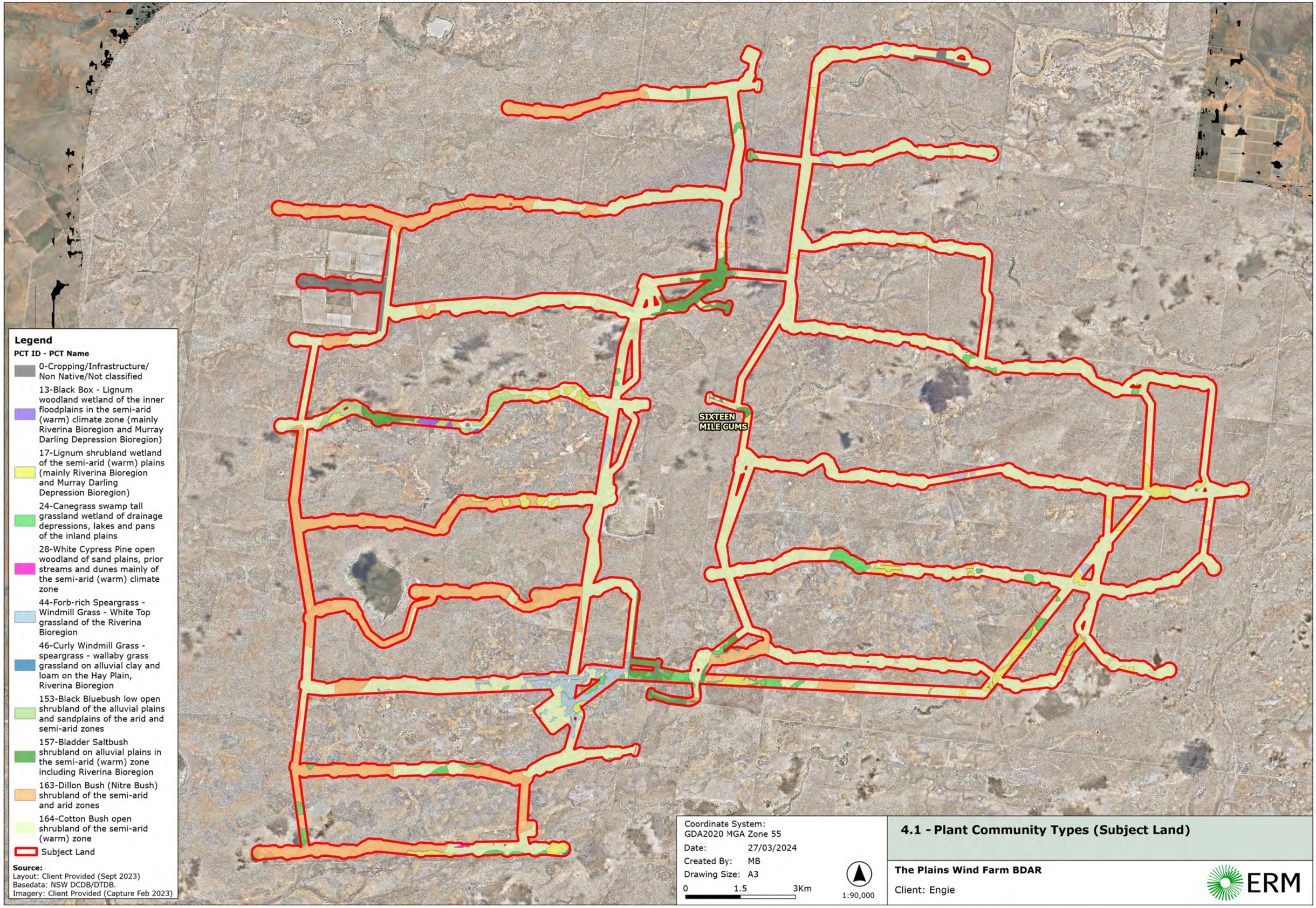
4.1.4 PLANT COMMUNITY TYPES

Vegetation within the Subject Land has been assessed as aligning with the BioNet Vegetation Classification PCTs identified within Table 4.2, with extent shown in Figure 4-1. A detailed description of each PCT as it presents within the Subject Land is provided in Table 4.3 to Table 4.11.

TABLE 4-2 PLANT COMMUNITY TYPES (SUBJECT LAND)

PCT ID	SIMPROF Group	PCT name	Subject Land area (ha)	Development Footprint area (ha)
13	A	Black Box - Lignum woodland wetland of the inner floodplains in the semi-arid (warm) climate zone (mainly Riverina Bioregion and Murray Darling Depression Bioregion)	16.84	2.01
17	B	Lignum shrubland wetland of the semi-arid (warm) plains (mainly Riverina Bioregion and Murray Darling Depression Bioregion)	355.96	87.09
24	J	Canegrass swamp tall grassland wetland of drainage depressions, lakes and pans of the inland plains	254.71	57.33
28	C	White Cypress Pine open woodland of sand plains, prior streams and dunes mainly of the semi-arid (warm) climate zone	3.24	0.69
44	G	Forb-rich Speargrass – Windmill Grass – White Top grassland of the Riverina Bioregion	222.56	73.63
46	N/A	Curly Windmill Grass - speargrass - wallaby grass grassland on alluvial clay and loam on the Hay Plain, Riverina Bioregion	3.67	0.00
153	E	Black Bluebush low open shrubland of the alluvial plains and sandplains of the arid and semi-arid zones	98.31	18.48

PCT ID	SIMPROF Group	PCT name	Subject Land area (ha)	Development Footprint area (ha)
157	F	Bladder Saltbush shrubland on alluvial plains in the semi-arid (warm) zone including Riverina Bioregion	256.14	48.41
163	I	Dillon Bush (Nitre Bush) shrubland of the semi-arid and arid zones	1,600.89	392.68
164	H	Cotton Bush open shrubland of the semi-arid (warm) zone	5,226.47	1,285.02
Total area			**8,038.78**	**1,965.33**



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TABLE 4-3 PCT 13 DESCRIPTION

PCT 13 Black Box - Lignum woodland wetland of the inner floodplains in the semi-arid (warm) climate zone (mainly Riverina Bioregion and Murray Darling Depression Bioregion)	
PCT ID	13
PCT name	Black Box - Lignum woodland wetland of the inner floodplains in the semi-arid (warm) climate zone (mainly Riverina Bioregion and Murray Darling Depression Bioregion)
Vegetation formation	Semi-arid Woodlands (Grassy sub-formation)
Vegetation class	Inland Floodplain Woodlands
TEC Status	PCT 13 has no associated EPBC Act or BC Act listed TECs
Percent cleared value	57.00%
BioNet VIS PCT Description	Woodland, open forest or open woodland averaging about 15 m high dominated by a sparse to dense stands of Lignum (*Muehlenbeckia florulenta*), Nitre Goosefoot (*Chenopodium nitrariaceum*) and River Cooba (*Acacia stenophylla*). The ground cover includes low shrubs such as *Sclerolaena muricata* var. *muricata*, *Enchylaena tomentosa, Einadia nutans* subsp*. nutans* and various saltbush species (*Atriplex* spp.). Forb species include *Solanum esuriale, Cotula australis, Oxalis perennans, Alternanthera denticulata* and *Pratia concolor*. Grass species include Warrego Summer Grass (*Paspalidium jubiflorum*), Curly Windmill Grass (*Enteropogon acicularis*) and *Walwhalleya proluta* and wallaby grasses (*Austrodanthonia* spp.). Weed species include the shrub African Boxthorn (*Lycium ferocissimum*), the forbs *Cotula bipinnata, Erodium cicutarium* and *Sisymbrium irio* and the *grasses Hordeum leporinum* and *Lolium perenne*.
Description within Subject Land	PCT 13 was only found in small areas. It was distinguished from the closely related PCT 15 by the presence of *Muehlenbeckia florulenta* (lignum) in the mid-storey. In comparison, The Plains Wind Farm Project Area had areas of PCT 15 with a mid-storey clearly dominated by chenopods. In comparison to PCT 15, PCT 13 tends to occur in lower lying areas which favours lignum.
Associated species present	Old Man Saltbush (*Atriplex nummularia*), Nitre Goosefoot (*Chenopodium nitrariaceum*), Climbing Saltbush (*Einadia nutans*), Ruby Saltbush (*Enchylaena tomentosa*), Curly Windmill Grass (*Enteropogon acicularis*), Black Box (*Eucalyptus largiflorens*), Juncus spp., Lignum (*Muehlenbeckia florulenta*), Dillon Bush (*Nitraria billardierei*), Thorny Saltbush (*Rhagodia spinescens*), Corrugated Sida (*Sida corrugate*).
Vegetation Zones	One distinct condition state for areas mapped as PCT 13 occur within the Subject Land, as outlined below: • Moderate condition, herein labelled as Vegetation Zone 1 (VZ1)

TABLE 4-4 PCT 17 DESCRIPTION

PCT 17 Lignum shrubland wetland of the semi-arid (warm) plains (mainly Riverina Bioregion and Murray Darling Depression Bioregion)	
PCT ID	17
PCT name	Lignum shrubland wetland of the semi-arid (warm) plains (mainly Riverina Bioregion and Murray Darling Depression Bioregion)
Vegetation formation	Freshwater Wetlands
Vegetation class	Inland Floodplain Shrublands
TEC Status	PCT 17 has no associated EPBC Act or BC Act listed TECs
Percent cleared value	63.00%
BioNet VIS PCT Description	Open shrubland usually up to 2 m high dominated by Lignum (*Muehlenbeckia florulenta*) often with Nitre Goosefoot (*Chenopodium nitrariaceum*) and low cover of Canegrass (*Eragrostis australasica*). Scattered trees of Black Box (*Eucalyptus largiflorens*) may be present. Cooba (*Acacia salicina*) and River Cooba (*Acacia stenophylla*) may be present as tall shrubs. Ground cover species include the small shrubs such as Giant Redburr (*Sclerolaena tricuspis*), Roly Poly (*Sclerolaena muricata var. muricata*), *Atriplex lindleyi, Atriplex suberecta* and *Salsola tragus* subsp. *tragus*, the fern *Marsilea drummondii*, the rush *Juncus flavidus*, the forbs *Rumex tenax, Einadia nutans* subsp. *nutans, Bulbine bulbosa, Senecio glossanthus* and *Senecio cunninghamii*. Grass species include *Walwhalleya proluata* and *Enteropogon ramosus*. Weed species include *Lolium perenne, Hordeum leporinum* and *Rapistrum rugosum*.
Description within the Subject Land	PCT 17 occurred in depressions and along watercourses. Tree species were absent from the community. The mid stratum ranged from dense to sparse and was dominated by *Muehlenbeckia florulenta* (lignum) with *Chenopodium nitrariaceum*, *Nitraria billardierei* or *Eragrostis australasica* sometimes being sub-dominant. The ground layer was generally dominated by a dense cover of *Marsilea drummondii* and a mix of associated grasses, forbs and chenopods also present.
Associated species present	*Calotis scabiosifolia*, Nitre Goosefoot (*Chenopodium nitrariaceum*), Climbing Saltbush (*Einadia nutans*), Spike-rush (*Eleocharis spp.*), Curly Windmill Grass (*Enteropogon acicularis*), Canegrass (*Eragrostis australasica*), *Juncus spp.*, Common Nardoo (*Marsilea drummondii*), Lignum (*Muehlenbeckia florulenta*), Dillon Bush (*Nitraria billardierei*), Pepper Grass (*Panicum laevinode*), Shiny Dock (*Rumex tenax*), Saltwort (*Salsola tragus*), Black Rolypoly (*Sclerolaena muricata*), Star Copperburr (*Sclerolaena stelligera*), Giant Redburr (*Sclerolaena tricuspis*).
Vegetation Zones	One distinct condition state for areas mapped as PCT 17 occur within the Subject Land, as outlined below: • Moderate condition, herein labelled as Vegetation Zone 2 (VZ2)

TABLE 4-5 PCT 24 DESCRIPTION

PCT 24 Canegrass swamp tall grassland wetland of drainage depressions, lakes and pans of the inland plains	
PCT ID	24
PCT name	Canegrass swamp tall grassland wetland of drainage depressions, lakes and pans of the inland plains
Vegetation formation	Freshwater Wetlands
Vegetation class	Inland Floodplain Shrublands
TEC Status	PCT 24 is associated with: • Artesian Springs Ecological Community in the Great Artesian Basin – Critically Endangered (BC Act) (part)
Percent cleared value	20.00%
BioNet VIS PCT Description	Tall, tussock grassland dominated by Canegrass (*Eragrostis australasica*) growing to over 2 m high ranging in cover from dense to isolated plants. Sometimes growing with Glasswort (*Sclerostegia tenuis*) or samphire (*Halosarcia pergranulata*). Depending which part of NSW a range of grass species may be present including Windmill Grass (*Chloris truncata*), Blown Grass (*Lachnagrostis filiformis*), Plains grass (*Austrostipa aristiglumis*), Neverfail (*Eragrostis setifolia*) and *Eragrostis parviflora*. A range of low shrubs occur including *Sclerolaena* spp., *Atriplex* spp. and *Teucrium racemosum*. Sedges such as *Eleocharis acuta, Eleocharis pusilla* and *Eleocharis pallens* may be common along with rushes (*Juncus* spp.). The aquatic *Marsilea drummondii, M. costulifera, Azolla filiculoides* and *Myriophyllum* spp. may be present but die off in dry times.
Description within Subject Land	PCT 24 occurred in depressions and along watercourses, trees were absent. The midstratum was dominated by *Eragrostis australasica* (canegrass) with only occasional *Muehlenbeckia florulenta*, *Chenopodium nitrariaceum* and *Nitraria billardierei*. The ground layer was generally dominated by a dense cover of *Marsilea drummondii,* with a mix of grasses and forbs also present. The density of canegrass ranged from moderately dense to sparse. In areas with sparse canegrass, it was sometimes difficult to detect the presence of a wetland without examining the groundcover to identify the indicative presence of dense *Marsilea drummondii.* Wetlands were also clearly visible on aerial imagery. The soil profiles of these ephemeral wetlands was a strong indicator to the decision making process.
Associated species present	*Brachyscome spp.,* Common Nardooo *(Marsilea drummondii),* Nitre Goosefoot (*Chenopodium nitrariaceum*), *Eleocharis spp.,* Canegrass (*Eragrostis australasica), Juncus spp*., *Minuria spp.,* Lignum (*Muehlenbeckia florulenta*), and Tall Groundsell (*Senecio runcinifolius*).
Vegetation Zones	One distinct condition state for areas mapped as PCT 24 occur within the Subject Land, as outlined below: • Moderate condition, herein labelled as Vegetation Zone 3 (VZ3)

TABLE 4-6 PCT 28 DESCRIPTION

PCT 28 White Cypress Pine open woodland of sand plains, prior streams and dunes mainly of the semi-arid (warm) climate zone	
PCT ID	28
PCT name	White Cypress Pine open woodland of sand plains, prior streams and dunes mainly of the semi-arid (warm) climate zone
Vegetation formation	Semi-arid Woodlands (Shrubby sub-formation)
Vegetation class	Riverine Sandhill Woodlands
TEC Status	PCT 28 is associated with: • Sandhill Pine Woodland in the Riverina, Murray-Darling Depression and NSW South Western Slopes bioregions – *Endangered* (BC Act) (part) • *Acacia melvillei* Shrubland in the Riverina and Murray-Darling Depression Bioregions - *Endangered* (BC Act) (part) PCT 28 is also associated with a TEC that has been nominated under the EPBC Act.
Percent cleared value	73.00%
BioNet VIS PCT Description	Open woodland or a derived grassland with scattered trees up to 15 m high dominated by White Cypress Pine (*Callitris glaucophylla*). Associated small trees or tall shrubs include Buloke (*Allocasuarina luehmannii*), Needlewood (*Hakea leucoptera*), Hooked Needlewood (*Hakea tephrosperma*), Sugarwood (*Myoporum platycarpum*), *Pittosporum angustifolium*, Western Rosewood (*Alectryon oleifolius* subsp. *canescens*), Emu Bush (*Eremophila longifolia*) and Wilga (*Geijera parviflora*). Common chenopod shrub species include Black Bluebush (*Maireana pyramidata*), *Maireana enchylaenoides* and Thorny Saltbush (*Rhagodia spinescens*). Copperburr low shrubs include *Sclerolaena diacantha* and *Sclerolaena obliquicuspis*. Forb species include *Tetragonia tetragonioides, Calandrinia eremaea, Calotis hispidula, Tribulus terrestris* and *Zygophyllum ammophilum*. Many stands contain a very sparse shrub understorey that has been grazed out with the ground being dominated by native and exotic grasses and forbs. Native grass species include *Austrostipa scabra* subsp*. scabra*, *Austrodanthonia caespitosa, Aristida behriana, Enneapogon nigricans* and *Paspalidium constrictum*. Exotic species include *Schismus barbatus, Brassica tournefortii* and *Medicago polymorpha*.
Description within Subject Land	PCT 28 was identified on sand dunes and sandy loam plains, in small areas of the southwestern portion of the Subject Land. The community was found in a low condition state with key characteristic canopy species, *Callitris glaucophylla*, being absent. The PCT presented as a derived grassland with scattered *Alectryon oleifolius, Acacia oswaldii, Hakea tephrosperma* and *Eremophila longifolia,* the latter two situated outside the BAM Plot. PCT 28 was selected as the most likely PCT due to the presence of these characteristic upper and middle stratum species. Ground layer was dominated by *Austrostipa scabra* and *Enteropogon spp..*
Associated species present	*Alectryon oleifolius, Acacia oswaldii, Hakea tephrosperma* and *Eremophila longifolia, Austrostipa scabra, Einadia nutans, Rhagodia spinescens, Rytidosperma caespitosa,* and *Sida corrugate.*

PCT 28 White Cypress Pine open woodland of sand plains, prior streams and dunes mainly of the semi-arid (warm) climate zone	
Vegetation Zones	Two distinct condition states for areas mapped as PCT 28 occur within the Subject Land, as outlined below: • Low condition, herein labelled as Vegetation Zone 4 (VZ4)



PHOTOGRAPH 5 PCT 28, VEGETATION ZONE 4 (LOW)

TABLE 4-7 PCT 44 DESCRIPTION

PCT 44 Forb-rich Speargrass - Windmill Grass - White Top grassland of the Riverina Bioregion	
PCT ID	44
PCT name	Forb-rich Speargrass - Windmill Grass - White Top grassland of the Riverina Bioregion
Vegetation formation	Grasslands
Vegetation class	Riverine Plain Grasslands
TEC Status	PCT 44 is associated with: • Natural Grasslands of the Murray Valley Plains – Critically Endangered (EPBC Act) (part)
Percent cleared value	73.00%
BioNet VIS PCT Description	Open to closed grasslands usually about 0.3 m high composed of speargrass (*Austrostipa nodosa*), Windmill Grass (*Chloris truncata*) and Whitetop Wallaby Grass (*Austrodanthonia caespitosa*) with forbs including a range of daisies such as *Leucochrysum molle* and *Calotis scabiosifolia* and legumes such as *Swainsona* spp. The bluebush species *Maireana pentagona* and *Maireana excavata* are often present as scattered low shrubs. Some annual exotic species such as Rye Grass (*Lolium* spp.) and Wild Oats (*Avena* spp.) can dominate cover in Spring then die off leaving native perennial grasses as dominants. This community is "disclimax" in that the grassland of today was probably mixed with chenopod shrublands prior to European settlement.
Description within Subject Land	PCT 44 presented as an open grassland situated in red-brown cracking clays, and particularly areas with abundant scalds. The cover of vegetation was generally very sparse and was dominated by *Austrostipa scabra, Rytidosperma caespitosum, Maireana pentagona* and a mix of forbs such as *Eriochlamys behrii, Calocephalus sonderi, Sida trichopoda, Crassula colorata, Silene apetala,* and *Calotis scabiosifolia*. *Sclerolaena tricuspis, S. stelligera, S. brachyptera* also often occurred. The threatened species, *Lepidium monoplocoides* and *Maireana cheelii* were sometimes found in this PCT. *Maireana aphylla* (cotton bush) sometimes occurred and at times it was difficult to distinguish the boundaries between PCT 44 and adjacent areas of PCT 164. Generally, PCT 44 was only mapped in areas containing red-brown cracking clays with scalds and in areas that contained a visible cover of small forbs. The fact that PCT 44 is derived led to decisions where marginal areas of PCT 164 / PCT 44 were found we tended towards a decision-making process that solidified the cottonbush community as still 'hanging on', albeit in a much reduced and degraded manner. PCT 44 was often a light wispy grassland community associated with scalds, and often around areas that had had previous heavy grazing or worked areas such as underneath powerlines or near dams.
Associated species present	Rough Speargrass (*Austrostipa scabra*), Ringed Wallaby Grass (*Rytidosperma caespitosa*), *Maireana pentagona*, Windmill Grass (*Chloris truncata*), Rough Burr-daisty (*Calotis scabiosifolia*), Corrugated Sida (*Sida corrugata*).
Vegetation Zones	One distinct condition state for areas mapped as PCT 44 occur within the Subject Land, as outlined below: • Moderate condition, herein labelled as Vegetation Zone 5 (VZ5)

PCT 44 Forb-rich Speargrass - Windmill Grass - White Top grassland of the Riverina Bioregion

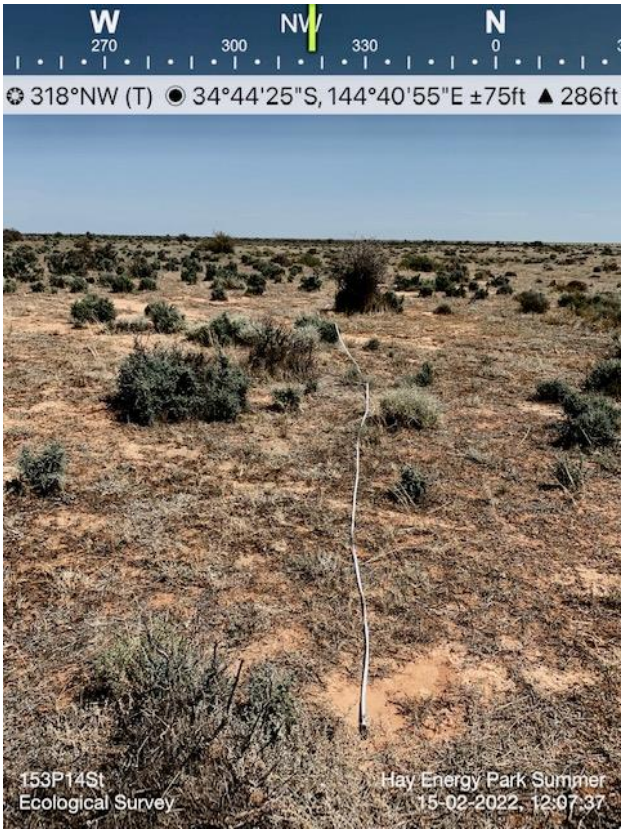


PHOTOGRAPH 5 PCT 44, VEGETATION ZONE 5

TABLE 4-8 PCT 153 DESCRIPTION

PCT 153 Black Bluebush low open shrubland of the alluvial plains and sandplains of the arid and semi-arid zones	
PCT ID	153
PCT name	Black Bluebush low open shrubland of the alluvial plains and sandplains of the arid and semi-arid zones
Vegetation formation	Arid Shrublands (Chenopod sub-formation)
Vegetation class	Aeolian Chenopod Shrublands
TEC Status	PCT 153 is associated with: • *Acacia loderi* shrublands – Endangered (BC Act) (part)
Percent cleared value	40.00%
BioNet VIS PCT Description	Mid-high open shrubland generally less than one meter high dominated by Black Bluebush (*Maireana pyramidata*) which may be dominant. Scattered low trees of Black Oak (*Casuarina pauper*) or Western Rosewood (*Alectryon oleifolius subsp. canescens*) may be present. Tall shrubs are rare or absent and may include *Eremophila sturtii*. Other chenopod shrub species include Thorny Saltbush (*Rhagodia spinescens*), bluebushes such as *Maireana georgei, Maireana sedifolia* and *Maireana appressa,* Bladder Saltbush (*Atriplex vesicaria sens lat*), *Atriplex lindleyi* and *Atriplex pumillio*, Cannonball (*Dissocarpus paradoxus*), Ruby Saltbush (*Enchylaena tom*entosa) and copperburrs such as *Sclerolaena obliquicuspis*, *Sclerolaena patenticuspis, Sclerolaena brachyptera, Sclerolaena lanicuspis, Sclerolaena divaricata, Sclerolaena tricuspis* and *Sclerolaena diacantha.* Grass species include the cork screw grasses *Austrostipa nitida, Austrostipa scabra* and *Austrostipa nodosa* and wallaby grass *Austrodanthonia caespitosa. Eragrostis dielsii* and *Enneapogon avenaceus* occur in northern areas. Forbs include *Calotis hispidula, Tetragonia tetragonioides, Goodenia pinnatifida, Plantago varia, Minuria integerrima, Senecio runcinifolius, Brachyscome lineariloba, Brachyscome ciliaris var. ciliaris, Calandrinia eremaea*. Bladder Saltbush may have been more common prior to stock grazing. Weeds include *Hordeum spp., Heliotropium europaeum, Salvia verbenaca, Medicago spp.* and *Salvia verbenacea*. Occurs on red-brown duplex soils with textures of clay loam, sandy-loam or light clay on low sandy rises, undulating sandplains, drainage depressions and prior stream levees in the semi-arid and arid zones of far western NSW extending into South Australia and northern Victoria.
Description within Subject Land	PCT 153 was mapped in small areas of the Subject Land on red-brown clay loam soils. These areas were easily defined by a clear dominance of *Maireana pyramidata* (Black Bluebush), which was not found as abundant in other PCTs across the site. Other species present included *Rhagodia spinescens, Atriplex vesicaria, Atriplex lindleyi, Sclerolaena brachyptera, Sclerolaena tricuspis, Maireana pentagona, Austrostipa scabra* and *Rytidosperma caespitosum.*
Associated species present	Black Bluebush (*Maireana pyramidata*), Bladder Saltbush (*Atriplex vesicaria*), Rough Speargrass (*Austrostipa scabra*), Dillon Bush (*Nitraria billardierei*), Ringed Wallaby Grass (*Rytidosperma caespitosa*), Thorny Saltbush (*Rhagodia spinescens*), Short-winged Copperburr (*Sclerolaena brachyptera*), Grey Copperbur (*Sclerolaena diacantha*), Giant Redbur (*Sclerolaena tricuspis*).

PCT 153 Black Bluebush low open shrubland of the alluvial plains and sandplains of the arid and semi-arid zones	
Vegetation Zones	One distinct condition state for areas mapped as PCT 153 occurs within the Subject Land, as outlined below: • Moderate condition, herein labelled as Vegetation Zone 6 (VZ6)



PHOTOGRAPH 6 PCT 153, VEGETATION ZONE 6

TABLE 4-9 PCT 157 DESCRIPTION

PCT 157 Bladder Saltbush shrubland on alluvial plains in the semi-arid (warm) zone including Riverina Bioregion	
PCT ID	157
PCT name	Bladder Saltbush shrubland on alluvial plains in the semi-arid (warm) zone including Riverina Bioregion
Vegetation formation	Arid Shrublands (Chenopod sub-formation)
Vegetation class	Riverine Chenopod Shrublands
TEC Status	PCT 157 is not associated with any EPBC or BC Act listed TECs
Percent cleared value	60.00%
BioNet VIS PCT Description	Low to mid-high to 90cm high, open to sparse chenopod shrubland dominated by Bladder Saltbush (*Atriplex vesicaria*) often with Desert Glasswort (*Pachycornia triandra*), Three-spined Copperburr (*Sclerolaena tricuspis*), *Sclerolaena intricata* and Pigface (*Disphyma crassifolium* subsp. *clavellatum*). Other commonly occurring small shrubs include Slender Glasswort (*Sclerostegia tenuis*), *Sclerolaena brachyptera, Sclerolaena tenuis, Maireana decalvans, Maireana aphylla, Malacocera tricornis, Dissocarpus biflorus* var. *biflorus, Atriplex lindleyi* and *Atriplex pseudocampanulata*. Grasses include *Chloris truncata, Austrodanthonia setacea* and *Sporobolus caroli*. Ephemeral daises occur after rains including *Minuria cunninghamii, Brachyscome smithwhitei* and *Rhodanthe corymbiflora*. The succulent forb *Calandrinia volubilis* often present. Myall (*Acacia pendula*) or Black Oak (*Casuarina pauper*) may occur as isolated trees. In heavily grazed regions Bladder Saltbush may be replaced by a disturbed shrubland complex composed of *Nitraria billardierei, Sclerolaena* spp. and Cotton Bush (*Maireana aphylla*) or Desert glasswort (*Pachycornia triandra*).
PCT Justification	PCT 157 occurred in areas across the site, generally presenting as an open to sparse shrubland with a moderately dense cover of *Atriplex vesicaria* (bladder saltbush), with a mix of other chenopods such as *Sclerolaena tricuspis, S. brachyptera, Maireana aphylla* and *Maireana pentagona; grasses such as Rytidosperma caespitosum* and *Austrostipa scabra* and forbs such as *Maireana pentagona and Crassula spp.*. Soils were grey, brown and red-brown cracking clay and clay loam.
Alternative PCTs	Bladder Saltbush (*Atriplex vesicaria*), Rough Speargrass (*Austrostipa scabra*), *Brachyscome spp.,* Pale Beauty-heads *(Calocephalus sonderi*), Nitre Goosefoot (*Chenopodium nitrariaceum*), Canegrass (*Eragrostis australasica*), Hairy Bluebush (*Maireana pentagona*), Black Bluebush (*Maireana pyramidata*), *Minuria sp*p., Dillon Bush (Nitraria billard*ierei*), Short-winged Copperburr (*Sclerolaena brachyptera*), Giant Redburr (*Sclerolaena tricuspis*), Fairy Grass (*Sporobolus caroli*).
Vegetation Zones	One distinct condition state for areas mapped as PCT 157 occurs within the Subject Land, as outlined below: • Moderate condition, herein labelled as Vegetation Zone 7 (VZ7)

PCT 157 Bladder Saltbush shrubland on alluvial plains in the semi-arid (warm) zone including Riverina Bioregion

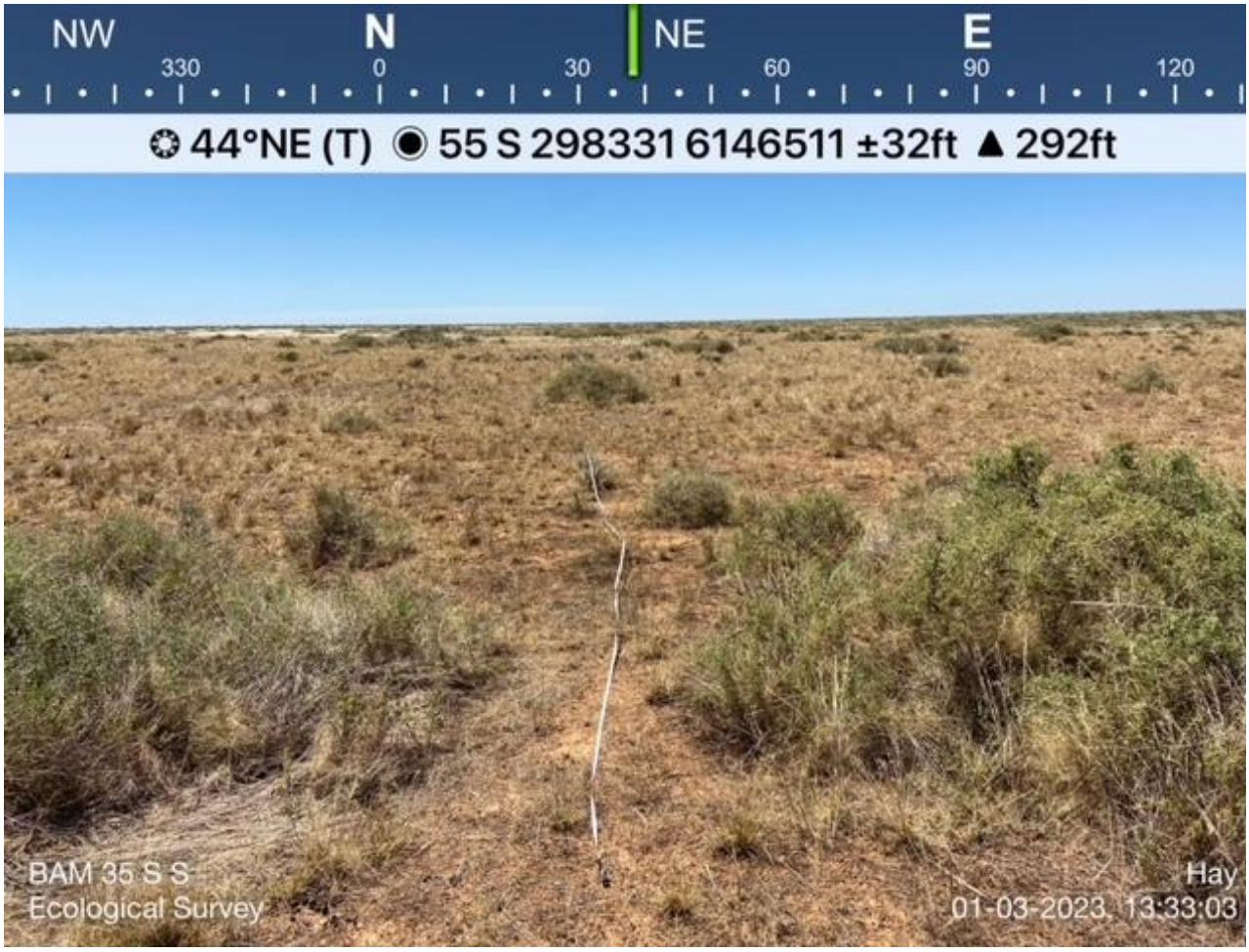


PHOTOGRAPH 7 PCT 157, VEGETATION ZONE 7

TABLE 4-10 PCT 163 DESCRIPTION

PCT 163 Dillon Bush (Nitre Bush) shrubland of the semi-arid and arid zones	
PCT ID	163
PCT name	Dillon Bush (Nitre Bush) shrubland of the semi-arid and arid zones
Vegetation formation	Arid Shrublands (Chenopod sub-formation)
Vegetation class	Riverine Chenopod Shrublands
TEC Status	PCT 163 is associated with: • Artesian Springs Ecological Community in the Great Artesian Basin – *Critically Endangered* (BC Act) (part)
Percent cleared value	26.00%
BioNet VIS PCT Description	Low to mid-high open to sparse shrubland dominated by Dillon Bush (*Nitraria billardierei*) with Cotton Bush (*Maireana aphylla*) and Thorny Saltbush (*Rhagodia spinescens*). The ground cover may be sparse or dense depending on the season. It includes low shrubs such as Giant Redburr (*Sclerolaena tricuspis*), *Sclerolaena divaricata* and *Sclerolaena obliquicuspis*, Cannonball Burr (*Dissocarpus paradoxus*), *Salsola tragus* subsp. *tragus, Atriplex lindleyi* and *Atriplex holocarpa*. Grasses may dominate a site and they include the wallaby grasses *Austrodanthonia setacea* and *Austrodanthonia caespitosa,* Rough Spear Grass (*Austrostipa scabra*). A high proportion or the ground cover may be composed of weed species including *Hordeum* spp., *Bromus* spp. *Cucumis myriocarpus* subsp. *leptodermis* and medics (*Medicago* spp.). Dillon Bush (*Nitraria billardierei*) shrubland occurs in heavily disturbed sites and is probably a derived community possibly from previous Bladder Saltbush ID157) and Old Man Saltbush shrubland communities that were heavily modified by heavy grazing by domestic stock and rabbits. Dillon Bush shrubland also occurs on lands that have been cropped in the past.
Description within Subject Land	PCT 163 occurred extensively across the site. It was characterised by a dominance of *Nitraria billardierei* (Dillon Bush) in the shrub layer, although *Maireana aphylla* (Cotton Bush) was co-dominant in some areas. The ground layer was dominated a mix of *Sporobolus caroli* and *Austrostipa scabra*, with a mix of *Sclerolaena tricuspis, Atriplex leptocarpa, A. pseudocampanulata, A. semibaccata, Enteropogon acicularis, Calocephalus sonderi, Maireana pentagona, Sclerolaena brachyptera,* and *Silene apetala*. Soils ranged from grey, brown and red-brown cracking clay and clay loam. PCT 163 was at times difficult to distinguish from PCT 164, in areas where cotton bush was co-dominant. Generally, any areas where Dillon bush was regularly occurring in the shrub layer was mapped as PCT 163. It was also noted that PCT 163 tended to occur in the more disturbed areas near dams and infrastructure and also in areas containing scalding and soil erosion.
Associated species present	Bladder Saltbush (*Atriplex vesicaria*), *Atriplex spp.,* Rough Speargrass (*Austrostipa scabra*), Cotton Bush (Maireana *aphylla),* Black Bluebush (*Maireana pyramidata*), Dillon Bush (*Nitraria billardierei*), Buckbush (*Salsola tragus*), Black Rolypoly (*Sclerolaena muricata*), Giant Redburr (*Sclerolaena tricuspis*).
Vegetation Zones	One distinct condition state for areas mapped as PCT 163 occurs within the Subject Land, as outlined below: • Moderate condition, herein labelled as Vegetation Zone 8 (VZ8)

PCT 163 Dillon Bush (Nitre Bush) shrubland of the semi-arid and arid zones

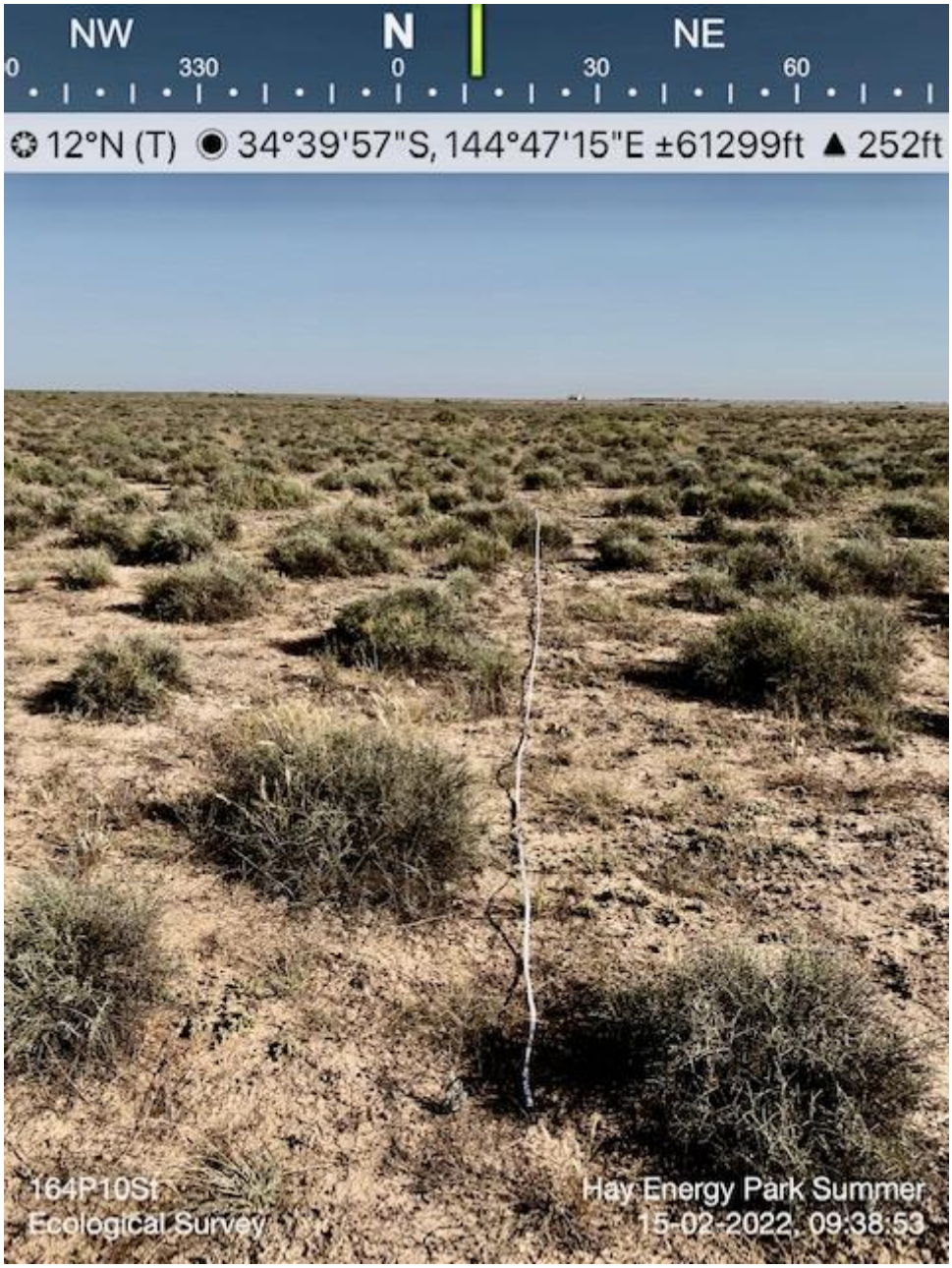


PHOTOGRAPH 8 PCT 163, VEGETATION ZONE 8

TABLE 4-11 PCT 164 DESCRIPTION

PCT 164 Cotton Bush open shrubland of the semi-arid (warm) zone	
PCT ID	164
PCT name	Cotton Bush open shrubland of the semi-arid (warm) zone
Vegetation formation	Arid Shrublands (Chenopod sub-formation)
Vegetation class	Riverine Chenopod Shrublands
TEC Status	PCT 164 has no associated BC Act or EPBC Act listed TECs
Percent cleared value	8.00%
BioNet VIS PCT Description	Low to mid-high sparse to mid-dense shrubland usually about 0.8 m high dominated by Cotton Bush (*Maireana aphylla*) with occasional remnant shrubs of Bladder Saltbush (*Atriplex vesicaria* s.l.). Smaller shrubs include copperburrs (*Sclerolaena muricata, Sclerolaena tricuspis* and *Sclerolaena bicornis*) and annual saltbushes (*Atriplex lindleyi, Atriplex leptocarpa*). The sparse ground cover contains native forbs such as paper daisies (Rhodanthe spp.), *Minuria cunninghamii*, and *Calotis scabiosifolia* var. *scabiosifolia* and grasses such as Austrodanthonia caespitosa. Often contains a very high cover of weed species including *Hordeum* spp., *Bromus* spp., *Vulpia* spp., Medicago spp., *Avena fatua* and *Lolium perenne*.
Description within Subject Land	PCT 164 is the most extensively occurring PCT across the Subject Land. The community presents s an open chenopod shrubland, dominated by *Maireana aphylla* (cotton bush) and the grasses, *Rytidosperma caespitosum, Sporobolus caroli* and *Austrostipa scabra.* A mix of characteristic forbs and small shrubs were also present. Soils were grey, brown and red-brown cracking clay and clay loam. PCT 164 was variable across the site, and it is likely that this variation is in constant flux due to grazing regimes. Areas were sometimes hard to distinguish from the grassland PCTs (PCT 44 and PCT 46). PCT 44 however tends to occur on red-brown clays with scalds, so it was only these areas that were mapped as PCT 44. PCT 46 is typically dominated by *Enteropogon acicularis*, which was only found to be dominant in a few small areas of the site (which were mapped as PCT 46). PCT 164 was also at times difficult to distinguish from PCT 163, in areas containing Dillon Bush. In general, any areas with a regular occurrence of Dillon Bush were mapped as PCT 163.
Associated species present	Eastern Flat-top Saltbush (*Atriplex lindleyi*), Bladder Saltbush (*Atriplex vesicaria*), Pale Beauty-heads (*Calocephalus sonder*i), *Calotis scabiosifolia*, Canegrass (*Eragrostis australasica*), Wooly Buttons (*Leiocarpa panaetioide*s), Cotton Bush (*Maireana aphylla*), Hairy Bluebush (*Maireana pentagona*), Soft Horns (*Malacocera tricornis*), Bush Minuria (*Minuria cunninghamii*), Dillon Bush (*Nitraria billardiere*i), Thorny Saltbush (*Rhagodia spinescens*), *Rhodanthe stuartiana, Sclerolaena bicornis*, Short-winged Copperburr (*Sclerolaena brachyptera*), Black Rolypoly (*Sclerolaena muricata*), Giant Redburr (*Sclerolaena tricuspis*), Fairy Grass (*Sporobolus caroli*).
Vegetation Zones	One distinct condition state for areas mapped as PCT 164 occurs within the Subject Land, as outlined below: • Moderate condition, herein labelled as Vegetation Zone 9 (VZ9)

PCT 164 Cotton Bush open shrubland of the semi-arid (warm) zone



PHOTOGRAPH 9 PCT 164, VEGETATION ZONE 9

Haul Route

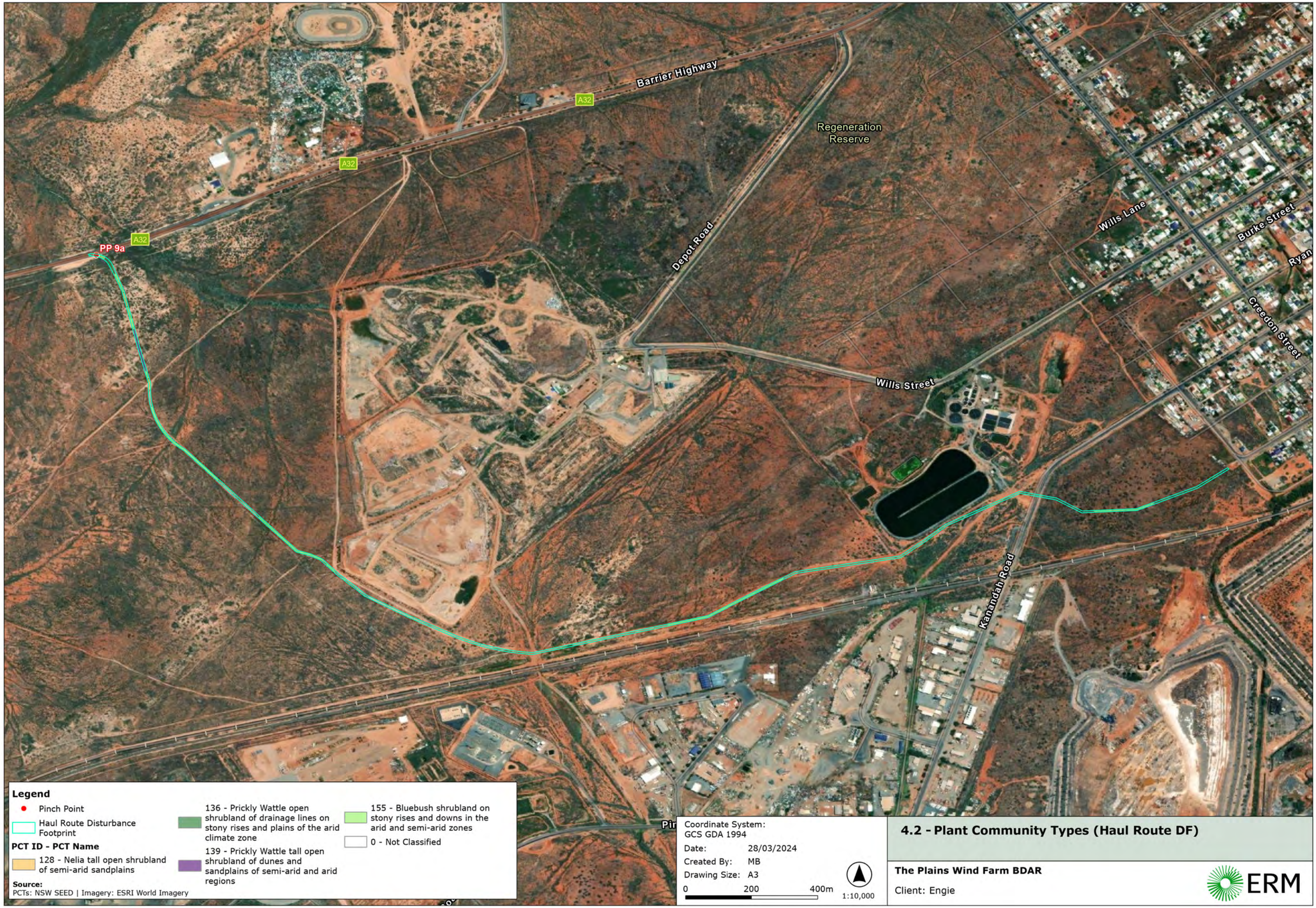
Vegetation within the Haul Route has been assessed as aligning with the SVTM (DPE, 2022a), including the BioNet Vegetation Classification PCTs identified within Table 4-12. Extent is shown in Figure 4-2.

Under the streamlined assessment module for small area developments, the dominant PCT on the site is identified and input into the BAM-C. PCT 155 is identified as the dominant PCT for the Haul Route DF, making up 79% of the mapped native vegetation. Total area for the dominant PCT has been input as 0.67 ha to capture the total impact to native vegetation as a result of the Haul Route DF.

It is noted only one location along the Haul Route, associated with PP09C (Haul Route DF), is consistent with the BioNet Vegetation Classification of PCTs. The remaining pinch points, PP10A, PP10B and PP11, present as disturbed urban environments as discussed in Appendix B.

TABLE 4-12 PLANT COMMUNITY TYPES (HAUL ROUTE DF)

PCT ID	PCT Name	Area (ha)
128	Nelia tall open shrubland of semi-arid sandplains	0.02
136	Prickly Wattle open shrubland of drainage lines on stony rises and plains of the arid climate zone	0.04
139	Prickly Wattle tall open shrubland of dunes and sandplains of semi-arid and arid regions	0.08
155	Bluebush shrubland on stony rises and downs in the arid and semi-arid zones	0.53
	Total Area	0.67



4.2 - Plant Community Types (Haul Route DF)

The Plains Wind Farm BDAR

Client: Engie

ERM

0667692_PlainsWF_BDAR_R02.aprx

4.1.6 THREATENED ECOLOGICAL COMMUNITIES

Four (4) EPBC Act Threatened Ecological Communities (TECs) were identified as part of the desktop assessment in the Protected Matters Search Tool (Appendix H) as having the potential to occur within the Subject Land. An additional five (5) TECs listed under either the BC Act and/ or EPBC Act have the potential to occur based on their association with PCTs. These communities are presented in Table 4-13.

Based on field verification surveys undertaken across the Subject Land, one (1) TEC is identified as occurring within the Subject Land. This is further discussed in Section 4.1.6.1.

TABLE 4-13 THREATENED ECOLOGICAL COMMUNITIES INVESTIGATION (SUBJECT LAND)

TEC	BC Act	EPBC Act	Associated PCT	Recorded within the Subject Land
Acacia loderi shrublands	Endangered	-	PCT 153	No – No form of *Acacia* shrublands recorded across the Subject Land
Acacia melvillei Shrubland in the Riverina and Murray-Darling Depression Bioregions	Endangered	-	PCT 28	No - No form of *Acacia* shrublands recorded across the Subject Land
Artesian Springs Ecological Community in the Great Artesian Basin	Critically Endangered	-	PCT 24, 163	No – Subject Land is situated outside distribution, TEC is restricted to north-western NSW.
Buloke Woodlands of the Riverina and Murray-Darling Depression Bioregions	-	Endangered	-	No - No associated PCTs nor record of key diagnostic species, Buloke, recorded across Subject Land.
Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of Southeastern Australia	-	Endangered	-	No – No associated PCTs nor key diagnostic species, Grey Box (*Eucalyptus microcarpa*), recorded across Subject Land.
Natural Grasslands of the Murray Valley Plains	-	Critically Endangered	PCT 44, 46	No – Further discussed in section 4.1.6.2.
Plains mallee box woodlands of the Murray Darling Depression, Riverina and Naracoorte Coastal Plain Bioregions	-	Critically Endangered	-	No - No associated PCTs nor mallee box woodland communities recorded across Subject Land.
Sandhill Pine Woodland in the Riverina, Murray-Darling Depression and NSW South Western Slopes bioregions	Endangered	-	PCT 28	Yes - further discussed in Section 4.1.6.1.

TEC	BC Act	EPBC Act	Associated PCT	Recorded within the Subject Land
Weeping Myall Woodlands	-	Endangered	-	No - No associated PCTs nor key diagnostic species, Weeping Myall (*Acacia pendula*), recorded across Subject Land.

4.1.6.1 SANDHILL PINE WOODLAND IN THE RIVERINA, MURRAY-DARLING DEPRESSION AND NSW SOUTH WESTERN SLOPES BIOREGIONS

The Sandhill Pine Woodland in the Riverina, Murray-Darling Depression and NSW Southwestern Slopes bioregions TEC (Sandhill Pine Woodland TEC) is listed as 'Endangered' under the BC Act and has been identified within the Subject land.

The TEC is generally characterised by an open tree stratum dominated by White Cypress Pine, *Callitris glaucophylla.* The canopy stratum may be reduced to isolated individuals or be completely absent as a result of past grazing and clearing history. Less abundant trees or tall shrubs are characteristic of the community, such as yarran (*Acacia melvillei*), *Acacia oswaldii*, buloke (*Allocasuarina luehmannii*), slender cypress pine (*C. gracilis subsp. murrayensis*), drooping sheoak (*A. verticillata*), needlewood (*Hakea leucoptera*), hooked needlewood (*H. tephrosperma*), sugarwood (*Myoporum platycarpum*), western rosewood (*Alectryon oleifolius subsp. canescens)*, emu bush (*Eremophila longifolia*), wilga (*Geijera parviflora*) and butterbush (*Pittosporum angustifolium*). A high degree of variation is seen amongst stratum species and is heavily dependent on environmental conditions, grazing pressures and land use or disturbance histories.

The Sandhill Pine Woodland TECs distribution is strongly associated with the red-brown loamy sands with alkaline sub-soils on the alluvial plain of the Murray River and its tributaries and parts of the sandplain in south-western NSW. The TEC has been recorded in the far south-western region of the NSW South Western Slopes bioregion, extending through the Riverina Bioregion and into the southern part of the Murray-Darling Depression bioregion, as far south as the South Australian border.

Within the Subject Land, the BC Act listed TEC has been assessed against the 0.69 ha of PCT 28 – White Cypress Pine open woodland of sand plains, prior streams and dunes mainly of the semi-arid (warm) climate zone present.

To be considered part of the BC Act listed TEC, patches must meet the key characteristics as discussed in Table 4-14, as per the field identification guidelines published by DECCW NSW, 2010.

TABLE 4-14 SANDHILL PINE WOODLAND TEC ASSESSMENT

Key Characteristic	Response
Is the site in the Riverina, Murray-Darling Depression or NSW South Western Slopes bioregions?	Yes – Subject Land is within the Riverina Bioregion
Is the vegetation an open woodland, or a derived grassland with scattered or no trees?	Yes – Areas of PCT 28 within the Subject Land display as a derived grassland with scattered mid and upper stratum species

Key Characteristic	Response
Does the tree layer, if present, contain any of the following: white cypress pine, slender cypress pine?	No – *Callitris* species are not present within Areas of PCT 28
Does a small tree or tall shrub layer, if present, contain any of the following: sugarwood, western rosewood, buloke, drooping sheoak, needlewood, hooked needlewood, berrigan/butterbush?	Yes – western rosewood (*Alectryon oleifolius subsp. canescens*), Hooked Needlewood (*Hakea leucoptera*), and berrigan/butterbush (*Eremophila longifolia*) are present within areas of PCT 28 in the Subject Land.
Does a shrub layer, if present, contain any of the following: *Dodonaea viscosa* subsp. *angustifolia,* ruby saltbush, black roly-poly, black bluebush, thorny saltbush, *Calytrix tetragona, Banksia marginata?*	Yes –thorny saltbush (*Rhagodia spinescens*) and black roly-poly (*Sclerolaena muricata*) are present within areas of PCT 28 in the Subject Land.
Determination of presence	**Present**

All areas of the associated PCT (PCT 28) within the Subject Land and The Plains Wind Farm Project Area have been found to conform with the Sandhill Pine Woodland TEC. Based on the vegetation integrity plots completed and observations made within the Subject Land, the VI score for PCT 28 is 35.3, representing low condition. The community present lacks the key diagnostic canopy species and is made up of a sparse collection of scattered trees and shrubs, including indicative species, Western Rosewood, Hooked Needlewood and Berrigan. PCT 28 also covers areas of The Plains Wind Farm Project Area, where canopy species *Callitris glaucophylla* is present and dominates the upper stratum. Vegetation integrity plots completed in patches outside the Subject Land resulted in a VI score of 45. Areas of higher VI score containing intact canopy layer have been avoided by the Project.

4.1.6.2 NATURAL GRASSLANDS OF THE MURRAY VALLEY PLAINS

The Natural Grasslands of the Murray Valley Plains TEC is listed as 'Critically Endangered' under the EPBC Act and at current, has no associated TEC under the BC Act. A substantial part of the ecological community lies within Victoria, in which it is listed under the *Flora and Fauna Guarantee Act* (FFG Act) as the threatened Northern Plains Grassland ecological community and this listing does not extend into the Murray-Darling Depression IBRA Bioregion.

The TEC is characterised by native perennial tussock grasses with broad-leaved herbs interspersed between the tussocks and a lack of woody vegetation. The ecological community may display as a herb or forbland depending on seasonal conditions and forbs may be in equal or higher abundance to grasses. Soils on which the ecological community occurs is mostly restricted to heavy-textured grey, brown and red clays (TSSC 2012).

The Conservation Advice for the community (TSSC 2012) details that within RIV2 (Murrumbidgee) IBRA Subregions it is possible to distinguish the natural grasslands ecological community from derived grasslands, as follows:

- The patch should contain at least as many, preferably more, of the species in Table 1(A) than in Table 1(B) presented within the Listing Advice; and
- The species in Table 1(A) are characteristic of the natural grasslands ecological community and not derived grasslands, and the opposite applies to Table 1(B).

Based on field surveys undertaken to date, no species from Table 1(A) have been identified, with species listed in Table 1(B) recorded in each BAM plot situated within the associated PCT (PCT 44) as presented in Table 4-15. Further assessment against key diagnostic features is provided in Table 4-16.

The Natural Grasslands of the Murray Valley Plains TEC is not considered to occur within the Subject Land.

TABLE 4-15 SPECIES ASSESSMENT NATURAL GRASSLANDS OF THE MURRAY VALLEY PLAINS TEC

BAM Plot ID	Table 1(A) species recorded	Table 1(B) species recorded
23.24.W	-	*Austrostipa scabra, Chenopodium nitrariaceum, Eragrostis australasica, Podolepis muelleri*
23.25.W	-	*Austrostipa scabra, Chenopodium nitrariaceum, Rumex tenax, Scleroleana stelligera*
23.26.W	-	*Austrostipa scabra, Chenopodium nitrariaceum, Rumex tenax.*
23.28.W	-	*Austrostipa scabra, Rumex tenax, Sida intricata,*
23.29.W	-	*Zygophyllum glaucum.*

TABLE 4-16 NATURAL GRASSLANDS OF THE MURRAY VALLEY PLAINS TEC ASSESSMENT

Key Characteristic	Response
In the Riverina Bioregion, Murray Darling Depression Bioregion or NSW South Western Slopes Bioregion?	**Yes,** Subject Land is within the Riverina Bioregion
On a landscape of flat alluvial lowland plains with heavy-textured grey, brown and red clays?	**Yes**, landscape across the Subject Land consists of red clays
Characteristic genera are present: Grasses – *Rytidosperma, Austrostipa, Chloris* and *Enteropogon* species Forbs – *Arthropodium, Bulbine, Calotis, Chrysocephalum, Leptorhynchos, Minuria, Ptilotus, Rhodanthe, Sida* and *Swainsona* species Small shrubs - *Atriplex* and *Maireana* species	**Yes**, grass species of *Austrostipa*, *Rytidosperma caespitosa*, forbs of *Sida* species present.
Trees and large shrubs >1 m are generally absent to sparse?	**Yes**, trees absent and shrubs <1 m
Presence or past records of 'diagnostic' indicator fauna species such as the Plains-wanderer, Striped Legless Lizard, Hooded Scaly-foot or Curl Snake within the patch?	**Yes**, indicator species Plains-wanderer present
The following applies to grasslands occurring in NSW in the Murrumbidgee IBRA subregion:	
There are more species present from Table 1(A) than in Table1(B)?	**No**

Key Characteristic	Response
Is there reliable evidence that a patch was once a woodland or shrubland with > 10% cover of trees and shrubs > 1 m? (If yes, patch is not considered part of the ecological community)	**No,** grassland community present is likely a derived form of chenopod shrublands <1m.
Soil type and landscape position corresponds with the ecological community and not other vegetation types?	**No**
Determination of Presence	**Not Present**

Haul Route

Three (3) PCTs mapped on the SVTM (DPE, 2022a) within the Haul Route DF have potential to be associated with TECs listed as Endangered under the BC Act. These include:

- *Acacia loderi* shrublands (PCT 155, 128 ,139);
- *Acacia melvillei* Shrubland in the Riverina and Murray-Darling Depression bioregions (PCT 128).

Acacia loderi shrublands are a community dominated by the tall shrub or small trees, *Acacia loderi* with a low, diverse understorey dominated by chenopod sub-shrubs, herbs and grasses. Other tree species may occur in association with *Acacia loderi.* During the field survey event, rapid vegetation assessments were conducted across the entirety of the Haul Route to identify vegetation present. No occurrences of *Acacia loderi* were recorded, nor communities dominated by the species.

Acacia melvillei Shrubland in the Riverina and Murray-Darling Depression bioregions is a community dominated by *Acacia melvillei*, typically occupying sandhills and undulating sandplains in south-western NSW. The communities shrub/tree layer is dominated by *Acacia melvillei,* either in pure stands or with a range of other less abundant trees or tall shrubs. During the field survey event, rapid vegetation assessments were conducted across the entirety of the Haul Route to identify vegetation present. No occurrences of *Acacia melvillei* were recorded, nor communities dominated by the species.

Based on field verification surveys, occurrences of *Acacia loderi* and *Acacia melvillei* are not present. The vegetation observed does not conform to any TECs listed.

4.1.7 VEGETATION ZONES

Vegetation Zones across the Subject Land were identified and delineated based on confirmed PCTs with similar levels of disturbance to growth form groups and/or extent of exotics. Nine (9) VZ's were identified based on field reconnaissance and 45 BAM plots undertaken in accordance with the BAM. Each PCT was found to present in a single condition state, details are provided below:

- Zone 1 – PCT 13 of moderate condition;
- Zone 2 – PCT 17 of moderate condition;
- Zone 3 – PCT 24 of moderate condition;
- Zone 4 – PCT 28 of low condition;
- Zone 5 – PCT 44 of moderate condition;
- Zone 6 – PCT 153 of moderate condition;

- Zone 7 – PCT 157 of moderate condition;
- Zone 8 – PCT 163 of moderate condition; and
- Zone 9 – PCT 164 of moderate condition.

Details on Subject Land vegetation zones and BAM plot requirements are provided in Table 4-17.

In accordance with the streamlined assessment module for small area developments, the dominant PCT for the Haul Route DF is identified as PCT 155. In the absence of plot-based data, a single VZ has been applied to the PCT, using the precautionary principal to assign high condition, as follows:

- Zone 10 – PCT 155 of high condition.

This is automatically populated in the Haul Route DF BAM-C as Vegetation Zone 1; however, is referred to as Vegetation Zone 10 throughout this report.

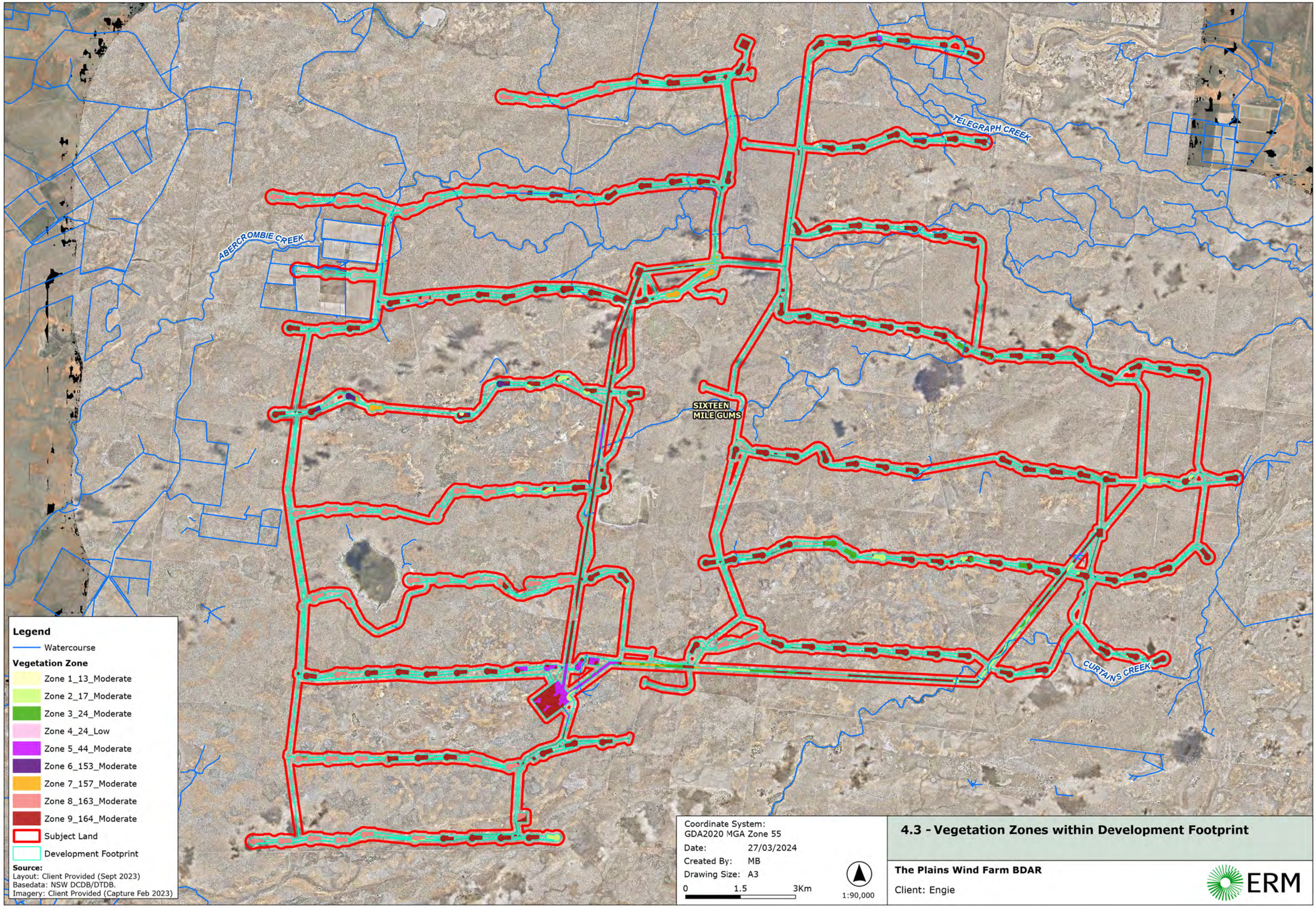
4.1.7.1 PATCH SIZE

Patch size of each vegetation zone was determined based on BAM Subsection 4.3.1. Patch sizes were assigned to vegetation zones within the Subject Land and Haul Route DF using ArcGIS to select boundaries depicted in the vegetation mapping for the site and aerial imagery. In accordance with the BAM, patch size area was assigned to each vegetation zone as a class, being < 5ha, 5–24 ha, 25–100 ha or ≥ 100 ha. The patch size for all zones was ≥ 100 ha. The patches extend onto adjoining land beyond the footprint of the Subject Land and Haul Route DF. Patch size of each vegetation zone were determined to be greater than 100 ha, the maximum patch size to be entered into the BAM-C.

TABLE 4-17 VEGETATION ZONES AND PATCH SIZES WITHIN THE SUBJECT LAND

Vegetation zone ID	PCT ID	Condition/ other defining feature	Area (ha) in Development Footprint	Patch size class	No. vegetation integrity plots required	No. vegetation integrity plots completed/used in assessment	Plot IDs of vegetation integrity plots used in assessment
VZ1	13	Moderate	2.01	>100 ha	2	2	2022.11 2022.16
VZ2	17	Moderate	87.09	>100 ha	5	7	2022.49 2022.52 2022.53 23.05.S 23.31.S 23.38.S 23.40.S
VZ3	24	Moderate	57.33	>100 ha	5	6	23.23.W 23.01.S 23.03.S 23.12.S 23.32.S 23.39.S
VZ4	28	Low	0.69	>100 ha	1	1	2023.100
VZ5	44	Moderate	73.63	>100 ha	5	5	23.24.W 23.25.W 23.26.W 23.28.W 23.29.W
VZ6	153	Moderate	18.48	>100 ha	3	3	2022.14 2022.73 2022.79

Vegetation zone ID	PCT ID	Condition/ other defining feature	Area (ha) in Development Footprint	Patch size class	No. vegetation integrity plots required	No. vegetation integrity plots completed/used in assessment	Plot IDs of vegetation integrity plots used in assessment
VZ7	157	Moderate	48.41	>100 ha	3	4	2022.12 2022.50 2022.70 23.02.S
VZ8	163	Moderate	392.68	>100 ha	6	7	2022.20 2022.21 23.07.S 23.11.S 23.33.S 23.34.S 23.35.S
VZ9	164	Moderate	1,285.02	>100 ha	8	10	2022.07 2022.08 2022.10 2022.22 2022.29 2022.51 2022.64 2022.69 2022.72 2022.80



4.3 - Vegetation Zones within Development Footprint

The Plains Wind Farm BDAR

Client: Engie

ERM

0667692_PlainsWF_BDAR_R02.aprx



4.4 - Vegetation Zones (Haul Route DF)

The Plains Wind Farm BDAR

Client: Engie

ERM

0667692_PlainsWF_BDAR_R02.aprx

4.1.8 VEGETATION INTEGRITY SCORES

The vegetation integrity score (VIS) is calculated in the online BAM Calculator (BAM-C) using the BAM plot data (i.e., composition, structure and function values (Appendix H) for each vegetation zone mapped within the Subject Land. The relevant BAM-C workings are summarized in Table 4-19.

TABLE 4-18 VEGETATION INTEGRITY SCORES

Vegetation zone ID	Composition condition score	Structure condition score	Function condition score	Vegetation integrity score	Hollow bearing trees present?
VZ1	60.3	81.4	27.1	51.1	Present
VZ2	71.1	88.2	-	79.2	-
VZ3	69.3	33	-	47.8	-
VZ4	100	100	4.4	35.3	-
VZ5	82.5	87	-	84.7	-
VZ6	99.7	71.8	-	84.6	-
VZ7	41.8	83.9	-	59.2	-
VZ8	59.9	98.7	-	76.9	-
VZ9	79.7	93.7	-	86.4	-

As plot-based assessments were not required for the Haul Route DF, the precautionary principal has been applied. High condition and a VIS of 100 was assigned to all vegetation present as provided in Table 4-19.

TABLE 4-19 HAUL ROUTE VEGETATION INTEGRITY SCORES

Vegetation zone ID	Composition condition score	Structure condition score	Function condition score	Vegetation integrity score	Hollow bearing trees present?
VZ10	100	100	-	100	-

4.2 BIRD COMMUNITY COMPOSITION

4.2.1 HABITAT

A relatively homogenous landform characterises the Subject Land (i.e., plain) and, with relatively consistent variation in vegetation structure (i.e., scattered low chenopod shrubs and tussocky groundcover), represent the main factors in defining bird habitat and associated composition. Dry chenopod shrublands and grasslands define that habitat values of the Subject Land, with the availability of water resources being seasonal and typical of a semi-arid climate.

The sparse occurrence of woody vegetation (i.e., trees and/or tall shrub canopy strata) means that many bird species reliant on hollows and/or tree canopies as part of their lifecycle are likely to have a patchy distribution aligned with drainages lined with Black Box or isolated sandy rises where remnant trees may occur. Similarly, water dependent species are also rare to absent as the flat plain that charactersies the Subject Land is generally dry with inundation being periodic and limited to lands with low relief.

Non-passerine bird species (birds not within the order Passeriformes) are most likely to benefit from the prevailing habitat characteristics of the Subject Land. Species likely to be observed include raptors, quails and allies, pigeons and doves, cockatoos and parrots, swifts and Emu. If observed, non-passerine species reliant on microhabitat offered by areas of wetland or a tree canopy would likely be transient such as grebes, pelicans and allies, herons and allies, ducks and allies, waders and gulls, cuckoos and kingfishers.

Smaller and/or generalist passerine species most likely to be observed in the Subject Land include crows, ravens, magpies, wrens and pipits. The presence of anthropogenic features such as fencelines, posts and dams would provide localised favourable conditions for some smaller passerine species such as larks, robins, wagtails, thornbills and finches. Non-passerine granivores such as parrots would also benefit from the presence of closed depressions like farm dams.

While trees and tall shrubs that typically support the lifecycle of passerine species do occur in the locality, the habitat that these features offer are typically restricted to proximal drainages located outside the Subject Land. Thus, passerine bird species that do occur in the Subject Land are either likely to have large home ranges (i.e., highly mobile) or are present in areas where tree cover is located nearby.

4.2.1.1 RESIDENT RAPTOR HABITAT

As per Section 6.1.5 of the BAM, the likely habitat for resident raptor species has been determined. This aligns with broad habitat types identified across the landscape. Broad habitat types have been grouped based on Keith (2004) vegetation class as presented in Table 4-20 . Woodland habitat has been observed to support resident raptor nesting sites, and as discussed in Section 4.2.2 relatively high levels of raptor activity. Avian activity was observed to dissipate in relation to proximity of woodland patches, with a decline in abundance evident at survey sites >300 m from a woodland patch. The highly mobile raptor species are likely to utilise remaining grassland, shrubland and non-native vegetation habitat across the site to support foraging behaviours.

As all habitat across the Subject Land conforms with raptor habitat, resident raptors are anticipated to inhabit the entirety of the site.

TABLE 4-20 RAPTOR HABITAT TYPES

Broad Habitat Type	Vegetation Class (Keith 2004)	Extent in Subject Land (ha)	Extent in Development Footprint (ha)
Woodlands	Inland Floodplain Woodland	16.84	2.01
	Riverine Sandhill Woodlands	3.24	0.69
Grasslands	Riverine Plain Grasslands	226.23	73.63
Shrublands	Inland Floodplain Shrublands	610.67	144.42
	Aeolian Chenopod Shrublands	3.67	0
	Riverine Chenopod Shrublands	1955.34	459.57
Non-native Vegetation	Non-native Vegetation	139.90	31.69

4.2.2 SPECIES COMPOSITION

A systematic bird survey dataset across four seasons has been obtained from 29 sites sampled throughout The Plains Wind Farm Project Area. Analysis indicates that bird community composition varies principally by season and not spatially throughout the Subject Land as shown in Chart 4-1.

Seasonal migrants (i.e., local, regional and nomadic) strongly influence bird community composition across the year. This pattern is evident in Chart 4-, as bird community composition is distinctly different in winter to the other three seasons.

Winter typically comprises resident species with some regional migrants. Frequently encountered species found in all seasons include the Galah (*Eolophus roseicapilla*), Magpie (*Gymnorhina tibicen*), Raven (*Corvus spp.*), Nankeen Kesteel (*Falco cenchroides*) and Black Kite (*Milvus migrans*). At this time of year, the White-fronted Chat (*Epthianura albifrons*, listed as Vulnerable under the BC Act), a sedentary species with a tendency for nomadic movement, is widespread throughout The Plains Wind Farm Project Area, with incidence during its breeding period more associated with drainages (i.e., August to March). Omnipresent raptors such as the Wedge-tailed Eagle (*Aquila audux*) are less frequently observed in winter than in other months but are always observed.

Chart 4- shows a spectrum in bird community composition from spring to autumn (as indicated by the overlap between seasonal sample sites), reflective of change in migratory and/or nomadic bird movement. Spring heralds the start of regional migrants entering the Subject Land, with peak incidence occurring in late summer to autumn. Migrants move into and out of the Subject Land during this period and quickly leave the Subject Land altogether in winter.

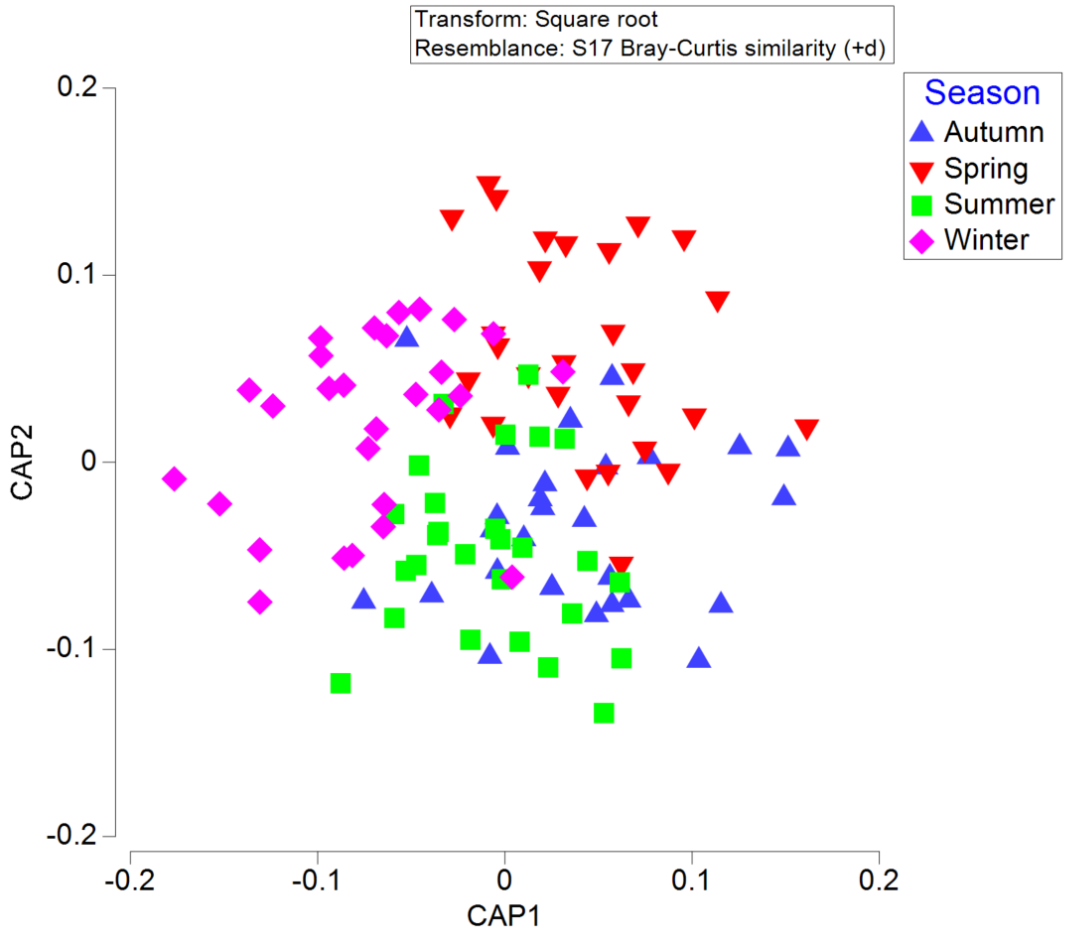


CHART 4-3 TWO DIMENSIONAL ORDINATION OF BUS SITES BY SEASON (CAP)

Species composition across the Subject Land is predominantly characterised by non-passerine species including raptor species with generalist passerines such as ravens (Little and Australian Ravens) and Australian Magpie also prominent. Hollow and/or tree canopy dependent species are typically absent.

Bird community composition across the Subject Land is strongly influenced by distance to woody vegetation (i.e., vegetation structure) as indicated in Chart 4-5. Lands within 50 m of woody vegetation (i.e., Group 1 in Chart 4-5) are likely to comprise birds such as the Noisy Minor (*Manorina melanocephala*), Galah (*Eolophus roseicapilla*), Magpie (*Gymnorhina tibicen*), Nankeen Kestrel (*Falco cenchroides*), Crested Pigeon (*Ocyphaps lophotes*), Red-rumped Parrot (*Psephotus haematonotus*), Willie Wagtail (*Rhipidura leucophrys*), Eastern Bluebonnet (*Northiella haematogaster*) and Southern Whiteface (*Aphelocephala leucopsis*).

The Wedge-tailed Eagle (*Audax aquila*) and Black Kite (*Milvus migrans*) are also more frequently observed nearer woody vegetation than elsewhere in the Subject Land, although both are highly mobile and also occur elsewhere less frequently within the Subject Land. Ravens (*Corvus spp*.) appear to be omnipresent throughout the landscape, thus not strongly influenced by the presence (or absence) or woody vegetation.

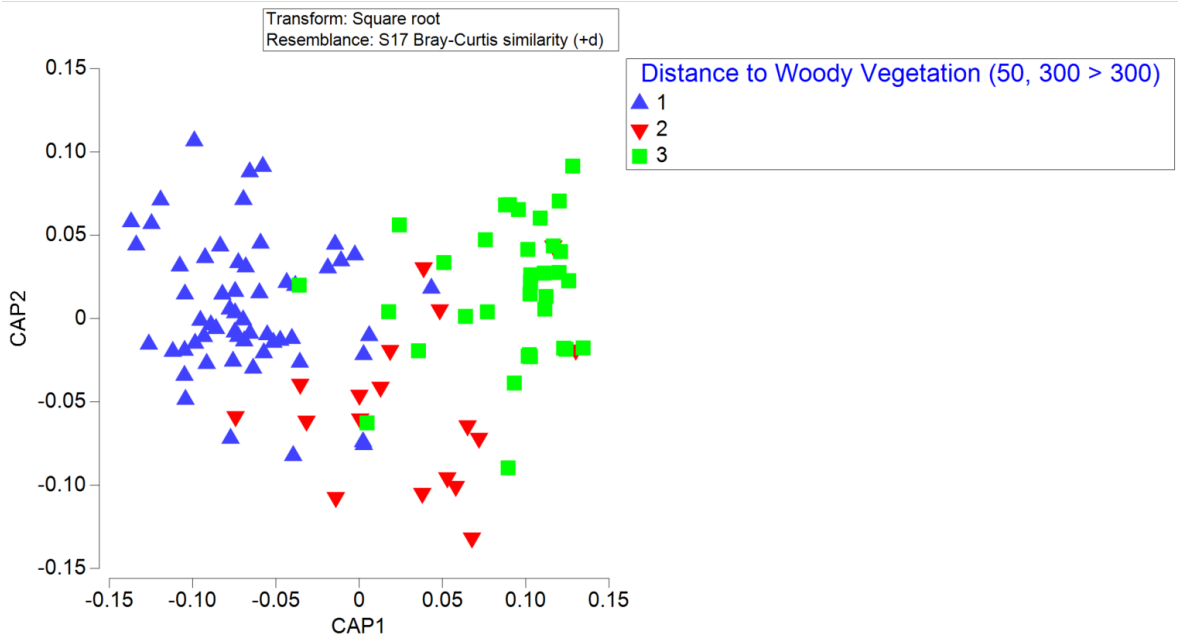


CHART 4-4 TWO DIMENSIONAL ORDINATION OF BUS SITES BY DISTANCE TO WOODY VEGETATION (CAP) (<50M, 50-300M AND >300M)

Species more likely to be observed at greater distances to woody vegetation (i.e., 50 - 300m; Group 2) appear increasingly reliant on habitat provided by the chenopod shrublands and grasslands with vegetation heights <1 m. This includes the Brown Songlark (*Cincloramphus cruralis*), Australasian Pipit (*Anthus australis*), White-winged Fairywren (*Malurus leucopterus*) and Superb Fairywren (*Malurus cyaneus*).

While more commonly found nearer woody vegetation, the Galah (*Eolophus roseicapilla*), Nankeen Kestrel (*Falco cenchroides*), Noisy Miner (*Manorina melanocephala*) and Magpie (*Gymnorhina tibicen*) may also be seen using chenopod shrubland habitat up to 300m from woody vegetation, presumably as they move through the landscape and/or seasonally forage in these areas.

The Black Kite (*Milvus migrans*) and Brown Falcon (*Falco berigora*) are typically observed using chenopod habitat greater than 300m from woody vegetation. Ravens (*Corvus spp*.) will also be commonly seen in this part of the landscape.

The White-fronted Chat (*Epthianura albifrons*) is likely to occur in habitat greater than 300m from woody vegetation. The species breeds in open environments (not woody vegetation), where it occupies small home ranges during breeding (i.e., August to March). Breeding activity would therefore likely associate with relatively resource rich parts of the landscape at this time such as drainages where woody vegetation is largely absent. In this landscape this is likely to align with patches of Lignum and Canegrass vegetation.

4.2.3 BIRD AND BAT ADAPTIVE MANAGEMENT PLAN

A Bird and Bat Adaptive Management Plan (BBAMP) will be prepared for the Project. The BBAMP will aim to minimise and manage the impact of operation of the WTGs associated with the proposed development on birds and bats that occur within the vicinity of the wind farm. The BBAMP further aims to enable the implementation of a long-term approach to the mitigation and management of potential impacts on listed threatened and migratory species. Monitoring will also be integrated into the BBAMP, to identify any potential changes to the species' utilisation of the project site and the surrounding landscape. The BBAMP is discussed in Section 7.1.4.

5. HABITAT SUITABILITY FOR THREATENED SPECIES

5.1 HABITAT SUITABILITY

Ecosystem credit species are threatened species whose occurrence can generally be predicted by vegetation surrogates and/or landscape features, or that have a low probability of detection using targeted surveys. The TBDC identifies the threatened species assessed for ecosystem credits. A targeted survey is not required to identify or confirm the presence of ecosystem credit species.

'Species credit species', also referred to as 'Candidate species', are threatened species for which vegetation surrogates and/or landscape features cannot reliably predict the likelihood of their occurrence. These species are identified in the TBDC. A targeted survey or an expert report is required to confirm the presence or absence of these species on the Subject Land. Alternatively, for a development, activity, clearing or biodiversity certification proposal only, the Applicant may elect to assume the species is present.

In some circumstances the TBDC may identify a threatened species that requires assessment for ecosystem credits and species credits (referred to as dual credit species). For dual credit species, part of the habitat is assessed as a species credit (e.g., breeding habitat or land mapped on an important habitat map for a species). The remaining habitat components for the species are assessed as an ecosystem credit (e.g., foraging habitat).

Under the streamlined assessment module for small area developments, applied only to the Haul Route DF, determination of the suite of threatened species likely to occur on or use the site is required according to Section 5.2.1 and 5.2.2 of the BAM. However, further assessment and survey in accordance with Section 5.2.3, 5.2.4, 5.2.5 and 5.2.6 is only required for candidate species credit species identified for the proposal at risk of an SAII.

For a small number of threatened species, a habitat constraint may refer to a mapped location (Important Mapped Area) that identifies areas that are considered important for those species. Currently available are Important Mapped Areas for the Swift Parrot (*Lathamus discolor*), Curlew Sandpiper (*Calidris ferruginea*) and Plains-wanderer (*Pedionomus torquatus*). These maps have been reviewed and it has been determined that no Important Mapped Areas are present within the Haul Route DF, and the Subject Land does not form part of the Swift Parrot or Curlew Sandpiper important habitat mapping. However, Important Mapped Areas for the Plains-wanderer are present within the Subject Land. In this instance, the Plains-wanderer is considered to occur within the Subject Land and targeted surveys are not required.

The following sections identify the ecosystem credit species, species credit species, SAII and dual credit species relevant to this BDAR.

5.1.1 ECOSYSTEM CREDIT SPECIES

The ecosystem credit species predicted to occur on or use the Subject Land as advised by the BAM-C are listed in Table 5-1 , and those predicted to occur on or use the Haul Route DF as advised by the BAM-C are listed in Table 5-2.

Two (2) ecosystem credit species have been excluded from further assessment across the Subject Land. The Painted Honeyeater (*Grantiella picta*) is excluded as the species has a listed habitat constraint, preferring habitat with Mistletoe present at an abundance of 5 individuals per hectare. Based on field survey verification, habitat within the Subject Land does not meet this constraint. The Regent Parrot (eastern subspecies) (*Polytelis anthopeplus monarchoides*) has been excluded as the species has a listed geographic limitation, the Subject Land is not situated within 10 km of the junction of the Murray River.

TABLE 5-1 PREDICTED ECOSYSTEM CREDIT SPECIES (SUBJECT LAND)

Common name	Scientific name	BC Act Listing status	EPBC Act Listing status	Species retained for further assessment	Associated PCT	Sensitivity to gain class
Magpie Goose	*Anseranas semipalmata*	V	-	Yes	24, 163	Moderate
Dusky Woodswallow	*Artamus cyanopterus cyanopterus*	V	-	Yes	13, 17, 24, 28, 44, 153, 157, 160, 163, 164	Moderate
Australasian Bittern	*Botaurus poiciloptilus*	E	E	Yes	13, 24, 17	Moderate
Curlew Sandpiper (Foraging)	*Calidris ferruginea*	E	CE	Yes	24	High
Pied Honeyeater	*Certhionyx variegatus*	V	-	Yes	13, 24, 28, 153, 163	Moderate
Little Pied Bat	*Chalinolobus picatus*	V	-	Yes	13, 17, 24, 28, 163, 157, 163, 164	High
Spotted Harrier	*Circus assimilis*	V	-	Yes	13, 17, 24, 28, 44, 153, 157, 163, 164	Moderate
Varied Sittella	*Daphoenositta chrysoptera*	V	-	Yes	13, 28	Moderate
White-fronted Chat	*Epthianura albifrons*	V	-	Yes	17, 24, 44, 153, 157, 153, 163, 164	Moderate
Grey Falcon	*Falco hypoleucos*	V	V	Yes	13, 17, 24, 28, 44, 153, 157, 163, 164	Moderate
Black Falcon	*Falco subniger*	V	-	Yes	13, 17, 24, 28, 44, 153, 157, 163, 164	Moderate

Common name	Scientific name	BC Act Listing status	EPBC Act Listing status	Species retained for further assessment	Associated PCT	Sensitivity to gain class
Painted Honeyeater	*Grantiella picta*	V	V	No	13, 28	Moderate
Brolga	*Grus rubicunda*	V	-	Yes	13, 17, 24, 163	Moderate
White-bellied Sea-Eagle (Foraging)	*Haliaeetus leucogaster*	V	-	Yes	13, 17, 15, 24, 28, 44, 153, 157, 163, 164	High
Little Eagle (Foraging)	*Hieraaetus morphnoides*	V	-	Yes	13, 17, 24, 28, 44, 153, 157 , 163, 164	Moderate
White-throated Needletail	*Hirundapus caudacutus*	-	V	Yes	13, 17, 24, 44, 157	High
Swift Parrot (Foraging)	*Lathamus discolor*	E	CE	Yes	13, 24	Moderate
Major Mitchell's Cockatoo (Foraging)	*Lophochroa leadbeateri*	V	-	Yes	13, 28, 153, 163	Moderate
Square-tailed Kite (Foraging)	*Lophoictinia isura*	V	-	Yes	13, 28, 153	Moderate
Hooded Robin (south-eastern form)	*Melanodryas cucullata cucullata*	V	-	Yes	13, 28	Moderate
Barking Owl (Foraging)	*Ninox connivens*	V	-	Yes	13	High
Blue-billed Duck	*Oxyura australis*	V	-	Yes	24, 17	Moderate
Gilbert's Whistler	*Pachycephala inornata*	V	-	Yes	13, 28, 17	Moderate

Common name	Scientific name	BC Act Listing status	EPBC Act Listing status	Species retained for further assessment	Associated PCT	Sensitivity to gain class
Plains-wanderer (Foraging)	*Pedionomus torquatus*	E	CE	Yes	44	High
Regent Parrot (eastern subspecies) (Foraging)	*Polytelis anthopeplus monarchoides*	E	V	No	13	Moderate
Superb Parrot (Foraging)	*Polytelis swainsonii*	V	V	Yes	13, 28	Moderate
Grey-crowned Babbler (eastern subspecies)	*Pomatostomus temporalis temporalis*	V	-	Yes	13, 28	Moderate
Redthroat	*Pyrrholaemus brunneus*	V	-	Yes	24, 17, 153, 163	Moderate
Australian Painted Snipe	*Rostratula australis*	E	E	Yes	13, 17, 24	Moderate
Yellow-bellied Sheathtail-bat	*Saccolaimus flaviventris*	V	-	Yes	13, 17, 24, 28	High
Diamond Firetail	*Stagonopleura guttata*	V	-	Yes	13, 28, 44	Moderate
Freckled Duck	*Stictonetta naevosa*	V	-	Yes	13, 17, 24	Moderate
Western Blue-tongued Lizard	*Tiliqua occipitalis*	V	-	Yes	153	High
Masked Owl (Foraging)	*Tyto novaehollandiae*	V	-	Yes	13, 24	High
Inland Forest Bat	*Vespadelus baverstocki*	V	-	Yes	13, 28	High

TABLE 5-2 PREDICTED ECOSYSTEM CREDIT SPECIES (HAUL ROUTE DF)

Common name	Scientific name	Listing Status		Species likely to be retained for further assessment	Associated PCTs	Sensitivity to gain class
		BC Act	EPBC Act			
Kultarr	*Antechinomys laniger*	E	-	Yes	128, 136, 139, 150, 155	High
Dusky Woodswallow	*Artamus cyanopterus cyanopterus*	V	-	Yes	128, 136, 139, 150, 155	Moderate
Woma	*Aspidites ramsayi*	V	-	Yes	128, 136, 139, 155	High
Rufous Fieldwren	*Calamanthus campestris*	V	-	Yes	155	Moderate
Pied Honeyeater	*Certhionyx variegatus*	V	-	Yes	128, 136, 139, 155	Moderate
Little Pied Bat	*Chalinolobus picatus*	V	-	Yes	128, 136, 139, 150, 155	High
Spotted Harrier	*Circus assimilis*	V	-	Yes	128, 136, 139, 150, 155	Moderate
Wedgesnout Ctenotus	*Ctenotus brooksi*	V	-	Yes	128, 136, 139, 150, 155	High
White-fronted Chat	*Epthianura albifrons*	V	-	Yes	150, 155	Moderate
Grey Falcon	*Falco hypoleucos*	V	-	Yes	128, 136, 139, 150, 155	Moderate

Common name	Scientific name	Listing Status		Species likely to be retained for further assessment	Associated PCTs	Sensitivity to gain class
		BC Act	EPBC Act			
Black Falcon	*Falco subniger*	V	-	Yes	128, 139, 150, 155	Moderate
Little Eagle (foraging)	*Hieraaetus morphnoides*	V	-	Yes	128, 136, 139, 150, 155	Moderate
Forrest's Mouse	*Leggadina forresti*	V	-	Yes	136, 150, 155	High
Yellow-tailed Plain Slider	*Lerista xanthura*	V	-	Yes	128, 139	High
Pink Cockatoo (foraging)	*Lophochroa leadbeateri*	V	-	Yes	128, 136, 139, 150, 155	Moderate
Dusky Hopping-mouse	*Notomys fuscus*	E	V	Yes	136, 155	High
Flock Bronzewing	*Phaps histrionica*	E	-	Yes	139, 150, 155	High
Bolam's Mouse	*Pseudomys bolami*	E	-	Yes	155	High
Sandy Inland Mouse	*Pseudomys hermannsburgensis*	V	-	Yes	128, 136, 150, 155	High
Ringed Brown Snake	*Pseudonaja modesta*	E	-	Yes	128, 136, 150, 155	Moderate
Redthroat	*Pyrrholaemus brunneus*	V	-	Yes	136, 155	Moderate

Common name	Scientific name	Listing Status		Species likely to be retained for further assessment	Associated PCTs	Sensitivity to gain class
		BC Act	EPBC Act			
Long-haired Rat	*Rattus villosissimus*	V	-	Yes	136, 155	High
Stripe-faced Dunnart	*Sminthopsis macroura*	V	-	Yes	128, 136, 139, 150, 155	High

5.1.2 SPECIES CREDIT SPECIES

The species credit species (candidate species) identified by the BAM-C for the Subject Land are listed in Table 5-3 and Table 5-4, with candidate species identified by the BAM-C for the Haul Route DF being listed in Table 5-5.

TABLE 5-3 PREDICTED FLORA CANDIDATE SPECIES (SUBJECT LAND)

Common name	Scientific name	Listing status		Species retained for further assessment	Associated PCTs
		BC Act	EPBC Act		
A Spear Grass	*Austrostipa wakoolica*	E	E	Yes	17, 28
Claypan Daisy	*Brachyscome muelleroides*	V	V	No	13, 24, 44, 153, 157, 163, 164
Mossgiel Daisy	*Brachyscome papillosa*	V	V	Yes	13, 24, 44, 153, 157, 160, 163, 164
Sand-hill Spider Orchid	*Caladenia arenaria*	E	E	No	28
A burr-daisy	*Calotis moorei*	E	E	Yes	153, 157
Bindweed	*Convolvulus tedmoorei*	E	-	No	24, 44, 157, 160, 163, 164
Small Scurf-pea	*Cullen parvum*	E	-	Yes	44
Yellow Gum	*Eucalyptus leucoxylon* subsp. *pruinosa*	V	-	Yes	13, 24
Winged Peppercress	*Lepidium monoplocoides*	E	E	Yes	13, 153, 160, 163

Common name	Scientific name	Listing status		Species retained for further assessment	Associated PCTs
		BC Act	EPBC Act		
Lanky Buttons	*Leptorhynchos orientalis*	E	-	Yes	24, 44
Chariot Wheels	*Maireana cheelii*	V	V	Yes	44, 46, 157, 164
Austral Pillwort	*Pilularia novae-hollandiae*	E	-	No	13, 44,
Turnip Copperburr	*Sclerolaena napiformis*	E	E	Yes	44
Menindee Nightshade	*Solanum karsense*	V	V	No	N/A
Slender Darling Pea	*Swainsona murrayana*	V	V	Yes	28, 44, 157, 163, 164
Red Darling Pea	*Swainsona plagiotropis*	V	V	Yes	44
Silky Swainson-pea	*Swainsona sericea*	V	-	Yes	28, 44

TABLE 5-4 PREDICTED FAUNA SPECIES CREDIT SPECIES (SUBJECT LAND)

Common name	Scientific name	Listing status		Dual credit species	Species retained for further assessment	Associated PCTs
		BC Act	EPBC Act			
Pink-tailed Legless Lizard	*Aprasia parapulchella*	V	V	No	No	N/A
Australian Bustard	*Ardeotis australis*	E	-	No	Yes	24, 28, 44, 153, 157, 160, 163, 164
Bush Stone-curlew	*Burhinus grallarius*	E	-	No	Yes	28, 13
Curlew Sandpiper (Breeding)	*Calidris ferruginea*	E	CE	No	No	N/A
White-bellied Sea-eagle (Breeding)	*Haliaeetus leucogaster*	V	-	No	No	13, 17, 24, 28, 44, 153, 157, 160, 163, 164

Common name	Scientific name	Listing status		Dual credit species	Species retained for further assessment	Associated PCTs
		BC Act	EPBC Act			
Little Eagle (Breeding)	*Hieraaetus morphnoides*	V	-	No	No	13, 17, 24, 28, 44, 153, 157, 160, 163, 164
Swift Parrot (Breeding)	*Lathamus discolor*	E	CE	No	No	N/A
Southern Bell Frog	*Litoria raniformis*	E	V	No	No	13, 17, 24
Major Mitchell's Cockatoo (Breeding)	*Lophochroa leadbeateri*	V	-	No	Yes	13, 28, 153, 163
Square-tailed Kite (Breeding)	*Lophoictinia isura*	V	-	No	No	13, 28, 153
Barking Owl (Breeding)	*Ninox connivens*	V	-	No	Yes	13
Plains-wanderer (Breeding)	*Pedionomus torquatus*	E	CE	No	Yes	44
Koala	*Phascolarctos cinereus*	E	E	No	Yes	13, 17, 24, 28, 153, 157, 160 VZ1
Regent Parrot (Eastern Subspecies) (Breeding)	*Polytelis anthopeplus monarchoides*	E	V	No	No	13
Superb Parrot (Breeding)	*Polytelis swainsonii*	V	V	No	No	13, 28
Masked Owl (Breeding)	*Tyto novaehollandiae*	V	-	No	Yes	13,24 VZ1

TABLE 5-5 PREDICTED SPECIES CREDIT SPECIES (HAUL ROUTE DF)

Common name	Scientific name	Listing status		Species retained for further assessment	Associated PCTs	Sensitivity to gain class	SAII
		BC Act	EPBC Act				
Showy Indigo	*Indigofera longibractea*	E	-	No	136, 155	High	Yes
Yellow-Keeled Swainsona	*Swainsona flavicarinata*	E	-	Yes	128, 139, 150, 155	High	Yes
Creeping Darling Pea	*Swainsona viridis*	E	-	Yes	155	High	Yes

5.1.3 EXCLUDED THREATENED SPECIES

Modification to the BAM-C generated list is appropriate where one or more of the following factors is relevant to the species:

- Disturbance;
- Vagrancy;
- Geographical limitations; and/or
- Absence of habitat constraints.

Fourteen (14) species have been excluded from assessment across the Subject Land as outlined below;

- Two (2) species excluded based on the absence of Important Habitat Mapping for the species across the Subject Land;
- Four (4) species excluded based on TBDC listed geographical constraints;
- Five (5) species excluded based on TBDC listed habitat constraints;
- One (1) species excluded based on the lack of microhabitat features;
- Two (2) species have been excluded based on vagrancy; and
- No species have been excluded based on expert reports.

One (1) species has been excluded from assessment across the Haul Route DF as outlined below:

- One (1) species excluded based on TBDC listed habitat constraints.

Further assessment was undertaken for the remaining species.

Justification for the exclusion of threatened species in this assessment is provided in Table 5-6.

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TABLE 5-6 JUSTIFICATION FOR EXCLUSION

Common Name	Scientific Name	Justification for Exclusion
Pink-tailed Legless Lizard	*Aprasia parapulchell*	Subject Land does not contain Rocky areas, nor is it situated within 50 m of rocky areas.
Curlew Sandpiper (Breeding)	*Calidris ferruginea*	Subject Land does not occur within species 'Important Mapped Areas'.
White-bellied Sea-Eagle (Breeding)	*Haliaeetus leucogaster*	Subject Land does not contain living or dead mature trees within suitable vegetation within 1km of a rivers, lakes, large dams or creeks, wetlands and coastlines.
Little Eagle (Breeding)	*Hieraaetus morphnoides*	Subject Land does not contain suitable nest trees.
Square-tailed Kite (Breeding)	*Lophoictinia isura*	Subject Land does not contain suitable nest trees.
Swift Parrot (Breeding)	*Lathamus discolor*	Subject Land does not occur within species 'Important Mapped Areas'.
Southern Bell Frog	*Litoria raniformis*	Subject Land does not contain microhabitat features for the Southern Bell Frog. The species is associated with swamps dominated by River Red Gums (*Eucalyptus camaldulensis*), Lignum and Typha, and Black Box (*Eucalyptus largiflorens*) / Lignum / Nitre Goosefoot, with a preference for permanent waterbodies, or those in close proximity to permanent water. Critical features of these habitat types appear to be that they are large, continuous areas containing both permanent and ephemeral waterbodies that undergo regular flooding and are surrounded by areas containing suitable refugia in the form of ground debris, vegetation cover and cracking soils. The Subject Land contains areas of Lignum and Nitre Goosefoot swamplands, and Black Box; however, this vegetation was observed to be dry during all five survey events, despite substantial rainfall previous to and rainfall during these events. Areas of Nitre Goosefoot swamplands beyond the Subject Land and within The Plains Wind Farm Project Area were observed to be inundated, and subsequently surveyed in Summer 2023 with no Southern Bell Frogs recorded.
Regent Parrot (eastern subspecies) (Breeding)	*Polytelis anthopeplus monarchoides*	Subject Land is not within 10 km of the junction of the Murray River.
Superb Parrot (Breeding)	*Polytelis swainsonii*	Subject Land does not contain Living or dead *E. blakelyi, E. melliodora, E. albens, E. camaldulensis, E. microcarpa, E. polyanthemos, E. mannifera,* or *E. intertexta*
Menindee Nightshade	*Solanum karsense*	Subject Land is not situated west of Maude, NSW.
Austral Pillwort	*Pilularia novae-hollandiae*	Subject Land is not situated east of Deniliquin, NSW.
Sand-hill Spider Orchid	*Caladenia arenaria*	Subject Land is not situated east of Jerilderie, NSW.

Common Name	Scientific Name	Justification for Exclusion
Bindweed	*Convolvulus tedmoorei*	The normal distribution of the species is north of the Subject Land and outside the Murrumbidgee IBRA subregion. As shown in Figure 5-10, species records indicate a central Australian distribution across a broad area referred to as channel country (i.e., the catchment associated with Lake Eyre). The Subject Land is situated over 60 km west from the sole Murrumbidgee IBRA subregion collection, which is over 50 years old (1969). This record, which has not been confirmed since 1969, is the most southeastern extent of the species with no other collections occurring in the Murrumbidgee IBRA subregion. NSW SC (2002) notes the species is known from only two collections, made in 1969 and 1971. BioNet records show occurrences near Broken Hill, NSW, approximately 425 km northwest of the Subject Land in the Barrier Range and Barrier Range Outwash IBRA subregions. Other records also exist in the Louth Plains IBRA subregion and Sturt Stoney Desert IBRA subregion. The species is classed a vagrant and is not considered likely to occur within the Subject Land.
Claypan Daisy	*Brachyscome muelleriodes*	The Subject Land is on the boundary of the TBDC listed geographic limitation for the Claypan Daisy, excluding areas of the Project situated to the west of the Cobb Highway. The Subject Land is situated approximately 110 km north of the nearest record and known population of the species. As shown in Figure 5-11, all nearest records of the species are located within, or on the boundary of, adjacent IBRA sub-regions, including the Lower Slopes IBRA sub-region and Murray Fans IBRA sub-region. The species is classed a vagrant and is not considered likely to occur within the Subject Land.
Showy Indigo	*Indifofera longibractea*	The Haul Route DF does not consist of the TBDC listed habitat constraint for the species. The species is restricted to rocky creekbeds and drainage lines, or within 100 m of such habitat features. The Haul Route DF does not contain, nor is it situated within 100 m of, rocky creekbeds and drainage features.

5.2 HABITAT SURVEYS: CANDIDATE SPECIES CREDIT SPECIES

A targeted survey or an expert report is required to confirm the presence of these species on the Subject Land and within the Haul Route DF. Alternatively, for a development activity, the Applicant may elect to assume the species is present.

5.2.1 CANDIDATE SPECIES OCCURRENCE

Presence of a species can be determined based on the following:

- Assumed presence;
- An Important Mapped Area (for dual credit species);
- Targeted threatened species surveys; or
- An expert report.

Table 5-7 details candidate species assessed as not occurring within the Development Footprint.

Table 5-8 lists the species credit species that have been assessed as occurring within the impact area. None of the remaining candidate species credit species, or their habitat components (e.g., large stick nests) were detected within the Subject Land or Haul Route DF during targeted surveys.

TABLE 5-7 THREATENED SPECIES EFFORT

Species	Effort / Justification
Lanky Buttons *Leptorhynchos orientalis*	Targeted flora surveys for Lanky Buttons were completed in associated PCTs (PCT 24, 44), covering 15.93 km across the Subject Land. Despite the survey effort, no records of the species were observed. The nearest recent record from 2016 is located approximately 85 km north east from the Subject Land. Lanky Buttons are threatened by clearing for cropping and pasture improvement, as well as over-grazing, and weed invasion (NSW SC, 2002b). Associated PCTs across the Subject Land have been subject to historical agricultural pressures, potentially impacting the species presence. Based on survey effort completed across the Subject Land and substantial distance from known records, the species is not considered to occur within the Subject Land.
Turnip Copperburr *Sclerolaena napiformis*	Targeted flora surveys for Turnip Copperburr were completed in associated PCTs (PCT 44), covering 10.95 km across the Subject Land. Despite the survey effort, no records of the species were observed. The current NSW populations of Turnip Copperburr are confined to the area between Jerilderie and Moama on travelling stock routes and road reserves. The nearest records are within roadside habitat outside of Jerilderie, approximately 88 km south east of the Subject Land. Noting also, the EPBC distribution map for the species does not intersect the Subject Land. PCT 44 and 46 is present in moderate condition and has been subject to historical agricultural pressures across the Subject Land. The Turnip Copperburr is probably palatable to stock and is apparently absent from sites subject to heavy and/or long-term grazing (Mavromihalis, 2010). Based on survey effort completed across the Subject Land, historical grazing pressures and substantial distance from known records, the species is not considered to occur within the Subject Land.
Red Darling-pea *Swainsona plagiotropis*	Targeted flora surveys for Red Darling-pea were completed in associated PCTs (PCT 44), covering 10.95 km across the Subject Land. Despite the survey effort, no records of the species were observed. Populations known in NSW are concentrated around Jerilderie, with an outlier 250 km to the north-west in the Willandra National Park (all within the Riverina bioregion) and a recently discovered population near Warren, 480 km north-east of Jerilderie. All records of the species are greater than 80 km from the Subject Land. Based on survey effort completed across the Subject Land, and distance from known records, the species is not considered to occur within the Subject Land.
Silky Swainson-pea *Swainsona sericea*	Targeted flora surveys for Silky Swainson-pea were completed in associated PCTs (PCT 44), covering 10.95 km across the Subject Land. Despite the survey effort, no records of the species were observed. The species has been found very rarely in surveys of the Riverina, most records in the region are historical (over 20 years old), with a recent (2021) observation made approximately 48 km south east of the Subject Land. Based on survey effort completed across the Subject Land, and distance from known records, the species is not considered to occur within the Subject Land.

Species	Effort / Justification
Koala *Phascolarctos cinereus*	Koala SATs, spotlighting and call play back surveys have been completed across The Plains Wind Farm Project Area, with no signs or records of Koalas made. The connectivity between patches of *E.largiflorens* (locally important koala trees) is relatively low, the species is known to disperse across distances of 1 to 3 km, sometimes 10 km. Koalas are known to use scattered trees as stepping stones through the landscape to aid in dispersal. The landscape within and surrounding the Subject Land has been historically cleared, with low abundance of scattered trees and substantial fragmentation between patches. Koala records in the bioregion are largely associated with vegetated riparian areas, with the nearest record being along the Murrumbidgee River in River Red Gum community, situated over 25 km north of the patch of *E.largiflorens* within the Subject Land.

5.2.1.1 ASSUMED PRESENCE

Targeted threatened flora surveys were completed across the Subject Land and Haul Route DF, presence for threatened flora has been assumed in areas where survey was not completed to a satisfactory level.

Three (3) species credit species are assumed to be present across the Subject Land, including:

- A Spear-grass (*Austrostipa wakoolica)*;
- Mossgiel Daisy (*Brachyscome papillosa*); and
- Small Scurf-pea (*Cullen parvum)*.

One (1) species credit species is assumed to be present within the Haul Route DF:

- Creeping Darling Pea (*Swainsona viridis*).

As previously stated, the Applicant commits to undertaking additional targeted surveys during the response to submissions phase and in response to detailed project design for the above species where required.

5.2.1.2 PRESENT THREATENED SPECIES

Nine (9) threatened species have been determined to occur within the Subject Land, with an additional three (3) species assumed to be present, one (1) microbat species 'possible' recording, and one species presence based on Mapped Important Areas. One (1) threatened species has been assumed to occur within the Haul Route DF. These species are detailed in Table 5-8. Species polygons are required to be prepared in accordance with the BAM for each species credit species present, or assumed to be present, within the Subject Land and Haul Route DF. Species polygons have been developed based on the species polygon specifications outlined in the TBDC and relevant guidelines for the species detailed in Table 5-8.

Targeted threatened flora transects were undertaken across the Subject Land and Haul Route DF. Despite 439.95 km of transecting effort across the Subject Land, the survey effort requirements were not met for some species. Species polygons have been developed for these species, excluding areas surveyed where no individuals were recorded. The area of exclusion was developed based on flora transect lines, with a buffer of 7.5 m applied. The applied buffer is based on 15 m transects for open vegetation, with 7.5 m being the line of sight from each transect line (NSW DPIE, 2020).

Species Polygons are presented in Figure 5-1 to Figure 5-9.

This assessment has not utilised expert reports in place of any threatened species surveys.

It is noted that additional threatened species were recorded within The Plains Wind Farm Project Area, yet outside the current Subject Land. The Sharp-tailed Sandpiper (*Calidris acuminata*), listed as Vulnerable under the EPBC Act, was observed in wetland habitat during the Summer 2023 survey event. This survey occurred post rainfall events of November 2022, that resulted in substantial flooding across the Hay Plains, and inundation of usually dry wetlands. The wetlands were subsequently avoided by the Project. Further, the Grey-crowned Babbler (eastern subspecies) (*Pomatostomus temporalis temporalis*), Little Eagle (*Hieraaetus morphnoides*), Mossgiel Daisy (*Brachyscome papillosa*) were recorded and a possible echolocation call recording of *Nyctophilus corbeni* was made across The Plains Wind Farm Project Area; however, not within the Subject Land.

BioNet records within proximity to the Haul Route DF includes ecosystem credit species; Redthroat (*Pyrrholaemus brunneus*), White-fronted Chat (*Epthianura albifrons*), Southern Whiteface (*Aphelocephala leucopsis*), and Black Falcon (*Falco subniger*). The vegetation present is likely to provide foraging habitat for these species. Habitat suitable for Black Falcon breeding, in the form of nest trees, is not present.

TABLE 5-8 PRESENT AND ASSUMED THREATENED SPECIES

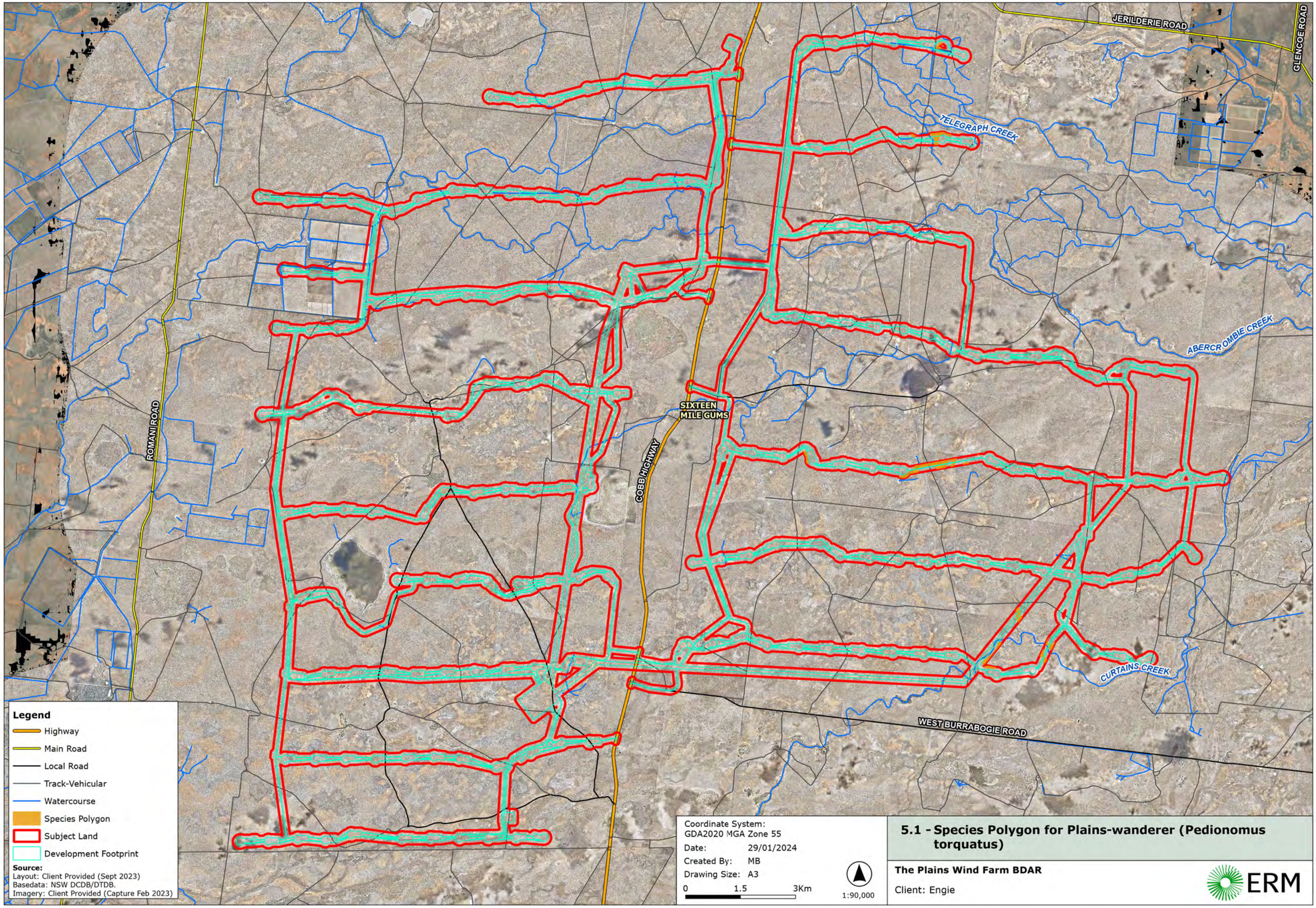
Common name	Scientific name	BC Act Status	EPBC Act Status	Biodiversity risk weighting	SAII entity	Record Notes	Species Polygon
Candidate Species							
Plains-wanderer	*Pedionomus torquatus*	E	CE	3.0	Yes	-	Mapped Important Areas across the Subject Land.
Winged Peppercress	*Lepidium monoplocoides*	E	E	2.0	No	Recorded in association with PCT 44 across Subject Land.	Winged Peppercress were observed across the Subject Land and The Plains Wind Farm Project Area within claypan microhabitats associated with PCT 44. Species Polygons have been developed taking the local microhabitat features into consideration and applying a 50 m buffer to records to account for potential seasonal variation. The Species Polygon is based on the above, in addition to unsurveyed areas of all associated PCTs (PCT 24, 44, 46, 163) where the species is assumed to be present.
Chariot Wheels	*Maireana cheelii*	V	V	2.0	No	Recorded in association with PCT 44 across Subject Land.	Chariot Wheels were observed across the Subject Land and The Plains Wind Farm Project Area within claypan microhabitats associated with PCT 44. Species Polygons have been developed taking the local microhabitat features into consideration and applying a 50 m buffer to records to account for potential seasonal variation. The Species Polygon is based on the above buffer, in addition to unsurveyed areas of all associated PCTs (PCT 44, 157, 164) where the species is assumed to be present.
Slender Darling Pea	*Swainsona murrayana*	V	V	2.0	No	Recorded across the Subject Land	Slender Darling Pea was recorded within the subject Land within areas of PCT 164. A 50 m buffer to species observations forms part of the Species Polygon. In addition, the Species Polygon includes areas of associated PCTs (PCT 44, 157, 163, 164), minus areas surveyed during the Spring 2021 and Spring 2023 survey events.

Common name	Scientific name	BC Act Status	EPBC Act Status	Biodiversity risk weighting	SAII entity	Record Notes	Species Polygon
Mossgiel Daisy	*Brachyscome papillosa*	V	V	2.0	No	Assumed present. Recorded across The Plains Wind Farm Project Area.	Species polygon based on associated PCTs (PCT 17, 24, 44, 46, 157, 160, 163, 164), minus areas of associated PCTs surveyed during the Spring 21 and Spring 23 survey events.
A Burr Daisy	*Calotis moorei*	E	E	3.0	Yes	Recorded within the Subject Land, approximately 106 individuals present.	Species polygon based on recorded individuals with 30 m buffer applied, and associated PCTs (PCT 157), minus areas surveyed during the Spring 21 and Spring 23 survey events.
A spear-grass	*Austrostipa wakoolica*	V	V	2.0	No	Assumed present within the Subject Land	Species polygon based on associated PCTs (PCT 17, 28)
Small Scurf-pea	*Cullen parvum*	E	-	2.0	No	Assumed present within the Subject Land	Species polygon based on associated PCTs (PCT 44)
Creeping Darling Pea	*Swainsona viridis*	E	-	3.0	Yes	Assumed present within the Haul Route DF	Species polygon based on associated PCTs (PCT 155)
Ecosystem Credit Species							
Black Falcon	*Falco subniger*	V	-	-	No	Recorded during several survey events and seasons within and in proximity to the Subject Land. BioNet record within 1.5 km of Haul Route DF.	-
Redthroat	*Pyrrholaemus brunneus*				No	BioNet record within 1.5 km of Haul Route DF.	-

Common name	Scientific name	BC Act Status	EPBC Act Status	Biodiversity risk weighting	SAII entity	Record Notes	Species Polygon
Spotted Harrier	*Circus assimilis*	V	-	-	-	Recorded during several survey events and seasons within and in proximity to the Subject Land	-
Yellow-bellied Sheath-tailed Bat	*Saccolaimus flaviventris*	V	-	-	No	Definite recording at SD01 and SD02 in Summer 2022 (Appendix E).	-
White-fronted Chat	*Epthianura albifrons*	V	-	-	-	Recorded within open chenopod shrublands across the Subject Land. BioNet record within 1.5 km of Haul Route DF.	-
Other listed species							
Southern Myotis	*Myotis Macropus**	V	-	N/A	No	Possible recording at all eight Anabat survey locations in Summer 2022 (Appendix E), and Site 10, 17 and 27 anabat survey locations in Summer 2023 (Appendix F).	Species Polygons for the Southern Myotis are developed where recordings are situated within 200 m boundary of associated PCTs. No associated PCTs are present within the Subject Land, nor suitable breeding/roosting habitat in proximity to possible recordings within the Subject Land.

Common name	Scientific name	BC Act Status	EPBC Act Status	Biodiversity risk weighting	SAII entity	Record Notes	Species Polygon
Southern Whiteface	*Aphelocephala leucopsis*	-	V	-	-	Recorded within woodland habitat across The Plains Wind Farm Project Area and patch of PCT 13 within Subject Land. Noting no record points were taken as observations of the species were made prior to listing (listed under EPBC act 31st March 2023). BioNet record within 1.5 km of Haul Route DF.	-

**Possible: call is comparable with the named species, with a moderate to high probability of confusion with species of similar calls.*



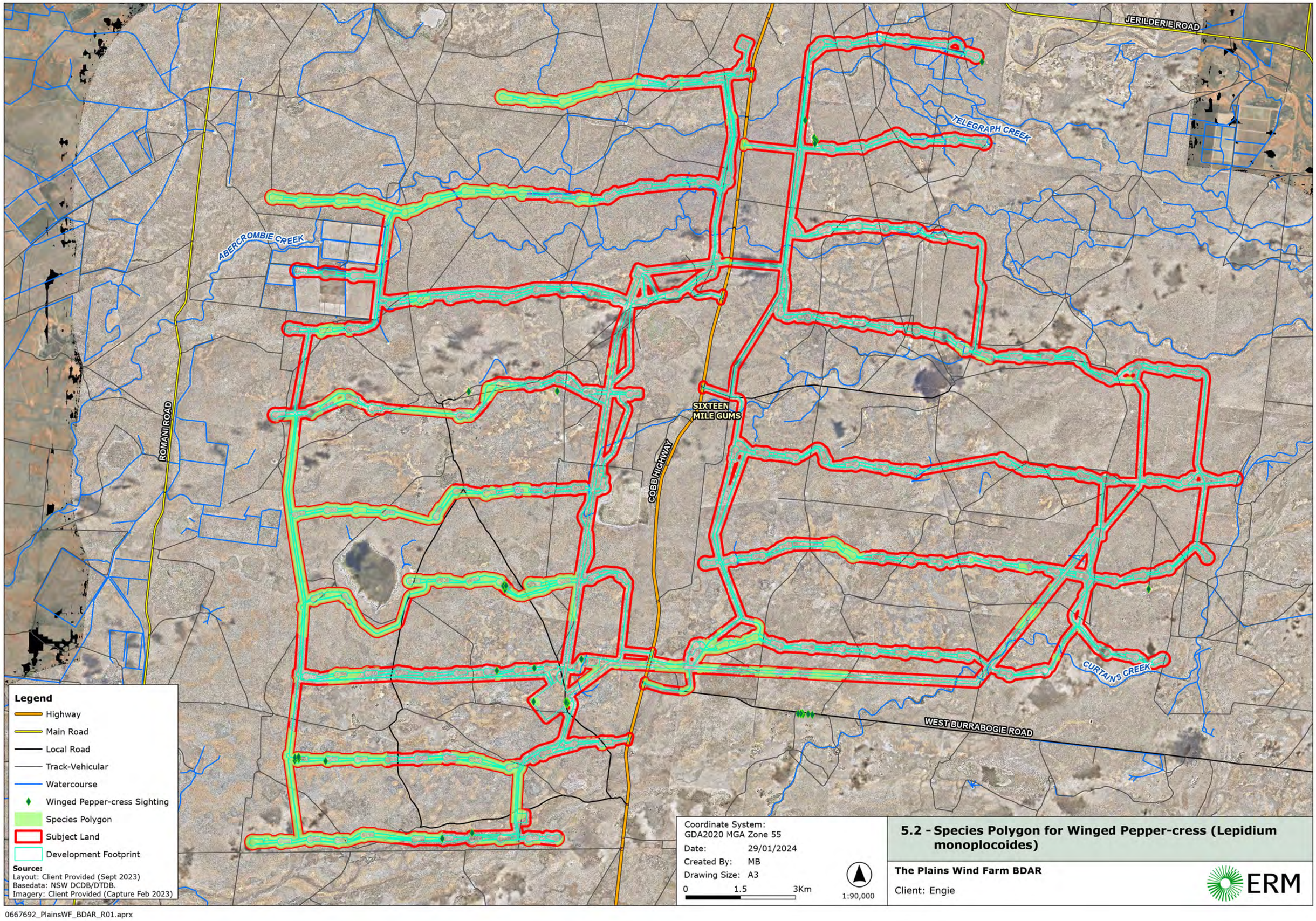
5.1 - Species Polygon for Plains-wanderer (Pedionomus torquatus)

The Plains Wind Farm BDAR

Client: Engie

ERM

0667692_PlainsWF_BDAR_R01.aprx



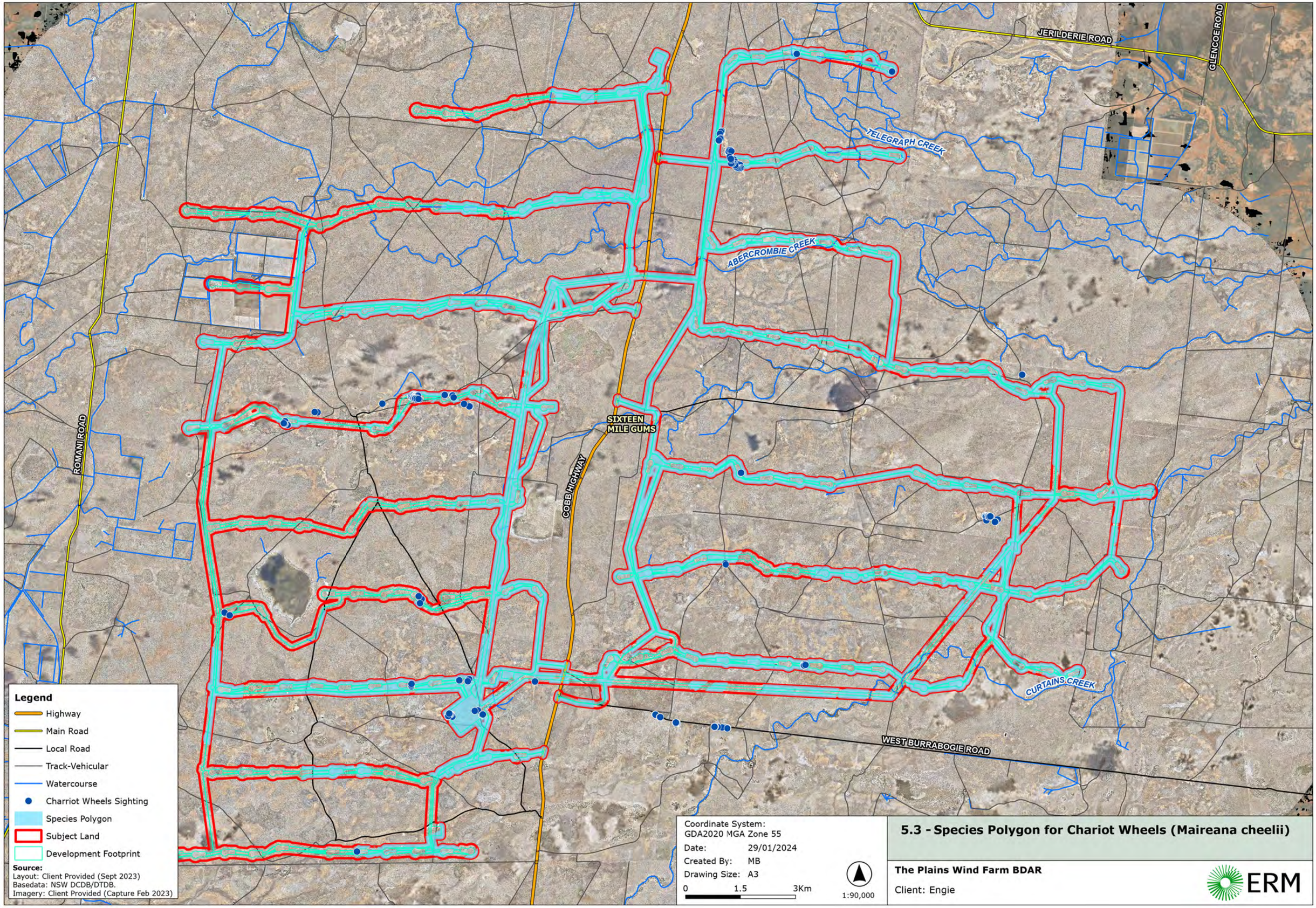
5.2 - Species Polygon for Winged Pepper-cress (Lepidium monoplocoides)

The Plains Wind Farm BDAR

Client: Engie

ERM

0667692_PlainsWF_BDAR_R01.aprx



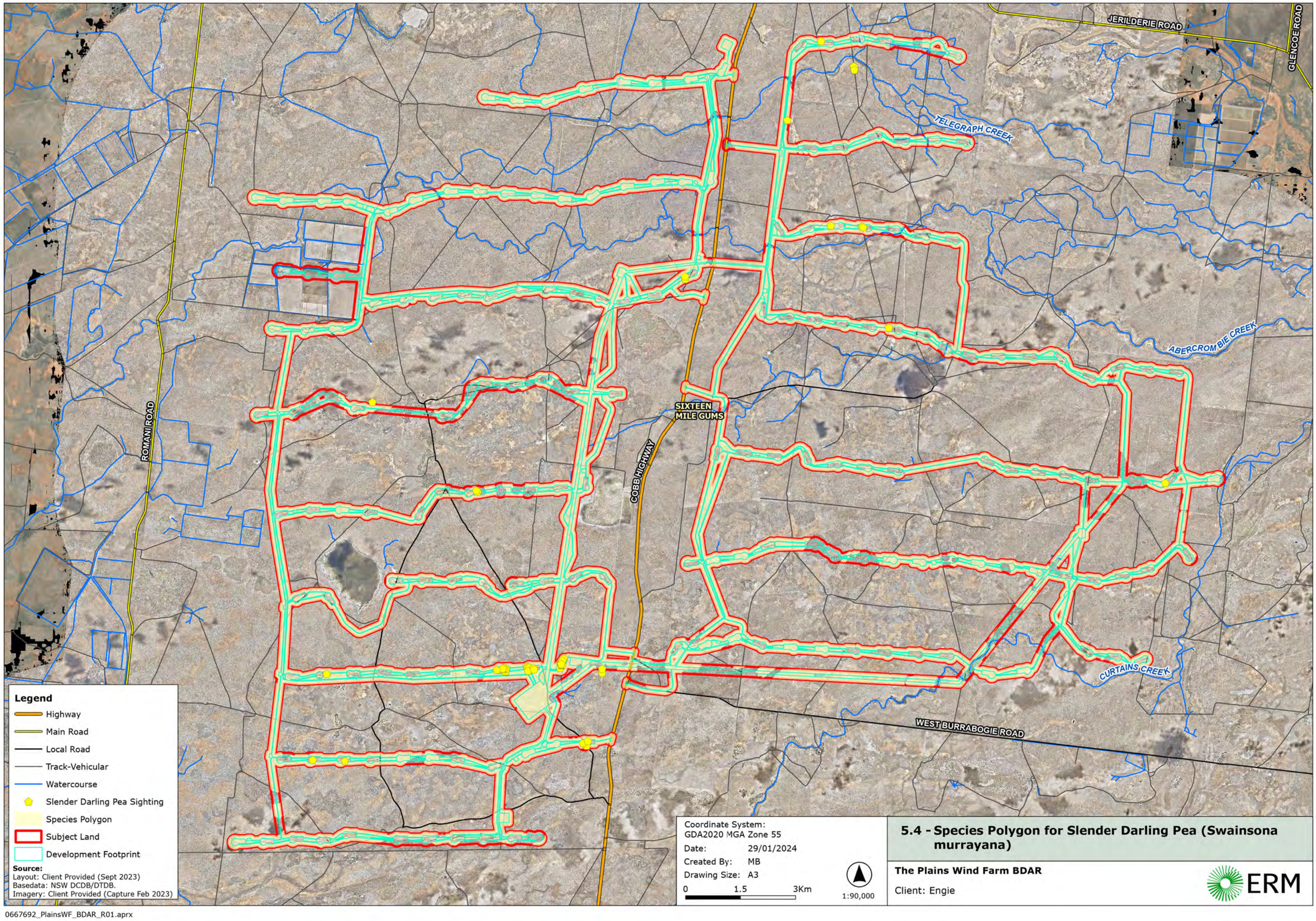
5.3 - Species Polygon for Chariot Wheels (Maireana cheelii)

The Plains Wind Farm BDAR

Client: Engie

ERM

0667692_PlainsWF_BDAR_R01.aprx



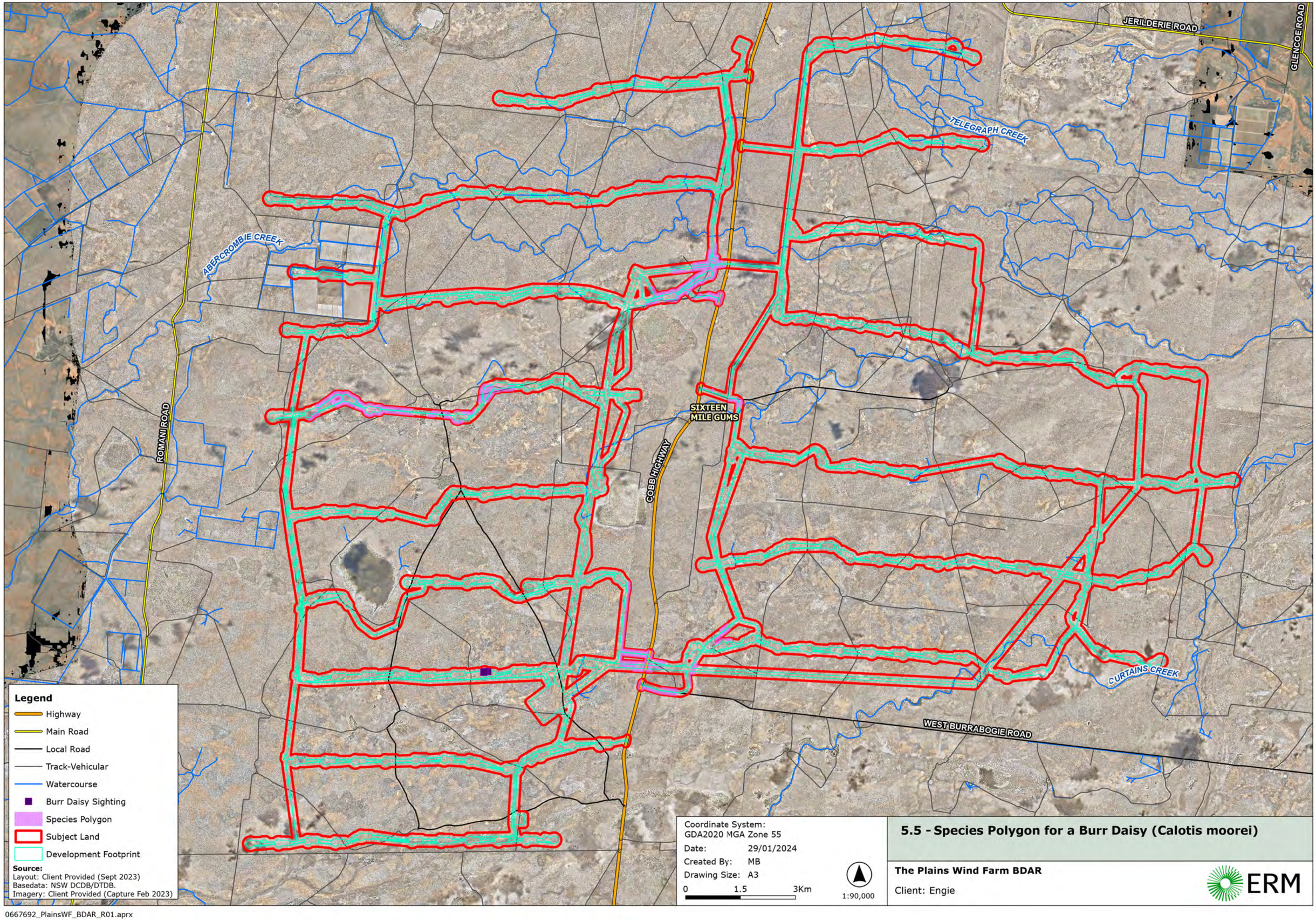
5.4 - Species Polygon for Slender Darling Pea (Swainsona murrayana)

The Plains Wind Farm BDAR

Client: Engie

ERM

0667692_PlainsWF_BDAR_R01.aprx



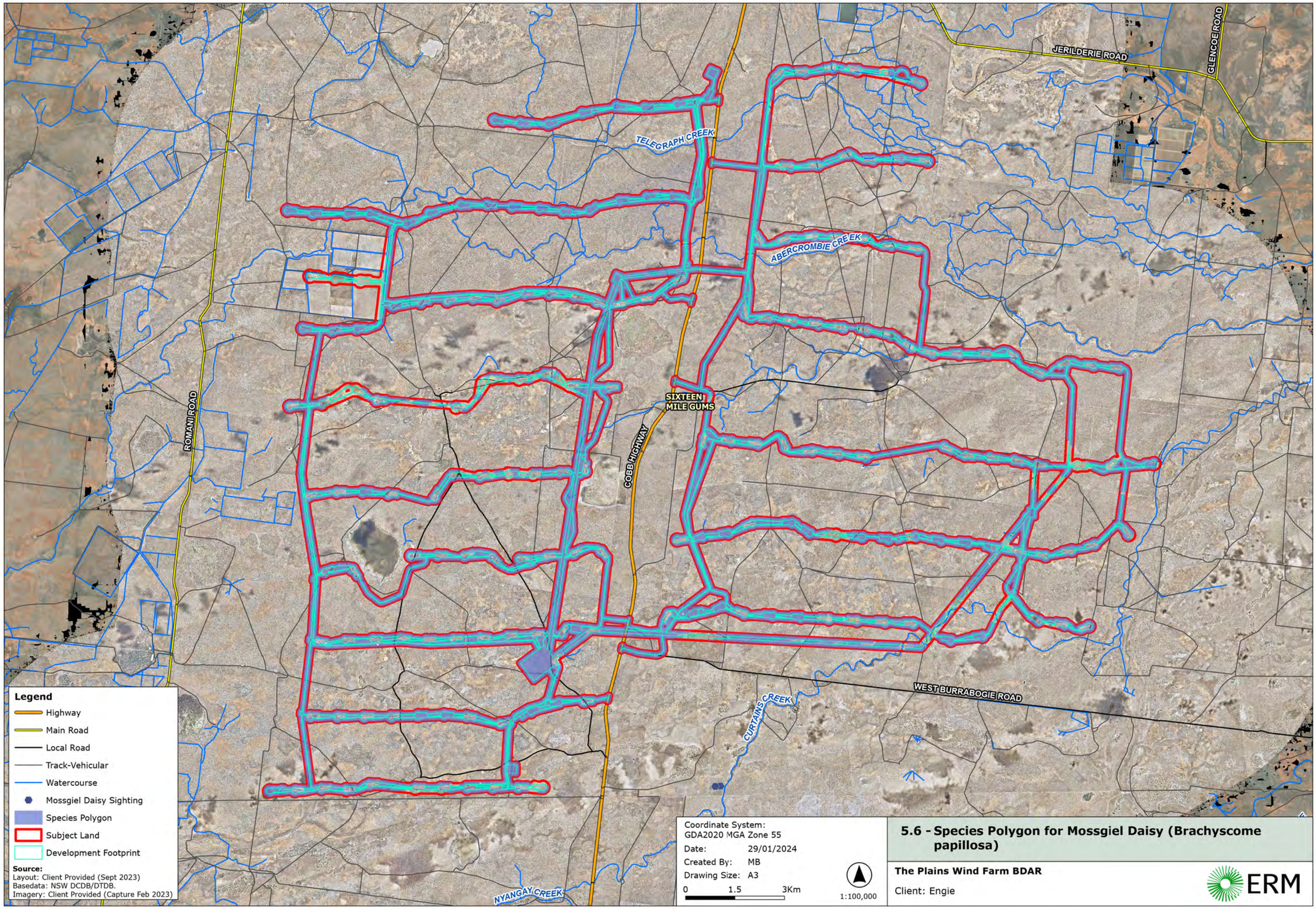
5.5 - Species Polygon for a Burr Daisy (Calotis moorei)

The Plains Wind Farm BDAR

Client: Engie

ERM

0667692_PlainsWF_BDAR_R01.aprx



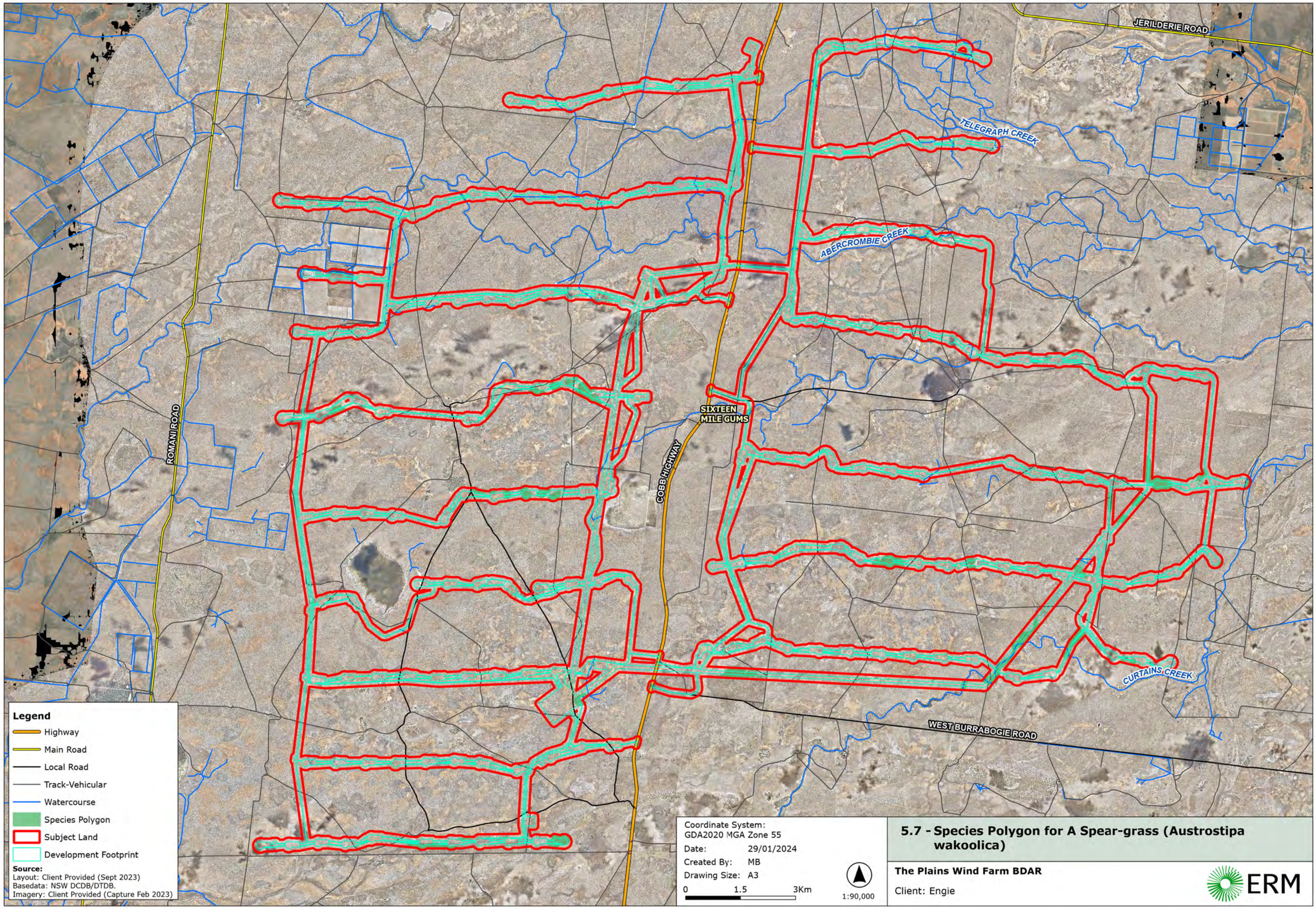
5.6 - Species Polygon for Mossgiel Daisy (Brachyscome papillosa)

The Plains Wind Farm BDAR

Client: Engie

ERM

0667692_PlainsWF_BDAR_R01.aprx



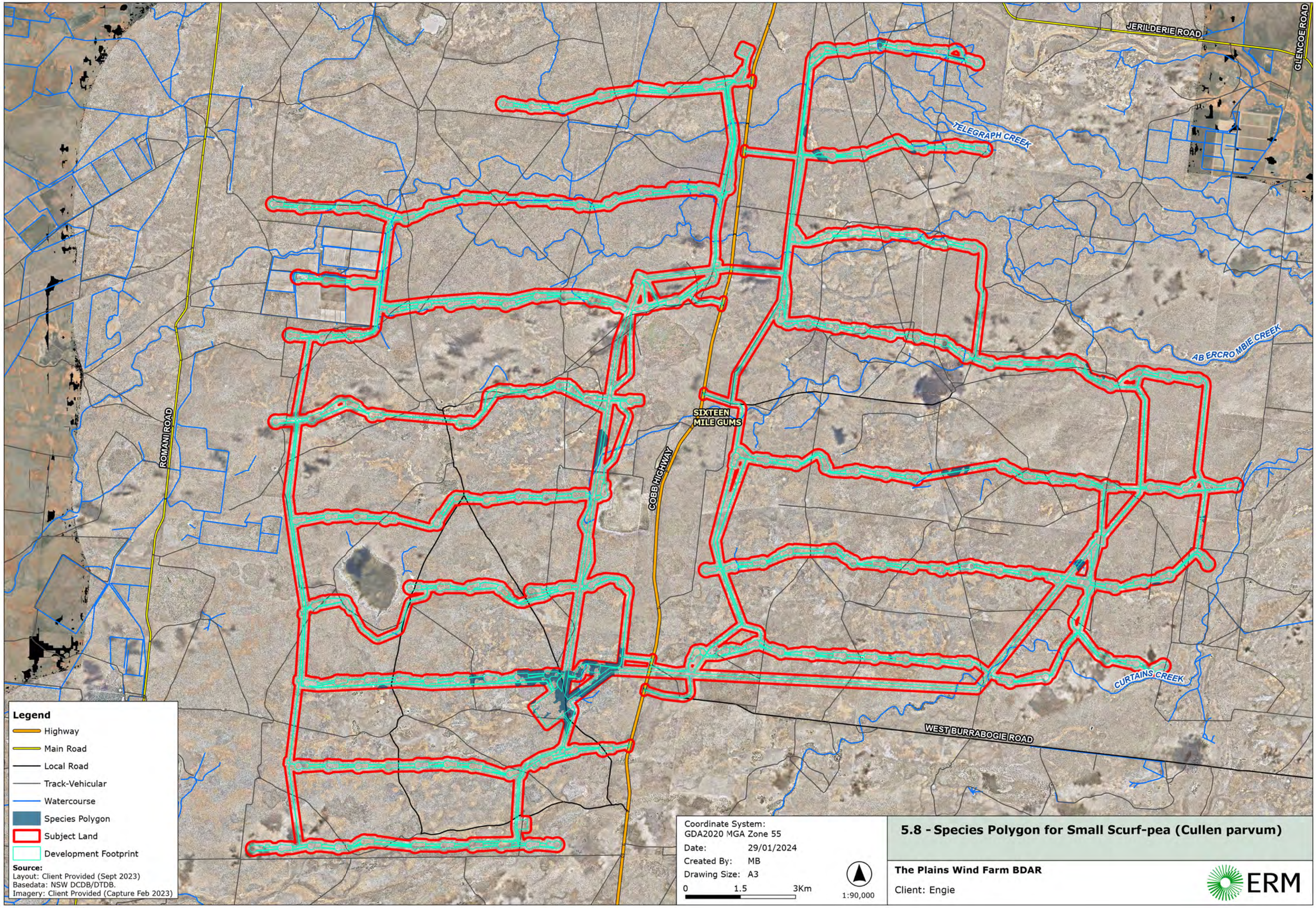
5.7 - Species Polygon for A Spear-grass (Austrostipa wakoolica)

The Plains Wind Farm BDAR

Client: Engie

ERM

0667692_PlainsWF_BDAR_R01.aprx



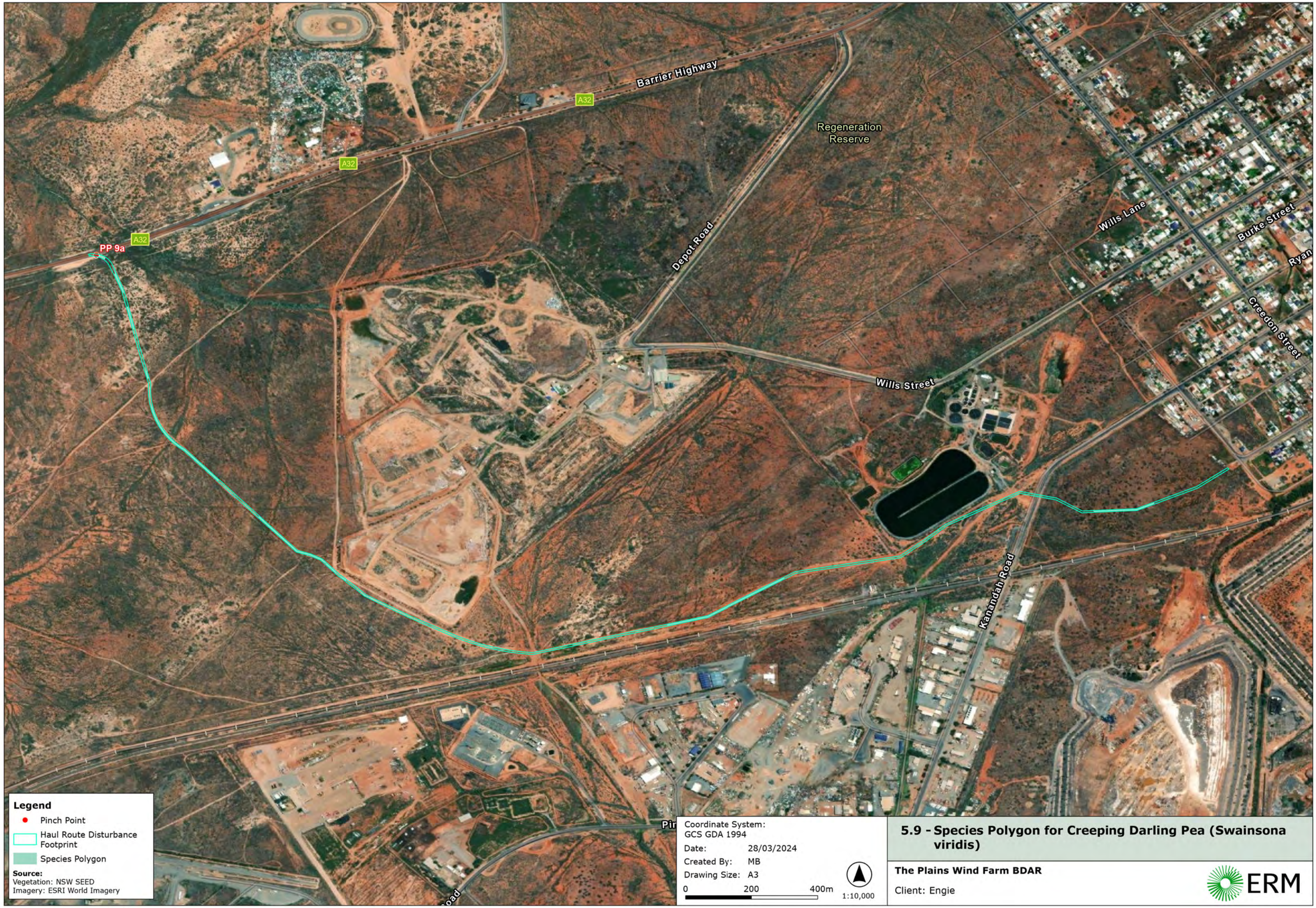
5.8 - Species Polygon for Small Scurf-pea (Cullen parvum)

The Plains Wind Farm BDAR

Client: Engie

ERM

0667692_PlainsWF_BDAR_R01.aprx



5.9 - Species Polygon for Creeping Darling Pea (Swainsona viridis)

The Plains Wind Farm BDAR

Client: Engie

ERM

0667692_PlainsWF_BDAR_R02.aprx

Alice Springs
AUSTRALIA
Brisbane
South Australia
New South Wales
Sydney
Spencer Gulf
Subject Land Location
Adelaide
Canberra

Legend

- Record of Bindweed (Convolvulus tedmoorei)
- IBRA Subregions
- Subject Land

Source:
Boundary: Client Provided (Sept 2023)
Basedata: NSW SEED. ALA
Imagery: ESRI World Imagery

Coordinate System:
GDA2020 MGA Zone 55
Date: 27/03/2024
Created By: MB
Drawing Size: A3
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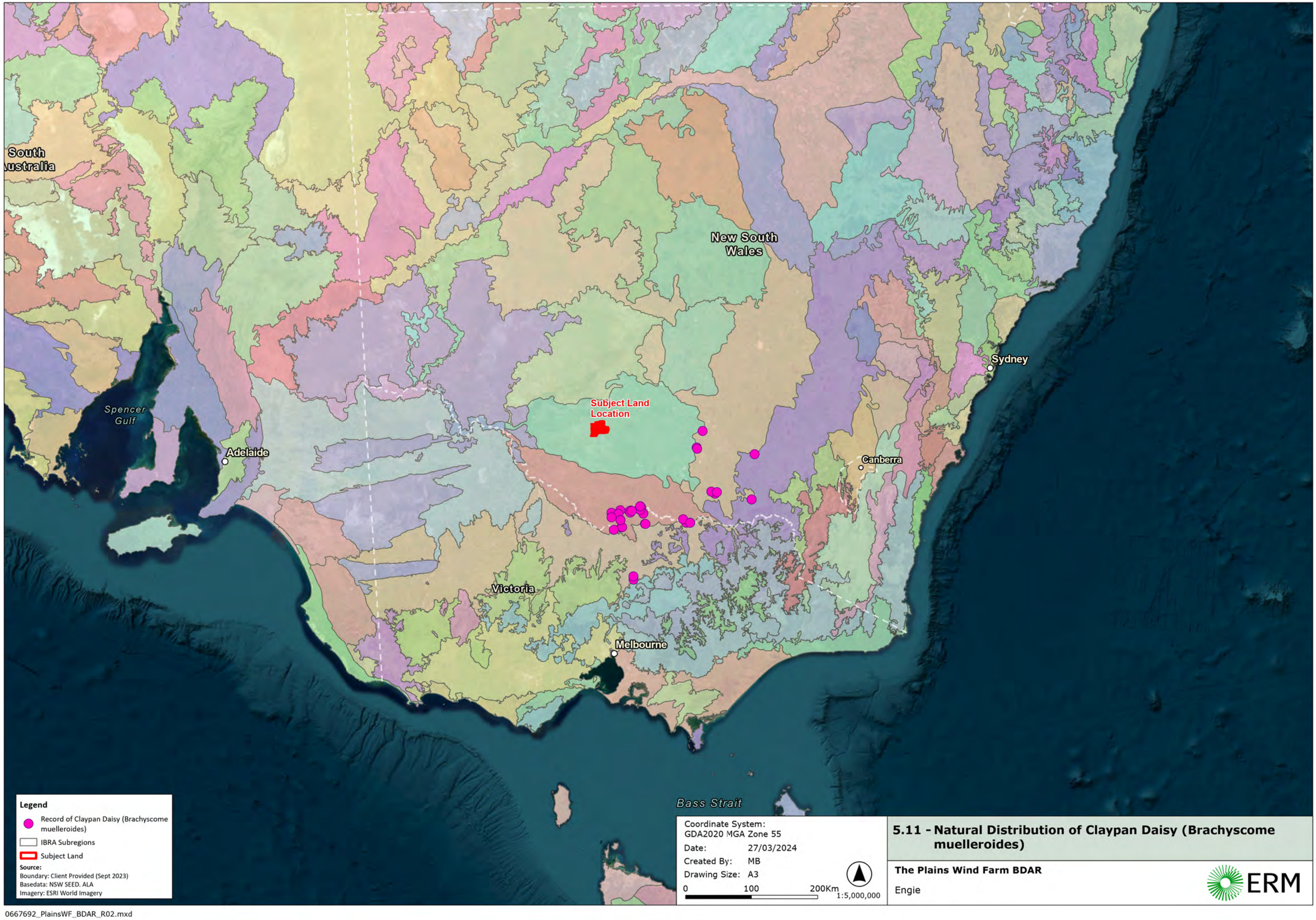
5.10 - Natural Distribution of Bindweed (Convolvulus tedmoorei)

The Plains Wind Farm BDAR

Engie

ERM

0667692_PlainsWF_BDAR_R02.mxd



5.11 - Natural Distribution of Claypan Daisy (Brachyscome muelleroides)

The Plains Wind Farm BDAR

Engie

ERM

0667692_PlainsWF_BDAR_R02.mxd

6. IDENTIFYING PRESCRIBED IMPACTS

Prescribed impacts are identified in Clause 6.1 of the BC Regulation. Prescribed impacts are those that are additional to the clearing of native vegetation and associated habitat. These include:

- Development on the habitat of threatened species or ecological communities associated with:
  - Karst, caves, crevices, cliffs, rock outcrops and other geological features of significance;
  - Human-made structures; and
  - Non-native vegetation.
- Development on areas connecting threatened species habitat, such as biodiversity corridors;
- Development on water quality, waterbodies and hydrological processes that sustain threatened species and TECs (including from subsidence or upsidence from underground mining);
- Wind turbine strikes on protected animals; and
- Vehicle strikes on threatened species or on animals that are part of a TEC.

The BAM does not provide an approach to determine the number and class of biodiversity credits that are required for a prescribed impact. However, the additional prescribed impacts on biodiversity may be considered by a consent authority when they determine the biodiversity credits required to be retired (or other conservation measures required to be taken) under a planning approval.

An assessment of the relevance of these prescribed impacts to the Project is provided in Table 6-1.

TABLE 6-1 ASSESSMENT OF PRESCRIBED IMPACTS

Feature	Present	Description of feature characteristics and location	Threatened entities that use, are likely to use, or are part of the habitat feature.
Karst, caves, crevices, cliffs, rocks or other geological features of significance	☐Yes / ☒No	Not present within Subject Land nor Haul Route DF.	Not applicable.
Human-made structures	☐Yes / ☒No	Not present within Subject Land nor Haul Route DF.	Not applicable.
Non-native vegetation	☒Yes / ☐No	Areas within the Subject Land are mapped under the LLS Act as Category 1 – 'Exempt land', land not subject to clearing approval. This vegetation is non-native vegetation and is associated with land used for cropping. Areas of the Haul Route DF are mapped as non-native based on the SVTM (DPE, 2022a).	This form of non-native vegetation is likely to provide supplementary foraging habitat for threatened raptors, including those recorded across the Haul Route DF (Black Falcon) and those recoreded across the Subject Land and The Plains Wind Farm Project Area (Little

Feature	Present	Description of feature characteristics and location	Threatened entities that use, are likely to use, or are part of the habitat feature.
			Eagle, Spotted Harrier and Black Falcon). Provided the disturbance footprint in this modified landscape is minimal, it is considered unlikely that the disturbance to this feature will have a significant impact on raptor species.
Habitat connectivity	☐Yes / ☒No	The Subject Land has low levels of connectivity as discussed in Section 3.1. The Haul Route DF is largely situated along an existing access through acacia and chenopod shrublands and is considered to have low levels of connectivity as discussed in Section 3.1.	Not applicable.
Waterbodies, water quality and hydrological processes	☐Yes / ☒No	Farm dams are mapped across the Subject Land, and the site intersects ephemeral creek lines, Curtains Creek, Telegraph Creek and Abercrombie Creek, as discussed in Section 3.1.1. These features are not considered likely to sustain threatened species. No waterbodies are mapped, nor were they observed, intersecting the Haul Route DF.	Not applicable.
Wind turbine strikes (wind farm development only)	☒Yes / ☐No	The Project involves the construction of wind turbines.	Threatened, migratory and resident avian and microbat species have potential to be impacted by wind turbine strike. Mitigation measures will be implemented to reduce the risk of turbine strike, this is discussed in Section 8.3.2.
Vehicle strikes	☒Yes / ☐No	The Project is located on either side of the Cobb Highway, includes the unsealed public road, West Burrabogie, and will include the construction of internal access tracks and the delivery of wind farm components via the Haul Route from the Port of Adelaide to the Subject Land. It is possible that fauna will venture onto these roads and access tracks, particularly during the construction phase, resulting in vehicle strikes.	Threatened avian species have been recorded across the Subject Land and the Plains Wind Farm Project Area, including the ground-dwelling Plains-wanderer. These species are at risk of vehicle strike because of the Project. Mitigation measures will be implemented to reduce the risk of vehicle strike, discussed in Section 8.3.1.

STAGE 2: IMPACT ASSESSMENT (BIODIVERSITY VALUES AND PRESCRIBED IMPACTS)

7. AVOID AND MINIMISE IMPACTS

7.1 AVOID AND MINIMISE DIRECT AND INDIRECT IMPACTS

7.1.1 PROJECT LOCATION AND DESIGN

Strategic development context

The location for the Project has been selected based on the high quantity wind resources determined to be available within the South West Renewable Energy Zone (REZ) implemented by the NSW Government under section 19(1) of the *Electricity Infrastructure Investment Act 2020.*

The *NSW Electricity Strategy* (DPIE, 2019a) and Electricity Infrastructure Roadmap (DPIE, 2020d) establishes the framework to deliver the State's first five REZ in strategic areas including around Hay. The REZ will play a significant role in delivering renewable energy generation and storage to help replace existing fossil fuel power stations as they come to their end of operational life.

The South-West region has been identified as one of five REZs, with others being declared/proposed in the Central-West Orana, Illawarra, New England and Hunter-Central Coast regions of NSW. REZ combine wind, solar, hydroelectric and energy storage, and high-voltage transmission lines, to generate and deliver clean, renewable energy. By connecting multiple generators and storage in the same area, REZ capitalise on economies of scale to deliver cheap, reliable and clean electricity for homes and businesses in NSW.

The objectives of REZ are to:

- Deliver affordable energy into the future;
- Diversify the NSW energy mix;
- Expand electrical transmission capabilities; and
- Open new parts of the NEM for energy generation in locations that can benefit from diverse weather patterns.

The Project aligns with the strategic objectives of the South West REZ. The Project will deliver affordable energy, contribute to the diversification of the NSW energy sector, and facilitate the expansion of electrical transmissions capabilities and the opening up of new parts of the NEM for energy generation.

Project design and iteration

Since the conception of the Project, the design has evolved through consideration of technical, environmental, social, and commercial limitations. A significant aspect of this design refinement comprised engagement with landowners, neighbours to the Project, the broader community, local government, State and Federal Agencies, and business and stakeholder groups. This engagement, along with technical studies undertaken, has helped to shape the current Development footprint presented in this report.

Preliminary biodiversity desktop and field verification surveys completed across The Plains Wind Farm Project Area identified high value biodiversity areas. As ecological surveys and vegetation community mapping were completed, areas of constraint have been identified, mapped and largely avoided by the Project from the onset. The Project has been designed in a manner to avoid impact to remnant woodland vegetation present across The Plains Wind Farm Project Area, wetland habitat, resident raptor and threatened raptor nests, TECs and Important Mapped Areas for the Plains-wanderer. The avoidance of most patches of remnant woodland is likely to have a corresponding reduced impact on the Southern Whiteface (*Aphelocephala leucopsis*, listed as Vulnerable under the EPBC Act), as this species is typically associated with woody vegetation.

Remnant woodland habitat was identified as having high biodiversity value for resident fauna within an otherwise open landscape, and in areas constituted threatened ecological communities. Two BC Act listed TECs were confirmed within The Plains Wind Farm Project Area, being:

- Weeping Myall Woodlands; and
- Sandhill Pine Woodland in the Riverina Murray-Darling Depression and NSW South Western Slopes bioregions.

The mapped extent of these TECs and woodland habitat was used to affect an avoidance during Project design. Weeping Myall Woodlands have been avoided in totality, and large extends of Sandhill Pine Woodland TEC have been avoided. A small patch comprising 3.24 ha of the Sandhill Pine Woodland TEC is situated within the Subject Land, with 0.69 ha within the Disturbance Footprint. Based on the vegetation integrity plot completed within the Subject Land, the VI score for the associated PCT (PCT 28) is 35.3, representing low condition. The community present lacks key characteristic canopy species, *Callitris glaucophylla*, and is made up of a disturbed, sparse shrubland dominated by Western Rosewood, Needlewood and Berrigan. Where the TEC is mapped outside the Subject Land, the community contains the characteristic canopy species, *Callitris glaucophylla,* as a dominant species. Vegetation integrity plots completed in patches outside the Subject Land resulted in a VI score of 45. Areas of higher VI score and intact canopy species have been avoided by the Project.

During the field survey events it was observed that The Plains Wind Farm Project Area supported several breeding raptors. One (1) of these resident raptors, the Little Eagle (*Hieraaetus morphnoides*), is considered Vulnerable under the BC Act. A further in-flight observation of the Little Eagle was made, flying in the north-west of The Plains Wind Farm Project Area. During the design phase, a 500 m buffer was applied to all raptor nests, aiming for total avoidance. Additionally, no turbines are situated within 2 km of the confirmed Little Eagle nest.

Review of Important Mapped Areas for the Plains-wanderer and the mapping of suitable habitat in association with PCT 44 and PCT 46 delineated across The Plains Wind Farm Project Area has been completed. The Development Footprint has been designed to largely avoid Important Mapped Areas, with the impact being restricted to 5.35 ha associated with access tracks to be developed between transmission line towers and WTGs, comparative to 523.469 ha mapped within the Assessment Area.

The Project has been designed to maximise use of existing public and internal access tracks across the Subject Land where possible, minimising vegetation clearance required and where possible preventing an increase to predatory access routes and activity. The Project design will also allow for the implementation of plain wire fencing to be used as perimeter fencing in place of barbed wire fencing, to reduce potential impacts from entanglement.

During the field survey events it was observed that wetland communities were present across the western portion of The Plains Wind Farm Project Area as presented in Figure 2-2. During the initial four (4) survey events, these habitats, largely associated with Black Box communities, were consistently dry despite regular rainfall events. During the Summer 2023 survey, all mapped wetlands were inundated as a result of substantial rainfall and flooding across the site in previous months. These habitats were observed to support a variety of water birds, including the Sharp-tailed Sandpiper. The Project design was amended to avoid all wetland habitat as mapped in Figure 2-2.

Four (4) ephemeral creeklines intersect the Subject Land, fish passage will be provided for in the design of waterway crossings of these creeklines. The design and construction of waterway crossings on the Subject Land will be undertaken in accordance with the Department's Policy and Guidelines for Fish Habitat Conservation and Management (Update 2013) and Why Do fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings (2003). Further, any temporary waterway crossings will be removed immediately upon completion of the various stages of construction.

Further, the Project will aim for the total avoidance of *Calotis moorei* and *Swainsona viridis* occurrences. The *Calotis moorei* is at current known to occur and assumed to occur in areas of associated PCT (PCT157) where survey effort is not met across the Subject Land. Similarly, *Swainsona viridis* is currently assumed to occur in associated PCT 155 that are within the Haul Route DF. The completion of the required targeted survey effort for these species will be undertaken during the response to submissions phase to inform detailed design, with an aim of no net loss of both species.

The Project design has been revised and refined for the EIS based on detailed assessments and in response to the identification and assessment of environmental limitations, constructability requirements, and consideration of the outcomes of agency, landowner, and community consultations. Details on project amendments are provided in Table 7-1 with alternative locations shown in Figure 7-1.

TABLE 7-1 PROJECT AMENDMENTS

Project Element	Initial Scoping Layout	Current layout
Project Area/ Subject Land	8382.193 ha	8178.426 ha
WTGs	226	188
Development Footprint	2959.714 ha	1996.906 ha
Plains-wanderer Important Mapped Areas	23.332 ha	5.352 ha
Woodland PCTs	51.447 ha	2.702 ha
Sandhill Pine TEC	18.666 ha	0.694 ha
Wetland Habitat	10.033 ha	0.353 ha

Alternative locations that would avoid or minimise impacts on biodiversity values and justification for selecting the proposed location.

The Project is located within the dedicated South West REZ with the Applicant not having any alternative sites proposed. A careful site selection process was undertaken for the development by the Applicant focusing on the key requirements of the Project. Initial feasibility studies of the land surrounding the currently selected Subject Land including reviews of the following aspects:

- Proximity and access to existing 220 kV line and EnergyConnect;
- Accessibility to the Project via a major road;
- An area that would avoid or limit the need to remove native vegetation or impact on other environmental values;
- A site with topographical features that would require minimal earthworks / soil disturbance;
- A site with minimal flooding or bushfire risk;
- Minimal impact on surrounding privately or publicly owned land;
- High wind resource;
- Further than 5 km from non associated dwellings; and
- Minimal environmental impacts.

The Applicant considered several alternative sites that did not meet these criteria. The site location for the Project was selected as it ranked highest in each of these criteria at the time of assessment.

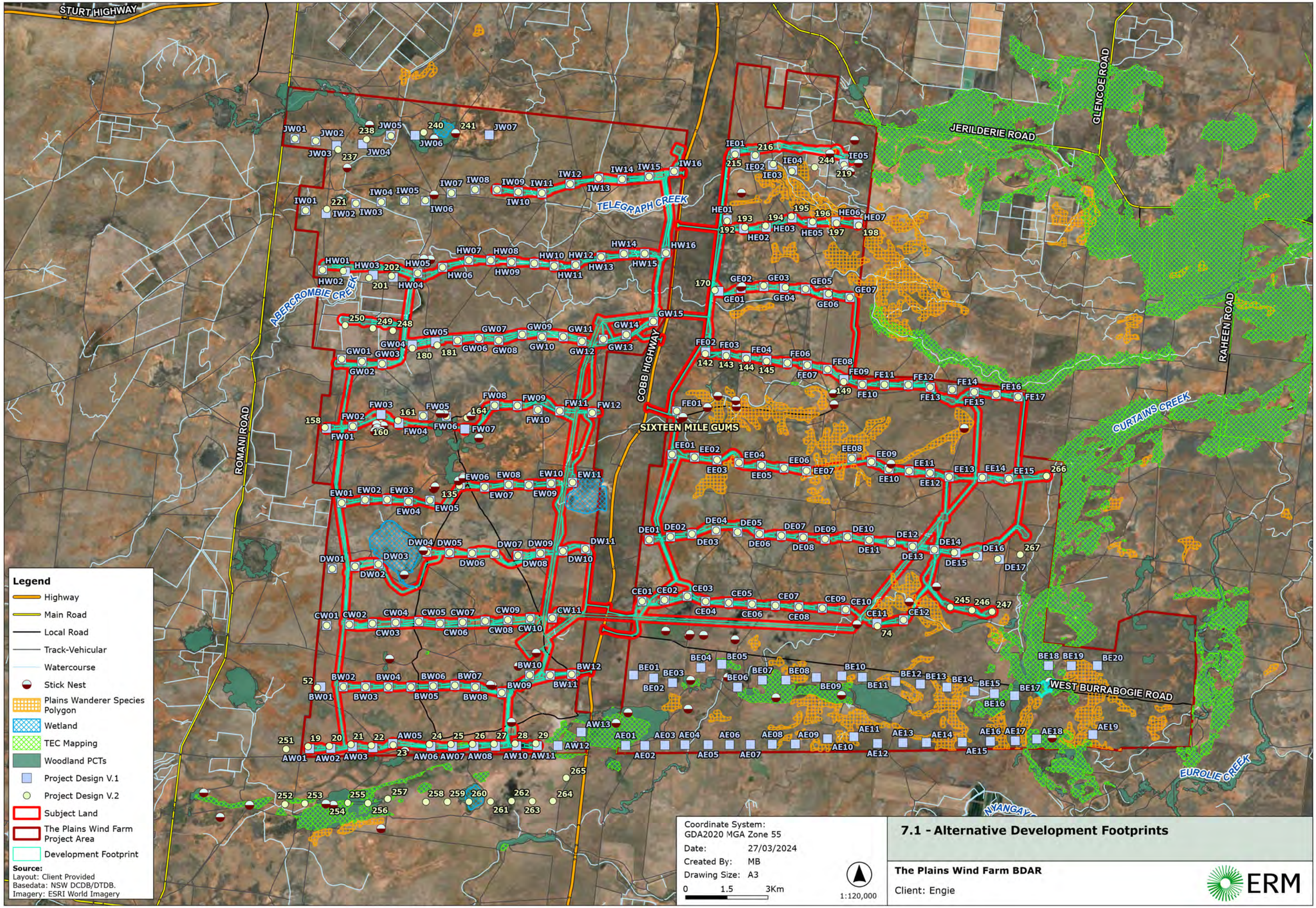
7.1.2 ALTERNATIVE HAUL ROUTES

The Haul Route due diligence assessments (refer Appendix A and Appendix B) identify the proposed transport route for oversized and overmass (OSOM) vehicles. The Applicant has identified that the preferred transport route from the port to Subject Land is via the Port of Adelaide.

Alternate transport routes were considered by the Applicant; however, they presented additional impacts relating to road upgrades, traffic management, and Project expenses.

7.1.3 FURTHER MEASURES TO AVOID AND MINIMISE IMPACTS

Impacts will be further avoided and minimised through several measures, designed to protect retained and adjacent vegetation and habitat during construction, operation and decommissioning phases. These measures are detailed in Section 7.2 of this BDAR.



Legend

- Highway
- Main Road
- Local Road
- Track-Vehicular
- Watercourse
- Stick Nest
- Plains Wanderer Species Polygon
- Wetland
- TEC Mapping
- Woodland PCTs
- Project Design V.1
- Project Design V.2
- Subject Land
- The Plains Wind Farm Project Area
- Development Footprint

Source:
Layout: Client Provided
Basedata: NSW DCDB/DTDB.
Imagery: ESRI World Imagery

Coordinate System: GDA2020 MGA Zone 55
Date: 27/03/2024
Created By: MB
Drawing Size: A3
0 1.5 3Km
1:120,000

7.1 - Alternative Development Footprints

The Plains Wind Farm BDAR

Client: Engie

ERM

0667692_PlainsWF_BDAR_R02.aprx

7.1.4 WIND TURBINE STRIKE

To minimise any potential impacts to bird and bat species, associated with operation of the WTGs, within the vicinity of the Subject Land, a BBAMP will be prepared. The BBAMP will intend to enable the implementation of a long-term approach to the mitigation and management of potential impacts on listed threatened and migratory species. Monitoring will also identify any potential changes to the species' utilisation of the Subject Land and the surrounding landscape.

In accordance with the draft BBAMP guidance provided by DPE (27th July 2023), the following aspects of the draft BBAMP have been detailed in the following sections:

- BBAMP objectives and consent conditions;
- Baseline data;
- Proposed monitoring program;
- Preliminary turbine risk assessment;
- Proposed trigger action response plan;
- Offsetting and compensatory means; and
- Proposed turbine strike notification process.

The final BBAMP is to be prepared in consultation with the BCD, following approval of the Project.

7.1.4.1 OBJECTIVES AND CONSENT CONDITIONS

Objectives

The objective of the BBAMP is to minimise and manage the impact of operation of the WTGs associated with the proposed development on birds and bats that occur within the vicinity of the wind farm. Specifically, the BBAMP will:

- Detail potential mitigation measures and implementation strategies to minimise impacts to birds and bats;
- Establish an adaptive management framework for managing and mitigating impacts on birds and bats;
- Outline a monitoring program to understand the impact of the proposed development to at-risk birds and bats;
- Document an agreed decision-making framework that identifies operational-phase impact triggers leading to a management response;
- Identify any additional measures that can be used to manage impacts based on the outcomes of ongoing monitoring; and
- Aim to offset mortality impacts to listed threatened species where applicable.

The BBAMP will aim to achieve the following environmental outcomes:

- An improved understanding of the risk of turbine collision and barotrauma impacts on listed bird and bat species;
- An improved understanding of weather and how project site usage changes as a result of wind farm construction and operation;

- An improved monitoring approach for the timely identification of turbine collisions and collection and analysis of data;
- An improved approach to the timely and regular validation and update to the Collision Risk Modelling (CRM) using monitoring data, and a robust adaptive management approach; and
- Development of management and corrective actions to minimise risk of turbine collision and other impacts on threatened bird and bat species.

Legislation and Policy Requirements

The Department of Climate Change, Energy, the Environment and Water [DCCEEW] *Onshore Wind Farms – interim guidance on bird and bat management* (DCCEEW, 2023) states that:

The BBMP (Bird and Bat Management Plan) must be prepared by a suitably qualified ecologist and in accordance with the department's Environmental Management Plan Guidelines. The BBMP must be informed by desktop and field-derived information, and best available practices, and include the following key requirements at a minimum:

- *standards for pre and post-commissioning surveys that are appropriate to the scale and environmental risks of the project;*
- *evidence of effectiveness of the methods used for other similar actions;*
- *demonstration that the proposed measures and outcomes of the BBAMP are supported by published scientific evidence; and*
- *where innovative measures are proposed, details about how desired outcomes will be met.*

In line with the *Onshore Wind Farm Guidance* (DCCEEW, 2023), specific objectives of individual species to achieve outcomes will be provided. Specific objectives include the implementation of mitigations measures against not to exceed designated thresholds. If thresholds are reached, corrective actions will be implemented.

The BBAMP will be adaptive in response to outcomes of monitoring, detection of potential species triggers that could result due to identified impacts to bird and bats from WTG collisions. This adaptive management framework will involve consultation with BCD for a management response following identification of mortality considered to meet trigger levels for at risk species.

The BBAMP will be implemented during pre-commissioning, and construction, and it is proposed to be implemented across the first two years of operation, commensurate to the level of potential risk to birds and bats resulting from the proposed development.

The BBAMP will aim to fulfil the requirements of Conditions of consent schedule 3, 21 and, subject to BBAMP approval by the Secretary of DPE, will be implemented during the development and initial operation of the Project.

7.1.4.2 BASELINE DATA

Baseline data collected to date to inform the BBAMP has been determined through survey events across The Plains Wind Farm Project Area completed between 2021 and 2023, literature reviews, desktop searches and statistical analysis.

Prior to field surveys, several desktop sources were reviewed to identify ecological values that may occur within the Subject Land. Desktop analysis was also used to guide development of field survey sampling techniques, followed by a field survey program to collect data to describe on-ground conditions. The information from the desktop sources and field surveys were used to assess and document the likelihood of occurrence and potential occurrence of bird and bat species within the Subject Land.

Bird and Bat Survey Methods

A summary of the survey efforts undertaken to date to inform this report were conducted between October 2021 and November 2023.The survey design, including targeted surveys for candidate species with potential to occur in the Subject Land, was developed on the basis of the survey guidelines detailed below. Additional survey effort will be completed to inform the final BBAMP.

Anabat devices were deployed across The Plains Wind Farm Project Area to provide microbat community data. This included the following:

- 8 devices deployed in Summer 2022;
- 6 devices deployed in Summer 2023; and
- 1 device deployed at height on a metmast from 24th March 2023 to present.

The Applicant is committed to deploying another at height device on Met Mast approval (DA lodged with council) to further inform the BBAMP.

BUSs were undertaken across The Plains Wind Farm Project Area, which involved fixed point surveys aimed to provide data based on the species present and their height, speed and direction of flight as stipulated by the Band Model (SNH 2012, Band 2000). These survey are further detailed below.

2021 – 2022: DAWE Onshore Wind Farms – interim guidance on bird and bat management

BUSs undertaken between 2021 and 2022 were completed in accordance with guidance by DAWE (2021), provided in the *Onshore Wind Farms – interim guidance on bird and bat management.* 29 fixed-point BUS locations were established across The Plains Wind Farm Project Area. Each fixed-point survey site was located to provide a search radius of at least 100 m for small birds and up to 800 m for large birds. Searches were conducted over 20 minutes at each survey site per season and were primarily focused on birds most likely to be affected by the development, such as raptors (birds of prey) and large flocks of birds. Under the interim guidance, BUSs were required to be completed over each relevant season over a minimum of 24 months prior to commissioning of the wind farm.

Survey Guidelines for Australia's threatened birds (DEWHA, 2011) outlines steps that aid in determining survey effort and timing, noting a particular focus on optimal timing for surveys of 'target' taxa. With the timing of surveys critical to species detection, it is important that surveys be timed to maximise potential detection across the year. As such, BUS survey events were initially proposed over distinct seasons in NSW over a 12-month period.

2023: Draft Wind Farm Assessment Guidance for the Sout West REZ

The Draft Wind Farm Assessment Guidance for the South West REZ was released in July 2023, and was inclusive of a suggested BBUS method. This method was adopted and applied to the Spring 2023 BUS event. Survey locations were adjusted where required to best align with the current development layout. A 3kmx3km grid was applied to the Subject Land as per the suggested method, with survey points situated within 40% of grid squares. The Subject Land presents as an open landscape with flat topography allowing for high levels of visibility for avifauna in flight, it is anticipated that 40% cover via 29 survey sites will be sufficient to inform the BBAMP.

During the Spring 2023 survey event searches were conducted over 30 minutes, repeated on six (6) occasions at each survey site. The six occasions were completed over the following periods:

- 2 x Morning (sunrise to 10:00am);
- 2 x Midday (10:00am to 2:00pm); and
- 2 x Afternoon (2:00pm to sunset).

All detections were recorded, irrespective of distance from the survey site, behaviour or flight height of the observed bird/s.

This approach will be replicated during future BBUS survey events to inform the BBAMP.

Survey locations are presented in Figure 7-2.

SIXTEEN MILE GUMS

Legend

- Bird Utilisation Survey - Spring 2021
- Bird Utilisation Survey - Summer 2022
- Bird Utilisation Survey - Autumn 2022
- Bird Utilisation Survey - Winter 2022
- Bird Utilisation Survey - Spring 2023
- Subject Land
- The Plains Wind Farm Project Area

Source:
Layout: Client Provided (Sept 2023)
Basedata: NSW DCDB/DTDB.
Imagery: Client Provided (Capture Feb 2023)

Coordinate System:
GDA2020 MGA Zone 55
Date: 27/03/2024
Created By: MB
Drawing Size: A3
0 1.5 3Km
1:110,000

7.2 - Location of Bird Utilisation Surveys

The Plains Wind Farm BDAR

Client: Engie

ERM

0667692_PlainsWF_BDAR_R02.aprx

Bird Community Composition

Analysis of the data collected to date was completed to determine bird community composition as presented in Section 4.3. The analysis largely indicates that bird community composition varies principally by season and not spatially throughout the Subject Land.

Bat Community Composition

Bat call analysis undertaken by Green Tape Solutions have identified fifteen species of microbat determined 'definite', 'probable' or 'possible' within The Plains Wind Farm Project Area (Table 7-2). A single species (*Saccolaimus flaviventris*) listed as Vulnerable under the BC Act has been confirmed to be present following the two survey periods. Possible *Myotis macropus* and *Nyctophilus spp.* calls were detected; however, these cannot be confirmed due to moderate to high probability of confusion with species of similar calls.

These results provide a preliminary assessment of bat community composition across The Plains Wind Farm Project Area. Further assessment will be undertaken pre-construction and potential impacts to bat community composition will be assessed further in the BBAMP.

TABLE 7-2 BAT CALL ANALYSIS RESULTS

Scientific Name	Common Name	BC Act	EPBC Act	Confirmed Presence
Austronomus australis	White-striped Freetail Bat	-	-	Definite
Chalinolobus gouldii	Gould's Wattled Bat	-	-	Definite
Chalinolobus morio	Chocolate Wattled Bat	-	-	Definite
Myotis macropus	Southern Myotis	V	-	Possible
Ozimops planiceps	South-eastern Freetail Bat	-	-	Probable
Nyctophilus corberni	Corben's Long-eared Bat	V	V	Possible
Nyctophilus geoffroyi	Lesser Long-eared Bat	-	-	Possible
Nyctophilus gouldi	Gould's Long-eared Bat	-	-	Possible
Ozimops ridei	Ride's Free-Tailed Bat	-	-	Definite
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	V	-	Definite
Scotorepens balstoni	Inland Broad-nosed Bat	-	-	Definite
Scotorepens greyii	Little Broad-nosed Bat	-	-	Definite
Vespadelus darlingtoni	Large Forest Bat	-	-	Definite
Vespadelus regulus	Southern Forest Bat	-	-	Possible
Vespadelus vulturnus	Little Forest Bat	-	-	Possible

Analysis of echolocation calls recorded at height from a met mast from 24 March 2023 until present was undertaken by Lachlan McRae Fauna Services. Six species and one species group were identified and determined to be of 'Moderate', 'High', or 'Certain' identification confidence based on the quality of recording and the similarities of calls between species with similar call profiles (Table 7-3). No listed EPBC Act or BC Act species were identified.

TABLE 7-3 MET MAST BAT CALL ANALYSIS RESULTS

Scientific name	Common Name	BC Act	EPBC Act	Identification Confidence
Austronomus australis	White-striped Free-tailed Bat	-	-	Certain
Ozimops planiceps	South-east Free-tailed Bat	-	-	High
Chalinolobus gauldii	Gould's Wattled Bat	-	-	High
Ozimops ridei or *Ozimops petersi*	Ride's Free-tailed Bat or Inland Free-tailed Bat	-	-	High
Scotorepens balstoni	Inland Broad-nosed Bat	-	-	Moderate
Vespadelus vulturnus	Little Forest Bat	-	-	High
Chalinolobus morio	Chocolate Wattled Bat	-	-	High

Excluded Species

Impacts to species during operation of the Project are limited to direct mortality through collision with WTGs, and indirect impacts of barotrauma. Although potentially suitable habitat for listed threatened and migratory species is present throughout the site, not all species move at heights considered to be at risk of collision with WTGs and so the operation of the Project will pose a negligible risk. To identify those species for which suitable habitat is present but are not considered to be at risk of collision, a literature review was undertaken to identify the following aspects of species behavior and ecology:

- Are there documented maximum flight heights for a species that are below that of the Rotor Swept Area (RSA)?;
- Is the species known to be behaviorally restricted by the height of available canopy or shrub cover?; and
- Is the species known to rarely disperse over long distances, is behaviorally sedentary or possesses rigid territory boundaries, and does not undertake seasonal migrations?

Candidate and Ecosystem Credit Species that met these criteria were then discounted from needing to be applied to the risk matrices presented in Table 7-6, Table 7-7, and Table 7-8. These species are presented below in Table 7-4.

TABLE 7-4 CANDIDATE AND ECOSYSTEM CREDIT SPECIES EXCLUDED FROM COLLISION RISK ASSESSMENT

Species	EPBC Act	BC Act	Comments
Burhinus grallarius Bush Stone-curlew	-	E	Bush stone-curlew are nocturnal, ground-dwelling birds preferring open forests and grassy woodlands (Murialdo, Kleisner, Wolfenden, & Old, 2015). Although capable of flight, the species rarely does so unless threatened and rarely, if ever, at heights considered to be at risk of collision. While potential habitat may be impacted, no detections have been made of bush stone-curlews across any survey efforts for the Project and therefore the species has not been assessed in this collision risk assessment.
Ardeotis australis Australian Bustard	-	E	The Australian bustard is a large, heavy, ground-dwelling bird typically found on dry plains, grasslands and open woodlands. The bustard is known to rarely fly, instead dispersing on foot when disturbed (Abbot, 2008). Juveniles are completely flightless and rely on camouflage. While the bustard is known to fly, spatial movement is considered to be largely intra-regional with inter-continental movement considered uncommon (Ziembicki & Woinarski, 2007). While potentially suitable habitat is present within the Subject Land, no detections have been made during targeted fauna transects or through traversing the site and therefore the species is not considered to be at risk of collision.
Certhionyx variegatus Pied Honeyeater	-	V	The pied honeyeater is a nomadic species found in arid and semi-arid ecosystems categorised by shrublands and woodlands, particularly those dominated by Erimophila, Grevillea, and Mulga (Higgins, Peter, & Steele, 2001). While song flights above the canopy have been described for the species, it is not considered to be at heights at risk of collision and so has not been included in the collision risk assessment of the BBAMP.
Epthianura albifrons White-fronted Chat	-	V	The white-fronted chat is a small ground-feeding, insectivorous passerine occurring typically occurring in open country, particularly salt-marshes and other wetlands (Jenner, French, Oxenham, & Major, 2016). While impacts to habitat may occur during construction, this species is not known to regularly fly at heights considered at risk of collision.
Melanodryas cucullata cucullate Hooded Robin (south-eastern form)	-	V	The hooded robin is a largely sedentary species of robin typically seen in pairs or small groups in areas characterised by dry eucalypt and acacia woodlands and shrublands with an open understory, some grassy areas and a complex understory. Foraging typically occurs at ground level or the first few meters of vegetation height and is not considered to exceed that of the canopy (Antos, Bennett, & White, 2008). Due to minimal movement ecology and flight and foraging not considered to be at heights at risk of collision, this species has not been considered as part of the collision risk assessment in the BBAMP.

Species	EPBC Act	BC Act	Comments
Ninox connivens Barking Owl	-	V	The barking owl typically occurs in open woodland and open forests ecosystems and with an abundance of large hollows suitable for nesting. As an ambush predator that typically forages at canopy height, the species is unlikely to fly at heights considered at risk of turbine collision and so has not been considered in the collision risk assessment of the BBAMP.
Pachycephala inornate Gilbert's Whistler	-	V	The gilbert's whistler is a an arid shrubland specialist that is known to forage predominantly on or near the ground, in shrub thickets, or the canopy of low growing trees. Largescale movement is generally believed to be limited with breeding pairs likely hold and defend territories all year round. The gilberts whistler is not considered to be at risk of collision.
Pedionomus torquatus Plains-wanderer	CE	CE	The plains wanderer is ground-dwelling bird that is known to rarely fly beyond two to three meters in height. While associated habitat is present within proximity to wind turbine generators, this species is not considered at risk of collision.
Petroica boodang Scarlet Robin	-	V	The scarlet robin is a woodland species that is known to forage at ground level, or in shrub and canopy layers. While the species disperses seasonally, movement heights are considered to be restricted to the canopy height of available woodland vegetation (Robinson, 1992). The species is not considered at risk of collision.
Pomatostomus temporalis temporalis Grey-crowned Babbler (eastern subspecies)	-	V	Foraging and dispersal habitat for the grey-crowned babbler is defined as open forests and woodlands with an open shrub cover. The species is known to form territorial groups with long distance dispersal limited (Morcombe, 2000). Flight heights are largely restricted to canopy heights of vegetation and so the species is not considered at risk of collision.
Pyrrholaemus brunneus Redthroat	-	V	The redthroat is a mostly ground dwelling bird occurring mostly in arid and semi-arid regions containing acacia and chenopod shrublands. Observations of foraging behavior identified that foraging heights rarely exceeded 1m and never exceeded heights of 3m. While suitable habitat may be present in close proximity to wind turbine generators, the species is not considered at risk of collision.
Saccolaimus flaviventris Yellow-bellied sheath-tailed bat	-	V	The yellow-bellied sheath-tailed bat has a widespread distribution throughout Australia but is known to be rare throughout. The species is characterized by large body size and long narrow wings and displays rapid flight with low maneuverability suitable for flight in very open areas or above the canopy. While this flight pattern may lead to an increased risk of collision and barotrauma, known flight heights are restricted to approximately 20m high (Rhodes & Hall, 1997). This is not considered to be at risk of collision with WTGs and so, although known to be present, this species has been excluded from collision risk assessment.

Species	EPBC Act	BC Act	Comments
Myotis Macropus Southern Myotis	-	V	The southern myotis is a specialized species that utilizes a 'trawling'; foraging strategy to hunt for aquatic prey. Trawling involves individuals flying 5-100cm above a water surface before dipping to make contact with the water to rake their feet to capture aquatic invertebrates and small fish (Gonsalves & Law, 2017). The low flying foraging behaviours of the species is unlikely to put individuals at risk of collision with WTGs or barotrauma. Although known to be present the species has been excluded from the collision risk assessment.

Vagrant species with the potential to occur

Despite the presence of potentially suitable habitat, several Candidate and Ecosystem Credit Species not listed as migratory have not been detected across the Subject Land following the survey effort completed between November 2021 and November 2023. While these species are not considered to be present at the time of survey effort, as the Subject Land remains within their known distributions there is the potential for these species to be present throughout the operational life of the Project.

A list of those species categorized as vagrants within the BBAMP is provided below in Table 7-5.

TABLE 7-5 VAGRANT SPECIES WITH THE POTENTIAL TO OCCUR

Species	EBPC Act	BC Act	Associated PCTs
Haliaeetus leucogaster White-bellied Sea-eagle (Breeding)	-	V	13, 15, 24, 28, 44, 163, 167, 160, 163, 164
Lophochroa leadbeateri Pink Cockatoo	E	V	13, 28, 153, 163
Lophoictinia isura Square-tailed Kite	-	V	13, 28, 153
Anseranas semipalmata Magpie Goose	-	V	24, 160, 163
Artamus cyanopterus cyanopterus Dusky Woodswallow	-	V	13, 24, 28, 44, 153, 157, 160, 163, 164
Botaurus poiciloptilus Australasian Bittern	E	E	13, 24, 160
Daphoenositta chrysoptera Varied Sittella	-	V	13, 28
Falco hypoleucos Grey Falcon	V	V	13, 24, 28, 44, 153, 157, 160, 163, 164
Oxyura australis Blue-billed Duck	-	V	24, 160
Rostratula australis Australian Painted Snipe	E	E	13, 24, 160
Stagonopleura guttata Freckled Duck	-	V	13, 24, 160
Grus rubicunda Brolga	-	V	13, 24, 160, 163

Currently, these species are not considered to be at risk of collision due to presence within the Subject Land being unlikely, and so have not been applied through the risk matrices presented in Table 7-6, Table 7-7, and Table 7-8. However, these species are known to fly at heights consistent with those of the RSA and so a theoretical risk remains if present. These species have been categorised as vagrant species which, for the purposes of the BBAMP, will be defined as those species not known to be migratory but who still disperse over large distances or are nomadic in behaviour.

7.1.4.3 PRELIMINARY TURBINE RISK ASSESSMENT

A preliminary turbine risk assessment framework has been developed, considering the likelihood and consequences of events including collision with WTGs and the impact of construction and operation on the proposed development causing changes in site utilisation by bird and bat species.

Before-After-Control-Impact (BACI) is recommended by DAWE (2021) as a design principle for surveys where the Subject Land is determined to support significant bird species. The aim of the BACI design is to compare environmental variables before and after a human activity and between the area affected by the development (impact) and an unaffected area (control) (Stewart-Oaten, 1986). In this instance, this would compare control and impact areas, before and after the construction of the windfarm, to determine if there are any avian impacts as a result of the development.

Collision Risk Modelling (CRM) will be undertaken in accordance with the Band CRM Method (Band, 2007) for any non-threatened raptor species and listed threatened and migratory species recorded in the Subject Land and assessed as having a potential collision risk. This will be dependent on the collection of additional data in accordance with the latest BBUS guidance.

Turbine Preliminary Risk Rating

A total of 188 WTG have been proposed across the Subject Land. The current layout, shown in Figure 2-5, has been refined following preliminary ecological investigations to ensure the suitable avoidance of areas of high ecological value and habitat quality. Risk factors associated with the current turbine layout can be categorized by the proximity of turbines to important habitat features, such as woodlands and important wetlands. A preliminary risk matrix (Table 7-6) has been developed to assess turbine specific risk in relation to available habitat features.

TABLE 7-6 TURBINE PRELIMINARY RISK MATRIX

Risk	Description
Very High	*Very High* risk based on any of the following being located within 200 m of the proposed turbine location: • Migratory or nomadic species habitual flight path • Landscape feature/s likely to increase bird and/or bat activity (including distance to nearest canopy, waterbodies, riparian corridors, updraft locations, caves etc.)
High	*High* risk based on any of the following being located within 500 m of the proposed turbine location: • Migratory or nomadic species habitual flight path • Landscape feature/s likely to increase bird and/or bat activity (including distance to nearest canopy, wetlands etc.)

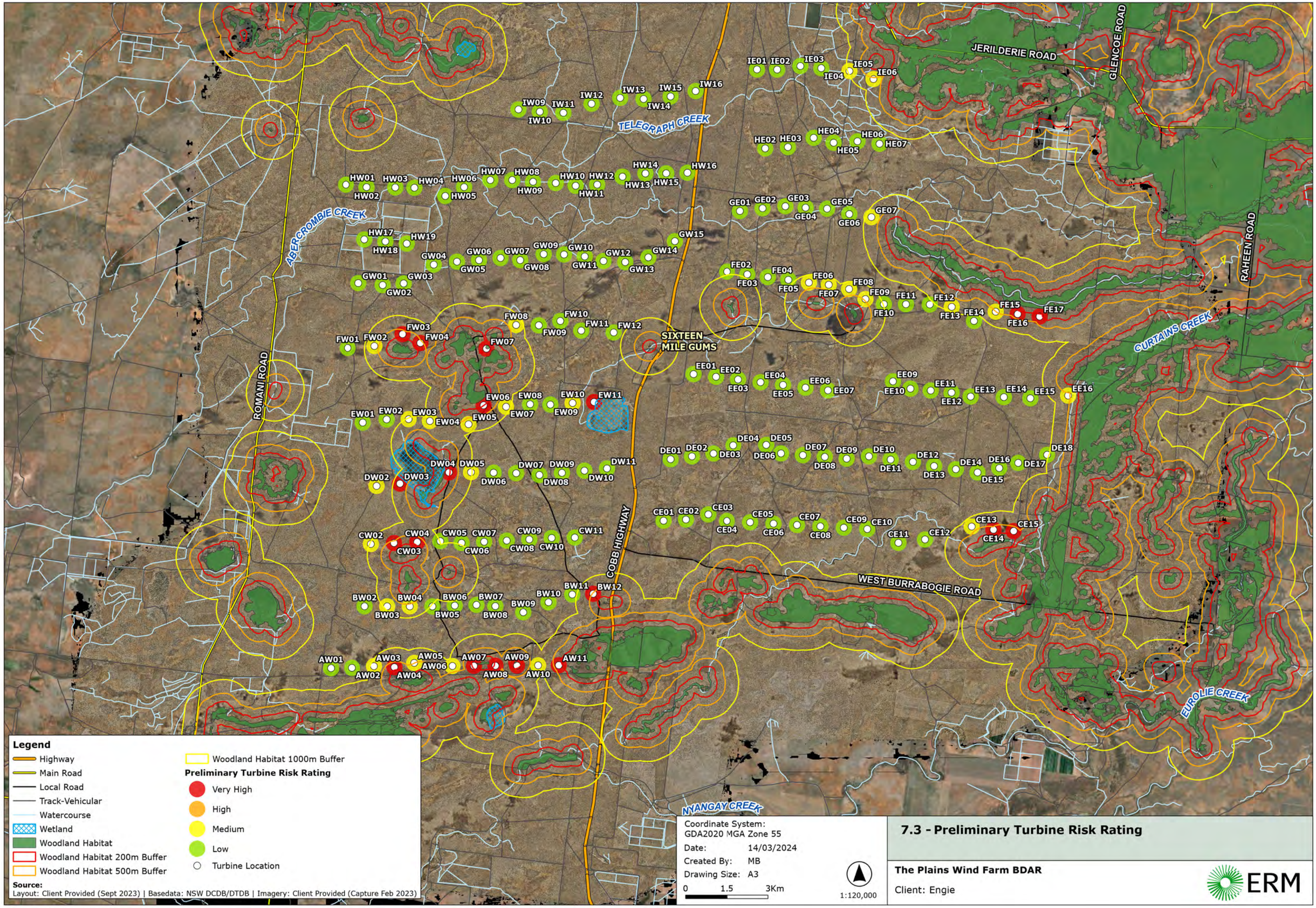
Risk	Description
Medium	*Moderate* risk based on any of the following being located within 1000 m of the proposed turbine location: • Migratory or nomadic species habitual flight path • Landscape feature/s known or predicted to increase bird and/or bat activity (including distance to nearest canopy, wetlands etc.)
Low	*Low* risk based on any of the following being located greater than 1000 m away (or absent): • Migratory or nomadic species habitual flight path • Landscape feature/s known or predicted to increase bird and/or bat activity (including distance to nearest canopy, wetlands etc.)

Turbines are predominantly situated within vegetation communities mapped as low open shrub-land or grassland communities with little to no canopy cover. Important habitat features are isolated to small, often fragmented, patches of remnant, open eucalypt woodland dominated by Black Box (*Eucalyptus largiflorens*). Large ephemeral wetlands are present, however are strongly associated with Black Box communities. Following ground-truthing, these communities have been found to provide important foraging and breeding habitat for avifauna and bats and are associated with an increase in species diversity and site utilization. Using the matrix presented in Table 7-5, a preliminary risk rating for each turbine has been established and is presented in Table 7-7 and Figure 7-3.

TABLE 7-7 TURBINE PRELIMINARY RISK RATING

Turbine Number	Risk Rating	Turbine Number	Risk Rating	Turbine Number	Risk Rating	Turbine Number	Risk Rating	Turbine Number	Risk Rating
AW01	Low	CW04	Very High	EE03	Low	FE16	Very High	HE06	Low
AW02	Low	CW05	Low	EE04	Low	FE17	Very High	HE07	Low
AW03	Medium	CW06	Low	EE05	Low	FW01	Low	HW01	Low
AW04	Very High	CW07	Low	EE06	Low	FW02	Medium	HW02	Low
AW05	Medium	CW08	Low	EE07	Low	FW03	Very High	HW03	Low
AW06	Medium	CW09	Low	EE09	Low	FW04	Very High	HW04	Low
AW07	Very High	CW10	Low	EE10	Low	FW07	Very High	HW05	Low
AW08	Very High	CW11	Low	EE11	Low	FW08	Medium	HW06	Low
AW09	Very High	DE01	Low	EE12	Low	FW09	Low	HW07	Low
AW10	Medium	DE02	Low	EE13	Low	FW10	Low	HW08	Low
AW11	Very High	DE03	Low	EE14	Low	FW11	Low	HW09	Low
BW02	Low	DE04	Low	EE15	Low	FW12	Low	HW10	Low
BW03	Medium	DE05	Low	EE16	Medium	GE01	Low	HW11	Low
BW04	Medium	DE06	Low	EW01	Low	GE02	Low	HW12	Low
BW05	Low	DE07	Low	EW02	Low	GE03	Low	HW13	Low
BW06	Low	DE08	Low	EW03	Medium	GE04	Low	HW14	Low
BW07	Low	DE09	Low	EW04	Medium	GE05	Low	HW15	Low
BW08	Low	DE10	Low	EW05	Medium	GE06	Low	HW16	Low
BW09	Low	DE11	Low	EW06	Very High	GE07	Medium	HW17	Low
BW10	Low	DE12	Low	EW07	Medium	GW01	Low	HW18	Low

Turbine Number	Risk Rating	Turbine Number	Risk Rating	Turbine Number	Risk Rating	Turbine Number	Risk Rating	Turbine Number	Risk Rating
BW11	Low	DE13	Low	EW08	Low	GW02	Low	HW19	Low
BW12	Very High	DE14	Low	EW09	Low	GW03	Low	IE01	Low
CE01	Low	DE15	Low	EW10	Medium	GW04	Low	IE02	Low
CE02	Low	DE16	Low	EW11	Very High	GW05	Low	IE03	Low
CE03	Low	DE17	Low	FE02	Low	GW06	Low	IE04	Low
CE04	Low	DE18	Low	FE03	Low	GW07	Low	IE05	Medium
CE05	Low	DW02	Medium	FE04	Low	GW08	Low	IE06	Medium
CE06	Low	DW03	Very High	FE05	Low	GW09	Low	IW09	Low
CE07	Low	DW04	Very High	FE06	Medium	GW10	Low	IW10	Low
CE08	Low	DW05	Medium	FE07	Medium	GW11	Low	IW11	Low
CE09	Low	DW06	Low	FE08	Medium	GW12	Low	IW12	Low
CE10	Low	DW07	Low	FE09	Medium	GW13	Low	IW13	Low
CE11	Low	DW08	Low	FE10	Low	GW14	Low	IW14	Low
CE13	Medium	DW09	Low	FE11	Low	GW15	Low	IW15	Low
CE14	Very High	DW10	Low	FE12	Low	HE02	Low	IW16	Low
CE15	Very High	DW11	Low	FE13	Medium	HE03	Low		
CW02	Medium	EE01	Low	FE14	Low	HE04	Low		
CW03	Very High	EE02	Low	FE15	Medium	HE05	Low		



Legend

- Highway
- Main Road
- Local Road
- Track-Vehicular
- Watercourse
- Wetland
- Woodland Habitat
- Woodland Habitat 200m Buffer
- Woodland Habitat 500m Buffer
- Woodland Habitat 1000m Buffer

Preliminary Turbine Risk Rating

- Very High
- High
- Medium
- Low
- Turbine Location

Source:
Layout: Client Provided (Sept 2023) | Basedata: NSW DCDB/DTDB | Imagery: Client Provided (Capture Feb 2023)

Coordinate System:
GDA2020 MGA Zone 55
Date: 14/03/2024
Created By: MB
Drawing Size: A3
0 1.5 3Km
1:120,000

7.3 - Preliminary Turbine Risk Rating

The Plains Wind Farm BDAR

Client: Engie

ERM

0667692_PlainsWF_BDAR_R02.aprx

The BBAMP will further assess turbine risk rating determined based on the risk matrix of risk level based on likelihood and consequence presented in Table 7-10, informed by the criteria in Table 7-8 and Table 7-9.

TABLE 7-8 CONSEQUENCES OF TURBINE STRIKE CRITERIA

Minor	Moderate	Major	Severe
Protected (non-threatened) species (or no species detected).	Vulnerable species (BC Act or EPBC Act) or non-threatened at-risk species, such as Wedge-tailed Eagle and the White striped Free-tailed Bat	Endangered species (BC Act or EPBC Act)	Critically endangered species and/or a species listed as at risk of a serious and irreversible impact

TABLE 7-9 LIKELIHOOD OF TURBINE STRIKE CRITERIA

Likelihood	Description
Very Likely	Very High likelihood of turbine strike based on any of the following being located within 200 m of the proposed turbine location: • Resident threatened species habitat or non-threatened raptor species habitat • Migratory or nomadic species habitual flight path • Landscape feature/s likely to increase bird and/or bat activity (including distance to nearest canopy, waterbodies, riparian corridors, updraft locations, caves etc.)
Likely	High likelihood of turbine strike based on any of the following being located within 500 m of the proposed turbine location: • Resident threatened species habitat or non-threatened raptor species habitat • Migratory or nomadic species habitual flight path • Landscape feature/s likely to increase bird and/or bat activity (including distance to nearest canopy, waterbodies, riparian corridors, updraft locations, caves etc.)
Moderately Likely	Moderate likelihood of turbine strike based on any of the following being located within 1000 m of the proposed turbine location: • Resident threatened species habitat or non-threatened raptor species habitat • Migratory or nomadic species habitual flight path • Landscape feature/s known or predicted to increase bird and/or bat activity (including distance to nearest canopy, waterbodies, riparian corridors, updraft locations, caves etc.)
Less Likely	Low likelihood of turbine strike based on any of the following being located greater than 1000 m away (or not detected): • Resident threatened species habitat or non-threatened raptor habitat • Migratory or nomadic species habitual flight path • Landscape feature/s known or predicted increase bird and/or bat activity (including distance to nearest canopy, waterbodies, riparian corridors, updraft locations, caves etc.)

TABLE 7-10 RISK MATRIX OF RISK LEVEL BASED ON LIKELIHOOD AND CONSEQUENCE

Likelihood Criteria	**Consequence Criteria**			
	Severe	High	Moderate	Minor
Very Likely	Very High	Very High	Very High	High
Likely	Very High	High	High	Moderate
Moderately Likely	Very High	High	Moderate	Low
Less Likely	High	Moderate	Low	Low

TABLE 7-11 RISK ASSESSMENT SPECIFIC CRITERIA

Risk Category	**Category Criteria and Detail**
Low	• Species unlikely, or with the potential to occur within the Subject Land; • No records in the Subject Land and locality within 10 years; • No records in the broader locality within 10 years (up to 150 km from Subject Land); • Flight height outside of RSA; and • No to low amounts of potential or suitable habitat in the Subject Land (such that site utilisation unlikely to be impacted).
Moderate	• Species with the potential to occur within the Subject Land; • No records in the Subject Land and locality within 10 years; • Moderate records in the broader locality within 10 years (up to 150 km from Subject Land); • Flight height inside of RSA; and • Low to moderate amount of potential or suitable habitat in the Subject Land, unlikely to be impacted by the proposed development (such that site utilisation unlikely to be impacted).

High	• Species known, likely or with the potential to occur within the Subject Land;
	• No to low amounts of records in the Subject Land and locality within 10 years;
	• Moderate to high records in the broader locality within 10 years (up to 150 km from Subject Land);
	  • Flight height inside of RSA; and
	  • Moderate to high amounts of potential or known habitat in the Subject Land, likely to be significantly impacted by the proposed development (such that site utilisation likely to be impacted).

Very High	• Species known, likely or with the potential to occur within the Subject Land;
	• Moderate to high amounts of records in the Subject Land and locality within 10 years;
	• Moderate to high records in the broader locality within 10 years (up to 150 km from Subject Land);
	  • Flight height inside of RSA; and
	  • Moderate to high amounts of potential or known habitat in the Subject Land, likely to be significantly impacted by the proposed development (such that site utilisation likely to be impacted).

This approach has the following assumptions:

- That the observer will see the bird on the given day of the surveys, at the given times;
- The number of records is in line with literature on flock size, and number of records recorded within the broader locality of 150 km (from the past 10 years);
- The seasonality of observations and migratory pathways has been taken into account however, it is not certain that such survey periods would capture the species flying through; and
- All sightings of individuals within the Subject Land occur within the RSA.

Other factors will be incorporated to determine bird and bat species risk, including whether any site-specific information identified any WTGs are of 'high risk' to relevant species. As a result of the risk assessment, four listed threatened and/or migratory bird species, were considered to be at a very high risk of impact by the proposed development.

TABLE 7-12 COLLISION RISK ASSESSMENT

Species	Listed Status		Likelihood of Event	Consequence of Event	Risk Rating	Comments
	EPBC Act	BC Act				
Listed Birds						
Hirundapus caudacutus white-throated needletail	V, M	-	Very Likely	Moderate	**Very High**	The white-throated needle-tail is a migratory species with a global distribution. Breeding in Siberia, the species is typically present in Australia between September and April where it is almost exclusively an aerial flyover with only occasional observations made of roosting behaviour. There is evidence that this species can stop to forage within elevated eucalypt forests while in Australia. No detections of the species have been made following survey effort to date however it is likely that foraging behaviour may lead to risk of collision in the event that the species is present. Potential foraging habitat is noted to be present throughout the Project within proximity to WTGs. As a result, this species has assessed to have a **Very High** risk of collision.
Hieraaetus morphnoides Little Eagle (Breeding)	-	V	Very Likely	Moderate	**Very High**	The little eagle has a broad range throughout mainland Australia and can be found in a variety of ecosystems with the exception to the heavily forested pars of the Great Dividing Range. It typically occurs in open woodland, grassland and arid regions particularly within close proximity to open woodland and riparian zones suitable for breeding. While hunting, the little eagle is known to soar up to 500m in search prey and will typically take prey on the ground or from trees and shrubs in open woodlands. The species is known to be present within The Plains Wind Farm Project Area following a detection of a single individual flying approximately 400m above the ground and record of a nesting site. Potential foraging and breeding habitat is present throughout the Subject Land, including within proximity to WTGs. As a result this species has been assess to possess a **Very High** risk rating.

Species	Listed Status		Likelihood of Event	Consequence of Event	Risk Rating	Comments
	EPBC Act	BC Act				
Circus assimilis Spotted Harrier	-	V	Very Likely	Moderate	**Very High**	The spotted harrier typically inhabits open wooded country in tropical and temperate Australia, particularly in arid and semi-arid areas. Breeding habitat is characterized by open or remnant woodland with nests rarely being built in isolated trees. The spotted harrier is a diurnal species feeding primarily on ground active birds, mammals, and reptiles and hunting behavior is characterized by quartering, or systematic searching, of the landscape low to the ground. Although no observations of the spotted harrier were made flying at heights considered at risk of turbine collision, the species is known to be present and potentially suitable foraging and nesting habitat is present throughout the Subject Land within proximity to WTG. As such this species has been assessed to possess a **Very High** risk of collision.
Falco subniger Black Falcon	-	V	Very Likely	Moderate	**Very High**	The black falcon is widely distributed across mainland Australia but is typically found in arid and semi-arid zones. Hunting occurs over open wooded grasslands, saltbush plains and other areas low and open shrublands, particularly within close proximity to watercourses or remnant patches of isolated trees. While hunting the black falcon often soars for long periods of time at height and takes prey in the air or on the ground. The species is known to be present and individuals have been observed flying at heights considered to be at risk of collision with WTB. Potentially suitable foraging and breeding habitat is present throughout the Subject Land within proximity to WTG. As such this species has been assessed to possess a **Very High** risk of collision.
Non-listed Birds						
Aquila audax Wedge-tailed Eagle	-	-	Very Likely	Minor	**High**	The wedge-tailed eagle can be found throughout Australia and has an extensive range of habitats, including woodlands, shrublands, and grasslands of arid and semi-arid Australia (Ferguson-Lees & Christie, 2001). Nesting occurs typically on available tall trees, however artificial structures such as transmission lines are regularly used. The species spends large amounts of time searching for prey at large heights and is frequently observed flying beyond 500m in height. Suitable foraging, hunting, and breeding habitat is present throughout the Subject Land within proximity to WTG. As such this species has been assessed to possess a **High** risk of collision.

Species	Listed Status		Likelihood of Event	Consequence of Event	Risk Rating	Comments
	EPBC Act	BC Act				
Falco cenchroides Nankeen Kestral	-	-	Very Likely	Minor	**High**	The nankeen kestrel is a very common falcon throughout Australia and is often found throughout grasslands, shrublands and open woodlands of Australia's arid and semi-arid regions. Nankeen kestrels predate on insects, small birds, reptiles, and mammals and typically hover over vegetation in search of prey. While hovering heights are usually below 100m, the species has been observed foraging at heights above this. Suitable foraging, hunting, and breeding habitat is present throughout the Subject Land within proximity to WTG. As such this species has been assessed to possess a **High** risk of collision.
Falco berigora Brown Falcon	-	-	Very Likely	Minor	**High**	The brown falcon is a medium-sized raptor found throughout Australia across a highly diverse habitat range and is relatively common throughout its distribution. Brown falcons predate on insects as well as small mammals, reptiles and birds and spend large amounts of time searching for prey from a perched vantage point or soaring at heights. Suitable foraging, hunting, and breeding habitat is present throughout the Subject Land within proximity to WTG. As such this species has been assessed to possess a **High** risk of collision.
Milvus migrans Black Kite	-	-	Very Likely	Minor	**High**	The black kite is a medium-sized bird of prey with an extensive global distribution. Within Australia, the black kite is found throughout a variety of habitat types including open woodland, grasslands and shrublands and is particularly common throughout arid and semi-arid landscapes. The black kite is known to regularly fly at heights above 100m and is flexible in foraging behaviour with active hunting and scavenging both common. Suitable foraging, hunting, and breeding habitat is present throughout the Subject Land within proximity to WTG. As such this species has been assessed to possess a **High** risk of collision.
Elanus axillaris Black-shouldered Kite	-	-	Very Likely	Minor	**High**	Black-shouldered kites are small raptors found throughout Australia. While known across a diversity of habitat types, black-shouldered kites are typically found in open grasslands or woodland. The species us a soecialise hunter of small mammals, insects, and reptiles and hunts by hovering over vegetation in search of prey. While hovering heights are typically below 100m, individuals are known to fly at heights above this. Suitable foraging, hunting, and breeding habitat is present throughout the Subject Land within proximity to WTG. As such this species has been assessed to possess a **High** risk of collision.

Status listing per EPBC and NC Acts: CE = Critically Endangered; E = Endangered; V = Vulnerable; M = Migratory; LC = Least Concern; SLC = Special Least Concern.

Mathematical Collision Risk Modelling

The Band Collision Risk Model (Band, 2007) will be used to predict the total number of bird collisions that may result from the Project. This method of CRM requires the input of parameters that describe species-specific biometrics, flight speeds and characteristics and the expected amount of flight activity as derived from field surveys in the Subject Land. It also requires the input of WTG specific information such as the blade size and pitch, hub height and rotor rotation period as well as the proportion of time the WTG will be operational (Band, 2007).

The CRM should use observational BUS data to determine the flight heights, frequency of time spent in the RSA for the species known to occur within the RSA. Literature may be used to determine average flock size, but observational data must be used for presence/absence of species, as well as time spent within the RSA. This follows the process of determining:

- Stage 1: the number of birds or bats colliding per annum = the number of birds or bats flying through the RSA); and
- Stage 2: the probability of the bird or bats flying through the RSA being hit (Band, Madders & Whitfield 2007).

Stage 1 depends on bird surveys at vantage points used to gather information on frequency of bird and bat flights in the RSA (Band, Madders & Whitfield 2007) and has been informed from data across survey periods across relevant seasons in The Plains Wind Farm Project Area, with additional data to be collected to inform the final BBAMP. This also depends on the flock size of the species as well as the species activity during the year (e.g., whether it is diurnal or nocturnal, migratory or present all year round).

Stage 2 depends on the characteristics of the bird and bat such as length and wingspan, as well as the breadth and pitch of the WTG blades, rotation speed of the WTG and average flight speed of birds and bats identified as flying in the rotor swept volume (Band, Madders & Whitfield 2007).

Collision Risk Model Inclusion Criteria

The following Section details the CRM and the process that was undertaken for the threatened, migratory and raptor species considered for the proposed development CRM. The risk assessment identified the following three categories listed in Table 7-13.

TABLE 7-13 COLLISION RISK MODEL INCLUSION CRITERIA

Risk Category	Category Criteria and Detail	Included in CRM
Negligible	• Species unlikely, or with the potential to occur within the Subject Land; • No records in the Subject Land and locality for 10 years; • No to low records in the broader locality for 10 years (up to 150 km from Subject Land); • Flight height outside of RSA; and • No to low amounts of potential habitat in the Subject Land / no impact to site utilisation.	NO
Low	• Species with the potential to occur within the Subject Land;	YES (only with sightings in RSA)

Risk Category	Category Criteria and Detail	Included in CRM
	• No records in the Subject Land and locality for 10 years; • Low to moderate records in the broader locality for 10 years (up to 150 km from Subject Land); • Flight height inside of RSA; and • Limited potential habitat in the Subject Land/ no to low impact to site utilisation.	
High	• Species known, likely or with the potential to occur within the Subject Land; • No to low amounts of records in the Subject Land and locality for 10 years; • Moderate to high records in the broader locality for 10 years (up to 150 km from Subject Land); • Flight height inside of RSA; and • Limited to moderate known and potential habitat in the Subject Land / likely impact to site utilisation.	YES (only with sightings in RSA)
Very High	• Species known, likely or with the potential to occur within the Subject Land; • No to low amounts of records in the Subject Land and locality for 10 years; • high records in the broader locality for 10 years (up to 150 km from Subject Land); • Flight height inside of RSA; and • moderate to high known and potential habitat in the Subject Land / likely impact to site utilisation	YES (only with sightings in RSA)

The species that were assessed as having a low, high, and very high risk of impact from the proposed development, as determined by the risk assessment, were considered for the CRM.

Collision Risk Model Peer Review Recommendations

The peer review of the CRM methodology was undertaken by Principal Consultant Peter Wright, with 15 years' experience and Senior Consultant Sebastian Ellis, with 4 years' experience, from the ERM Europe Business Unit. These two professionals have each worked on multiple Projects that require the use of CRM using the Band Model, throughout the UK and Europe. While the case study that was subject to peer review differs from The Project discussed by this BDAR, learnings from this peer review have been applied to the collision risk modelling presented within this BDAR.

Overall, the peer review detailed the Band Model as an adequate model to analyse the data collected from the survey effort of the Project Area. To provide a more robust, and conservative estimate of collision risk, the peer review detailed a number of recommendations to improve the model methodology and output, as provided in Table 7-14.

TABLE 7-14 DETAILS A SUMMARY OF THE RECOMMENDATIONS FROM THE PEER REVIEW.

Peer Review Recommendations	Implementation into CRM
Use of hypothetical data, or data from a broader area than the windfarm Subject Land leads to a large amount of uncertainty and undermines confidence in the model. If a species is not recorded in the survey area but is expected, further survey effort would be preferable to utilisation of data from a wider area. Bird activity is typically site specific, with topography, habitat, food/prey availability and other factors all influencing bird flight activity at any one location. Although regional datasets may provide information on bird density that can be extrapolated to a proposed wind farm site, the CRM requires additional assumptions to be made around bird occupancy (e.g., number and duration of flights at potential collision risk height) or bird flux (number of regular flights through the wind farm at collision risk height). As with all models, the more assumptions made for the model inputs, the more uncertainty there is in the outputs.	On the guidance of the peer review model, as well as the literature review of models used throughout the world for CRM, hypothetical modelling is not an accurate way to understand the collision risk for a proposed development. using this recommendation, only birds that have been observed within the RSA for the Project Area, will be included in the CRM prepared as part of this BDAR.
Reference to WTG and bird specific parameters need to be made and justified.	The parameters for the WTGs are based upon the worst-case scenarios. Bird morphology and flight speed parameters were based on literature and observational data, with all of these bird parameters found in Table 7-13.
The calculation of bird occupancy across the whole site requires equal duration of survey effort across all areas of the site (e.g., if 2 hours survey is undertaken at 3 locations simultaneously to cover the whole site then this equates to 2 hours surveyed across the site rather than 6 hours in total).	The calculation for time spent surveying the Project Area was based on surveys conducted by two ecologists at one time. BUS were never conducted simultaneously but rather were conducted one after the other during the survey periods. Therefore, the total time spent surveying the Project Area was calculated based on the accumulation of all survey minutes conducted during each BUS in the Project Area, where no overlap occurred during surveying.
It is recommended that a rule of 2 km visibility per vantage point survey (BUS equivalent in the UK) be used to calculate the total area surveyed.	This recommendation as implemented in order to reduce and give a more accurate representation of the total area surveyed across the Project Area. For each BUS point, a visibility estimate was given to be 1 km, which provided a more conservative estimate than the 2 km recommended. This was to account for areas with low visibility due to vegetation density, topography and weather.
The initial infrastructure footprint was calculated using a 100m buffer. In the UK, a 500m buffer around the infrastructure to calculate the risk envelope is typically used.	A 500 m buffer of the disturbance footprint has been applied to ensure any impacts are not underestimated and provide a worst-case collision risk estimate.
Bird parameters used to calculate collision risk should be referenced and the input of 'flapping' bird behaviour should be applied over 'gliding' bird behaviour to give a precautionary outcome.	Bird parameters used for the CRM referenced has part of Table 7-13, and 'flapping' bird behaviour applied.

Peer Review Recommendations	Implementation into CRM
One of the assumptions used in the model is that each flight observed lasted 30 minutes duration. No justification is provided for using this value, and best practice would be to use actual flight durations recorded from site specific surveys.	The data that was recorded was the bird presence within an indicative RSA of 60-290 m, and direction flying. The survey effort did not capture the total time that the birds sighted spent in the RSA. Each BUS lasted for 30 minutes and therefore it was concluded that if any bird was seen during that BUS within the RSA, that it was seen for the total 30 minutes within the RSA. This does not give the exact period of observation in the RSA, but instead provides the total maximum time the bird could have been sighted in the RSA. Therefore, this provides a conservative and worst-case timeframe for observations in the RSA.
Incorrect application of avoidance rates and 98% avoidance rates should be applied.	Avoidance rates have now been implemented correctly for 95%, 98% and 99% avoidance for each bird species, and given as a range.

Windfarm and WTG Parameters

Table 7-13 details the WTG parameters of the planned infrastructure for the proposed development. These parameters have been used in the CRM for the Project Area to calculate collision risk for detected species under different scenarios.

TABLE 7-15 WTG PARAMETERS FOR THE PROPOSED DEVELOPMENT

WTG Parameters	WTG Specifications
Number of WTG	188
WTG Hub Height	Up to 180 m
WTG Rotor Diameter	Blade length up to 90 m
Rotor Swept Area (RSA) Height	60 - 290 m (lowest point and highest point) *Noting actual RSA is likely to be 90-270 m, however conservative approach has been taken allowing for flexibility in final design.*
Number of Blades	3
Chord Width of Blade	4825 mm
Average Pitch Angle of Rotor	7.5 degrees
Average Rotation Period of WTG	6.66 seconds/ rotation

Bird Species Parameters

The following table provides morphometric parameters, known behavioural traits, and observations of site utilisation following seasonal surveys. The parameters presented below have informed the collision risk model undertaken for each species and have been obtained through a combination of literature review and field observations. The range of flight heights and flock size of the species does not reflect the observed flight heights during survey seasons to date, but rather a maximum estimate based on known behaviours.

TABLE 7-16 BIRD SPECIES OBSERVED WITHIN THE RSA

Species Name	Wingspan (cm)	Length (cm)	Flight Speed (m/s)	Range of Flight Heights for the Species (m)	Flock Size for the Species	Number of Modelled Sightings in the RSA during Survey Period	Total Minutes Sighted during Survey Periods
Black Falcon	102	50	13.6	Up to 500m	2	2	60
Brown Falcon	115	45	13.6	Up to 500m	2	5	150
Black Kite	145	54	17.3	Up to 650 m	1000	26	780
Nankeen kestrel	74	30	17.4	Up to 200m	30	27	810
Wedge-tailed Eagle	230	110	16.7	Up to 650 m	2	42	1260
Australian Magpie	76	40	20.1	Up to 200m	24	30	900
Fairy Martin	30	11	7.7	Up to 300m	Over 100	16	480
Little Raven	69	49	20.1	Up to 200m	Over 100	12	360
Straw-necked ibis	88	60	8.3	Up to 500m	200	25	750

Collision Risk Modelling Results

A summary of model output for preliminary collision risk model is presented in Table 7-16. Three different avoidance scenarios (95%, 98%, and 99%) have been included.

For the nine species included in the model, collision risk has been calculated as the number of collisions per species per annum (Table 7-16). It is expected that birds in practice show a high level of avoidance of WTGs (Band, Madders, & Whitfield, 2007). However, avoidance rates have not been calculated for all species and research is necessary to determine each species-specific avoidance rates. For this CRM, 95% 98% and 99% avoidance rates have been used to calculate collision numbers per annum for the given species. These avoidance rates are what is typically used in CRM exercises (Smales & Muir, 2005).

TABLE 7-17 MODEL CRM ESTIMATED COLLISION RISK NUMBERS PER ANNUM

Estimated annual number of collisions (based on a rotor swept range of 60-290m)			
Species Name	**95%**	**98%**	**99%**
Australian Magpie	0.19	0.08	0.04
Black Falcon	0.03	0.01	0.01
Brown Falcon	0.04	0.02	0.01
Black Kite	0.29	0.12	0.058
Fairy Martin	0.07	0.03	0.01
Little Raven	0.12	0.05	0.02
Straw-necked ibis	0.19	0.08	0.04
Nankeen kestrel	0.25	0.1	0.05
Wedge-tailed Eagle	0.62	0.25	0.12
Total	**1.79**	**0.72**	**0.36**

In total, this CRM Model indicates that approximately two birds are expected to collide with the WTGs per year assuming the lowest avoidance rate of 95%. Under scenarios with avoidance rates of 98% and 99% less than one bird is expected to collide with WTGs per year across all species. This is the worst-case scenario, based on the modelling approach as described. Based on the field investigations that have been undertaken as well as the literature providing the maximum parameters for the species, the total annual collision numbers in the above table are considered the 'worst-case' scenario for the project.

7.1.4.4 MONITORING PROGRAM

Design for the bird and bat monitoring program has been based on the desktop and field investigations conducted for the proposed development to date. The design of the monitoring program will be finalized in the BBAMP and will include potential habitat that has been mapped for 'low' risk of impact species. This will also apply to other potentially occurring species with negligible risk of impact, where habitat (or potential habitat) occurs in the Subject Land. The following Sections detail the methods for the bird and bat monitoring program.

Construction Phase

During the construction phase, a BUS in each of the remaining seasons (summer, autumn, winter) will be undertaken (in addition to the five baseline surveys that have already been undertaken and informed the development of this report). Bird and bat survey techniques undertaken during the construction phase of the proposed development will be consistent with the techniques and locations undertaken in November 2023.

Operation Phase

Bird and bat surveys during the commencement of operation will target the species listed as 'known' or 'likely' to occur within the Subject Land, as well as those listed species with potential to occur in the Subject Land. Bird surveys will occur during the first two years of commencement of operation with surveys being undertaken across each season in those years. The monitoring methods used in the initial two years of operation of the proposed development will be consistent with techniques used during the November 2023 survey event.

The monitoring during operation will be based on two main approaches. The first is to monitor bird and bat activity and ongoing mortality searches that aim to determine impacts (collisions) occurring during the first two years of operation. The second is to inform specific response to impact triggers that may result to bird and bat species, which will include increased monitoring surveys and carcass searches, investigation of risk behaviours and subsequent risk mitigation. This adaptive management approach is further detailed below.

Carcass Search Methodology

As part of the monitoring program, carcass searches will be performed to determine the actual impact of the proposed development on birds and bats. The results of the monitoring will be used to review the risk assessment if necessary and to identify and determine if any further monitoring of bird and bat species is required and to update mitigation measures or adaptive management approaches.

The proposed development is to comprise of up to 188 WTGs. At the commencement of operation, it is proposed that a subsample of turbines across all risk categories will be selected for monitoring over a two-year period at monthly intervals. Following the assessment of turbine specific risk rating, searches will be undertaken to detect the presence of raptor nests and other habitat features that may raise the risk rating of individual turbines across the lifetime of the Project. The number of turbines chosen for carcass searches will be updated accordingly to reflect the evolving risk.

The selected turbines will be revisited over the course of the first two years of operation. These visits will ensure that carcass searches are able to gain high accuracy on data regarding the mortality associated with WTG strike. The order of selected WTGs searched will be random during each monitoring event. The final number and location of individual WTGs that will be constructed is not yet known, and so this will be reflected in an updated map of selected WTGs for monitoring.

All carcass searches will be undertaken by suitably qualified personnel with appropriate skills in both bird and bat identification as well as in the handing of deceased species. Searches within areas and near selected WTGs will target birds and bats of medium to large size as per the Hull and Muir Model (2010), which uses the Monte Carlo simulation. The model suggests that 95% of bat carcasses should be present within 74 m of a WTG, and the carcasses for birds of medium to large sizes would be distributed to distances up to 122 m. Some species (larger birds) may be found further out from this model, however 95% are expected to occur within an approximate 122 m search area from each selected turbine (Hull & Muir, 2010). This model was based upon parameters of a 72 m rotor radius and 120 m hub height.

Based on the principles adopted in Hull and Muir (2010), the following search areas have been designed for birds and bats for the Project, with its approximate rotor tip height of up to 270 m and turbine rotor size of up to 110 m:

- Bats and small to medium sized birds, including some large sized birds: 100 m radius around the turbine. Transects will be spaced every 6 m from the WTG; and
- Medium to large sized birds (and some larger bats): 100-150 m radius around the WTG. Transects in this search area will be 12 m apart, undertaken from the inner (100 m) to outer (150 m) sections of the search area.

Recording information and carcass handling procedures

The following information is to be recorded if a carcass is detected during the carcass searches:

- Position of the carcass in relation to the WTG;
- Comments on the vegetation type and area where the carcass was located, including if the species was found on an access path or on the WTG hard-stand area;
- Details on the individual found such as species, age, sex, number of individuals, the injury description as well as the estimate time of death if found deceased. If the carcass is unable to identified, this will be taken to appropriate facilities for DNA testing to be undertaken;
- Photos must be taken of the area and of the individual found. Such photos will need to be sent to an appropriately qualified ecologist within two business days so they can adequately undertake identification; and
- Whether details on the find date, as well as details taken of the weather conditions in the time preceding the find date of the carcass, including wind speeds, temperate and rainfall amounts.

Scavenger Rates and Trials

The scavenger trial is adopted to ascertain at what rate naturally occurring scavengers remove carcasses from the Subject Land. These trials will be developed such that they are adopted twice within the first year following operation commencement, with each trial undertaken across 30 days. This will ensure that the difference in seasonal vegetation condition is accounted for. Such periods are also going to be associated with different stocking levels across seasons.

Scavenger trials will be undertaken in the inner search area of the turbines selected for carcass search trials (100 m radius from the turbine). Carcasses will be distributed sufficiently with lower than ten carcasses per trial to avoid biasing the results through scavenger swamping. (Smallwood, 2010).

Two different categories of carcasses will be used for the scavenger trials. Such carcasses will be those that are found during mortality trials. Additionally, small mice can be used in place of micro-bats if these carcasses are not able to be found. The two different categories will help to ascertain the different scavenger rates in the search area.

The two categories and the number of replicates that will be used for each trial are:

- Micro-bats and small birds: seven replicates/trial; and
- Medium sized birds: six replicates/trial.

At each of the randomly selected turbines used for the carcass searches, carcasses will be randomly placed under the turbines. The carcasses will be checked as follows:

- Each day for the first five days;
- Every two days from day six to 10;
- Every three days from day 11 to 19; then
- Every four days from day 20 until they disappear or until the end of the 30-day trial period.

The proposed development operation staff will be trained over a five-day period to undertake the scavenger trials following trial establishment by a suitably qualified ecologist.

In the event that a trigger point criteria is approached or met through general monitoring, additional targeted species monitoring may be required in response where additional information is needed.

Additional procedures to follow for scavenger trials is detailed below:

- Timing of searches has been based on the detailed experience and regulatory approval of other windfarms where scavenger trials have been undertaken that show almost all carcasses have been scavenged within a period of 5-10 days. Additionally, GPS coordinates will be taken for all carcasses placed during the scavenger trials, so as not to confuse these with any naturally occurring carcasses in the search areas;
- A mix of carcass sizes of bird and bats (small, medium to very large) will be obtained to use in scavenger trials from prior searches of the Subject Land. If a carcass of species at risk or of concern cannot be located for the trial, a substitute of the same colour and size will be used in its place;
- Thick latex gloves must be always worn when handling the bird and bat carcasses. This will ensure that both the safety of the personnel but also that human scent will not replace the scent of the carcass which will alter scavenger behaviour and find rates;
- One carcass at minimum will be placed randomly within the 100 m search area at each trial site. This carcass will be thrown in the air to recreate the natural landing of a carcass from impact with a wind turbine, such that feathers or fur may become dislodged or ruffled from the impact of the simulated fall;

- Detailed observations will be taken at the search areas where carcasses have been scavenged, including the composition of the carcass and weather any types of scavenging behaviour have been present (feathers, bones dispersed, pecking, tearing, partial removal of carcasses, as well as scats and tracks of potential predators); and
- The final state of the carcass will be recorded at the end of the survey period.

The outcome focused objectives for the scavenger trials are detailed below:

- Ascertain at what rate naturally occurring scavengers remove carcasses from the Subject Land to determine removal rate of carcasses that cannot be found due to scavenger removal; and
- Use removal rates to enable more accurate estimations of fatality rates of turbine strikes, to determine if mortality rates reach or exceeds an ecologically significant proportion of a population.

Scavenger trials will be conducted across seasons to account for different rates of scavenging that has been observed across seasons (Catling 1988; Molsher et al., 2000). Dependant on results of the scavenger trials, reassessment of requirements and procedures (including replicate numbers) will be reassessed to determine if changes to the above procedures are needed.

An alternative to the method used above is to use motion sensor cameras that monitor scavenger activity. In this case a star picket (approximately 1 m high) will be placed in the ground approximately 4 m away from the carcass, with a camera attached. This camera will record any scavenging activity over the course of 30 days from placement. This method gathers the exact time and method of scavenging and thus eliminates any uncertainties in the results analysis.

Detectability Trial

Detectability trials will be conducted at the same time as scavenger trials, during the first day of placing carcasses. These detectability trials will be conducted to test the efficiency of searchers in finding the carcasses for the Subject Land. The detectability trials will be conducted four times in the first year of operation, sampling across all four seasons (Summer, Autumn, Winter, Spring). This sampling will represent the greatest change in vegetation cover. Such detectability trials will also be conducted for handlers and dogs, if they are to be used for the proposed development. The detectability trials will be conducted by personnel who have been involved in the monthly carcass searches.

The detection efficiency that is determined from the detectability trials will be incorporated into mortality rates and analyses to account for the error associated with human detection of carcasses. This detectability analysis will be documented in the report at the end of the first two-year monitoring period in accordance with the BBAMP.

Carcasses will be randomly placed in the inner search area of a turbine (100 m zone) and their location noted by the suitably qualified ecologist. The efficiency will be recorded as the number of successful finds by a searcher against the actual carcasses placed by the suitably qualified ecologist.

The categories, number of carcasses and replicates to be used in the detectability trials across the wet and dry season is presented in Table 7-18.

TABLE 7-18 NUMBER OF REPLICATES OF BIRD AND BAT CARCASSES FOR DETECTABILITY TRIALS

Season	Micro-bat - Small birds	Medium sized birds	Large raptor sized birds
Summer	7	7	3
Autumn	7	7	2
Winter	7	7	2
Spring	7	7	3

Results Analysis and Presentation

It is proposed that a 12-month monitoring report and a final monitoring report (end of two-year monitoring period) will be prepared. Annual compliance reports will include an assessment of the monitoring programs and whether any trigger limits have been met. Ongoing monitoring will be assessed following risk assessments as a component of the described adaptive management framework.

Data that will be analysed and documented in the reports will include information on carcass identification and timing, the results of the trials (scavenger and detectability) so that factors influencing mortality can be determined. Mortality rates should be expressed as the number of carcasses discovered per turbine per year and any spatiotemporal variation across the Subject Land and seasons should be presented and discussed.

Data analysis will estimate mortality rates of birds and bats within the Subject Land, considering standard error and variation. Appropriate software packages will be used to inform variables needed to be determined during the carcass, detectability and scavenger trials which will subsequently inform the survey design.

The following software packages and statistical principles are proposed for the proposed development, with specific variables to be measured and data input requirements (and associated assumptions) considered in the final monitoring design:

- Logistical regression (general liner modelling) to be used to determine searcher efficiency. This will account for significance;
- The proportion of the area searched to be estimated using the Monte-Carlo Simulation method as described in Hull and Muir (2010);
- Mortality will be estimated using the Hortvitz-Thompson style estimator from Huso (2011);
- Survival analysis (survival regression to account for interval censoring) to be calculated using Generalised Estimator (GenEst) (or similar). GenEst is used to estimate the total number of individuals that are present within an area in a given time period, when their detection probability may not be known. This program is used as counts of carcasses alone is not an accurate way to measure the true number of fatalities in an area due to those that may be missed in the process. This method also allows for comparisons across locations and years taking into account the rate of detection:
  - GenEst includes tools for estimating searcher efficiency, carcass persistence, and other detection probability parameters from experimental field trials. GenEst is not an evidence of absence-type estimator and is not going to be used in circumstances where few carcasses are found. This is where the EoA program will be adopted; and

- Evidence of Absence (EoA). This program can be used to help determine potential fatalities which may have occurred, with respect to the survey effort, even in the absence of a carcass being located.

Statistical analyses will assist in determining potential significant differences across size categories of species, vegetation composition or across seasons.

Documented results will inform adaptive management on whether additional mitigation measures are necessary and whether specific turbines in the Subject Land pose higher risks to birds and bats than others. Such adaptive management will occur in consultation with BCD.

BBAMP personnel and associated training requirements

All personnel involved in the implementation of the BBAMP will be familiar with the approved BBAMP, relevant proposed development policies and procedures, and other important administrative matters such as health and safety documents. The Proponent will be responsible for ensuring that suitably qualified and trained people are engaged to supervise and implement the formal monitoring program as defined in the BBAMP. Beyond the formal period of monitoring, the Proponent will be additionally responsible for ensuring ongoing reporting of incidental finds and the engagement of relevant specialists were triggered by the BBAMP.

Training will be provided to all personnel that will be undertaking carcass searches, species identification and handling. Such training will be delivered by suitably qualified ecologists who are specialists in the field of bird and bat carcass retrievals. The training will include trial establishment, transect search techniques, selection of specific turbines for monitoring, species identification, carcass handling practices and PPE management.

The qualified ecologist will be involved in the initial search program of the turbines to oversee and assist with the carcass search, handling and identification. So that the BBAMP is being implemented and monitoring routinely performed to standard, the suitably qualified ecologist will undertake an audit after the first 6 months of the commencement of the implementation of the BBAMP.

The suitably qualified ecologist will be available to identify any carcasses that proposed development personnel are unable to identify, either from frozen specimens or from photographs taken at the search area.

Training will be provided to assigned operational personnel which on how to properly prepare and handle carcasses and how to randomise the placement of carcasses in trial areas.

Scavenger trials will be developed by the suitably qualified ecologist, who will supervise the searches undertaken by trained operational personnel.

The suitably qualified ecologist will undertake data analysis and prepare the 12-month interim and two-year final monitoring reports.

Training will be provided by the suitably qualified ecologist to operational personnel involved in the monitoring program and trials, with refresher training available if requested or deemed necessary during the two-year implementation period of the BBAMP.

7.1.4.5 TRIGGER ACTION RESPONSE PLAN

This section outlines the impact triggers and the process for assessing if an impact exceeds a significant residual impact to that species associated with interactions with turbines, including the decision-making framework and adaptive management where a response is required.

Impact triggers and response requirements will be different for both listed and non-listed species. For listed threatened and migratory species, two levels of assessment are to be considered in the BBAMP:

1. An impact trigger, defined as a single mortality event to a listed species that triggers an ecological investigation into the cause and significance of the event, with recommendations for adaptive management to avoid, minimise and manage the impact; and
2. Assessment of the significance of the impact, with a method for estimating if the impact exceeds a significant residual impact, as defined by Significant Impact Guidelines 1.1 - Matters of National Environmental Significance (DEWHA, 2013) to identify if offsets are required to compensate for the significant residual impact.

The Applicant will be responsible for ensuring implementation of the developed BBAMP and the adaptive management approach. A suitably qualified ecologist will be required to support decision-making elements and provide advice in relation to the impact significance and where Regulator consultation (State and Commonwealth) is required.

Threatened and Migratory species impact trigger requirements

Where a single listed threatened and/or migratory bird or bat species are found dead within the search area of a turbine (proximity that can be attributed to turbine collision) during implementation of the BBAMP, or via an incidental find, then the impact trigger methodology as described below applies. Additionally, if a breeding area for these species is located within 200 m of a turbine, then an impact trigger will occur. There are currently no known breeding places for the likely or known species within the Subject Land.

Where a single carcass of a listed threatened and/or migratory species is detected within the Subject Land, a decision-making framework will be implemented. This includes additional surveys being undertaken within two weeks of the carcass find by a suitably qualified ecologist, and where data is available, a population viability analysis (PVA) will be undertaken. A report will be prepared by a suitably qualified ecologist and presented to DCCEEW and/or BCS outlining the next steps of mitigation and management. Additionally, the developed collision risk model will be updated following any suspected turbine collision. It is noted that documents that will be assessed in determining impact triggers will include:

- Significant Impact Guidelines 1.1 - Matters of National Environmental Significance per the EPBC Act (DEWHA, 2013);
- Draft referral guideline for 14 birds listed as migratory species under the EPBC Act (Department of the Environment, 2015); and
- Species-specific management plans and Conservation Advice from SPRAT profiles.

Additionally, if any threatened species are identified throughout the monitoring program would trigger additional mitigation actions, including:

- Species specific monitoring;
- Flight path mapping; and
- Additional targeted surveys.

Threatened and Migratory Species Decision making framework

If the impact trigger requirements are met for the proposed development the following decision-making framework will be followed:

1. Any bird or bat carcass must be immediately reported to the development's Responsible Officer, including information such as the species type, the area where the species was found and any other contributing factors that appear appropriate. Photos must be taken of the carcass or injured species so that correct identification can be carried out.
2. A suitably qualified ecologist, engaged by the Applicant (and managed by the Responsible Officer), will undertake an analysis to determine the presence of the impact trigger either in person or through analysis of the carcass and/or photographic evidence. The ecologist will assess whether the death/injury can be directly attributed to a WTG strike. Where there is conclusive evidence the death/ injury is not related to WTG strike, no further action is required.
3. If the impact trigger has been confirmed by the ecologist, the proposed development's Responsible Officer will report the trigger to DPE and/or DCCEEW within two business days.
4. The suitably qualified ecologist will undertake a detailed investigation to determine the events that caused the death or injury of the listed species. This investigation will include a PVA where data is available for the species. Once this investigation is concluded and if it is deemed that WTG collision or interference with the WTG has caused the death/injury, other factors like species behaviour will also be considered:
    a. If the evaluation undertaken by the suitably qualified ecologist (including a PVA) reveals the impact trigger has the potential to contribute a significant impact to the species, species-specific monitoring will likely be recommended and implemented. This monitoring will be informed by the ecologist, with a minimum six-week period of fortnightly monitoring. These monitoring exercises will need to be supervised and reported by the suitably qualified ecologist, who will include in the report any recommendations for additional mitigation measures to manage or reduce the impact to the species, in accordance with the adaptive management measures. BCD and/or DCCEEW will be consulted on the next steps in the course of action to best close-out the response.
    b. If the evaluation undertaken by the suitably qualified ecologist can demonstrate that a significant impact is unlikely and no further action will be required. This significant impact will be determined through following the relevant guidelines including but not limited to the Significant Impact Guidelines 1.1 - Matters of National Environmental Significance per the EPBC Act (DEWHA, 2013), and the process provided in Section 6.4 of this BBAMP. Species-specific guidelines will be applied as well as current knowledge of the species populations and ranges.
    c. If the evaluation undertaken by the suitably qualified ecologist cannot determine the cause of the impact trigger beyond reasonable doubt, further monitoring (fortnightly for six-weeks) may be proposed to determine re-occurrences/extent of the impact. As with the previous steps, if the additional monitoring confirms a one-off occurrence to the species, then no further action except advising the relevant authority is required. If more than a one-off occurrence is observed, then step 4b) above applies.

5. If the impact trigger is assessed as having the potential to contribute to a significant residual impact, adaptive management will be designed to reduce and mitigate impact to the species. Further monitoring of the effect of these additional mitigation measures and their impact would be undertaken by suitably qualified ecologist to determine and report on their effectiveness. The BBAMP will be updated to include any additional or adjusted mitigation measures. As part of the adaptive management strategy, several mitigation measures may be considered, such as:
   - Acoustics to discourage foraging birds at specific locations;
   - Encourage species into alternative low-risk areas using social attraction techniques (decoys and audio playback systems);
   - Removal of foraging habitat where appropriate; and
   - Investigate alternative stocking arrangements.
6. All evaluations and decisions regarding mitigation measures for the impacted species will be reported to BCD and/or DCCEEW, with consultations to ensure the best course of action is applied for the proposed development and species affected. Outcomes will also be reported in the monitoring reports that are prepared by the ecologist to the Proponent.
7. Offsets may be required where the significant residual impact to the species cannot be effectively mitigated by other measures. Offsets may be in the form of financial offsets under the BOS or research-based offsets where an appropriate institution can undertake species specific research. Offsets will need to be considered and developed in accordance with the BOS. Any offset consultations will need to be undertaken with BCD. Additionally, if a trigger is assessed to have occurred, surveys will be undertaken to review the area, and discussions with BCD will occur, which may include turbine curtailing if assessed as appropriate for species management.

Non-threatened (protected and locally abundant species) Impact trigger requirements

The impact trigger for the non-listed threatened species in the BBAMP will be a total of five or more bat or bird carcasses of the same species that are recorded at the same WTG during a 12 month period.

The definition of a significant impact to a non-listed threatened species is an impact that is likely to reduce the viability of the population of the species within that bioregion. Sometimes the population numbers for a species are not known or reported. In the case where such information is not publicly available, a suitably qualified ecologist will undertake an assessment of the potential impact to a species in the bioregion to determine whether the impact will exceed indicative significant impact thresholds.

Non-threatened Species Decision making framework

If the impact trigger requirements are met for the proposed development, the following decision-making framework will be followed:

1. BCD will be notified of the trigger (including species, time and area) within seven days of the trigger event.

2. A suitably qualified ecologist will undertake an analysis to determine if the impact trigger will exceed the indicative significant impact threshold. This assessment will consider factors like the distribution of the species, known population size and habitat requirements, as well as any literature on specific threats to the species within the bioregion.
3. A report on the findings of the analysis will be prepared by the suitably qualified ecologist and presented to the proposed development's Responsible Officer and subsequently then presented to BCD within three weeks of the impact triggering event (this date may be subject to change upon consultation with BCD).
    a. If the evaluation undertaken by the suitably qualified ecologist reveals the impact trigger to be a one-off event and unlikely to occur again, no further action will be required.
    b. If the evaluation undertaken by the suitably qualified ecologist reveals the impact trigger may lead to the indicative significant impact thresholds being exceeded, species-specific monitoring will likely be recommended and implemented. These monitoring exercises (fortnightly for six-weeks) will need to be observed and reported on by the suitably qualified ecologist, who will then determine if any additional mitigation measures are necessary to manage or reduce the significant impact upon the species. Such measures will be decided upon through adaptive management approach.
4. The investigations and mitigation measures recommended in the case of a significant impact will need to be included in the monitoring reports, in accordance with the BBAMP.

Adaptive Management

In the event of an impact trigger to a listed threatened bird or bat species, adaptive management principles will be applied. Application of adaptive management will be upon written recommendation (from the reporting requirement of the impact trigger response) by a suitably qualified ecologist, in accordance with the BBAMP.

Adaptive management will take into consideration the species impacted, the area of impact and other factors such as population dynamics, to determine the most appropriate solution.

Additional mitigation and monitoring measures, should they be required, and potential effects will be monitored and documented within the monitoring reports, in accordance with the BBAMP, and presented to the BCD for consultation on the next steps for management and mitigation to be implemented.

7.1.4.6 MITIGATION MEASURES

The BBAMP will define environmental objectives for the proposed development that will enable the implementation of a long-term approach to the mitigation and management of potential impacts on listed threatened and migratory species. Monitoring will also identify any potential changes to the species' utilisation of the project site and the surrounding landscape.

Mitigation measures will be implemented for potential significant impacts to listed threatened species arising out of the operation of the proposed development. Impact triggers act as a measure to determine when additional mitigation measures should be implemented. Mitigation measures will be reviewed throughout the monitoring period, and at the end of every two-year monitoring period, a suitably qualified ecologist will oversee and determine whether any adjustments should be made. The required monitoring frequency over the lifetime of the Project will be reviewed by a suitably qualified ecologist in consultation with DCCEEW to establish an appropriate frequency based on results and changes in collision risk following monitoring completed to date.

The adaptive management approach proposed to monitor impacts, detect impact triggers and apply corrective actions is outlined in Section 7.2.2.5. The measures in Table 7-18 have been designed so that species (locally abundant, least concern and listed species) are not significantly impacted by the proposed development. If changes to the mitigation measures are likely to result in a new or increased impact to any EPBC Act listed species (i.e., beyond minor variations or updates to the BBAMP), impacts may need to be referred to the Minister in accordance with Section 143A of the EPBC Act, following a self-assessment.

The main causes of impact to listed species for the proposed development are considered as:

- Collision of birds and bats with blades of operating WTGs is likely to occur, with non-listed species most at risk;
- Injury and mortality of birds and bats caused by exposure to rapid air pressure reduction due to proximity to turbine blades, causing barotrauma; and
- Removal or reduction of critical foraging, dispersal and breeding habitat is likely to occur following construction of WTGs and associated infrastructure.

Factors that can increase the potential of impacts to listed species for the proposed development are considered as:

- Promotion of water and foraging resources that result in attracting birds and bats into the vicinity of the WTGs. This could result in higher rates of collision and injury/death. Nesting may occur close to WTGs; and
- Lighting on WTGs and buildings causing an increase in bird and bat prey. This may result in increased bird and bat abundance in the vicinity of the WTGs and increase collision risk.

An adaptive management process has been established by this BBAMP, which includes the following broad elements:

- Baseline monitoring surveys – prior to the commencement of operation of the proposed development (six of which have already occurred from 2021-2023, and two of which are yet to occur from 2023-2024);
- Operational monitoring surveys – to be undertaken at selected WTGs throughout the operation of the proposed development, to estimate mortality of bird and bat species as well as record species within the Subject Land;
- Reporting – to be undertaken in the first and second year of operation and agreed upon timeframes thereafter with DCCEEW and BCD. Such reports will include mortality estimates, incident findings, mitigation measure effectiveness or inefficiencies; and
- Development of mitigation measures based on monitoring surveys and reporting results to manage risks such as minimising mortality.

The management actions will aim to minimise the impact of mortality associated with collisions with WTGs. The success of management actions will be measured through performance indicators related to impact triggers, monitoring and assessment outputs. Despite these measures, a residual risk will likely remain. The success of the proposed management actions will be measured through monitoring documentation and reporting.

7.1.4.7 TURBINE STRIKE NOTIFICATION

Assessment of Significant Residual Impacts

As part of the ecological investigation completed when an impact trigger is detected, the significance of impact will be assessed by a suitably qualified ecologist with reference to the EPBC Act Significant Impact Guidelines 1.1 - Matters of National Environmental Significance.

It is proposed that the method for assessment for identifying if an impact will exceed an indicative significant impact threshold will quantify the number of mortalities of each species based on the carcass search results (see section 5.3 Carcass Search Methodology) that reaches or exceeds an ecologically significant proportion of a population over a defined period (referred to as a "significant impact threshold").

As described in the referral guideline for 14 birds listed as migratory species under the EPBC Act (2015), an ecologically significant proportion of a population is defined as being 0.1% of the estimated national population size for a species. Where this is exceeded, offsets may be required for the significant residual impact.

A high-level review of species population ecology has been used to establish an indicative significant impact estimate, that considers the number of mortality events and time frame considered as potentially significant to the species identified at low risk in this BBAMP. Generational time, defined as the average interval between the birth of an individual and the birth of its offspring, is approximately ten years for most species identified as having a potential future risk in this BBAMP. These generational times can be used as an indication of the time required for a population to replace individuals lost to turbine collisions. The species ranges and population sizes have also been considered for these estimates presented in this BBAMP, with those having larger populations. Table 7-19 provides an indicative significant impact threshold associated with four at risk listed threatened and migratory bird species, and twelve species identified as vagrants (section 3.1.2). Due to unknown population estimates for some species, a conservative approach has been taken to proposed impact thresholds that are likely to be a greater proportion of the population than is applied to the remaining species. In these instances, a significant impact threshold of one mortality has been proposed. In the event that population estimates for a species become available, the significant impact thresholds proposed by this BBAMP will be updated accordingly. Where a species is listed as threatened under the BC Act but not listed as threatened under the EPBC Act, known population estimates specific to NSW have been used to calculate mortality thresholds.

TABLE 7-19 SPECIES INDICATIVE SIGNIFICANT IMPACT THRESHOLD

Common Name	Scientific Name	Australian Population Estimate	Indicative Significant Impact Threshold (0.1% of population)
White-throated Needletail	*Hirundapus caudacutus*	41,000	41 mortalities over a five-year period
Little Eagle	*Hieraaetus morphnoides*	Unknown	1 mortality within a one-year period*
Australian Painted Snipe	*Rostratula australis*	340	1 mortality within a one-year period
Black Falcon	*Falco subniger*	4,000	4 mortalities within a one-year period
Spotted Harrier	*Circus assimilis*	Unknown	1 mortality within a one-year period*
Major Mitchell's Cockatoo	*Lophochroa leadbeateri*	15,000	15 mortalities within a five-year period
Grey Falcon	*Falco hypoleucos*	1,000	1 individual within a one-year period
White-bellied Sea-eagle	*Haliaeetus leucogaster*	1600 (NSW)	1 individual within a one-year period
Square-tailed Kite	*Lophoictinia isura*	Unknown	1 mortality within a one-year period*
Magpie Goose	*Anseranas semipalmata*	1,000,000	3 mortalities within a one year period
Dusky Woodswallow	*Artamus cyanopterus cyanopterus*	200,000	200 mortalities within a five-year period
Australasian Bittern	*Botaurus poiciloptilus*	1,300	1 mortality within a one-year period
Varied Sitella	*Daphoenositta chrysoptera*	Unknown	1 mortality within a one-year period*
Blue-billed Duck	*Oxyura australis*	15,000	15 mortalities within a five-year period
Freckled Duck	*Stictonetta naevosa*	18,000	18 mortalities within a five-year period
Brolga	*Grus rubicunda*	1,000 (Southern Australia)	1 mortality within a one-year period

These significant impact thresholds are indicative only, and the actual significant impact assessment and associated advice will be provided by a qualified ecologist aligned with the investigation process outlined in the BBAMP. These indicative thresholds may exhibit fluctuations through time as updated species population estimates become available and it is expected that contemporary information be used during an investigation, as required throughout the life of the BBAMP.

* A conservative estimate of significant impact threshold has been made in the absence of population estimates. See section 7.2.2.7

Specific management objectives, activities, timing and performance criteria

Table 7-20 summarises management objectives, activities, timing and responsible parties for the implementation of this BBAMP. This table should be referred to for reporting and monitoring purposes throughout the two-year monitoring period. It is noted that adaptive management may require an adjustment to the requirements under the direction of a suitably qualified ecologist.

TABLE 7-20 MANAGEMENT ACTIONS

Stage	Management Action
Pre-Development	The two-stage impact and disturbance mitigation process will be implemented. Areas of remnant and regrowth vegetation will be avoided at the design and micro-siting phases
	Design of a turbine with a blade sweep area >60 m above ground level to provide a collision-free foraging zone within the canopy and 20 m above the canopy
	Locating turbines away from key bird and bat habitats (waterways and drainage lines)
	Initial field surveys for bird and bats will be undertaken. Impacts areas to be selected as part of the BACI designed bird surveys. A further iteration of the CRM to be undertaken, utilising updated BUS data, and incorporating any additional listed threatened or migratory species detected.
Pre-construction	Pre-clearing surveys shall be undertaken prior to clearing efforts within the marked boundaries. These pre-clearance surveys will form part of the micro-siting process, which will closely analyse potential infrastructure locations. If potential habitat for bats, such as riparian areas and dense woodlands, occur in such locations, development layout will be adjusted. Control areas to be selected as part of BACI designed bird surveys. Surveys will then be undertaken in the control and impact areas prior to construction beginning. These surveys will include BUS such as point, waterbody and bird of prey surveys, to determine species presence in the RSA and bat surveys will be conducted via the use of echolocation call detectors and harp trapping
	Targeted surveys to identify important habitat features of value to birds and bats in the Subject Land, in particular, identify raptor nesting sites so that turbine location can be adjusted as part of micro-siting requirements to minimise collision risk
Construction	All clearing shall be within clearly marked boundaries and in accordance with the Development Permit
	Where trenching and excavations are created which may entrap fauna, suitable escape measures are put in place, and excavation are checked for fauna before backfilling
	Include toolbox talks for site specific bird and bat information during the proposed development
	Ensure appropriate waste management (lidded bins), including food scraps, to reduce potential for feral species to become established on-site
	BACI surveys conducted at impact and control areas during construction to determine bird and bat composition, abundance and density at control and development areas. This includes BUS and use of bat survey techniques
Monitoring	Daily inspections by spotter / catcher during clearing, specifically hollow trees, roosting sites, and rocky outcrops and caves for birds and bats
	Weekly site inspections to review flora and fauna control measures during clearing and construction

Stage	Management Action
	Annual auditing of Construction Environmental Management Plan (CEMP) during construction
	BACI surveys to be conducted in the operation phase at control and impacts areas, to determine the 'after' development effect on bird and bat composition, abundance and density.
	Mortality monitoring: at approximately 30% of turbines (approximately 8 WTGs) monthly for two years. Any extension to monitoring is considered under Section 6.3 of this document
	Scavenger and detectability trials: two of each, undertaken within the first year of monitoring, approximately 6 months apart.
	Adaptive management and inclusion of additional mitigation measures as a result of impact triggers as a result of recommendations from a suitably qualified ecologist
Reporting	Sightings and incidents reported in daily Pre-starts
	Fauna spotter-catcher will keep an inventory of any bird and bat species encountered with details of species, capture and release condition and capture and release GPS co-ordinates during construction. This also includes carcass reporting and notification
	Injured native fauna to be reported to Health, Safety, Environment Quality (HSEQ) Manager
	Preparation of monitoring BBAMP reports: one within three months of the first year of monitoring, and one within three months of the second year of monitoring
	Monitoring report after two years: estimates of mortality for bird and bat species across the monitoring period. Taking into account detectability and scavenger trial results
Corrective Action	All near misses and incidents will be investigated to establish root cause. Where necessary corrective actions will be developed to improve existing processes

7.2 SUMMARY OF MEASURES TO AVOID AND MINIMISE IMPACTS

TABLE 7-21 AVOIDANCE AND MINIMISATION MEASURES FOR DIRECT, INDIRECT AND PRESCRIBED IMPACTS

Action	Justification	Outcome	Timing	Responsibility
Implementation of a suite of mitigation measures	To minimise the impacts on biodiversity a suite of mitigation measures will be implemented such as the delineation of clearing areas, erosion sedimentation and pollution control, timing of construction works, mammalian predator management, pre-clearance surveys, clearance supervision, weed management, a BBAMP, and a VMP.	Minimise impacts on biodiversity	Pre and post construction and during operation phase	Applicant and consultant team
Design amendments to various elements of the Project design	Several design amendments have been implemented for the Project to avoid and minimise impacts on biodiversity.	Avoid and minimise direct and indirect impacts on TECs and fauna habitat	During design and approval	Applicant and consultant team
Consideration of alternative sites and layouts for the development within the Subject Land	The potential sites reviewed for development were considered on the basis of a variety of developmental factors, including environmental limitations, wind resource and planning considerations. The Subject Land contains valuable characteristics that satisfied initial feasibility for wind farm development.	Appropriate site selection to avoid environmental constraints while optimising location for the Project.	Preconstruction	Applicant

8. IMPACT ASSESSMENT

8.1 DIRECT IMPACTS

The construction and operational phase of the development will result in direct impacts to biodiversity values (change in vegetation integrity score and habitat suitability) within the Subject Land and Haul Route DF which cannot be avoided. Direct impacts include habitat clearance, noise and disturbance associated with clearing and construction, and presence of infrastructure which may create barriers to movement.

The direct impacts of the development on:

- Native vegetation and threatened ecological communities (outlined in Table 8-1); and
- Threatened species and threatened species habitat (outlined in Table 8-2).

TABLE 8-1 SUMMARY OF RESIDUAL IMPACTS TO NATIVE VEGETATION

Entity directly impacted	BC Act status	EPBC Act status	SAII entity	Project phase/timing of impact	Extent (ha)
Zone 1 (PCT13_Moderate)	-	-	No	Construction	2.01
Zone 2 (PCT17_Moderate)	-	-	No	Construction	87.09
Zone 3 (PCT24_Moderate)	-	-	No	Construction	57.33
Zone 4 (PCT28_Low)	E	-	No	Construction	0.69
Zone 5 (PCT44_Moderate)	-	-	No	Construction	73.63
Zone 6 (PCT153_Moderate)	-	-	No	Construction	18.48
Zone 7 (PCT157_Moderate)	-	-	No	Construction	48.41
Zone 8 (PCT163_Moderate)	-	-	No	Construction	392.68
Zone 9 (PCT164_Moderate)	-	-	No	Construction	1,285.02
Zone 10* (PCT155_High)	-	-	No	Construction	0.67

**Zone 10 relates to the Haul Route DF only*

TABLE 8-2 SUMMARY OF RESIDUAL IMPACTS TO THREATENED SPECIES AND THREATENED SPECIES HABITAT

Candidate Species Credit Species	BC Act	EPBC Act	SAII entity	Project phase/ timing of impact	Candidate Species Credit Species
Plains-wanderer *Pedionomus torquatus*	E	CE	Yes	Construction	305
A spear-grass *Austrostipa wakoolica*	V	V	No	Construction	3,447
A burr-daisy *Calotis moorei*	E	E	Yes	Construction	2,176
Small Scurf-pea Cullen parvum	E	-	No	Construction	3,084

Candidate Species Credit Species	BC Act	EPBC Act	SAII entity	Project phase/ timing of impact	Candidate Species Credit Species
Winged Peppercress *Lepidium monoplocoides*	E	E	No	Construction	13,441
Chariot Wheels *Maireana cheelii*	V	V	No	Construction	44,233
Slender Darling Pea *Swainsona murrayana*	V	V	No	Construction	55,536
Creeping Darling Pea* *Swainsona viridis*	E	-	Yes	Construction	40

**Relates to the Haul Route DF only*

8.1.1 CHANGE IN VEGETATION INTEGRITY SCORE

Table 8-3 details the change in vegetation integrity score for each vegetation zone. The direct impacts of the Project involve all three vegetation zones, resulting in the total clearing of vegetation within the development footprint.

TABLE 8-3 IMPACTS TO VEGETATION INTEGRITY

Vegetation zone	PCT ID	Area (ha) in Development Footprint	Before development				Change in VI score
			Composition	Structure	Function	VI score	
Zone 1	13	2.01	60.3	81.4	27.1	51.1	-51.1
Zone 2	17	87.09	71.1	88.2	-	79.2	-79.2
Zone 3	24	57.33	69.3	33	-	47.8	-47.8
Zone 4	28	0.69	100	100	4.4	35.3	-35.3
Zone 5	44	73.63	82.5	87	-	84.7	-84.7
Zone 6	153	18.48	99.7	71.8	-	84.6	-84.6
Zone 7	157	48.41	41.8	83.9	-	59.2	-59.2
Zone 8	160	392.68	59.9	98.7	-	76.9	-76.9
Zone 9	164	1,285.02	79.7	93.7	-	86.4	-86.4
Zone 10*	155	0.67	100	100	-	100	-100

**Zone 10 relates to the Haul Route DF only*

8.2 INDIRECT IMPACTS

The BAM (Section 8.2.2) identifies 16 potential indirect impacts that, as a minimum, must be considered as a part of a BDAR. Residual indirect impacts of the Project on native vegetation, threatened entities and their habitat beyond the development footprint have been considered in accordance with the BAM in Table 8-4.

TABLE 8-4 SUMMARY OF RESIDUAL INDIRECT IMPACTS

Indirect impact	Impacted entities	Project phase/ timing of impact	Likelihood and consequences
Impacts of the proposal on TECs/PCTs and/or threatened species and their habitat beyond the construction area, including but not limited to: (a) Inadvertent impacts on adjacent habitat or vegetation	Retained vegetation and adjacent vegetation.	Construction	There are potential impacts to retained and adjacent vegetation through edge effects resulting from increased dust and runoff from construction activities, potential impact from trampling by site vehicles, and overstepping clearing and disturbance boundaries. These risks will be mitigated through environmental management measures and controls via the preparation and implementation of a Construction Environmental Management Plan (CEMP). There is unlikely to be residual inadvertent impacts to adjacent vegetation.
(b) Reduced viability of adjacent habitat due to edge effects	Retained vegetation and adjacent vegetation.	Operation	Impacts to viability of adjacent habitat due to edge effects is considered very low due to current land use and condition (livestock grazing and weed incursions) of the Subject Land. These impacts are also considered low for the Haul Route DF due to the route largely following existing tracks. However, to minimise edge effects as a result of the Project the CEMP will include measures to minimise soil disturbance, artificial light, runoff, noise and dust incursions on adjoining vegetation. The CEMP will also be implemented to manage weed incursions.
(c) Reduced viability of adjacent habitat due to noise, dust or light spill	The Project is not expected to result in reduced viability of adjacent habitat due to noise, dust or light spill.	N/A	N/A
(d) Transportation of weeds and pathogens from the Subject Land or Haul Route DF to adjacent vegetation	Adjacent land	Construction, operation and rehabilitation	There is a potential risk of transportation of introduced weeds and pathogens during construction and operation to adjacent vegetation as weed species have been recorded across the Subject Land and Haul Route DF. The risk of weed and pathogen spread is considered manageable and will be management as part of the CEMP

Indirect impact	Impacted entities	Project phase/ timing of impact	Likelihood and consequences
(e) Increased risk of starvation, exposure and loss of shade or shelter	The Project is not expected to result in any indirect impacts resulting in an increased risk of starvation, exposure and loss of shade or shelter for further species.	N/A	N/A
(f) Loss of breeding habitat due to vegetation clearance	The Project is not expected to result in any indirect impacts to breeding habitat due to vegetation clearing.	N/A	N/A
(g) Trampling of threatened flora species	Identified and assumed present threatened flora species.	Construction, operation and rehabilitation	Winged Pepper-cress, Chariot Wheels, A Burr Daisy, and Slender Darling Pea are confirmed to occur within the Subject Land, with a further three (3) species assumed to be present. One (1) threatened flora species is assumed to occur within the Haul Route DF. The Project has potential to result in trampling of these threatened flora where they occur beyond the construction area. These risks will be mitigated through environmental management measures and controls via the preparation and implementation of a Construction Environmental Management Plan (CEMP). There is unlikely to be residual inadvertent impacts to threatened flora.
(h) Inhibition of nitrogen fixation and increased soil salinity	The Project is not expected to result in the inhibition of nitrogen or increased soil salinity.	N/A	N/A
(i) Fertiliser drift	The Project is not expected to result in any fertiliser drift.	N/A	N/A
(j) Rubbish dumping due to improper management of waste	The Project is not expected to result in rubbish dumping.	N/A	N/A

Indirect impact	Impacted entities	Project phase/ timing of impact	Likelihood and consequences
(k) Wood collection	The Project is not expected to result in increased wood collection.	N/A	N/A
(l) Removal and disturbance of rocks, including bush rocks	The Project is not expected to result in any indirect impacts resulting in Removal and disturbance of rocks, including bush rocks.	N/A	N/A
(m) Increase in predators	The Project will result in larger access routes across the Subject Land with potential to be utilised by predatory species. This has potential to impact the Plains-wanderer.	N/A	The Plains-wanderer is at risk of predation from Feral cats and European Foxes known to occur in the locality. Mitigation measures will be implemented to minimise residual impact to the Plains-wanderer. Additionally, the Applicant will consider funding local control actions for the European Fox to further support conservation efforts for the species. This is further discussed in Section 8.2.2
(n) Increase in pest animal populations	The Project is unlikely to increase pest animal populations.	N/A	N/A
(o) Change in fire regimes	The Project is not expected to result in any change in fire regimes.	N/A	N/A
(p) Disturbance to specialist breeding and foraging habitat, e.g. beach nesting for shorebirds	The Project is not expected to result in any disturbance to specialist breeding habitat	N/A	N/A

Despite the propensity for indirect impacts, it is considered that the mitigation measures proposed are reliable and capable of remedying the effects of these impacts without causing harm to the adjoining environment. No residual indirect impacts are expected. See Section 8.4 for recommended mitigation measures.

8.2.1 INCREASED RISK OF PREDATORS

European Foxes (*Vulpes vulpes*), Feral Cats (*Felis catus*) and native birds of prey, such as the Spotted Harrier (*Circus assimilis*) and Black Falcon (*Falco subniger*), are all potential predators of the Plains-wanderer. Predation by European Foxes is considered a major threat to the species in New South Wales and is listed as a Key Threatening Process in Schedule 4 of the BC Act. European Foxes and remaining Plains-wanderer predatory species have been recorded within The Plains Wind Farm Project Area and are considered likely to traverse and forage across the Subject Land.

The Project includes the construction of internal roads and tracks, that will lead to a larger road network across the site. The European Fox and Feral Cat commonly make use of cleared areas with easy access such as tracks and roads, with greater hunting success for Foxes observed along linear habitats such as roadsides when compared to remnant vegetation and open paddocks.

The Project has been designed to maximise use of existing access tracks across the Subject Land where possible, reducing the potential for an increase to predatory access and activity. The potential risks will be mitigated further via the preparation and implementation of feral pest management programs to be developed in accordance with guidelines and relevant code of practice, including but not limited to the following:

- NSW Threat Abatement Plan: Predation by the Red Fox (Vulpes vulpes) (NSW OEH, 2010);
- Regional Pest Management Strategy 2012-2017: Western Rivers Region (NSW OEH, 2013); and
- NSW Code of Practice and Standard Operating Procedures for the Effective and Humane Management of Feral Cats (NSW DPI, 2022).

The Applicant will consider funding control actions for the European Fox in the local area to further support conservation efforts for the species.

8.3 PRESCRIBED IMPACTS

8.3.1 VEHICLE STRIKES

The potential increased risk of vehicle strikes as a result of the Project are identified in Section 1858.3.1. With the implementation of mitigation measures the risk of vehicle collision will be substantially reduced and considered low. These measures will be addressed in the CEMP, and include examples such as on-site education, identifying and reporting hazards as they occur during construction, and setting appropriate working hours and vehicle speed limits.

8.3.2 WIND TURBINE STRIKES

The potential risk of wind turbine strikes as a result of the Project will be mitigated through measures presented in the BBAMP, as identified in Section 8.3.2.

8.4 CUMULATIVE IMPACTS

The Project will contribute to the overall development of the South West REZ. REZ combine wind, solar, hydroelectric and energy storage, and high-voltage transmission lines, to generate and deliver clean, renewable energy. Relevant clean energy proposed, approved, under construction and operational SSDs known at the time of finalisation of this BDAR and within and in the vicinity of the South West REZ have been considered.

Potential biodiversity direct, indirect and prescribed impacts as a result of the Project have been assessed, additionally it is acknowledged the Project will contribute to cumulative impacts during construction and operation within the existing environment. Cumulative impacts occur when impacts from a project interact or overlap with impacts from other projects and can potentially result in a larger overall effect on the environment.

A review of relevant clean energy proposed known at the time of finalisation of this BDAR and within and in the vicinity of the South West REZ has been undertaken, with potential cumulative biodiversity impacts provided in Table 8-6. A large portion of these projects are in the planning phase, and as such the level of direct impacts to native vegetation, TECs, and threatened and migratory listed species is unknown. It is considered likely that cumulative impacts will increase the loss of similar native vegetation and threatened species habitat in the region.

Of the projects detailed, seven (7) have received consent. Of these, the EnergyConnect (Eastern) project (EnergyConnect) and Yanco Delta Wind Farm occur across similar vegetation communities and have direct impacts to similar listed species as the Project. The expected loss as a result of all considered projects is presented in Table 8-6.

Yanco Delta Wind Farm is situated within the Riverina IBRA region and Murrumbidgee IBRA Bioregion, as is the Project. The direct impact on native vegetation for Yanco Delta Wind Farm is calculated at 173.39 ha, with PCTs matching those with direct impact as a result of this Project (PCTs 13, 17, 28, and 44). EnergyConnect covers an area of the Murrumbidgee IBRA subregion, direct impacts to this region as a result of the development have been considered. Direct impacts for EnergyConnect (Murrumbidgee subregion) is associated with the removal of native vegetation, with PCTs matching all those impacted by this Project (PCTs 157, 153, 164, 17, 24, 44, 13, and 28).

Cumulative impacts to threatened species across Yanco Delta Wind Farm, EnergyConnect (Murrumbidgee subregion) and this Project will include those provided in Table 8-5.

The removal of habitat across the landscape for this Project will contribute to the cumulative loss of native vegetation.

TABLE 8-5 CUMULATIVE IMPACTS ACROSS YANCO WF, ENERGYCONNECT AND THE PROJECT

Threatened Species	**Impact area (ha)**			
	Yanco Delta Wind Farm	**Energy Connect (Murrumbidgee Subregion)**	**The Project**	**Total**
Swainsona Murrayana Slender-darling Pea	32.12	241.98	1,331.03	1605.13
Brachyscome Papillosa Mossgiel Daisy	23.60	132.19	1,376.57	1532.36
Calotis moorei A Burr Daisy	-	18.43	46.29	64.72
Cullen parvum Small Scurf-pea	35.29	23.79	72.81	131.89
Lepidium monoplocoides Winged Peppercress	-	59.86	367.42	427.28
Maireana Cheeli Chariot Wheels	12.92	144.71	1,036.75	1194.38
Pedionomus torquatus Plains-wanderer	1.78	0.37	5.35	7.5

TABLE 8-6 POTENTIAL CUMULATIVE IMPACTS

Project	Description	Distance (km)	Construction Period / Timeline	Potential Cumulative Biodiversity Impacts
Bullawah Wind Farm *(In Planning (Prepare EIS))*	• Nominal generating capacity of 1,000 MW. • Up to 170 WTGs, BESS and ancillary infrastructure. • Peak construction workforce 400 FTE. • Operational workforce 40 FTE. • Temporary workers accommodation located within the Project Area.	4 km east	• Construction estimated to commence mid to late 2025. • Construction period about 24-months. • Commissioning expected 2027.	Direct Impacts to biodiversity values are yet to be confirmed or estimated. The Scoping Report maps 29,870.15 hectares of native vegetation across the project area. The Scoping Report identifies potential impacts to the following entities: TECs with high likelihood of occurrence: • Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South Western Slopes bioregions (BC Act) • Weeping Myall Woodlands (EPBC Act) • Sandhill Pine Woodland in the Riverina, Murray-Darling Depression and NSW South Western Slopes bioregion (BC Act) • Natural Grasslands of the Murray Valley Plains (EPBC Act) Threatened flora with high likelihood of occurrence: • *Brachyscome papillosa* • *Lepidium monoplocoides* • *Maireana cheelii* • *Pilularia novae-hollandiae* • *Swainsona murrayana* Threatened fauna known or with high likelihood of occurrence: • *Petroica phoenicea* • *Epthianura albifrons* • *Falco subniger* • *Pomatostomus temporalis temporalis* • *Circus assimilis* • *Pedionomus torquatus* • *Polytelis swainsonii* • *Grantiella picta* • *Hieraaetus morphnoides* • *Stagonopleura guttata* • *Falco hypoleucos*

Project	Description	Distance (km)	Construction Period / Timeline	Potential Cumulative Biodiversity Impacts
Argoon Wind Farm *(In Planning (Prepare EIS))*	• Installed generating capacity of up to 901 MW. • Up to 106 WTGs, BESS (460 MW/2300 MWh, up to 5-hour battery).and ancillary infrastructure. • Peak construction workforce 340 FTE. • Operational workforce between 6 and 12 FTE. • Temporary workforce accommodation will be included if required.	70 km southeast (estimate only)	• Construction estimated to commence within one year of project approval. • Construction period about 24-36 months.	Direct impacts to biodiversity values are yet to be confirmed or estimated. The Scoping Report maps 10,888.16 hectares of native vegetation across the project area. The Scoping Report identifies potential impacts to the following entities: TECs with high likelihood of occurrence: • Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South Western Slopes bioregions (BC Act) • Weeping Myall Woodlands (EPBC Act) • Sandhill Pine Woodland in the Riverina, Murray-Darling Depression and NSW South Western Slopes bioregion (BC Act) • Natural Grasslands of the Murray Valley Plains (EPBC Act) Threatened flora with high likelihood of occurrence: • *Swainsona murrayana* • Swainsona plagiotropis Threatened fauna known or with high likelihood of occurrence: • *Litoria raniformis* • *Artamus cyanopterus* • *Circus assimilis* • *Climacteris picumnus victoriae* • *Epthianura albifrons* • *Falco subniger* • *Grantiella picta* • *Haliaeetus leucogaster* • *Hirundapus caudacutus* • *Melithreptus gularis gularis* • *Pedionomus torquatus* • *Petroica phoenicea* • *Petroica phoenicea*

Project	Description	Distance (km)	Construction Period / Timeline	Potential Cumulative Biodiversity Impacts
Pottinger Wind Farm *(In Planning (Prepare EIS))*	• Nominal generating capacity of 750 MW. • Up to 108 WTGs, BESS and ancillary infrastructure. • Peak construction workforce 450 FTE. • Operational workforce 40 FTE. • Temporary workers accommodation located within the Project Area or located offsite.	0 km east	• Construction estimated to commence 2025 or 2026. • Construction period about 24-months. • Commissioning expected 2027 or 2028.	The Direct impacts to biodiversity values are yet to be confirmed, with only estimates provided. The Scoping Report estimated impacts to 416 hectares (approx.) of native vegetation. The Scoping Report estimates impacts to the following entities: TECs: • 'Myall Woodland' (EPBC Act and BC Act listed) – 7.99 ha • Sandhill Pine Woodland in the Riverina, Murray-Darling Depression and NSW South Western Slopes bioregion (BC Act) – 14.95 ha • Natural Grasslands of the Murray Valley Plains (EPBC Act) (potential) – 63.36 ha Threatened flora with high likelihood of occurrence: • *Brachyscome papillosa* • *Pilularia novae-hollandiae* • *Swainsona murrayana* Threatened and migratory fauna known or predicted to occur: • *Litoria raniformis* • *Pedionomus torquatus* • *Falco subniger* • *Grus rubicunda* • *Calidris ferruginea* • *Artamus cyanopterus* • *Plegadis falcinellus* • *Falco hypoleucos* • *Hieraaetus morphnoides* • *Circus assimilis* • *Lophoictinia isura* • *Polytelis swainsonii* • *Haliaeetus leucogaster* • *Hirundapus caudacutus* • *Saccolaimus flaviventris* • *Anseranas semipalmata*
Tchelery Wind Farm *(In Planning (Prepare EIS))*	• Nominal generating capacity of 800 MW. • Up to 120 WTGs, ancillary	25 km west	• Construction expected to commence 2026. • Construction period about 30-months.	Direct impacts to biodiversity values have been estimated based on a proposed disturbance area. The Scoping Report maps 642.96 hectares of native vegetation across the disturbance area. The Scoping Report estimates impacts to the following entities: TECs:

Project	Description	Distance (km)	Construction Period / Timeline	Potential Cumulative Biodiversity Impacts
	infrastructure and future BESS. • Peak construction workforce 500 FTE. • Operational workforce: up to 20 FTE. • Temporary workforce accommodation to be investigated.		• Commissioning expected late 2028 early 2029.	• Acacia melvillei Shrubland in the Riverina and Murray-Darling Depression bioregions (BC Act) – 23.13 ha • Allocasuarina luehmannii Woodland in the Riverina and Murray-Darling Depression Bioregions (BC Act and EPBc Act) – 0.16 ha • Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South Western Slopes bioregions (BC Act and EPBC Act) – 1.52 ha • Sandhill Pine Woodland in the Riverina, Murray-Darling Depression and NSW South Western Slopes bioregion (BC Act) – 14.37 ha Threatened flora with a moderate or higher likelihood of occurrence: • *Brachyscome papillosa* • *Pilularia novae-hollandiae* • *Calotis moorei* • *Eleocharis Obicis* • *Eucalyptus leucoxylon subsp. Pruinose* • *Lepidium monoplocoides* • *Leptorhynchos orientalis* • *Maireana cheelii* • *Swainsona murrayana* Threatened or migratory fauna with a moderate or higher likelihood of occurrence: • *Litoria raniformis* • *Apus pacificus* • *Artamus cyanopterus* • *Cyanopterus* • *Burhinus grallarius* • *Calidris acuminata* • *Calidris ferruginea* • *Calidris ruficollis* • *Circus assimilis* • *Epthianura albifrons* • *Falco hypoleucos* • *Falco subniger* • *Grus rubicunda* • *Haliaeetus leucogaster* • *Hieraaetus morphnoides* • *Hirundapus caudacutus* • *Lathamus discolor* • *Lophochroa leadbeateri*

Project	Description	Distance (km)	Construction Period / Timeline	Potential Cumulative Biodiversity Impacts
				• *Melanodryas cucullata cucullate* • *Merops ornatus* • *Microcarbo melanoleucos* • *Pedionomus torquatus* • *Pelecanus conspicillatus* • *Pomatostomus temporalis temporalis* • *Polytelis swainsonii* • *Threskiornis spinicollis* • *Saccolaimus flaviventris*
Baldon Wind Farm *(In Planning (Prepare EIS))*	• Nominal generating capacity 1,000 MW. • Up to 162 WTGs, BESS and ancillary infrastructure. • Peak construction workforce 350 FTE. • Operational workforce 25 FTE. • Temporary workers accommodation will be established within Project Area.	45 km west	• Construction expected to commence Q4 2024. • Construction period about 23 to 27 months. • Commissioning expected Q4 2026.	Direct impacts to biodiversity values are yet to be confirmed or estimated. The Scoping Report identifies listed biodiversity entities to be considered. TECs considered to likely or potentially occur: • Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South Western Slopes bioregions • Sandhill Pine Woodland in the Riverina, Murray-Darling Depression and NSW South Western Slopes bioregions Threatened species considered to likely or with potential to occur: • *Brachyscome papillosa* • *Maireana cheelii* • Southern Bell Frog • Spotted Harrier • White-fronted Chat • White-bellied Sea-Eagle • Major Mitchell's Cockatoo • Plains-wanderer • Painted Honeyeater

Project	Description	Distance (km)	Construction Period / Timeline	Potential Cumulative Biodiversity Impacts
Dinawan Wind Farm *(In Planning (Prepare EIS))*	• Nominal generating capacity of 1,500 MW. • Up to 250 WTGs, BESS and ancillary infrastructure. • Peak construction workforce 800 FTE. • Operational workforce up to 50 FTE . • Workforce accommodation is expected to rely on available rental, motel and other accommodation in surrounding townships and regional centres.	28 km southwest	• Construction expected to commence 2025. • Construction period about 36 months. • Commissioning expected 2028.	Direct impacts to biodiversity values are yet to be confirmed or estimated. The Scoping Report identifies listed biodiversity entities to be considered. TECs considered to likely or potentially occur: • Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South Western Slopes bioregions (BC Act) • Weeping Myall Woodlands (EPBC Act) • Sandhill Pine Woodland in the Riverina, Murray-Darling Depression and NSW South Western Slopes bioregion (BC Act) • Natural Grasslands of the Murray Valley Plains (EPBC Act) Threatened flora species considered to have medium or greater likelihood to occur: • *Brachyscome muelleroides* • *Leptorhynchos orientalis* • *Maireana cheelii* • *Caladenia arenaria* • *Lepidium monoplocoides* • *Sclerolaena napiformis* • *Swainsona murrayana* • *Swainsona plagiotropis* • *Swainsona sericea* • *Austrostipa wakoolica* • *Pilularia novae-hollandiae* Threatened fauna species considered known or predicted with a medium or greater likelihood to occur (including those at high turbine strike risk): • *Vespadelus baverstocki* • *Artamus cyanopterus cyanopterus* • *Polytelis swainsonii* • *Falco subniger* • *Hieraaetus morphnoides* • *Chalinolobus picatus* • *Circus assimilis* • *Hirundapus caudacutus* • *Lophoictinia isura* • *Lophochroa leadbeateri* • *Saccolaimus flaviventris*

Project	Description	Distance (km)	Construction Period / Timeline	Potential Cumulative Biodiversity Impacts
				• *Apus pacificus* • *Gallinago hardwickii* • *Pedionomus torquatus* • *Litoria reniformis and* • *Botaurus poiciloptilus (movement patterns only)*
Keri Keri Wind Farm *(In Planning (Prepare EIS))*	• Nominal generating capacity of 1,003 MW. • Up to 176 WTGs, BESS and ancillary infrastructure. • Peak construction workforce 400 FTE. • Operational workforce up to 12-14 FTE. • Temporary workforce accommodation to be investigated.	55 km west	• Construction expected to commence in 2024-2025. • Construction period about 18-24 months. • Commissioning expected 2027.	Direct impacts to biodiversity values are yet to be confirmed or estimated. The Scoping Report identifies listed biodiversity entities to be considered. TECs: • Natural Grasslands of the Murray Valley Plains BC Act Known and likely threatened flora species: • *Maireana cheelii* • *Brachyscome papillosa* • *Lepidium monoplocoides* Known and likely threatened fauna species: • *Circus assimilis* • *Litoria raniformis* • *Pedionomus torquatus* • *Pomatostomus temporalis* • *Epthianura albifrons* • *Falco subniger* • *Hieraaetus morphnoides*
Yanco Delta Wind Farm *(Approved – December 2023)*	• Nominal generating capacity of 1,500 MW. • Up to 208 WTGs, BESS and ancillary infrastructure • Peak construction workforce 300 FTE.	42 km southwest	• Construction expected to commence 2024-2025. • Construction period about 36 months. • Commissioning expected 2028.	The BDAR identifies direct impacts on 173.39 hectares of native vegetation. Impacts to threatened biodiversity entities as a result of this project include: Threatened Flora: • *Swainsona Murrayana* – 32.12 ha • *Austrostipa Wakoolica* – 19.57 ha • *Brachyscome Muelleroides* – 23.57 ha • *Brachyscome Papillosa* – 23.60 ha • *Caladenia Arenaria* – 1.49 ha • *Convolvulus Tedmoorei* – 12.27 ha • *Cullen parvum* – 35.29 ha • *Lepidium Monoplocoides* – 12.92 ha

Project	Description	Distance (km)	Construction Period / Timeline	Potential Cumulative Biodiversity Impacts
	• Operational workforce up to 30 FTE . • Workforce accommodation is expected to rely on available rental, motel and other accommodation in surrounding townships and regional centres.			• *Leptorhynchos Orientalis* – 25.75 ha • *Maireana Cheelii* – 25.75 ha • *Pilularia novae-hollandiae* – 14.43 ha • *Sclerolaena Napiformis* – 25.75 ha • *Swainsona Plagiotropis* – 28.94 ha • *Swainsona sericea* – 27.24 ha Threatened Fauna: • Plains-wanderer – 1.78 ha • Southern Myotis – 0.90 ha TECs: • Natural Grasslands of the Murray Valley Plains CEEC – 88.33 ha • Weeping Myall Woodlands listed endangered under the EPBC Act – 29.69 ha • Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South Western Slopes bioregions listed endangered under the BC Act – 31.09 ha • Sandhill Pine Woodland in the Riverina, Murray-Darling Depression and NSW South Western Slopes bioregions listed endangered under the BC Act – 10.28 ha
Wilan Wind Farm *(In Planning (Prepare EIS))*	• Nominal generating capacity of up to 800 MW. • Up to 138 WTGs, BESS and ancillary infrastructure. • Peak construction workforce 400 FTE. • Operational workforce 10-15 FTE. • Temporary workers accommodation	57 km west	• Construction expected to commence early 2025. • Construction period about 24 to 30 months. • Commissioning expected 2027-2028.	Direct impacts to biodiversity values are yet to be confirmed or estimated. The Scoping Report identifies listed biodiversity entities to be considered. TECs with medium or high potential to occur: • Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South Western Slopes bioregions listed endangered under the BC Act • Sandhill Pine Woodland in the Riverina, Murray-Darling Depression and NSW South Western Slopes bioregions listed endangered under the BC Act • Acacia melvillei Shrubland in the Riverina and Murray-Darling Depression bioregions BC Act • Allocasuarina luehmannii Woodland in the Riverina and Murray-Darling Depression Bioregions BC Act and EPBC Act Threatened flora known or with high/medium likelihood of occurrence: • *Brachyscome papillosa*

Project	Description	Distance (km)	Construction Period / Timeline	Potential Cumulative Biodiversity Impacts
	will be established, location is subject to Project design and community consultation.			• *Maireana cheelii* • *Austrostipa metatoris* • *Lepidium monoplocoides* • *Solanum karsense* Threatened flora known or with high/medium likelihood of occurrence: • *Nyctophilus corbeni* • *Saccolaimus Flaviventris* • *Anseranas semipalmata* • *Artamus cyanopterus cyanopterus* • *Botaurus poiciloptilus* • *Calidris ferruginea* • *Circus assimilis* • *Climacteris* • *picumnus victoriae* *Daphoenositta chrysoptera* • *Epthianura albifrons* • *Falco subniger* • *Grus rubicunda* • *Haliaeetus leucogaster* • *Hieraaetus morphnoides* • *Limosa limosa* • *Lophochroa leadbeateri* • *Lophoictinia isura* • *Oxyura australi* • *Pomatostomus temporalis temporalis* • *Pyrrholaemus brunneus* • *Rostratula australis* • *Stagonopleura guttata* • *Stictonetta naevosa* • *Litoria raniform*

Project	Description	Distance (km)	Construction Period / Timeline	Potential Cumulative Biodiversity Impacts
Junction Rivers Wind Farm *(In Planning (Prepare EIS))*	• Nominal generating capacity 750 MW. • Up to 107 WTGs, BESS and ancillary infrastructure. • Peak construction workforce 250 FTE. • Operational workforce 10-15 FTE. • Existing facilities in Balranald and other options in Kyalite and surrounding region will be utilised for construction staff accommodation.	86 km west	• No current information available regarding construction.	Direct impacts to biodiversity values are yet to be confirmed or estimated. The Scoping Report identifies listed biodiversity entities to be considered. TECs • Acacia melvillei Shrubland in the Riverina and Murray-Darling Depression bioregions (BC Act) • Natural Grasslands of the Murray Valley Plains (EPBC Act) Potential SAII candidate species: • *Calotis moorei* • *Dodonaea stenozyga* • *Lasiopetalum behrii* • *Leptorhynchos waitzia* • *Pimelea serpyllifolia ssp. serpyllifolia* • *Pseudomys desertor*
Project EnergyConnect (NSW – Eastern Section) *(Approved - September 2022)*	• 330kV transmission line • 375 km of new transmission lines and associated infrastructure	0 km		The BDAR identifies direct impacts on 1,615.20 hectares of native vegetation. Impacts to threatened biodiversity entities as a result of this project include: TECs within the Murrumbidgee IBRA subregion: • Acacia melvillei shrubland in the Riverina and Murray Darling Depression bioregions – 5.61 ha • Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South Western Slopes bioregions listed endangered under the BC Act – 101.83 ha

Project	Description	Distance (km)	Construction Period / Timeline	Potential Cumulative Biodiversity Impacts
				• Sandhill Pine Woodland in the Riverina, Murray-Darling Depression and NSW South Western Slopes bioregions listed endangered under the BC Act – 22.25 ha • White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland – 0.25 ha Threatened Flora within the Murrumbidgee IBRA subregion: • *Austrostipa wakoolica* – 41.15 ha • *Brachyscome papillosa* – 132.19 ha • *Caladenia arenaria* – 1.07 ha • *Calotis moorei* – 18.43 ha • *Convolvulus tedmoorei* – 62.77 ha • *Cullen parvum* – 23.79 ha • *Lepidium monoplocoides* – 59.86 • *Leptorhynchos orientalis* - 44.46 ha • *Maireana cheelii* – 144.71 ha • *Pilularia novae-hollandiae* – 4.45 ha • *Swainsona murrayana* – 241.98 ha • *Swainsona sericea* – 44.80 ha Threatened fauna within the Murrumbidgee IBRA subregion: • *Burhinus grallarius* – 150.86 • *Hieraaetus morphnoides* – 5.67 • *Lophochroa leadbeateri* – 29.91 • *Myotis macropus* – 26.55 ha • *Ninox connivens* – 24.01 ha • *Pedionomus torquatus* – 0.37 ha • *Polytelis anthopeplus monarchoides* – 23.26 ha • *Polytelis swainsonii* – 12.45 ha
The Plains Solar Farm (In Planning (Prepare EIS)	• Nominal generating capacity of 400 MW. • BESS with a capacity of up to 400 MW / 1.6 GWh.	0 km (Project overlaps with the Plains Solar Farm footprint)	• Construction estimated to commence in 2026. • Construction period approximately 18 months. • Commissioning expected 2028.	The development is estimated to have a direct impact on 1010.48 ha of native vegetation. Direct impacts to threatened entities are provided below. Threatened flora: • *Austrostipa wakoolica* – 109.6 ha • *Brachyscome papillosa* – 10.14 ha • *Calotis moorei* – 1.51 ha • *Cullen parvum* – 33.85 ha

Project	Description	Distance (km)	Construction Period / Timeline	Potential Cumulative Biodiversity Impacts
	• Peak construction workforce: up to 150 FTE employees • Operational workforce: up to 46 FTE employees • Temporary workers accommodation to be utilised from this Project.			• *Lepidium monoplocoides* – 9.37 ha • *Leptorhynchos orientalis* – 32.10 ha • *Maireana cheelii* – 871.04 ha • *Swainsona murrayana* – 874.63 ha • *Swainsona sericea* – 29.70 ha • Sclerolaena napiformis – 29.70 • Swainsona plagiotropis – 29.70 Threatened fauna: • Pedionomus torquatus – 0.19 ha
Hay Solar Farm (Approved - December 2017)	• Generating capacity 110 MW. • 300,000 panels. • Area across 660 ha. • Currently under construction. • 700 FTE during peak construction and between 2 and 5 FTE during operation.	15 km north	• Construction estimated to commence in 2026. • Construction period approximately 18 months. • Commissioning expected 2028.	• Total removal of 0.95 hectares of native vegetation within the development site for the solar panel arrays, power line construction access track and power pole footprints. • Partial removal of 3.84 hectares of native vegetation (canopy cover only) within the grid connection transmission line easement. • Removal of three isolated hollow bearing trees. No threatened entities are impacted by the development.

Project	Description	Distance (km)	Construction Period / Timeline	Potential Cumulative Biodiversity Impacts
Pottinger Solar Farm (In Planning (Prepare EIS)	• Generating capacity 300 MW. • BESS and ancillary infrastructure. • Peak construction workforce of 220 FTE and operational workforce of at least 4 FTE. • Temporary workforce accommodation to be investigated.	5 km east	• Construction period of about 12-months. • No information available regarding construction commencement.	The direct impacts as a result of the development are yet to be determined. Considered entities are provided below: TECs: • Myall Woodland is a BC Act and EPBC Act • Natural Grasslands of the Murray Valley Plains is an EPBC Act listed • Sandhill Pine Woodland is a BC Act Threatened species known or considered highly likely to occur: • *Brachyscome Papillosa* • *Lepidium monoplocoides* • *Maireana cheelii* • *Pilularia novae-hollandiae* • *Swainsona murrayana*
Keri Keri Solar Farm (In Planning (Prepare EIS)	• Generating capacity 400 MW. • BESS and ancillary infrastructure. • Peak construction workforce of 300 FTE. • Temporary workforce accommodation to be investigated.	68 km west	• Construction expected to commence in 2026. • Construction period is estimated to take 24 months including commissioning.	The direct impacts as a result of the development are yet to be determined. Considered entities are provided below: TEC: • Natural Grasslands of the Murray Valley Plains Threatened flora considered to likely or with potential to occur: • *Brachyscome papillosa* • *Maireana cheelii* • *Lepidium* monoplocoides Threatened fauna considered to likely or with potential to occur: • Plains-wanderer • Southern Bell Frog

Project	Description	Distance (km)	Construction Period / Timeline	Potential Cumulative Biodiversity Impacts
Currawarra Solar Farm (Approved -May 2018)	• Generating capacity 195 MW. • Associated infrastructure. • Workforce of approximately 200 FTE during construction and 3-4 FTE during operations.	67 km south	• Construction expected to commence in 2024-2025. • Construction period about18-24 months including commissioning.	The direct impacts to the development relate only to the disturbance of 7.06 ha of native vegetation within the development envelope.
Southdown Solar Farm (In Planning (Prepare EIS)	• Generating capacity 70 MW. • Associated infrastructure. • Workforce of up to 200 FTE during construction.	85 km south	• Construction period about 18 months. • Construction has not commenced.	Direct impacts relating to the Project are not determined, however it is stated that of the total development area, approximately 375 ha (96%) is cleared and the vegetation is highly modified from its original state. These areas are not likely to require any biodiversity offsets, given that any vegetation present is not native and habitat quality is very low. The majority of the solar farm will be built in these areas.
Tarleigh Park Solar Farm (Approved -May 2018)	• Generating capacity 90 MW. • Associated infrastructure. • Workforce of approximately 700 FTE during construction and 3-4 FTE during operations.	85 km south	• Construction expected to commence in 2022. • Construction period about 15 months.	Direct impacts relating to the clearing of 3.37 ha of native vegetation. No threatened entities were assessed as being impacted by the development.

Project	Description	Distance (km)	Construction Period / Timeline	Potential Cumulative Biodiversity Impacts
Sunraysia Solar Farm (Operational)	• Generating capacity 200 MW. • Ancillary infrastructure. • Peak construction workforce of 250 FTE and operational workforce of at least 2 FTE.	104 km west	• Currently operational.	The direct impacts as a result of the development are provided below: Native vegetation – 12.11 ha TEC: • Acacia melvillei Shrubland in the Riverina and Murray-darling Depression Bioregion – 1.29 ha Ecosystem credit species: • *Ardeotis australis* • *Ninox connivens* • *Burhinus grallarius* • *Cinclosoma castanotum* • *Nyctophilus corbeni Stagonopleura guttata* • *Pachycephala inornata* • *Pomatostomus temporalis subsp. Temporalis* • *Melanodryas cucullata subsp. Cucullata Hieraaetus morphnoides* • *Anseranas semipalmata* • *Lophochroa leadbeateri* • *Grantiella picta* • *Certhionyx variegatus* • *Polytelis anthopeplus subsp. Monarchoides* • *Circus assimilis* • *Daphoenositta chrysoptera*
Limondale Solar Farm (Operational)	• Generating capacity 250 MW. • BESS and ancillary infrastructure. • Peak construction workforce of 40 FTE and operational workforce of 20 FTE.	100 km west	• Currently operational. • Additional construction expected to commence between Q3 2022 and Q4 2024. • Construction period about 15 months.	The development direct impacts include the removal of 5.32 hectares of native vegetation within the development site, and removal of 18 hollow bearing trees.

8.5 MIGITATING RESIDUAL IMPACTS – MANAGEMENT MEASURES AND IMPLEMENTATION

A range of mitigation measures have been developed for the Project to mitigate the impacts to native vegetation and habitat that are unable to be avoided. These include a range of measures to be undertaken before and during construction to limit the impact of the Project. Each mitigation measure is discussed in detail below, and a summary is provided in Table 8-7.

TABLE 8-7 SUMMARY OF PROPOSED MITIGATION AND MANAGEMENT MEASURES FOR RESIDUAL IMPACTS (DIRECT, INDIRECT AND PRESCRIBED)

Mitigation measure	Method	Timing	Frequency	Responsibility
Removal of native and threatened species habitat and habitat features				
Offsets	Residual impacts on habitat will be offset through the Biodiversity Offset Scheme. The residual impact of the Project is to be verified for all candidate species by way of completing seasonally appropriate targeted surveys. A revised offset liability is to be calculated for any reduction in the residual impact as calculated and stated in this report.	Detailed design	Planning phase	Applicant
Vegetation clearing protocol	There is limited treed habitat present within the Subject Land, however where vegetation is to be removed it will be undertaken in accordance with specifications provided in a vegetation clearing protocol, detailed within the CEMP.	Pre-construction and construction phase	Throughout planning and construction phase	Construction contractor
Plain wire used where possible on perimeter fence and stock fencing	Plain wire perimeter fences (opposed to barbed-wire fencing) will be used where practical and agreed with landowners based on the requirements for specific areas of the property. The use of plain wire will aid in avoiding potential entrapment of fauna on fences.	Construction phase	Ongoing	Construction contractors
Chemical Protocols	Protocols for the use of spraying exclusion zones around Plains-wanderers and their habitat to be implemented	Construction phase	Ongoing	Construction contractors
Impact to native vegetation				
Delineation of clearing areas	To avoid unnecessary removal or damage to retained vegetation, the limit of clearing will be clearly demarcated with temporary fencing and signed as 'Environmental Sensitive No-Go Zones' prior to the commencement of clearing. This will be detailed within the CEMP, including measures: • Vehicles or machinery will not be permitted to park within or drive through areas of retained vegetation. • Construction materials will not be stockpiled or stored within areas of retained vegetation. • Ancillary facilities, such as site compounds and construction zones, will not be located beyond the limits of clearing. • Temporary fencing and signage will be maintained throughout construction.	Pre-construction and construction phase	Throughout planning and construction phase	Construction contractor

Mitigation measure	Method	Timing	Frequency	Responsibility
	• Site inductions will be given by the civil contractor to all personnel and visitors to ensure all site workers and visitors are aware of any No-Go Zones.			
Light/noise/dust				
Daily/seasonal timing of construction activities to reduce impact of noise and light spill	The CEMP will include measures to avoid light encroachment on adjacent habitats such as restricting construction works to daylight hours and incorporating sensitive lighting arrays that shield the adjoining native vegetation and habitat from stray light, with low-level lighting installed for all required external lighting.	Pre-construction and construction phase	Throughout planning and construction phase	Construction contractor
Adaptive dust monitoring programs to control air quality	The Applicant will implement daily monitoring programs to monitor the generation of dust during construction activities. All activities relating to the Project would be undertaken with the objective of preventing visible dust emissions from the development footprint.	Construction phase	Clearing phase	Construction contractor
Invasive flora/pathogens				
Weed management	To minimise the spread of weeds throughout the Subject Land and surrounding patches, appropriate weed control activities will be undertaken in accordance with all state and regional weed management plans. The Subject Land is subject to the Riverina Regional Strategic Weed Management Plan 2017 – 2022 (LLS, 2017) and management of Weeds of National Significance. The NSW Biosecurity Act 2015 and regulations provide specific legal requirements for state level priority weeds and high-risk activities. In order to comply with the objectives of the Riverina Regional Strategic Weed Management Plan 2017 – 2022 (LLS, 2017), the following measures be implemented as part of the CEMP for the Subject Land: • Initial weed treatment - Including eliminating woody species and targeting infestations of exotic herbs. In particular, High Threat Exotic weed species occurring within the subject land will be managed in order to prevent further spread. Prior to any vegetation clearance, High Threat Exotic weeds should be demarcated in order for these to be disposed of separately from native material. • Containment – Follow-up monitoring and maintenance should be undertaken in areas of the development site that have received past primary weeding treatments in the following months, to contain any re-emergence of weed species.	Construction and operations phase	Ongoing	Construction and operations contractor

Mitigation measure	Method	Timing	Frequency	Responsibility
	• Minimisation – Minimisation of weed species that cannot be effectively controlled on the site, such as exotic grasses, will be prevented from further spread through construction and operational phase site hygiene procedures. The CEMP will include provisions for elevated non-native vegetation (i.e Lycium ferocissimum) with potential to provide perches for known predators of the the Plains-wanderer, this non-native vegetation is to be removed within 300 m of suitable habitat for the species.			
Pathogen management	A pathogen management protocol will be implemented. Infection of native plants by *Phytophthora cinnamomic* is listed as a key threatening process under the BC Act and EPBC Act. *P. cinnamomic* is known to occur within the Riverina IBRA Bioregion can lead to death of trees and shrubs, resulting in devastation of native ecosystems. The risk of spreading pathogens and the mitigation measures required on site will be regularly communicated to staff and contractors e.g. during inductions and toolbox talks.	Construction and operations	Ongoing	Construction and operations contractors
Increased pest species presence				
Pest management programs	Feral pest management programs will be developed and implemented for the Project, with focus on Feral Cats and European Foxes. All control methods will be completed in accordance with relevant legislation / standard operating procedures, including but not limited to the following: • Regional Pest Management Strategy 2012-2017: Western Rivers Region (NSW OEH, 2013); • NSW Code of Practice and Standard Operating Procedures for the Effective and Humane Management of Feral Cats (NSW DPI, 2022); and • NSW Threat Abatement Plan: Predation by the Red Fox (Vulpes vulpes) (NSW OEH, 2010).	Construction and operations	Ongoing	Construction and operations contractors

Mitigation measure	Method	Timing	Frequency	Responsibility
Erosion and sediment				
Erosion and sediment control plan	A site-specific Erosion and Sediment Control Plan will be developed and implemented to minimise erosion and sediment control risks. The Plan will include arrangements for managing wet weather events, and working with high surface water levels, including monitoring of potential high-risk events and specific controls and follow-up measures to be applied in the event of wet weather to avoid adverse impacts to hydrological processes, wetlands and ephemeral creek lines; Curtains Creek, Telegraph Creek and Abercrombie Creek.	Construction phase	Ongoing	Construction contractors
Turbine Strike				
BBAMP	A Bird and Bat Adaptive Management Plan will be developed in accordance with the Draft Wind Farm Assessment Guidance for the SW REZ, released by DPE in July 2023.	Pre-construction, construction and operations	ongoing	Environmental consultant contractors

9. ASSESSING AND OFFSETTING IMPACTS

9.1 SERIOUS AND IRREVERSIBLE IMPACTS

A SAII is listed under the BC Act as an impact that is likely to contribute significantly to the risk of extinction of a threatened entity.

An impact is to be regarded as serious and irreversible if it is likely to contribute significantly to the risk of a threatened species or ecological community becoming extinct because:

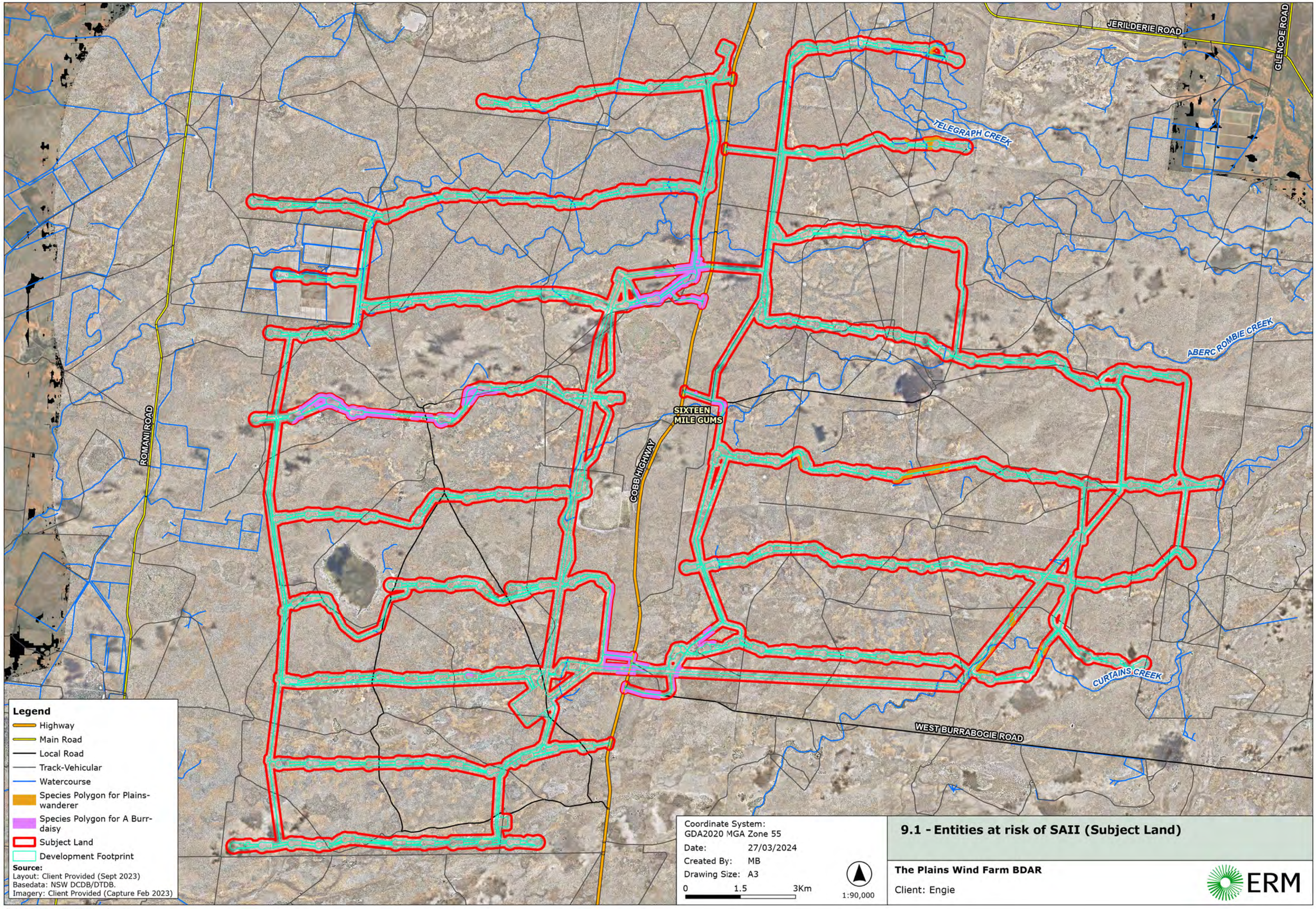
- It will cause a further decline of a species or ecological community that is currently observed, estimated, inferred or reasonably suspected to be in a rapid rate of decline;
- It will further reduce the population size of the species or ecological community that is currently observed, estimated, inferred or reasonably suspected to have a very small population size;
- It is an impact on the habitat of the species or ecological community that is currently observed, estimated, inferred or reasonably suspected to have a very limited geographic distribution;
- The impacted species or ecological community is unlikely to respond to measures to improve its habitat and vegetation integrity and therefore its members are not replaceable; or
- Potential SAII has been addressed in the following sections in accordance with Section 9.1 of the BAM (2020).

9.1.1 ASSESSMENT FOR SERIOUS AND IRREVERSIBLE IMPACTS ON BIODIVERSITY VALUES

Based on candidate ecosystem credit species, species credit species, and result of field surveys, the potential SAII for the Subject Land and Haul Route DF are listed in Table 9-1. Species polygons for threatened entities retained for assessment for SAII in the Subject Land and Haul Route DF are presented in Figure 9-1 and Figure 9-2 respectively.

TABLE 9-1 ENTITIES AT RISK OF AN SAII

Entity	SAII Principles	Reason for inclusion in assessment	Section
Plains-wanderer *Pedionomus torquatus*	Principle 1: Population reduction of >=80% in 10 years or three generations.	Important Mapped Areas are present	Section 9.1.1.1
A burr-daisy *Calotis moorei*	Principle 3: Known from <=3 locations and/or an area of occupancy (AOO) <10 km^2 or extent of occurrence (EOO) <100 km^2.	Recorded within Subject Land.	Section 9.1.1.2
Creeping Darling Pea *Swainsona viridis*	Principle 3: Known from <=3 locations and/or an AOO <10 km^2 or EOO <100 km^2.	Assumed within the Haul Route DF.	Section 9.1.1.3



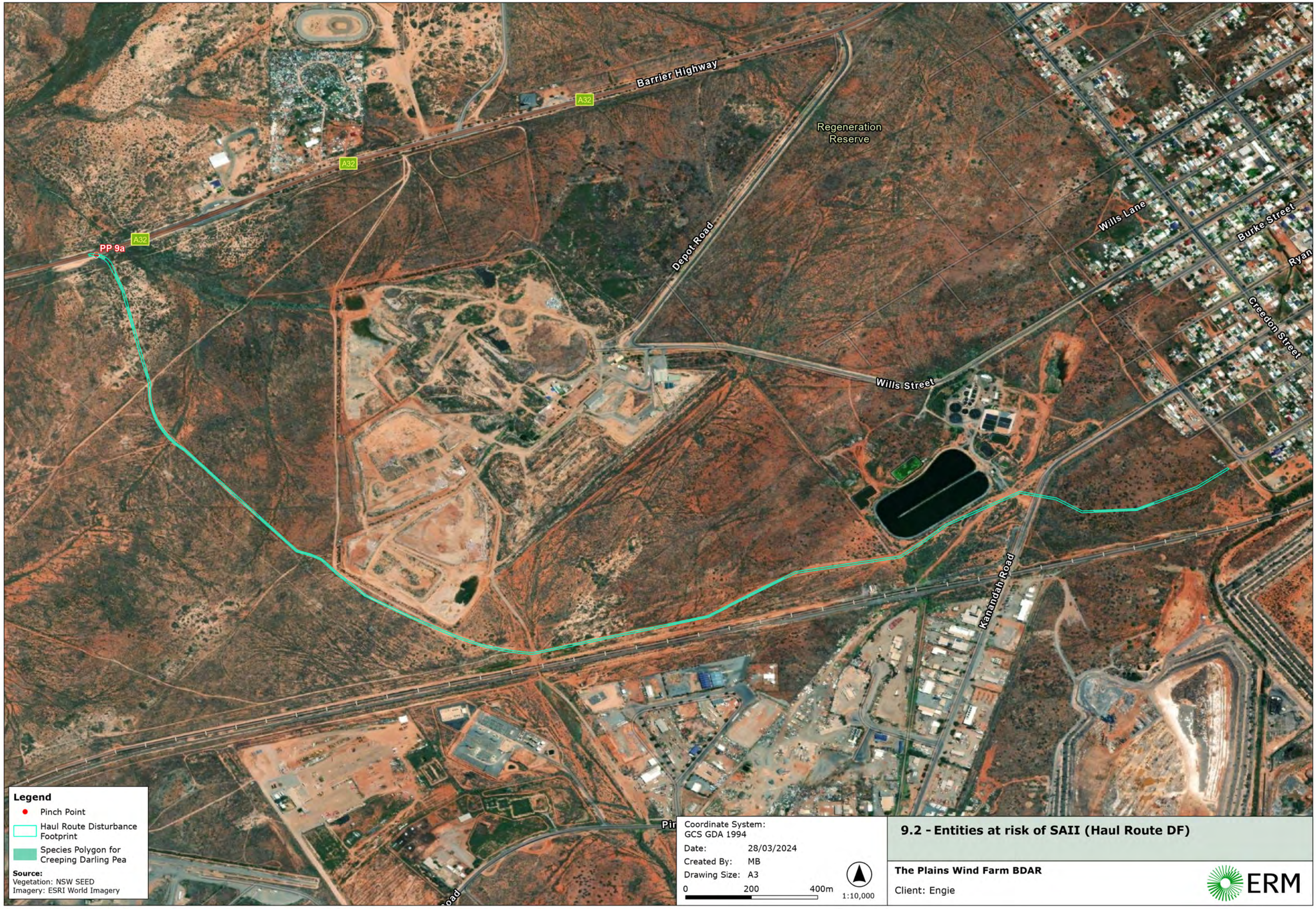
9.1 - Entities at risk of SAII (Subject Land)

The Plains Wind Farm BDAR

Client: Engie

ERM

0667692_PlainsWF_BDAR_R02.aprx



9.2 - Entities at risk of SAII (Haul Route DF)

The Plains Wind Farm BDAR

Client: Engie

ERM

0667692_PlainsWF_BDAR_R02.aprx

9.1.1.1 PLAINS WANDERER

An assessment for SAII as a result of the Project has been undertaken for the Plains-wanderer (*Pedionomus torquatus*) in accordance with BAM Section 9.1.2 and is presented in Table 9-2 .

TABLE 9-2 PLAINS-WANDERER SAII ASSESSMENT

Additional Impact Assessment in accordance with BAM Section 9.1.2
1. What action and measures taken to avoid the direct and indirect impact on the potential entity for an SAII?
Avoidance: Plains-wanderer habitat was considered during the design process, with the Development Footprint largely avoiding Important Mapped Areas, with the impact being restricted to 5.35 ha largely associated with access tracks to be developed between transmission line towers and WTGs comparative to 523.47 ha mapped within the Assessment Area. Suitable habitat, as defined by the extent of associated PCT 44, also occurs within the Development Footprint; however, only covers an area of 73.63 ha. The Project has been designed to maximise use of existing access tracks across the Subject Land where possible, minimising an increase to predatory access routes and activity. **Mitigation**: Several mitigation measures will be implemented to further avoid and minimise impacts to the species with consideration of the National Recovery Plan for the Plains-wanderer (*Pedionomus torquatus*) (DoE, 2016): • The potential risks of predation will be mitigated via the preparation and implementation of feral pest management programs to be developed in accordance with guidelines and relevant codes of practice. • During construction, pre-clearance surveys will be undertaken, flushing ground-dwelling avian species from the clearance path, and searches for Plains-wanderer nests will be undertaken to ensure no individuals are directly impacted by the Project. • The CEMP will include retained vegetation and weed management actions, including provisions for elevated non-native vegetation (i.e *Lycium ferocissimum*) with potential to provide perches for known predators of the species to be removed within 300 m of mapped habitat. • Protocols for the use of spraying exclusion zones around plains-wanderers and their habitat to be implemented.
2. The assessor must consult the TBDC and/or other sources to report on the current population of the species including:
a) evidence of rapid decline presented by an estimate of the: i. decline in population of the species in NSW in the past 10 years or three generations (whichever is longer), or ii. decline in population of the species in NSW in the past 10 years or three generations (whichever is longer) as indicated by: an index of abundance appropriate to the species; decline in geographic distribution and/or habitat quality; exploitation; effect of introduced species, hybridisation, pathogens, pollutants, competitors, or parasites

Additional Impact Assessment in accordance with BAM Section 9.1.2

i. The Plains-wanderer occurs in a single widely-dispersed population; however, the evidence for this is not strong (Department of Environment (DoE) and the South Australia Department of Environment, Water and Natural Resources (SA DAWNR), 2016). The population has experienced significant decline in number in core locations, with monitoring of the species across the Riverina NSW reporting an overall decline of 84% between 2010 and 2014. This decline was preceded by significant fluctuations in numbers across the region from 2001 onwards, with an overall decline of 93% across the region over the period from 2001 to 2014 (Wilson, Ingwersen & Parker, 2014).

ii. The Plains-wanderer has declined to a record low, with 250 to 1000 birds estimated to be extant as of 2015 (Baker-Gabb, 2015; OEH, 2015). The distribution of the Plains-wanderer was formerly widespread, however is now locally-extinct or near extinct in coastal and sub-coastal areas in all four states in which it is known to occur, and is mainly confined to small inland areas that are subject to grazing (SA DAWNR, 2016).
Historically, the major factor contributing to the decline of the Plains-wanderer was habitat loss as a result of the widespread conversion of lowland native grasslands to crops and dense introduced pastures. The Plains-wanderer is now locally-extinct or near extinct in coastal and sub-coastal areas in all four states in which it is known to occur, and is mainly confined to small inland areas that are subject to grazing (SA DAWNR, 2016).
Current recognised threatening processes for the Plains-wanderer include; Habitat loss, inappropriate grazing, small population size, predation by feral species, pesticide use, planting and natural recruitment of trees in or near native grasslands, lack of appropriate fire regimes, quail hunting and climate change (SA DAWNR, 2016).

b) evidence of small population size (Principle 2, clause 6.7(2)(b) BC Regulation) presented by:

i. an estimate of the species' current population size in NSW, and

ii. an estimate of the decline in the species' population size in NSW in three years or one generation (whichever is longer), and

iii. where such data is available, an estimate of the number of mature individuals in each subpopulation, or the percentage of mature individuals in each subpopulation, or whether the species is likely to undergo extreme fluctuations

i. As of 2015, the Plains-wanderers population size was estimated between 250 and 1,000 individuals (DoE & SA DAWNR, 2016).

ii. In the four years between 2010 and 2014, the NSW Riverina population of the species was monitored and found to decrease by 84% (Wilson et al., 2014).

iii. The number of mature individuals in each of the subpopulations (Victoria and NSW) is estimated to be below 250 individuals. Extreme fluctuations in this number have been observed within the NSW subpopulation (DoE, 2015).

Additional Impact Assessment in accordance with BAM Section 9.1.2

c) Evidence of limited geographic range for the threatened species (Principle 3, clause 6.7(2) BC Regulation) presented by:

i. Extent of occurrence

ii. Area of occupancy

iii. Number of threats defined locations (geographically or ecologically distinct areas in which a single threatening event may rapidly affect all species occurrences), and

iv. Whether the species' populations likely to undergo extreme fluctuations

i. As of 2011, the species' extent of occurrence was estimated at 930,000 km2 (Garnet et al., 2011).

ii. As of 2011 the species' area of occupancy was estimated at 33,000 ha and decreasing, which is described as restricted (DoE, 2015).

iii. Two current stronghold locations are recognised for the Plains-wanderer, the western Riverina in NSW and the Patho Plains in Victoria (OEH, 2019). Important area mapping has been undertaken for the species in NSW covering areas of the Riverina, including parts of the Subject Land.

iv. The Plains-wanderer has been observed to undergo extreme fluctuation in numbers in response to seasonal conditions, stocking rates, and time of year. Fluctuation by up to tenfold has been recorded in the Riverina (NSW Scientific Committee, 2009).

d) Evidence that the species is unlikely to respond to management (Principle 4, clause 6.7(2)(d) BC Regulation) because:

i. known reproductive characteristics severely limit the ability to increase the existing population on, or occupy new habitat (e.g. species is clonal) on, a biodiversity stewardship site

ii. the species is reliant on abiotic habitats which cannot be restored or replaced (e.g. karst systems) on a biodiversity stewardship site, or

iii. life history traits and/or ecology is known but the ability to control key threatening processes at a biodiversity stewardship site is currently negligible (e.g. frogs severely impacted by chytrid fungus)

a) No known reproductive characteristics severely limit the ability to increase the existing population, or occupy new habitat on, a biodiversity stewardship site. A national captive breeding program has been established, supported by the Biodiversity Conservation Trust, Local Land Services, Taronga Conservation Society and the NSW Saving Our Species program with the aim to replenish wild populations, with releases made during 2022.

b) The species is not reliant on abiotic habitats which cannot be restored or replaced on a biodiversity stewardship site. Active management of grassland vegetation and

Additional Impact Assessment in accordance with BAM Section 9.1.2

former cropping land can assist in the recovery of habitat values appropriate for the species (DoE & SA DAWNR, 2016).

c) Current threatening processes for the Plains-wanderer include; Habitat loss, inappropriate grazing, small population size, predation by feral species, pesticide use, planting and natural recruitment of trees in or near native grasslands, lack of appropriate fire regimes, quail hunting and climate change. These processes have potential to be controlled where possible at a biodiversity stewardship site.

3. Where the TBDC indicates data is 'unknown' or 'data deficient' for a species for a criterion listed in Subsection 9.1.2(2.), the assessor must record this in the BDAR or BCAR.

The TBDC does not indicate data is 'unknown' or 'data deficient' for this species.

4. In relation to the impacts from the proposal on the species at risk of an SAII, the assessor must include data and information on:

a) the impact on the species' population (Principles 1 and 2) presented by:

i. an estimate of the number of individuals (mature and immature) present in the subpopulation on the subject land (the site may intersect or encompass the subpopulation) and as a percentage of the total NSW population, and

ii. an estimate of the number of individuals (mature and immature) to be impacted by the proposal and as a percentage of the total NSW population, or

iii. if the species' unit of measure is area, provide data on the number of individuals on the site, and the estimated number that will be impacted, along with the area of habitat to be impacted by the proposal.

i. Targeted survey effort undertaken over two nights identified two adults and one chick across The Plains Wind Farm Project Area, with the nearest record situated approximately 1.8 km from the Subject Land boundary. The Disturbance Footprint intersects 5.35 ha of Important Mapped Areas and 73.63 ha of associated PCTs (PCT 44). Individual Plains-wanderers occupy home ranges averaging 12 ha; those of males and females overlap by 50% to give 18 ha per pair, but those of the same sex do not overlap (NSW Scientific Committee, 2009). The size of the present subpopulation is unknown, however based on important area mapping, suitable habitat mapping across the Subject Land and the species home range, the habitat present has potential to support approximately 4.39 pairs. Where individuals are estimated at 250-1000, this represents 1.76% – 0.44% of the NSW population.

ii. The Development Footprint contains 5.35 ha of Important Mapped Areas, and 73.63 ha of associated PCT 44, making up 78.98 ha of suitable habitat. The size of the present subpopulation is unknown, however based on suitable habitat mapping across the Disturbance Footprint and the species home range as discussed above, the

Additional Impact Assessment in accordance with BAM Section 9.1.2

habitat present has potential to support 4.39 pairs. Where individuals are estimated at 250-1000, this represents 1.76% – 0.44% of the NSW population.

iii. Refer to Answer 4.a.ii. above.

d) Impact on geographic range (Principles 1 and 3) presented by:

i. the area of the species' geographic range to be impacted by the proposal in hectares, and a percentage of the total AOO, or EOO within NSW

ii. the impact on the subpopulation as either: all individuals will be impacted (subpopulation eliminated); OR impact will affect some individuals and habitat; OR impact will affect some habitat, but no individuals of the species will be directly impacted

iii. to determine if the persisting subpopulation that is fragmented will remain viable, estimate (based on published and unpublished sources such as scientific publications, technical reports, databases or documented field observations) the habitat area required to support the remaining population, and habitat available within dispersal distance, and distance over which genetic exchange can occur (e.g. seed dispersal) and pollination distance for the species

iv. to determine changes in threats affecting remaining subpopulations and habitat if the proposed impact proceeds, estimate changes in environmental factors including changes to fire regimes (frequency, severity); hydrology, pollutants; species interactions (increased competition and effects on pollinators or dispersal); fragmentation, increased edge effects, likelihood of disturbance; and disease, pathogens and parasites. Where these factors have been considered elsewhere in relation to the target species, the assessor may refer to the relevant sections of the BDAR or BCAR

i. 78.98 ha of suitable habitat in the form of Important Mapped Areas (5.35 ha) and associated PCT 44 (73.63 ha) has potential to be impacted as a result of the Project. This habitat makes up 0.29% of the estimated AOO for the species (330 km2) and 0.000085% of the estimated EOO for the species (930 000 km).

ii. The Project will not directly impact on Plains-wanderer individuals. However, the Project will have direct impact on 78.98 ha of suitable habitat for the species in the form of Important Mapped Areas (5.35 ha) and associated PCT 44 (73.63 ha). To minimise impact, pre-clearance surveys, involving flushing ground-dwelling avian species from the clearance path and searching for Plains-wanderer nests, will be undertaken prior to habitat disturbance to ensure no individuals are directly impacted by the Project.

iii. 78.98 ha of suitable habitat will be impacted as a result of the Project. This has potential to impact 439% of a single breeding pairs habitat (based on breeding pair home range of 18 ha). However, the Project is not considered likely to reduce habitat to a level that would impact the subpopulations viability.

Additional Impact Assessment in accordance with BAM Section 9.1.2
iv. The Project has potential to result in indirect and prescribed impacts to the Plains-wanderer. These impacts include the potential for increased predator activities, vehicle strike, impact on viability of remaining vegetation (light spill) and introduction of weed species. To minimise impacts to the species, mitigation measures detailed in Question 1 above, and Section 8.4 will be implemented.

9.1.1.2 A BURR-DAISY

A Burr-daisy (*Calotis moorei*) has been recorded within the Subject Land, with approximately 106 individuals recorded during the Spring 2023 survey event. The Species Polygon for the Burr-daisy is based on the species records, with a 30 m buffer applied, in addition to assumed presence in remaining areas across the Subject Land not subject to surveys.

The Applicant consulted with BCS on 25 October 2022 and 28 June 2023 and commit to undertaking additional targeted spring surveys during the response to submissions phase and in response to detailed project design. The Project will aim for total avoidance of occurrences of *Calotis moorei*. This will be presented in a revised BDAR and updated SAII assessment where required, addressing any final design or layout changes made in response to the survey outcomes, public exhibition and agency comments.

An assessment for SAII as a result of the Project has been undertaken for *Calotis moorei* in accordance with BAM Section 9.1.2 and is presented in Table 9-3.

TABLE 9-3 A BURR-DAISY SAII IMPACT ASSESSMENT

Additional Impact Assessment in accordance with BAM Section 9.1.2
1. What action and measures taken to avoid the direct and indirect impact on the potential entity for an SAII?
A Burr-daisy (*Calotis moorei*) has been recorded across the Subject Land and within the current Disturbance Footprint, and is assumed presence in remaining areas across the Subject Land not subject to surveys. The Applicant has committed to undertaking further survey effort to confirm the presence or absence of this SAII to inform detailed design, aiming for full avoidance of the species. Results of the future surveys are to be presented in an updated BDAR, and where necessary an updated SAII impact assessment.
2. The assessor must consult the TBDC and/or other sources to report on the current population of the species including:
a) evidence of rapid decline presented by an estimate of the: i. decline in population of the species in NSW in the past 10 years or three generations (whichever is longer), or ii. decline in population of the species in NSW in the past 10 years or three generations (whichever is longer) as indicated by: an index of abundance appropriate to the species; decline in geographic distribution and/or habitat quality; exploitation; effect of introduced species, hybridisation, pathogens, pollutants, competitors, or parasites
During surveys across the Subject Land in Spring 2023, records of *Calotis moorei* were identified. *Calotis moorei* is only known from two additional distinct geographic areas, with a

Additional Impact Assessment in accordance with BAM Section 9.1.2

population at "Mount Mulyah" north-west of Louth, and three populations near Menindee, NSW. There is no evidence to suggest these populations are in decline (DECCW, 2009).

A further historical record from 1913 has been made in the Riverina IBRA bioregion, however several unsuccessful searches suggest that the population at this location is now extinct (DECCW, 2009).

b) evidence of small population size (Principle 2, clause 6.7(2)(b) BC Regulation) presented by:

i. an estimate of the species' current population size in NSW, and

ii. an estimate of the decline in the species' population size in NSW in three years or one generation (whichever is longer), and

iii. where such data is available, an estimate of the number of mature individuals in each subpopulation, or the percentage of mature individuals in each subpopulation, or whether the species is likely to undergo extreme fluctuations

During surveys across the Subject Land, records of *Calotis moorei* were made, making up a population of approximately 106 individuals.

Calotis moorei is currently only known from two distinct geographic areas, with a population at "Mount Mulyah" north-west of Louth, and three populations near Menindee, NSW. 45 individuals of the species were recorded in the 'Mount Mulyah' population, however it is noted that this count was not exhaustive. There is no count information for the populations near Menindee (DECCW, 2009).

There is consequently no data available to estimate the current population size of *Calotis moorei* across NSW.

c) Evidence of limited geographic range for the threatened species (Principle 3, clause 6.7(2) BC Regulation) presented by:

i. Extent of occurrence

ii. Area of occupancy

iii. Number of threats defined locations (geographically or ecologically distinct areas in which a single threatening event may rapidly affect all species occurrences), and

iv. Whether the species' populations likely to undergo extreme fluctuations

The area of occupancy and extent of occupancy are unknown for the *Calotis moorei.*

There are no obvious threats to the extant populations, however a very small, localised population size is inherently at risk from chance events. If the species proves to be confined to "Mount Mulyah" and three populations around Menindee, and the populations are small the species may be susceptible to adverse genetic influences, such as inbreeding depression (DECCW, 2009).

Additional Impact Assessment in accordance with BAM Section 9.1.2

d) Evidence that the species is unlikely to respond to management (Principle 4, clause 6.7(2)(d) BC Regulation) because:

i. known reproductive characteristics severely limit the ability to increase the existing population on, or occupy new habitat (e.g. species is clonal) on, a biodiversity stewardship site

ii. the species is reliant on abiotic habitats which cannot be restored or replaced (e.g. karst systems) on a biodiversity stewardship site, or

iii. life history traits and/or ecology is known but the ability to control key threatening processes at a biodiversity stewardship site is currently negligible (e.g. frogs severely impacted by chytrid fungus)

The Recovery Plan (DECCW, 2009) highlights that it is unlikely that populations of *Calotis moorei* will decline irrespective of recovery measures. The species appears to be capable of producing an abundance of offspring and may prove to be more widespread.

3. Where the TBDC indicates data is 'unknown' or 'data deficient' for a species for a criterion listed in Subsection 9.1.2(2.), the assessor must record this in the BDAR or BCAR.

The TBDC does not indicate data is 'unknown' or 'data deficient' for this species.

4. In relation to the impacts from the proposal on the species at risk of an SAII, the assessor must include data and information on:

b) the impact on the species' population (Principles 1 and 2) presented by:

i. an estimate of the number of individuals (mature and immature) present in the subpopulation on the subject land (the site may intersect or encompass the subpopulation) and as a percentage of the total NSW population, and

ii. an estimate of the number of individuals (mature and immature) to be impacted by the proposal and as a percentage of the total NSW population, or

iii. if the species' unit of measure is area, provide data on the number of individuals on the site, and the estimated number that will be impacted, along with the area of habitat to be impacted by the proposal.

Calotis moorei has been recorded within the Subject Land, with approximately 106 individuals present. The extent of the population is estimated based on the observed individuals and delineation of associated PCT 157, minus areas where survey effort was undertaken with no individuals recorded. This estimated extent is 51.23 ha within the Subject Land, and 1.51 ha within the Disturbance Footprint.

Additional Impact Assessment in accordance with BAM Section 9.1.2

e) Impact on geographic range (Principles 1 and 3) presented by:

i. the area of the species' geographic range to be impacted by the proposal in hectares, and a percentage of the total AOO, or EOO within NSW

ii. the impact on the subpopulation as either: all individuals will be impacted (subpopulation eliminated); OR impact will affect some individuals and habitat; OR impact will affect some habitat, but no individuals of the species will be directly impacted

iii. to determine if the persisting subpopulation that is fragmented will remain viable, estimate (based on published and unpublished sources such as scientific publications, technical reports, databases or documented field observations) the habitat area required to support the remaining population, and habitat available within dispersal distance, and distance over which genetic exchange can occur (e.g. seed dispersal) and pollination distance for the species

iv. to determine changes in threats affecting remaining subpopulations and habitat if the proposed impact proceeds, estimate changes in environmental factors including changes to fire regimes (frequency, severity); hydrology, pollutants; species interactions (increased competition and effects on pollinators or dispersal); fragmentation, increased edge effects, likelihood of disturbance; and disease, pathogens and parasites. Where these factors have been considered elsewhere in relation to the target species, the assessor may refer to the relevant sections of the BDAR or BCAR

Calotis moorei has been recorded within the Subject Land, with approximately 106 individuals present. The extent of the population is estimated based on the observed individuals and delineation of associated PCT 157, minus areas where survey effort was undertaken with no individuals recorded. This estimated extent is 51.23 ha within the Subject Land, and 1.51 ha within the Disturbance Footprint. The area of occupancy and extent of occupancy for the species is currently unknown.

The Disturbance Footprint allows for micrositing during detailed design, where possible the design will avoid impact to all occurrences of *Calotis moorei*.

9.1.1.3 CREEPING DARLING PEA

The Creeping Darling Pea (*Swainsona viridis*) has been assumed to be present within the Haul Route DF. Extent of the community is based on the presence of associated PCT 155. It is noted the species is only known from four (4) NSW records, with no records made in the previous 20 year, as of the time of writing.

An assessment for SAII as a result of the Project has been undertaken for Creeping Darling Pea in accordance with BAM Section 9.1.2 and is presented in Table 9-4.

TABLE 9-4 CREEPING DARLING PEA SAII IMPACT ASSESSMENT

Additional Impact Assessment in accordance with BAM Section 9.1.2
1. What action and measures taken to avoid the direct and indirect impact on the potential entity for an SAII?
The Creeping Darling Pea has been assumed to be present within the Haul Route DF. Presence is based on the occurrence of associated PCT 155. Survey undertaken across the Haul Route DF were completed outside the recommended survey period for the species. The Applicant has committed to undertaking further survey effort to confirm the presence or absence of this SAII to inform final Haul Route design, aiming for full avoidance of the species. Results of the future surveys are to be presented in an updated BDAR, and where necessary an updated SAII impact assessment.
2. The assessor must consult the TBDC and/or other sources to report on the current population of the species including: a) evidence of rapid decline presented by an estimate of the: i. decline in population of the species in NSW in the past 10 years or three generations (whichever is longer), or ii. decline in population of the species in NSW in the past 10 years or three generations (whichever is longer) as indicated by: an index of abundance appropriate to the species; decline in geographic distribution and/or habitat quality; exploitation; effect of introduced species, hybridisation, pathogens, pollutants, competitors, or parasites
Historically, the species has been recorded at four (4) locations across NSW, with no records made in the previous 20 year, as of the time of writing. The most recent species record of the species was made in 2001, situated approximately (approx.) 190 km northeast of the Haul Route DF. A record from 1971 is situated approx. 58 km north, with two records from 1985 located along Stephen's Creek, Broken Hill. The species was noted to be "large and plentiful" at Stephen's Creek Broken Hill in 1925, but is also known to occur infrequently in populations. The remaining records do not provide population size, nor are there details regarding extant populations.
b) evidence of small population size (Principle 2, clause 6.7(2)(b) BC Regulation) presented by: i. an estimate of the species' current population size in NSW, and ii. an estimate of the decline in the species' population size in NSW in three years or one generation (whichever is longer), and

Additional Impact Assessment in accordance with BAM Section 9.1.2

iii. where such data is available, an estimate of the number of mature individuals in each subpopulation, or the percentage of mature individuals in each subpopulation, or whether the species is likely to undergo extreme fluctuations

The Creeping Darling Pea is only known from four historical (>20 years) records in NSW. A Stephen's Creek, Broken Hill, record noted the species to be "large and plentiful" in 1925. However, the species is known to occur infrequently in populations. The remaining records do not provide population size, nor are there details regarding extant populations.

There is consequently no data available to estimate the current population size of Cathe Creeping Darling Pea across NSW.

c) Evidence of limited geographic range for the threatened species (Principle 3, clause 6.7(2) BC Regulation) presented by:

i. Extent of occurrence

ii. Area of occupancy

iii. Number of threats defined locations (geographically or ecologically distinct areas in which a single threatening event may rapidly affect all species occurrences), and

iv. Whether the species' populations likely to undergo extreme fluctuations

The area of occupancy and extent of occupancy are unknown for the Creeping Darling Pea.

There are no threat defined locations identified for the species, nor data regarding population fluctuations.

d) Evidence that the species is unlikely to respond to management (Principle 4, clause 6.7(2)(d) BC Regulation) because:

i. known reproductive characteristics severely limit the ability to increase the existing population on, or occupy new habitat (e.g. species is clonal) on, a biodiversity stewardship site

ii. the species is reliant on abiotic habitats which cannot be restored or replaced (e.g. karst systems) on a biodiversity stewardship site, or

iii. life history traits and/or ecology is known but the ability to control key threatening processes at a biodiversity stewardship site is currently negligible (e.g. frogs severely impacted by chytrid fungus)

A Saving Our Species conservation project is currently being developed for the species. No reproductive characteristics, abiotic factors, or life history traits are known that would impact the species ability to respond to management.

3. Where the TBDC indicates data is 'unknown' or 'data deficient' for a species for a criterion listed in Subsection 9.1.2(2.), the assessor must record this in the BDAR or BCAR.

Additional Impact Assessment in accordance with BAM Section 9.1.2

The TBDC does not indicate data is 'unknown' or 'data deficient' for this species.

4. In relation to the impacts from the proposal on the species at risk of an SAII, the assessor must include data and information on:

c) the impact on the species' population (Principles 1 and 2) presented by:

i. an estimate of the number of individuals (mature and immature) present in the subpopulation on the subject land (the site may intersect or encompass the subpopulation) and as a percentage of the total NSW population, and

ii. an estimate of the number of individuals (mature and immature) to be impacted by the proposal and as a percentage of the total NSW population, or

iii. if the species' unit of measure is area, provide data on the number of individuals on the site, and the estimated number that will be impacted, along with the area of habitat to be impacted by the proposal.

The Creeping Darling Pea is assumed to be present within the Haul Route DF, with extent estimated based on the delineation of associated PCT 155. This estimated extent is 0.53 ha.

f) Impact on geographic range (Principles 1 and 3) presented by:

i. the area of the species' geographic range to be impacted by the proposal in hectares, and a percentage of the total AOO, or EOO within NSW

ii. the impact on the subpopulation as either: all individuals will be impacted (subpopulation eliminated); OR impact will affect some individuals and habitat; OR impact will affect some habitat, but no individuals of the species will be directly impacted

iii. to determine if the persisting subpopulation that is fragmented will remain viable, estimate (based on published and unpublished sources such as scientific publications, technical reports, databases or documented field observations) the habitat area required to support the remaining population, and habitat available within dispersal distance, and distance over which genetic exchange can occur (e.g. seed dispersal) and pollination distance for the species

iv. to determine changes in threats affecting remaining subpopulations and habitat if the proposed impact proceeds, estimate changes in environmental factors including changes to fire regimes (frequency, severity); hydrology, pollutants; species interactions (increased competition and effects on pollinators or dispersal); fragmentation, increased edge effects, likelihood of disturbance; and disease, pathogens and parasites. Where these factors have been considered elsewhere in relation to the target species, the assessor may refer to the relevant sections of the BDAR or BCAR

Additional Impact Assessment in accordance with BAM Section 9.1.2

The Creeping Darling Pea is assumed to be present within the Haul Route DF, with extent estimated based on the delineation of associated PCT 155. This estimated extent is 0.53 ha. The area of occupancy and extent of occupancy for the species is currently unknown.

Extents of suitable habitat in associated PCT 155 are present in vegetation adjacent to the Haul Route DF that will not be disturbed as a result of the Project.

The Applicant has committed to undertaking further survey effort to confirm the presence or absence of this SAII to inform final Haul Route design, aiming for full avoidance of the species.

9.2 IMPACT SUMMARY

9.2.1 IMPACTS THAT REQUIRE AN OFFSET

Impacts requiring an offset for the Subject Land and Haul Route DF are shown in Figure 9-3 and Figure 9-4 respectively. In accordance with Section 9.2.1 of the BAM, these areas comprise native vegetation with vegetation integrity score of at least:

- ≥15, where the PCT is representative of an EEC or a CEEC;
- ≥17, where the PCT is associated with threatened species habitat (as represented by ecosystem credits) or represents a vulnerable ecological community; or
- ≥20, where the PCT does not represent a TEC and is not associated with threatened species habitat.

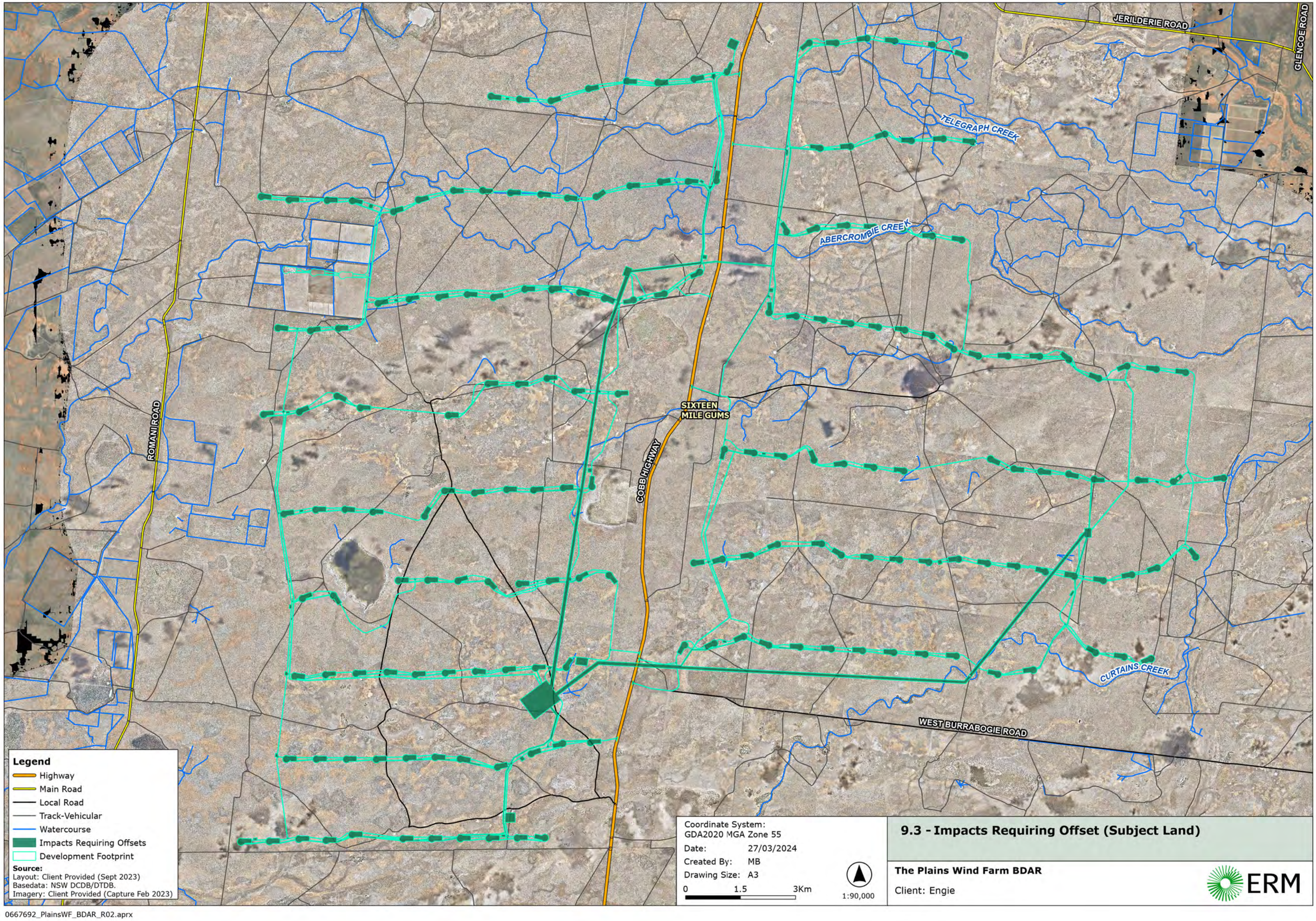
All PCTs mapped within the Subject Land and Haul Route DF that are to experience a permanent direct impact require offsetting as they meet the vegetation integrity score threshold above.

9.2.2 IMPACTS THAT DO NOT REQUIRE FURTHER ASSESSMENT

The Subject Land contains 8.78 ha of non-native vegetation that does not require assessment for ecosystem credits. This area is dominated by exotic species, with vegetation historically cleared/ disturbed. This land does not constitute habitat for threatened species. The Haul Route DF contains 1.5 ha of vegetation mapped as PCT-0, non-native vegetation. There are no prescribed impacts requiring offsets in areas of non-native vegetation. Non-native vegetation not requiring offset for the Subject Land and Haul Route DF is shown in Figure 9-5 and Figure 9-6 respectively.

Other scenarios

ENGIE have engaged with Local Land Services in the Riverina region to explore opportunities to collaborate on conservation programs with a focus on efforts towards the threatened Black Falcon and Plains-wanderer. This has potential to include funding local European Fox control measures to reduce predation risk to the Plains-wanderer.



9.3 - Impacts Requiring Offset (Subject Land)

The Plains Wind Farm BDAR

Client: Engie

ERM

0667692_PlainsWF_BDAR_R02.aprx



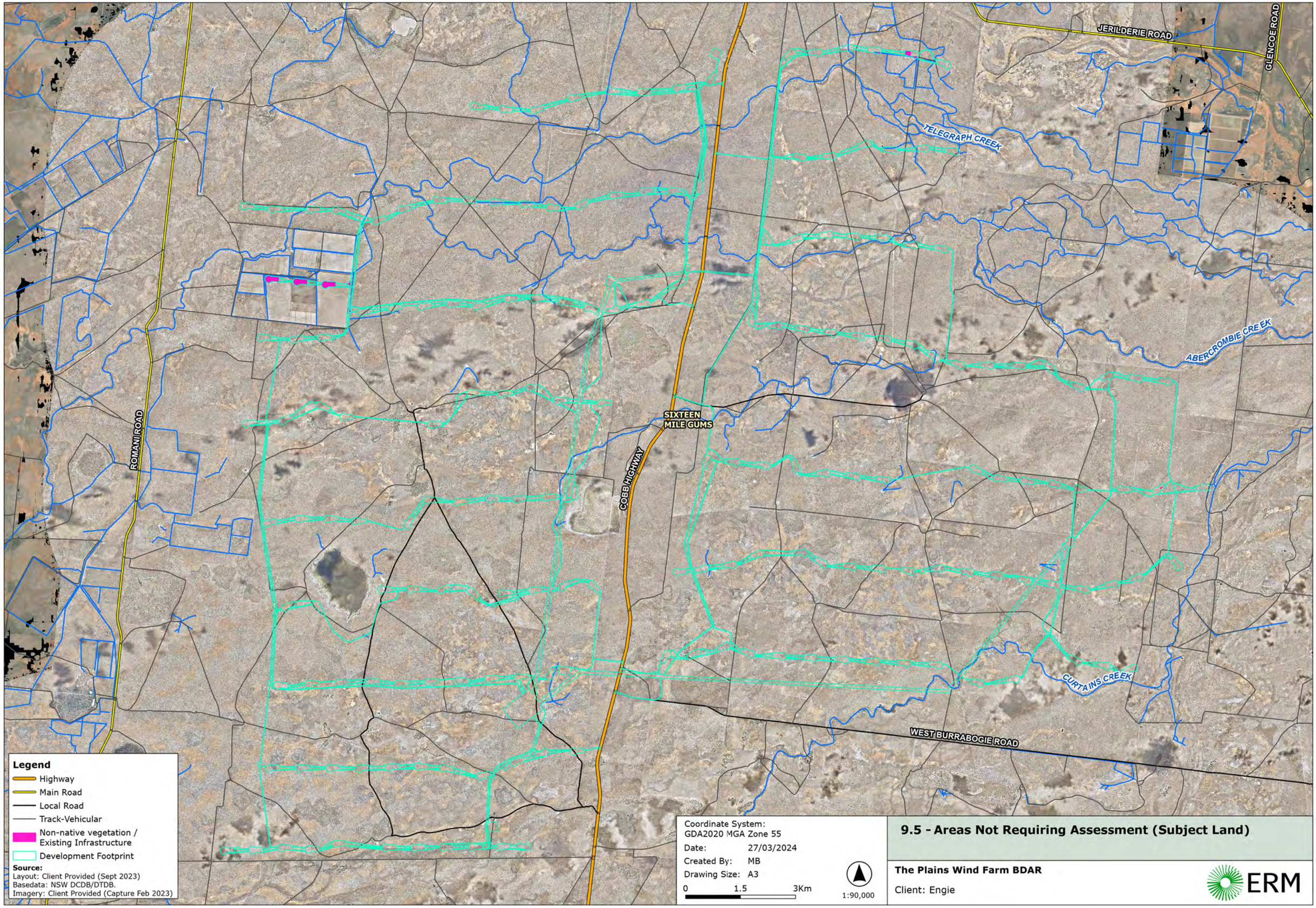
9.4 - Impacts Requiring Offset (Haul Route DF)

The Plains Wind Farm BDAR

Client: Engie

ERM

0667692_PlainsWF_BDAR_R02.aprx



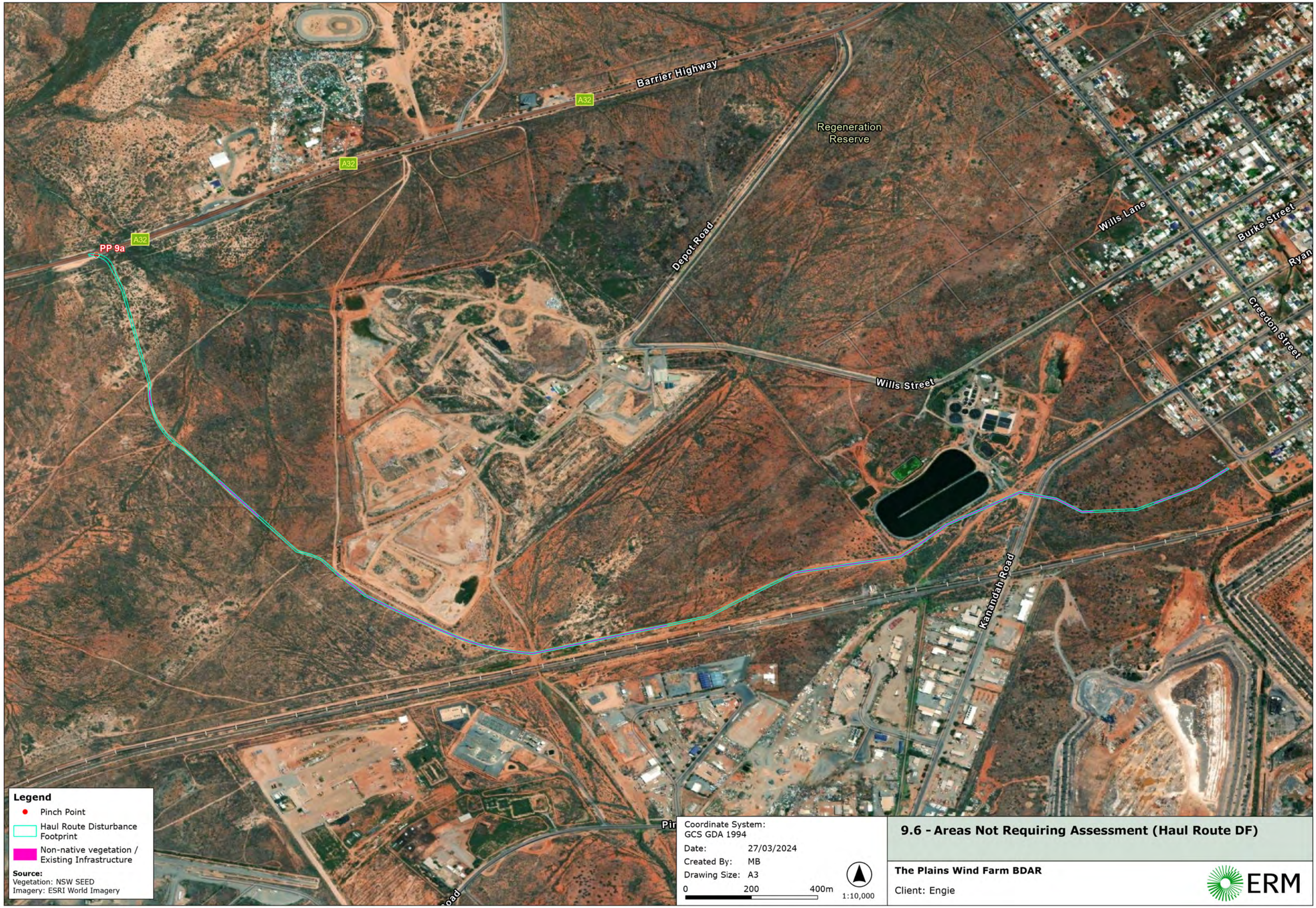
9.5 - Areas Not Requiring Assessment (Subject Land)

The Plains Wind Farm BDAR

Client: Engie

ERM

0667692_PlainsWF_BDAR_R02.aprx



9.6 - Areas Not Requiring Assessment (Haul Route DF)

The Plains Wind Farm BDAR

Client: Engie

ERM

0667692_PlainsWF_BDAR_R02.aprx

10. APPLYING THE NO NET LOSS STANDARD

The offset liability for the Project is calculated in the following sections. The Biodiversity Credit Report for the Subject Land is provided in Appendix H, and for the Haul Route DF is provided in Appendix I.

10.1 OFFSET REQUIREMENTS FOR DIRECT IMPACTS

10.1.1 ECOSYSTEM CREDITS

Table 10-1 identifies the ecosystem credits required to offset the Project as per BAM Subsection 9.2.1(1.). There are no vegetation zones, TECs or ECs that are assessed as not requiring offsets as per BAM Subsection 9.2.1(3.).

Like for like trading options apply to the Ecosystem credit classes as outlined in Table 10-1.

TABLE 10-1 IMPACTS THAT REQUIRE AN OFFSET – ECOSYSTEM CREDITS

Vegetation zone	PCT ID/Condition	Impact area (ha)	Change in VI score	Number of ecosystem credits required
1	13_Moderate	2.01	-51.1	45
2	17_Moderate	87.09	-79.2	3,016
3	24_Moderate	57.33	-47.8	1,028
4	28_Low	0.69	-35.3	12
5	44_Moderate	73.63	-84.7	3,119
6	153_Moderate	18.48	-84.6	586
7	157_Moderate	48.41	-59.2	1,254
8	163_Moderate	392.68	-76.9	11,320
9	164_Moderate	1,285.02	-86.4	41,766
10*	155_High	0.67	-100	29

**Vegetation Zone 10 relates to the Haul Route DF only.*

TABLE 10-2 ECOSYSTEM CREDIT CLASS AND MATCHING CREDIT PROFILE

PCT name	PCT vegetation class	Associated TEC or EC	Offset trading group	Hollow bearing trees present?	Credits
13-Black Box - Lignum woodland wetland of the inner floodplains in the semi-arid (warm) climate zone (mainly Riverina Bioregion and Murray Darling Depression Bioregion)	Inland Floodplain Woodlands This includes PCT's: 13, 15, 16, 83, 438, 454, 630	-	Inland Floodplain Woodlands - ≥ 50% - < 70% cleared group (including Tier 3 or higher threat status).	Yes	45
17-Lignum shrubland wetland of the semi-arid (warm) plains (mainly Riverina Bioregion and Murray Darling Depression Bioregion)	Inland Floodplain Shrublands This includes PCT's: 17, 115, 161, 241, 247, 375	-	Inland Floodplain Shrublands - ≥ 50% - < 70% cleared group (including Tier 3 or higher threat status).	No	3,016
24-Canegrass swamp tall grassland wetland of drainage depressions, lakes and pans of the inland plains	Inland Floodplain Shrublands This includes PCT's: 17, 24, 25, 115, 160, 161, 240, 241, 247, 261, 271, 375	-	Inland Floodplain Shrublands - < 50% cleared group (including Tier 4 or higher threat status)	No	1,028
28-White Cypress Pine open woodland of sand plains, prior streams and dunes mainly of the semi-arid (warm) climate zone	Riverine Sandhill Woodlands This includes PCT's: 19, 20, 21, 22, 23, 28, 48, 75, 86	Yes	Riverine Sandhill Woodlands - ≥ 70% - <90% cleared group (including Tier 2 or higher threat status).	No	12
44-Forb-rich Speargrass - Windmill Grass - White Top	Riverine Plain Grasslands This includes PCT's:	-	Riverine Plain Grasslands - ≥ 70% - <90% cleared group	No	3,119

PCT name	PCT vegetation class	Associated TEC or EC	Offset trading group	Hollow bearing trees present?	Credits
grassland of the Riverina Bioregion	44		(including Tier 2 or higher threat status).		
153--Black Bluebush low open shrubland of the alluvial plains and sandplains of the arid and semi-arid zones	Aeolian Chenopod Shrublands This includes PCT's: 151, 152, 153, 154, 222, 225	-	Aeolian Chenopod Shrublands - < 50% cleared group (including Tier 4 or higher threat status)	No	586
157-Bladder Saltbush shrubland on alluvial plains in the semi-arid (warm) zone including Riverina Bioregion	Riverine Chenopod Shrublands This includes PCT's: 157, 158, 159, 195, 196, 211, 377	-	Riverine Chenopod Shrublands - ≥ 50% - < 70% cleared group (including Tier 3 or higher threat status).	No	1,254
163-Dillon Bush (Nitre Bush) shrubland of the semi-arid and arid zones	Riverine Chenopod Shrublands This includes PCT's: 157, 158, 159, 163, 164, 168, 195, 196, 211, 212, 216, 236, 254, 377, 466	-	Riverine Chenopod Shrublands - < 50% cleared group (including Tier 4 or higher threat status).	No	11,320
164-Cotton Bush open shrubland of the semi-arid (warm) zone	Riverine Chenopod Shrublands This includes PCT's: 157, 158, 159, 163, 164, 168, 195, 196, 211, 212, 216, 236, 254, 377, 466	-	Riverine Chenopod Shrublands - < 50% cleared group (including Tier 4 or higher threat status).	No	41,766
155-Bluebush shrubland on stony rises and downs in the arid and semi-arid zones*	Gibber Chenopod Shrublands This includes PCT's: 155, 156	-	Gibber Chenopod Shrublands >=50% and <70%	No	29

**PCT 155 relates to the Haul Route DF only*

10.1.2 SPECIES CREDITS

Candidate species requiring an offset are presented in Table 10-3.

TABLE 10-3 IMPACTS THAT REQUIRE AN OFFSET – SPECIES CREDIT

Common name	Scientific name	BC Act status	EPBC Act status	Loss of habitat (ha)	Biodiversity risk weighting	Number of species credits required
Plains-wanderer	*Pedionomus torquatus*	E	CE	5.35	3	305
A spear-grass	*Austrostipa wakoolica*	V	V	87.78	2	3,447
A burr-daisy	*Calotis moorei*	E	E	46.29	3	2,176
Small Scurf-pea	*Cullen parvum*	E	-	72.81	2	3,084
Winged Peppercress	*Lepidium monoplocoides*	E	E	367.42	2	13,441
Chariot Wheels	*Maireana cheelii*	V	V	1,036.75	2	44,233
Slender Darling Pea	*Swainsona murrayana*	V	V	1,331.03	2	55,536
Mossgiel Daisy	*Brachyscome papillosa*	V	V	1,376.57	2	56,517
Creeping Darling Pea*	*Swainsona viridis*	E	-	0.67	3	40

**The Creeping Darling Pea relates to the Haul Route DF only*

The area from which the Species credits can be obtained is limited to the State of NSW.

10.2 OFFSET STRATEGY

The No Net Loss standard involves the retirement of ecosystem and species credits for Project related direct impacts in accordance with the BOS. The BOS requires all biodiversity impacts to be calculated using the BAM-C, which provides an output determining the final Species credit and Ecosystem credit obligations for the Project. Typically, the final credit obligations are to be 'retired' prior to construction or in accordance with an approved staged approach.

The Applicant is developing a biodiversity offset strategy in parallel with the Biodiversity Assessment Report. This strategy will detail the offset approach to be undertaken to retire credit obligations and will be achieved by:

- Retiring 'like for like' credits as specified in Sections 7.1 and 7.2 to the amount and from the regions indicated;
- Funding a biodiversity conservation action instead of, or in combination with, the retirement of species credits; or
- Payment into the Biodiversity Conservation Trust (BCT) in lieu of satisfying the offset liability specified in Section 7.1 and 7.2.

The fee associated with the latter option is to be determined through formal consultation with the BCT.

10.2.1 REDUCTION IN CALCULATED OFFSET LIABILITY

Due to insufficient targeted survey during the correct season, this BDAR has assumed presence for the following species:

- A Spear-grass (*Austrostipa wakoolica*);
- Mossgiel Daisy (*Brachyscome papillosa*);
- Small Scurf-pea (*Cullen parvum*); and
- Creeping Darling Pea (*Swainsona viridis*).

The offset credit summary report is based on 'assumed presence' and represents the maximum theoretical credit liability for the development.

However, it is possible/likely that the offset liability for each of the species credit species listed in Table 10-3 is substantially less than indicated (i.e., future survey results do not show uniform occurrence throughout PCTs associated with these threatened species). If this is proven to be the case through the completion of mitigation measures to improve avoid and/or minimize outcomes through (i.e., infrastructure micrositing using data obtained from seasonally appropriate targeted survey), then the offset credit liability should be reduced accordingly such that it is commensurate with the final residual impact of the development[2].

Prior to vegetation clearing commencing on site, the proponent will undertake additional targeted surveys (as required by the BAM) and submit a revised biodiversity offset plan to the Planning Secretary for approval including an updated offset credit summary report based on additional surveys and the final development footprint.

[2] Section 7.14(3) of *the Biodiversity Conservation Act 2016*

10.2.2 FUNDING A BIODIVERSITY CONSERVATION ACTION

Ancillary rules are available to SSD projects in making contribution to the offset liability for eligible species. Eligible species identified in this assessment that qualify for this are listed in Table 10-4.

TABLE 10-4 APPLICATION OF ANCILLARY RULES – PRESCRIBED BIODIVERISTY CONSERVATION ACTIONS

Common name	Scientific name	PRESCRIBED BIODIVERISTY CONSERVATION ACTIONS
Chariot Wheels	*Maireana cheelii*	Target survey at known locations in scalded country in salt bush plains area to identify extent of populations. Undertake a threat assessment at sites where populations are located in Moulamein, Deniliquin and Hay areas.
Mossgiel Daisy	*Brachyscome papillosa*	Targeted survey in areas of suitable habitat between Mungo National Park and Balranald; areas surrounding Willandra National Park; Lachlan Valley National Park south of Corrong; Murrumbidgee National Park (Yanga); Kalyarr and surrounding areas on travelling stock reserves, to confirm distribution, population sizes and undertake threat assessment. Investigate life history dynamics including seed viability, germination, dormancy and longevity (in the natural environment and in storage). Conduct experimental research into the relative impacts of different disturbance regimes such as grazing and fire on the species survival and recruitment

The extent to which these ancillary rules are applied and how they form part of the offset strategy is to be determined through consultation with BCS and DPHI. A written agreement is required from BCS to define the terms of this outcome.

11. CONCLUSION

11.1 BIODIVERSITY MATTERS REQUIRING ASSESSMENT

Ten (10) PCTs are identified within the Subject Land, with nine (9) of these situated within the Development Footprint making up nine (9) vegetation zones as provided below:

- VZ01: PCT 13 Black Box - Lignum woodland wetland of the inner floodplains in the semi-arid (warm) climate zone (mainly Riverina Bioregion and Murray Darling Depression Bioregion).
- VZ02: PCT 17 Lignum shrubland wetland of the semi-arid (warm) plains (mainly Riverina Bioregion and Murray Darling Depression Bioregion);
- VZ03: PCT 24 Canegrass swamp tall grassland wetland of drainage depressions, lakes and pans of the inland plains;
- VZ04: PCT 28 White Cypress Pine open woodland of sand plains, prior streams and dunes mainly of the semi-arid (warm) climate zone
- VZ05: PCT 44 Forb-rich Speargrass – Windmill Grass – White Top grassland of the Riverina Bioregion;
- VZ06: PCT 153 Black Bluebush low open shrubland of the alluvial plains and sandplains of the arid and semi-arid zones
- VZ07: PCT 157 Bladder Saltbush shrubland on alluvial plains in the semi-arid (warm) zone including Riverina Bioregion;
- VZ08: PCT 163 Dillon Bush (Nitre Bush) shrubland of the semi-arid and arid zones; and
- VZ09: PCT 164 Cotton Bush open shrubland of the semi-arid (warm) zone.

While in the Subject Land, PCT 46: Curly Windmill Grass - speargrass - wallaby grass grassland on alluvial clay and loam on the Hay Plain, Riverina Bioregion, is situated wholly outside of the operational and construction footprint (Development Footprint).

Four (4) PCTs are identified within the Haul Route DF. In accordance with the streamlined assessment module for small area developments the dominant PCT has been assessed, with a single VZ assigned as provided below:

- VZ10: PCT 155 Bluebush shrubland on stony rises and downs in the arid and semi-arid zones.

Four (4) ecosystem credit species has been recorded within the Subject Land, including:

- Black Falcon (*Falco subniger*);
- Spotted Harrier (*Circus assimilis*);
- Yellow-bellied Sheath-tailed Bat (*Saccolaimus flaviventris*); and
- White-fronted Chat (*Epthianura albifrons*).

Four (4) ecosystem credit species have been recorded in proximity to the Haul Route DF based on BioNet records, including:

- Redthroat (*Pyrrholaemus brunneus*);
- White-fronted Chat (*Epthianura albifrons*);
- Southern Whiteface (*Aphelocephala leucopsis*); and

- Black Falcon (*Falco subniger*).

A species polygon was developed for eight (8) species credit species across the Subject Land, including:

- Plains-wanderer (*Pedionomus torquatus*);
- A Spear-grass (*Austrostipa wakoolica*);
- Winged Pepper-cress (*Lepidium monoplocoides*);
- Chariot Wheels (*Maireana cheelii*);
- Mossgiel Daisy (*Brachyscome papillosa*);
- A burr-daisy (*Calotis moorei*);
- Slender Darling Pea (*Swainsona murrayana*); and
- Small Scurf Pea (*Cullen parvum*).

A species polygon was developed for one (1) species credit species across the Haul Route DF, including:

- Creeping Darling Pea (*Swainsona viridis*).

11.2 AVOID, MINIMISE, AND MITIGATE

The Project design has been revised and refined for the EIS based on detailed assessments and in response to the identification and assessment of environmental limitations, constructability requirements, and consideration of the outcomes of agency, landowner, and community consultations. The project design has aimed to avoid areas of biodiversity values as follows:

- Remnant woodland habitat and ephemeral wetlands were identified as having high biodiversity value for resident and nomadic fauna, and in areas woodland constituted threatened ecological communities. The mapped extent and condition of this habitat was used to affect an avoidance during Project design.
- Resident raptor nesting sites were identified during survey events and largely avoided, WTGs have been amended to be situated over 2 km from an identified Little Eagle nest.
- The Project has been designed to maximise use of existing public and internal access tracks across the Subject Land where possible, minimising vegetation clearance required and where possible preventing an increase to predatory access routes and activity.
- Where possible all occurrences of *Calotis moorei* will be avoided during final micrositing design.
- Review of Important Mapped Areas for the Plains-wanderer and the mapping of suitable habitat in association with PCT 44 delineated across The Plains Wind Farm Project Area was undertaken. The Development Footprint has been designed to largely avoid Important Mapped Areas, with the impact being restricted to 5.35 ha associated with access tracks to be developed between transmission line towers and WTGs.

A suite of mitigation measures to avoid and further minimise direct, indirect and prescribed impacts will be implemented, such as the development of a BBAMP, and the delineation of clearing areas, erosion sedimentation and pollution control, timing of construction works, light spill mitigation measures, mammalian predator management, pre-clearance surveys, clearance supervision, weed management, and a Vegetation Management Plan.

11.3 DIRECT IMPACTS ON ASSESSABLE BIODIVERSITY MATTERS

The Project will have a direct impact on native vegetation and the habitat of known and assumed Candidate threatened species. Direct impacts on PCTs are provided in Table 11-1 below.

TABLE 11-1 PCT DIRECT IMPACT

PCT ID	PCT	Direct Impact (ha)
13	Black Box - Lignum woodland wetland of the inner floodplains in the semi-arid (warm) climate zone (mainly Riverina Bioregion and Murray Darling Depression Bioregion)	2.01
17	Lignum shrubland wetland of the semi-arid (warm) plains (mainly Riverina Bioregion and Murray Darling Depression Bioregion)	87.09
24	Canegrass swamp tall grassland wetland of drainage depressions, lakes and pans of the inland plains	57.33
28	White Cypress Pine open woodland of sand plains, prior streams and dunes mainly of the semi-arid (warm) climate zone	0.69
44	Forb-rich Speargrass – Windmill Grass – White Top grassland of the Riverina Bioregion	73.63
153	Black Bluebush low open shrubland of the alluvial plains and sandplains of the arid and semi-arid zones	18.48
157	Bladder Saltbush shrubland on alluvial plains in the semi-arid (warm) zone including Riverina Bioregion	48.41
163	Dillon Bush (Nitre Bush) shrubland of the semi-arid and arid zones	392.68
164	Cotton Bush open shrubland of the semi-arid (warm) zone	1,285.02
155*	Bluebush shrubland on stony rises and downs in the arid and semi-arid zones	0.67

** PCT 155 relates to the Haul Route DF only. The direct impact area is made up of the total area of native vegetation across the Haul Route DF.*

Species polygon area for the nine (9) candidate threatened species impacted, or assumed to be impacted, by the Project are provided in Table 11-2 .

TABLE 11-2 CANDIDATE THREATENED SPECIES DIRECT IMPACT

Common name	Scientific name	Direct Impact
Plains-wanderer	*Pedionomus torquatus*	5.35
A spear-grass	*Austrostipa wakoolica*	87.78
A burr-daisy	*Calotis moorei*	46.29
Small Scurf-pea	*Cullen parvum*	72.81
Winged Peppercress	*Lepidium monoplocoides*	367.34
Chariot Wheels	*Maireana cheelii*	1,036.75
Slender Darling Pea	*Swainsona murrayana*	1,331.03
Mossgiel Daisy	*Brachyscome papillosa*	1,376.57
Creeping Darling Pea*	*Swainsona viridis*	0.53

**The Creeping Darling Pea relates to the Haul Route DF only.*

Three (3) of the above species; Plains-wanderer, A Burr-daisy and Creeping Darling Pea, were assessed as SAII. Additional survey will be undertaken during the response to submission phase and the SAII assessment will be updated, however using the precautionary approach in this assessment concludes that the Project would not result in a significant decline of the species assessed.

11.4 INDIRECT IMPACTS ON ASSESSABLE BIODIVERSITY MATTERS

Indirect and prescribed impacts are expected as a result of the Project and are associated with the following:

- Increase risk of mammal predatory species access;
- Increase risk of vehicle strike; and
- Risk of turbine strike.

Mitigation measures will be implemented to mitigate against these indirect impacts and are inclusive of the implementation of a Construction Environmental Management Plan (CEMP), Bird and Bat Adaptive Management Plan (BBAMP) and feral pest management plan.

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APPENDIX A THE PLAINS WIND FARM – HAUL ROUTE ASSESSMENT: SOUTH AUSTRALIA BIODIVERSITY DUE DILIGENCE

The Plains Wind Farm – SA Haul Route Assessment

Biodiversity Due Diligence

PREPARED FOR

Engie Australia Pty Ltd

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SIGNATURE PAGE

The Plains Wind Farm – SA Haul Route Assessment

Biodiversity Due Diligence

0667692



Jessica Gardner
Ecologist



Mark Aitkens
Principal Ecologist



Joanne Woodhouse
Principal Consultant/Project Manager



Mark Davey
Partner

Environmental Resources Management
Australia Pty Ltd
Level 14, 207 Kent Street
Sydney NSW 2000
T +61 2 8584 8888

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ACRONYMS AND ABBREVIATIONS

Acronyms	Description
ALA	Atlas of Living Australia
ARES	ARES Project Services Pty Ltd
BDAR	Biodiversity Development Assessment Report
CE	Critically Endangered
DCCEEW	Department of Climate Change, Energy, the Environment and Water (Commonwealth)
DEW	Department for Environment and Water (State)
E	Endangered
EIS	Environmental Impact Statement
Engie	Engie Australia Pty Ltd
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999 (Commonwealth)
ERM	Environmental Resources Management Australia Pty Ltd
ha	hectare
IBRA	Interim Biographic Regionalisation of Australia
km	Kilometre
LGA	Local Government Area
LoO	Likelihood of Occurrence
m	Metre
MNES	Matters of National Environmental Significance
MSES	Matters of State Environmental Significance
NPW Act	National Parks and Wildlife Act 1972 (State)
NSW	New South Wales
NV Act	Native Vegetation Act 1991 (State)
PDI Act	Planning, Development and Infrastructure Act 2016 (State)
PMST	Protected Matters Search Tool
R	Rare
SA	South Australia
TEC	Threatened Ecological Community
V	Vulnerable

1. INTRODUCTION

This Biodiversity Due Diligence Assessment has been prepared on behalf of Engie Australia Pty Ltd (Engie) relating to the proposed transport route for The Plains Wind Farm (the Project), which forms part of the Plains Renewable Energy Park (PREP) situated south of Hay, NSW. The blade and tower components of the wind turbines for the Project will require transport between the Port of Adelaide and the Project. This report includes assessment of eight (8) pinch points identified along the transport route where upgrades or modifications are proposed within South Australia (SA) (the Study Area, refer to Figure 1-1).

The purpose of this assessment is to characterise the biodiversity values within the indicated areas of each pinch point that may be subject to native vegetation removal (the Sites), and to identify the occurrence of (or habitat for) any species, populations or ecological communities that are listed as threatened under South Australia's *National Parks and Wildlife Act 1972* (NPW Act) or the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). This report provides an assessment of whether the Project is likely to impact flora, fauna and ecological communities and recommends mitigation measures to minimise impacts where required.

This assessment has been prepared to support the Environmental Impact Statement (EIS) associated with the Project. The assessment was informed by a combination of desktop reviews, database searches and fieldwork completed between 17th and 21st July 2023.

This report should be read in conjunction with the Statement of Limitations included in Section 8.

1.1 BACKGROUND

The Plains Wind Farm is located near Hay, New South Wales (NSW) (the Project Area). The blade and tower components of the wind turbines will require transport on oversize overmass (OSOM) vehicles between the Port of Adelaide and Project Site. The proposed transport route will head north from Port Adelaide travelling via the Port Wakefield Highway, North-south Motorway, Horrocks Highway, Barrier Highway crossing the state border at Cockburn, continue along the Barrier Highway, then on to the Cobb Highway before finishing at the Project site.

Eleven (11) pinch points have been identified along the entire transport route (ARES Group, 2024; Appendix A). Eight (8) of these pinch points are located in SA, with the remaining three (3) in NSW. This Biodiversity Due Diligence Assessment refers only the pinch points located in SA, the three pinch points located in NSW will be discussed within The Plains Wind Farm – NSW Haul Route Assessment Biodiversity Due Diligence Assessment, and Biodiversity Development Assessment Report (BDAR) for the Plains Wind Farm, currently being prepared by Environmental Resources Management Australia Pty Ltd (ERM).

There are slight differences between the transport routes for the blades and towers, three of the pinch points relate to both routes, while five of the pinch points relate to the blade route only. A summary of the pinch point locations and their associated Local Governments Areas (LGA) and Interim Biogeographic Regionalisation for Australia (IBRA) bioregions and subregions is provided in Table 1-1

The pinch points are located across three IBRA subregions, two within the Flinders Lofty Block bioregion (Mount Lofty Ranges and Broughton subregions) and one within the St Vincent subregion of the Eyre Yorke Block bioregion. The region of Eyre Yorke Block has been heavily cleared and the land is predominately used for agriculture, it has a temperate climate with cool, wet winters and warm summers. The climate becomes drier in the northern areas progressing into the Flinders Lofty Block bioregion which has a semiarid to arid climate with sporadic winter rainfall with much of the land used for sheep and cattle grazing. The locality of the pinch points and the surrounding IBRA bioregions can be seen in Figure 1-1.

TABLE 1-1 PINCH POINT LOCATIONS

Pinch Point	Address	Turn Direction	IBRA Bioregion	IBRA Subregion	LGA	Blade/Tower Route
1	Ocean Steamers Road and Eastern Parade Intersection, Port Adelaide	Right	Eyre Yorke Block	St Vincent	City of Port Adelaide Enfield	Both
2	Eastern Parade and Port River Expressway Intersection, Gillman	Left	Eyre Yorke Block	St Vincent	City of Port Adelaide Enfield	Both
3	Port Wakefield Highway and Angle Vale Road Intersection, Buckland Park	Right	Eyre Yorke Block	St Vincent	City of Playford	Both
4	Angle Vale Road and North-South Motorway Intersection, Angle Vale	Left	Flinders Lofty Block	Mount Lofty Ranges	City of Playford	Blade
5	Sturt Highway and Horrocks Highway Intersection, Gawler Belt	Left	Flinders Lofty Block	Mount Lofty Ranges	Light Regional Council	Blade
6	Horrocks Highway, Tarlee	Left	Flinders Lofty Block	Broughton	Clare and Gilbert Valleys Council	Blade
7	Barrier Highway and Copperhouse Road Intersection, Burra	Left	Flinders Lofty Block	Broughton	Regional Council of Goyder	Blade
8	Copperhouse Street & West Street Intersection, Burra	Left	Flinders Lofty Block	Broughton	Regional Council of Goyder	Blade



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1.2 THE PROJECT

The Plains Wind Farm is proposed to consist of up to 188 wind turbine generators with a maximum installed capacity of 1,350 megawatts. The turbines will have blade lengths of up to 90 metres (m) and maximum tip heights of 270 m. The anticipated total duration of OSOM movements is approximately 2 years, with an estimated 2 turbines to be delivered per week. ARES Group (2024) performed swept path analyses for the proposed transport route for transportation of the blades and towers and mapped 11 critical pinch points along the route. There is likely to be trimming (or complete removal) of some trees and shrubs, with temporary roads and hardstands may also need to be constructed.

The eight pinch points located in South Australia have been assessed for the type and scale of impact to ecological values predicted to occur as a result of trimming or clearing of trees and shrubs required to allow for the transportation of the blades and towers along the transport route. Measures for avoiding, minimising, managing and reporting on the biodiversity impacts have been described in order to mitigate impacts on ecological values.

2. LEGISLATION

Error! Reference source not found. below provides a description of the relevant legislative context for the transport route biodiversity assessment. This report addresses the objectives and requirements of the legislation as it relates to the identification of biodiversity and ecological values only.

TABLE 2-1 LEGISLATION APPLICABLE TO THE PLAINS WIND FARM HAUL ROUTE PROJECT

Commonwealth Legislation
Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)
The EPBC Act requires approval of the Commonwealth Minister for the Environment for actions that are likely to have a significant impact on Matters of National Environmental Significance (MNES) as assessed in accordance with the EPBC Significant Impact Guidelines 1.1. The EPBC Act is administered by the Commonwealth Department of Climate Change, Energy, the Environment and Water (DCCEEW) and lists threatened species, ecological communities and other MNES. Any proposed action that is expected to have an impact on MNES must be referred to the Minister for assessment under the EPBC Act, or assessed under the existing bilateral agreement, or accredited process between the Commonwealth and the State of South Australia. An assessment of MNES within the Study Area has been provided in Section 5.
SA Statutory Legislation and Guidelines
National Park and Wildlife Act 1972 (NPW Act)
The NPW Act is enforced for protection of representative areas of the state's diverse range of: • Ecosystems • Ecological Communities • Habitats • Species and their populations National parks and wildlife act 1972 (NPW Act) provides for the establishment of reserves, conservation of wildlife in a natural environment and for other purposes. Approximately 1,000 native species are listed at a state level under the NPW Act.
Native Vegetation Act 1991 (NV Act)
The NV Act is enforced for: • The protection of native vegetation, both for its own sake and as habitat of listed threatened species. • To regulate clearance of native vegetation. Native Vegetation Act 1991 and Native Vegetation Regulations 2003 (the Regulations) provides protection for native vegetation within South Australia and prescribes a process for applications to clear native vegetation. The act protects high conservation value areas and ensures that clearing of vegetation is subject to an assessment process. The assessment process is undertaken by the Native Vegetation Council. Applications for clearing vegetation are assessed against the principles of clearance: Native vegetation should not be cleared if, in the opinion of the Council – a. it comprises a high level of diversity of plant species; or b. it has significance as a habitat for wildlife; or c. it includes plants of a rare, vulnerable or endangered species; or d. the vegetation comprises the whole, or a part, of a plant community that is rare, vulnerable or endangered; or

e. it is significant as a remnant of vegetation in an area which has been extensively cleared; or

f. it is growing in, or in association with, a wetland environment; or

g. it contributes significantly to the amenity of the area in which it is growing or is situated; or

h. the clearance of the vegetation is likely to contribute to soil erosion or salinity in an area in which appreciable erosion or salinisation has already occurred or, where such erosion or salinisation has not yet occurred, the clearance of the vegetation is likely to cause appreciable soil erosion or salinity; or

i. the clearance of the vegetation is likely to cause deterioration in the quality of surface or underground water; or

j. the clearance of the vegetation is likely to cause, or exacerbate, the incidence or intensity of flooding; or

k.

   i. after clearance the land will be used for a particular purpose; and

   ii. the regional NRM board for the NRM region where the land is situated has, as part of its NRM plan under The Natural Resources Management Act 2004, assessed –

      A. the capability and preferred uses of the land; and

      B. the condition of the land; and

   iii. according to that assessment the use of the land for that purpose cannot be sustained; or

l. the clearance of the vegetation would cause significant harm to the River Murray within the meaning of the River Murray Act 2003; or

m. the clearance of vegetation would cause significant harm to the Adelaide Dolphin Sanctuary.

Native Vegetation Regulations 2017

Under Regulation 16 of the Native Vegetation Regulations 2017, certain clearance activities with a potential high or unknown level of risk of doing irreversible damage to biodiversity are required to undergo a risk assessment. A commercial vehicle access track exceeding 5 metres is an included activity under Schedule 1 of the Regulations. Applications in this pathway require approval from the Native Vegetation Council and a Significant Environmental Benefit.

Planning, Development and Infrastructure Act 2016 (PDI Act)

The PDI Act is enforced for:

- Considering native vegetation as a fundamental part of the planning process.

Where a proposed development involves the clearance of native vegetation, a development approval under the Planning, Development and Infrastructure Act 2016 is required.

Landscape South Australia Act

The Landscape South Australia Act 2019 provides key framework for the management of catchments, water, pest plants and animals, and biodiversity across South Australia. The objects of the Act include to support and enhance ecologically sustainable development by establishing an integrated scheme to promote the use and management of the natural resources that make up or contribute to South Australia's Landscape in an integrated manner (South Australian Government 2019).

3. METHODOLOGY

3.1 DESKTOP REVIEW

The Desktop Review included analysis of the following online resources:

- SA Department for Environment and Water (DEW) NatureMaps 3.0 vegetation mapping and flora and fauna records to identify Matters of State Environmental Significance (MSES) threatened species and communities with potential to occur within a 1 km buffer of the Study Area sites, accessed on 15 August 2023;
- Results of the DCCEEW's Protected Matters Search Tool (PMST) identifying MNES including threatened species and communities with potential to occur within a 1 km buffer of the Study Area sites, accessed on 15 August 2023; and
- Atlas of Living Australia (ALA) database flora and fauna records to identify MSES and MNES with potential to occur within a 1 km buffer of the Study Area sites, accessed on 15 and 16 August 2023.

3.2 FIELD SURVEYS

A five-day preliminary vegetation and habitat survey was undertaken between 17th and 21st of July 2023 by one ecologist to assess the entirety of the transport route. The eight pinch points located within South Australia were assessed on the first day, Monday 17th July 2023. The purpose of the field survey was to identify the presence of important biodiversity values within the Study Area, including:

- The likely presence of threatened fauna and flora species;
- Threatened ecological communities; and
- Habitat and resources considered important for threatened species or ecological communities.

Surveys were undertaken via a meander of the pinch point sites. Survey methodologies were designed to rapidly assess biodiversity values and to record native and non-native vegetation and features of ecological value present. Opportunistic sightings of fauna were also recorded throughout the survey period.

Comprehensive and targeted fauna surveys were not undertaken as part of the current survey.

3.3 LIKELIHOOD OF OCCURRENCE

Consistent with the accepted approach for biodiversity assessment, a Likelihood of Occurrence (LoO) assessment was undertaken, informed by desktop sources and results of the field survey. Desktop sources identified several fauna and flora species listed under the EPBC Act and/or the SA NPW Act that have been recorded previously or are predicted to occur within an approximately 1 km2 buffer centred on the Sites (the Pinch Points). The LoO approach refines the desktop generated list using site-specific and specific-species habitat information. Desktop sources are indicative only and likelihood rankings, particularly in regard to the presence of preferred habitat, are conservative. The assessment ranks the likelihood of the species occurring within the Project Area through analysis of species distribution information and the presence of specific habitat attributes as identified through the desktop analysis and field

survey. The criteria applied are outlined in Table 3-1 The assessment is presented within Appendix A.

TABLE 3-1 LIKELIHOOD OF OCCURRENCE ASSESSMENT CRITERIA

	Preferred habitat exists	**Suitable habitat exists[1]**	**Habitat does not exist[2]**
Records within the Sites (based on desktop searches and field surveys)	Known	Known	Known
Records in the Locality[3]	Likely	Potential	Unlikely
No records in the Locality, but the Sites are within known distribution	Potential	Unlikely	Unlikely
No records in the Locality, and the Sites are outside of the known distribution	Unlikely	Unlikely	Unlikely

1. *Habitat may be considered suitable, but not preferred because: some desired habitat features may be present, but not all; habitat may have poor connectivity; or habitat may be known to be disturbed.*
2. *Based on sources reviewed and/or field survey results.*
3. *'Locality' refers to a 1 km buffer of the Sites.*

3.4 ASSUMPTIONS AND LIMITATION

The field and desktop assessments undertaken provide an overview of the biodiversity values that exist within the Study Area. The one-day field survey was undertaken across the Study Area to gain a general understanding of the types of species and habitat features that occur.

The absence of a species from a database list or observational studies does not confirm its absence from the Study Area. The lack of existing records from databases may indicate a low historic sampling effort in the region, as opposed to an absence of species. Similarly, the timing of the July 2023 survey precludes the detection of a number of species that are typically absent from the area at that time of the year.

To overcome these limitations, the likelihood of occurrence is based on the precautionary approach and identifies species that have the potential to occur rather than relying on species sightings alone.

4. RESULTS

4.1 LIKELIHOOD OF OCCURRENCE ASSESSMENT

4.1.1 THREATENED FLORA AND FAUNA SPECIES

A total of 67 threatened species were considered within the LoO Assessment. Of these none are known to occur within the pinch point Sites, three (3) are likely to occur, 18 have the potential to occur, and the remaining are unlikely to occur within the Sites.

Species likely to occur are presented in Table 4-1. The complete LoO Assessment is attached as Appendix B.

TABLE 4-1 THREATENED SPECIES LIKELY TO OCCUR WITHIN THE SITES

Scientific Name	Common name	SA NPW Act	EPBC Act	Pinch Point
Likely				
Bubulcus ibis coromandus	Eastern Cattle Egret	R	-	2
Plegadis falcinellus	Glossy Ibis	R	Mi	2
Tiliqua adelaidensis	Pygmy Bluetongue	E	V	7

4.2 VEGETATION COMMUNITIES

None of the eight pinch points contained threatened ecological communities or vegetation communities.

4.3 FLORA, FAUNA AND HABITAT FEATURES OBSERVED

4.3.1 PINCH POINT 1

Pinch point 1 is a right turn exiting the Berth 18/20 storage area in Flinders Port, crossing Ocean Steamers Road onto Eastern Pde. No vegetation has been identified for removal/modification at this pinch point.

4.3.1.1 FLORA

Exotic dominated grassy road verge on the corner of Ocean Steamers Rd and Eastern Pde, including Wild Oat (*Avena fatua*), Ryegrass (*Lolium* sp.), Giant Brome (*Bromus diandrus*), Common Sow-thistle (*Sonchus oleraceus*), *Brassica* spp. and Capeweed (*Arctotheca calendula*).

4.3.1.2 FAUNA

No habitat features or signs of faunal use or presence were observed.

4.3.1.3 CONCLUSION

The verge on the corner of Ocean Steamers Rd and Eastern Pde has low habitat and vegetation value. No vegetation removal or modification is required at this pinch point, and turbine blade and truck movement are unlikely to impact native species of flora and fauna.



PHOTO 4-1: PINCH POINT 1

4.3.2 PINCH POINT 2

Pinch point 2 is a left turn on Eastern Pde onto the slip road to the Port River Expwy. Initial suggested vegetation removal/modification included trimming of branches on the large tree within private property. Subsequent revision has modified the blade path such that the blade tip can be kept clear of the trees to the south and will not stray into private property.

4.3.2.1 FLORA

Trees identified for potential impact include:

- One (1) approx. 18 m tall planted She-oak (*Allocasuarina* sp.) (Tree 1), with 2-3 seedlings approx. 4-5 m tall beneath; and
- A cluster of 8-10 She-oak (*Allocasuarina* sp.) and one (1) Wattle (*Acacia* sp.) (Tree 2 collectively), ranging between approx. 3-5 m in height.

Associated undergrowth vegetation in the bed along the fence line is also likely planted and includes Saltbush (*Atriplex* sp. or *Enchylaena* sp.) and various weedy herbs and forbs.

There is one (1) individual of Wattle (*Acacia* sp.) growing in the narrow strip between the channel and the road verge, at approx. 0.5 m above road level, the same height as the existing fence.

4.3.2.2 FAUNA

No nests or hollows were observed in Tree 1 nor in any of the smaller trees along the fence line. Tree 1 (She-oak, *Allocasuarina* sp.) likely provides habitat for nesting, roosting, perching, and may serve as a food source, for birds, arboreal mammals, and reptiles. The concrete-lined open channel immediately adjacent to Eastern Parade held water at the time of survey, and may provide intermittent habitat for frogs, and be a water source for other wildlife. There is also a culvert beneath the bridge/entry road over the channel leading to the private property

on which Tree 1 stands, which could provide habitat for microbats and mud-nests for birds such as Welcome swallows.

4.3.2.3 CONCLUSION

The large tree that requires trimming is identified here as Tree 1 (She-oak, *Allocasuarina* sp.). The lowest branch facing Eastern Pde is approx. 6 m high. Depending on the height of the turbine blade, branches on Tree 1 may not need to be trimmed. The small patch of trees and shrubs along the fence line (Tree 2) and adjacent to Tree 1, or a section thereof will likely require trimming to allow the blade to pass.

No modification of the concrete-lined open channel has been indicated, and as such potential habitat in existing infrastructure is unlikely to be affected.

Subsequent revisions to blade path no longer require tree trimming or removal.



Tree 1: 18 m tall She-oak



Cluster of 3-5 m tall She-oak



Wattle between the channel and the road verge

PHOTO 4-2: PINCH POINT 2

4.3.3 PINCH POINT 3

Pinch point 3 is at the intersection of Port Wakefield Rd and Angle Vale Rd. Blade trucks will need to cut across the median strips between north and south bound carriageways for Port Wakefield Rd, and east and west bound carriageways for Angle Vale Rd. Minor civil works will be required to make the median strips trafficable for truck and trailer wheels.

4.3.3.1 FLORA

The median strip between carriageways for Port Wakefield Rd is highly disturbed, with patchy groundcover dominated by exotic grasses and herbs, including Ryegrass (*Lolium* sp.), Common Sow-thistle (*Sonchus oleraceus*), Soursob (*Oxalis pes-caprae*), and Wild Radish (*Raphanus raphanistrum*).

The median strip between carriageways for Angle Vale Rd is highly disturbed, with dense groundcover dominated by exotic grasses and herbs, largely Ryegrass (*Lolium* sp.) and Galenia (*Aizoon pubescens*), with Soursob (*Oxalis pes-caprae*), and Wild Radish (*Raphanus raphanistrum*).

4.3.3.2 FAUNA

No habitat features or signs of faunal use or presence were observed.

4.3.3.3 CONCLUSION

Both median strips are highly disturbed and dominated by exotics and thus have low habitat and vegetation value. No vegetation removal is required at this pinch point, though vegetation present will be impacted by the required works to make them trafficable. Works and truck movement is unlikely to impact native species of flora and fauna.



PHOTO 4-3: VEGETATION PRESENT AT PINCH POINT 3

4.3.4 PINCH POINT 4

Pinch point 4 is an extended left turn from Angle Vale Rd, through a roundabout and into the slip road onto the Northern Expwy. No vegetation has been identified by ARES Group (2024) for removal or modification; however, it has been flagged that care must be taken to avoid the trees to the south of Angle Vale Rd.

4.3.4.1 FLORA

The trees to the south of Angle Vale Rd consist of a row of planted *Eucalyptus peninsularis* and *Olea europaea*, within the boundaries of 605 and 607 Angle Vale Rd. The understorey component consists of largely exotic herbs and grasses, including Soursob (*Oxalis pes-caprae*) and Wild Radish (*Raphanus raphanistrum*). The approach to the roundabout along Angle Vale Rd has a steep embankment to the SE and a level median to the NW. Both are dominated by exotic herbs and grasses.

4.3.4.2 FAUNA

There is a man-made drainage line downslope of the steep embankment, with a rocky section where the drain meets a channel. This may serve as potential habitat for frogs and reptiles.

A shallow culvert is present underneath Bain Rd serving to allow the flow of run-off along the channel. This culvert is potential habitat for microbats and mud-nests for birds such as Welcome swallows.

4.3.4.3 CONCLUSION

The median strips along Angle Vale Rd are disturbed and dominated by exotics and thus have low habitat and vegetation value. No vegetation removal is required at this pinch point, though care will need to be taken to avoid impacting the trees to the south of Angle Vale Rd, fronting 605 and 607 Angle Vale Rd. Truck movement is unlikely to impact native species of flora and fauna.

Potential habitat exists downslope of Angle Vale Rd in the approach to the roundabout. Any works required to stabilise the bank and render the route trafficable may incur runoff that can increase sediment and pollute the channel. It is recommended any works required along Angle Vale Rd in the approach to the roundabout implement adequate sediment, erosion and runoff controls to mitigate these effects.



PHOTO 4-4: PINCH POINT 4

4.3.5 PINCH POINT 5

Pinch point 5 is a left turn from the Sturt Hwy through the offramp to the Horrocks Hwy. Hard stand material will need to be put down on the eastern embankment and earthworks may be required to level the ground. No vegetation was identified for removal or modification, though plans indicated truck movement may have impacted a large tree on Horrocks Hwy as the turn was completed. Subsequent revision has modified this turn such that these potential impacts are no longer indicated.

4.3.5.1 FLORA

Vegetation on the eastern embankment of the Sturt Hwy offramp consisted largely of exotic herbs and grasses, including Galenia (*Aizoon pubescens*), Common Sow-thistle (*Sonchus oleraceus*), Soursob (*Oxalis pes-caprae*), Veldgrass (*Ehrharta* sp.) and Ryegrass (*Lolium* sp.).

Two trees were identified as having potential to be impacted by work and/or truck movement through the pinch point:

- One (1) approx. 20 m tall River Red-gum (*Eucalyptus camaldulensis*) (Tree 1); and

- One (1) approx. 8 m tall Mallee tree (*Eucalyptus* sp.) in the middle of the eastern embankment (Tree 2).

The large River Red-gum is located 2 m from the edge of the road, with branch overhang extending approx. 3 m over the road, the lowest at approx. 6 m high. There were several Wattles (*Acacia* sp.) to both sides of Tree 1. The understorey was weedy, including Soursob (*Oxalis pes-caprae*), Pincushion (*Scabiosa* sp.), and Rice Millet (*Piptatherum miliaceum*).

4.3.5.2 FAUNA

No nests or hollows were observed in either Tree 1 or Tree 2. Both trees, however, likely provide habitat for nesting, roosting, perching, and may serve as a food source, for birds, arboreal mammals and reptiles, particularly Tree 1 (River Red-gum, *Eucalyptus camaldulensis*). No other habitat features, or faunal use or presence were observed.

4.3.5.3 CONCLUSION

Initial conclusions based on preliminary examination of the transport route and site surveys were that overhanging branches from Tree 1 may need to be trimmed if they are determined to hang too low over the road. The Wattle to the south of Tree 1 may also require trimming as it extends to the edge of the road. Care will need to be taken to avoid impacting Tree 2 as the blade tip manoeuvres this area.

The subsequent revision to blade path (ARES 2024) has eliminated these potential impacts, with tree trimming or removal highly unlikely to be required.



Tree 1: *Eucalyptus camaldulensis*



Tree 2: Mallee *Eucalyptus* sp.



Grassy road verge

PHOTO 4-5: PINCH POINT 5

4.3.6 PINCH POINT 6

Pinch point 6 is a left turn on the Horrocks Hwy at Tarlee. Tree trimming is likely required on overhanging branches leading up to this turn (not shown).

4.3.6.1 FLORA

In the immediate lead up to the corner on the Horrocks Hwy, there is a row of nine (9) River Red-Gums (*Eucalyptus camaldulensis*), which are likely planted as they are of similar age and are evenly spaced. Two of the trees have branches that overhang the road, at 17hrhart. 6 m high. Just to the south of this row, there is one individual of River Red-Gum (*E. camaldulensis*). This tree is very large and old and could potentially be remnant. Branches from this tree overhang the Hwy at 6 to 8 m. Further to the south along the Horrocks Hwy there is a planted row of Pines (*Pinus* sp.). The canopy overhanging the Hwy is well maintained, trimming to 17hrhart. 6 m height.

4.3.6.2 FAUNA

A European Honey Bee (*Apis mellifera*) hive was observed in one of the central trees in the row of River Red-Gums. No nests or hollows were observed in any of the trees along Horrocks Hwy in the lead up to the PP6 left turn. All trees, including River Red-gums and Pines, are potential habitat for nesting, roosting, perching, and may serve as a food source, for birds, arboreal mammals and reptiles. No other habitat features or faunal use or presence was observed.

4.3.6.3 CONCLUSION

Branches from trees along Horrocks Hwy hang as low as 6 m and may require trimming to ensure clearance. Outside of trimming, truck movement is unlikely to impact native species of flora and fauna.



Row of planted River-red gum



Row of planted Pine



PHOTO 4-6: PINCH POINT 6

4.3.7 PINCH POINT 7

Pinch point 7 is a left turn from the Barrier Hwy onto Copperhouse Rd. For the NW corner and NE side of the turn, hard stand material will need to be placed where the wheels run off the existing road surface. It was initially identified that for the property to the south, the blade tip will cross into private land and several trees on this property will need to be removed/trimmed on the opposite side of Barrier Hwy. Subsequent revision of this route has removed this impact (ARES 2024).

4.3.7.1 FLORA

The road verge in the NW corner of the turn and to the east of Copperhouse Rd is largely composed of exotic herbs and grasses, including Pincushion (*Scabiosa* sp.), Common Sow-

thistle (*Sonchus oleraceus*), Oat grass (*Avena* sp.), Canary Grass (*Phalaris* sp.) and Veldgrass (*19hrhart asp*.).

The three trees previously identified for trimming and/or removal in adjacent private land are set well back from the road within the property boundary. Due to land access restrictions, the trees were observed from the fenceline. The trees appear to be part of a planted windbreak of Eucalypts, with Teatree (*Leptospermum* sp.) and Saltbush (*Atriplex/19hrhart asp19p*.).

The road verge to the south of the Barrier Hwy is largely composed of exotic herbs and grasses, including Pincushion (*Scabiosa* sp.), Veldgrass (*19hrhart asp*.) and Ryegrass (*Lolium* sp.).

4.3.7.2 FAUNA

No nests or hollows were observed in any of the trees in the planted windbreak, though this windbreak may serve as potential habitat for nesting, roosting, perching, and as a food source, for birds, arboreal mammals and reptiles. No other habitat features or faunal use/presence was observed.

4.3.7.3 CONCLUSION

Initial conclusions based on preliminary examination of the transport route and site surveys were that trees in the private property to the south of the Barrier Hwy would likely need to be trimmed or removed to accommodate blade passage as the truck makes the left turn.

The subsequent revision to blade path (ARES 2024) has eliminated these impacts, with tree trimming or removal no longer required.

The road verges beside the Barrier Hwy and Copperhouse Rd are disturbed and dominated by exotics and thus have low habitat and vegetation value.

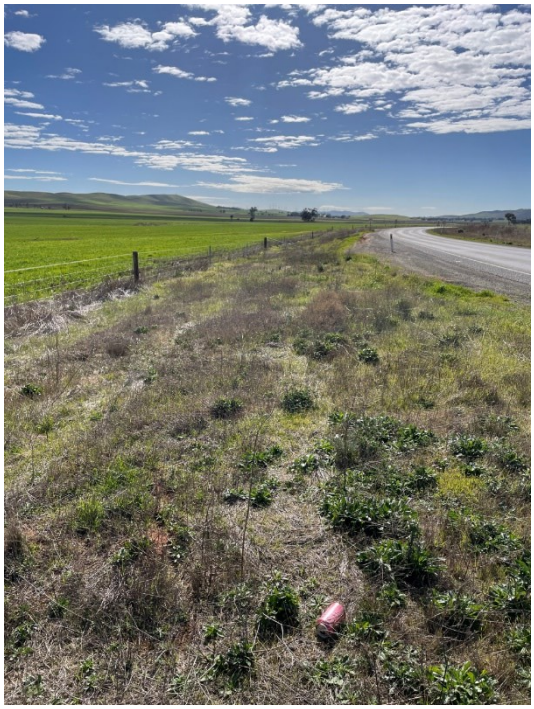






PHOTO 4-7: PINCH POINT 7

4.3.8 PINCH POINT 8

Pinch point 8 is a left turn on Copperhouse St becoming West St at the Bon Accord Hotel. It was originally identified that four trees would require trimming/removal; "Taking this turn conventionally will require a significant amount of tree trimming and/or removal to the south, with the tip swing intruding into private property. Some hard stand material is required where the truck and trailer wheels leave the existing road surface" . Subsequent revision of this route has significantly reduced this impact, with only one tree identified as requiring trimming/removal (ARES 2024).

4.3.8.1 FLORA

Four trees, or patches of trees, were identified for trimming and/or removal:

- Tree 1: very large and old planted Pink Peppercorn (*Schinus molle*);
- Tree 2: large cluster of multiple individuals of European Olive (*Olea europaea*) beneath Tree 1, to 3 m tall. Likely bird drop given position;
- Tree patch 1: small copse of planted Eucalypts (*Eucalyptus* sp.) 6-8 m high;
- Tree patch 2: small mixed copse of largely planted Eucalypts (*Eucalyptus* sp.) with a few Pink Peppercorn (*Schinus molle*) intermixed, to 6-8 m high; and
- Tree 3: large, planted Pink Peppercorn (*Schinus molle*). The base of Tree 4 stands at 2 m from the roads edge, with branches extruding from base to top. A larger branch at approx. 6m extends to overhang the road.

The groundcover in the open area on the corner of Copperhouse St and West St is patchy and dominated by exotic herbs and grasses. The groundcover beneath Tree 1 and Tree Patch 1 is largely leaf litter, with a few individuals of planted Ruby Saltbush (*Enchylaena tomentosa*) and small patches of exotics such as Cleavers/ Bedstraw (*Gallium aparine*).

The groundcover beneath Tree patch 2 is also largely composed of leaf litter, planted Old Man Saltbush (*Atriplex nummularia*) and Ruby Saltbush (*Enchylaena tomentosa*) intermixed with sparse exotic herbs and grass species.

4.3.8.2 FAUNA

Three species of birds were observed during surveys, including one (1) Willie wagtail (*Rhipidura leucophrys*), two (2) Yellow-rumped thornbill (*Acanthiza chrysorrhoa*) and two (2) Crimson Rosella (*Platycercus elegans*). Habitat features observed in the Burra Railway Reserve on the corner of Copperhouse St and West St included two (2) stick/log piles, which are likely to be utilised by reptiles. All trees and tree patches may serve as potential habitat for nesting, roosting, perching, and as a food source, for birds, arboreal mammals and reptiles.

4.3.8.3 CONCLUSION

Initial conclusions based on preliminary examination of the transport route and site surveys were that Tree 1, Tree patch 1 and the northern most section of Tree patch 2 would require removal to accommodate passage of the blade tip as the truck manoeuvres the left turn. Tree 3 would have required trimming or removal to accommodate front end manoeuvring of the blade truck.

The subsequent revision to blade path (ARES 2024) has eliminated the majority of these impacts. Remaining impact includes the removal or trimming of Tree 1 (Pink Peppercorn *Schinus molle*), and Tree 2 immediately beneath Tree 1 (European Olive *Olea europaea*). Care will need to be taken to avoid vegetation at the hard corner of Copperhouse St becoming West St, and to the north of the Bon Accord Hotel.


Exotic dominated area to east of Tree 1


Tree 1 (right) and Tree 2 (lower left)


Tree patch 2


Tree patch 1


Stick/log pile


Tree 2 beneath Tree 1

PHOTO 4-8: PINCH POINT 8

4.4 THREATENED SPECIES

Searches conducted through Nature Maps South Australia (DEW 2018) identified 28 threatened or rare species recorded within a 10 km buffer of the Pinch Points. Of these, 27 species are listed under the NPW Act and eight of these species are listed under the EPBC Act (Table 4-2).

TABLE 4-2 THREATENED SPECIES RECORDED WITHIN 10 KM OF THE PINCH POINTS

Scientific Name	Common Name	NPW Act	EPBC Act	Pinch Point
Fauna				
Actitis hypoleucos	Common Sandpiper	R	Mi	2
Biziura lobata menziesi	Musk Duck	R	-	2
Bubulcus ibis coromandus	Eastern Cattle Egret	R	-	2
Calidris melanotos	Pectoral Sandpiper	R	Mi	2
Calidris subminuta	Long-toed Stint	R	Mi	2
Coturnix ypsilophora australis	Brown Quail	V	-	2
Egretta garzetta nigripes	Little Egret	R	-	2
Falco subniger	Black Falcon	R	-	2
Falcunculus frontatus frontatus	Eastern Shriketit	R	-	5
Lewinia pectoralis pectoralis	Lewin's Rail	V	-	2
Plegadis falcinellus	Glossy Ibis	R	Mi	2
Spatula rhynchotis	Australasian Shoveler	R	-	2
Stictonetta naevosa	Freckled Duck	V	-	2
Tiliqua adelaidensis	Pygmy Bluetongue	E	V	7
Tringa glareola	Wood Sandpiper	R	Mi	2
Flora				
Acacia iteaphylla	Flinders Ranges Wattle	R	-	5, 8
Acacia pendula	Weeping Myall	V	-	5
Acacia trineura	Three-nerve Wattle	E	-	6
Aristida australis	-	R	-	4
Austrostipa multispiculis	Many-flowered Spear-grass	R	-	5
Caladenia tensa	Inland Green-comb Spider-orchid	-	E	
Choretrum chrysanthum	Yellow Sour-bush	R	-	5
Dianella longifolia var. grandis	Pale Flax-lily	R	-	6
Lachnagrostis limitanea	Spalding Blown-grass	E	E	6

Scientific Name	Common Name	NPW Act	EPBC Act	Pinch Point
Leptorhynchos elongatus	Lanky Buttons	E	-	5
Logania saxatilis	Rock Logania	R	-	8
Maireana decalvans	Black Cotton-bush	E	-	3
Mentha satureioides	Native Pennyroyal	R	-	6, 8

There were no threatened species recorded within the Sites during the one day field survey, however, there are three threatened fauna species considered likely to occur based on their known distribution (DAWE 2023), records in the locality (refer to Figure 4-) (ALA 2023) and habitat availability:

- Eastern Cattle Egret (*Bubulcus ibis coromandus*);
- Glossy Ibis (*Plegadis falcinellus*); and
- Pygmy Bluetongue (*Tiliqua adelaidensis*).

None of these species would be dependent solely on the resources present within the limited footprint of the Study Area.

Table 4-3 discusses the habitat requirements of these species, the potential impacts to these species that could occur resulting from clearing of vegetation within the Sites and their vulnerability to these impacts.



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TABLE 4-3 THREATENED SPECIES LIKELY TO OCCUR WITHIN THE STUDY AREA

Common Name	Scientific Name	BC Act	EPBC Act	Habitat Requirements	Vulnerability to Impact	Potential impact of clearing
Eastern Cattle Egret	*Bubulcus ibis coromandus*	R	-	The Cattle Egret is widespread and common according to migration movements and breeding localities surveys. Two major distributions have been located; from north-east Western Australia to the Top End of the Northern Territory and around south-east Australia. Occurs in tropical and temperate grasslands, wooded lands and terrestrial wetlands. Forages away from water on low lying grasslands, improved pastures and croplands, commonly found in cattle fields and other farm areas that contain livestock. Roosts in trees, or amongst ground vegetation in or near lakes and swamps. *Preferred habitat is present as modified grasslands in proximity to water sources. There are a number of records within the locality of pinch points near the Port of Adelaide.*	• Loss, modification and fragmentation of habitat - low • Vehicle strike - moderate	There is potential for foraging and roosting habitat to be lost, modified and/or fragmented as a result of clearing within Pinch Point 2. As the Site is in proximity to the Magazine Creek Wetlands, known to be utilised by the species, the surrounding modified grasslands can act as suitable foraging and roosting habitat for the species. Furthermore, any trees within the area may act as roosting habitat. An increase in vehicle movement within the area can in turn increase the risk of the species being struck by a vehicle, especially if roosting or feeding on the ground.
Glossy Ibis	*Plegadis falcinellus*	R	Mi	Within Australia, the Glossy Ibis is generally located east of the Kimberley in Western Australia and Eyre Peninsula in South Australia. The Glossy Ibis' preferred habitat for foraging and breeding are freshwater marshes at the edges of lakes and rivers, lagoons, flood-plains, wet meadows, swamps, reservoirs, sewage ponds, rice-fields and cultivated areas under irrigation. The species is occasionally found in coastal locations such as estuaries, deltas,	• Loss, modification and fragmentation of habitat - low • Vehicle strike - low	There is potential for roosting habitat to be lost, modified and/or fragmented as a result of clearing within Pinch Point 2. As the Site is in proximity to the Magazine Creek Wetlands, known to be utilised by the species, surrounding trees can act as suitable roosting habitat for the species.

Common Name	Scientific Name	BC Act	EPBC Act	Habitat Requirements	Vulnerability to Impact	Potential impact of clearing
				saltmarshes and coastal lagoons. Glossy Ibis roost in trees or shrubs usually near, but sometimes far, from water bodies. *Preferred foraging and breeding habitat is not present however preferred roosting habitat is present as trees and shrubs near watercourses. There are two records within the locality of the pinch points near the Port of Adelaide.*		An increase in vehicle movement within the area can in turn increase the risk of the species being struck by a vehicle.
Pygmy Bluetongue	*Tiliqua adelaidensis*	E	V	Pre-1992 specimens of the Pygmy Blue-tongue Lizard were collected in chenopod and mallee scrublands with compacting or crusty sandy soils associated with hollow mallee lignotubers, low stump hollows, near surface limestone sheets, and large slab floaters. The species was thought to burrow into moisture pockets in limestone sheeting, under outcroppings and slabs, between mallee lignotubers and sheeting, and into insect hollowed lignotubers and trunks. Post-1992 specimens have been found in a variety of habitats, ranging from highly degraded grasslands (dominated by exotic grasses) to grasslands with high native biodiversity. The lizard uses empty spider burrows of wolf (lycosid) and trapdoor (mygalomorph) spiders as refuges, basking sites and hunting ambush sites. *Preferred habitat is present as grasslands dominated by exotic species with potential to host spider burrows. There are a number of records of the species within the locality of Pinch Point 7.*	• Loss, modification and fragmentation of habitat - low • Vehicle strike - moderate	There is potential for dispersal habitat to be lost, modified and/or fragmented as a result of clearing within Pinch Point 7. The species is known to the locality of Burra and has been recorded on the side of the Barrier Highway in the area. Habitat features for hunting, basking and burrowing are not present but the modified grasslands may act as dispersal habitat.

4.5 THREATENED ECOLOGICAL COMMUNITIES

The PMST search identified three TECs with the potential to occur within the Sites (DCCEEW 2023). A description of these TECs is outlined in Table 4-4. The LoO assessment found that none of these communities were known or likely to occur within the Sites and the field survey confirmed no suitable vegetation was present to support these communities.

TABLE 4-4 TEC DESCRIPTIONS

TEC	Description	EPBC Status
Iron-grass Natural Temperate Grassland of South Australia	The Iron-grass Natural Temperate Grassland of South Australia ecological community extends from the western bank of the Murray River, through the Lofty Ranges and north to Mount Brown Conservation Park, west of Carrieton. The community occurs on gentle slopes of low hills above 380 m altitude on loams and clay loams. Trees and tall shrubs are generally absent and tussock-forming perennial grasses and Iron-grasses dominate the ground layer. A range of herbaceous plant species occur in the inter-tussock spaces.	CE
Peppermint Box (*Eucalyptus odorata*) Grassy Woodland of South Australia	This ecological community is dominated by *Eucalyptus odorata* with other canopy species including *E. microcarpa, E. leucoxylon, E. cladocalyx, E. porosa, Allocasuarina verticillata, Callitris glaucophylla* and *C. preissii*. Occurs as an open to dense woodland with the canopy comprised of low trees (5 – 10 m tall). The understorey mainly comprises grasses and herbs. In open sites this is found as a relatively dense and diverse layer, with a sparse layer found under more densely wooded sites. The shrub layer is sparse, with cover up to 30%. Occurs from the southern Flinders Ranges to Lake Alexandrina.	CE
Subtropical and Temperate Coastal Saltmarsh	This community occurs within a narrow margin of the coastline within the subtropical and temperate climatic zones from south-east Queensland, following the east and south coastlines up to Shark Bay in Western Australia. In the south, saltmarsh is often the main vegetation-type of the intertidal zone, often associated with estuaries. The community is mainly associated with soft substrate shores of estuaries and embayments on open, low wave energy coasts.	V

5. MATTERS OF NATIONAL ENVIRONMENTAL SIGNIFICANCE (MNES)

Based on the results of the desktop assessment and the one-day site inspection, an assessment of MNES within the Study Area has been provided in Table 5-1.

TABLE 5-1 MNES WITHIN THE STUDY AREA

Matters of National Environmental Significance	Application to the Subject Site
World heritage properties	None
National heritage places	Australian Cornish Mining Sites: Burra
Ramsar wetlands of international importance	The Coorong, and Lakes Alexandrina and Albert Wetland 150 – 200 km upstream
Nationally Important Wetlands	Barker Inlet & St Kilda
Listed threatened species and communities	No EPBC Act listed threatened species have been recorded within the Sites. However, as a result of the Likelihood of Occurrence assessment (Appendix A), one is considered likely to occur: • Pygmy Bluetongue (*Tiliqua adelaidensis*)
Internationally protected migratory species	Migratory species identified as likely or potentially occurring within the locality and may utilise (or fly over) the Sites based on their generalist habitat requirements include: • Common Sandpiper (Actitis hypoleucos) • Grey Wagtail (*Motacilla cinerea*) • Glossy Ibis (*Plegadis falcinellus*); • Wood Sandpiper (*Tringa glareola*);
Commonwealth marine areas	None
Commonwealth Land	The Sites are Crown Land (roadsides). The PMST identified the following Commonwealth Land within 1 km of the Study Area: • Defence – AIRTC Gawler • Defence – HMAS Encounter • Defence – Instrument Landing System (ILS) Outer Marker • Defence – Pt. Adelaide Shipyard & Boatshed (TS Adelaide) • Commonwealth Land – Defence Housing Authority • Commonwealth land – Australian National Railways Commission
The Great Barrier Reef Marine Park	None
State and Territory Reserves	• Adelaide Dolphin Sanctuary • HA1562 Heritage Agreement

Under the EPBC Act a referral is required to the DCCEEW for projects, or 'actions', that are likely to have a significant impact on a MNES or the environment on Commonwealth land. The Australian Government Minister for the Environment determines whether or not the Proposal will need formal assessment and approval under the EPBC Act. If so, that Proposal is a controlled action under the EPBC Act.

The findings of biodiversity values assessment carried out to date have not identified any significant impacts on MNES. There will be no loss of any EPBC listed Threatened Ecological Community (TEC) and the Project is not considered likely to affect a species listed under the EPBC Act, any MNES or environment on Commonwealth land.

6. SUMMARY AND RECOMMENDATIONS

Based on the results of the desktop surveys and one day field survey, the following species are considered 'likely' to occur within the Study Area based on their habitat preferences and previous records in the locality:

- Eastern Cattle Egret (*Bubulcus ibis coromandus*);
- Glossy ibis (*Plegadis falcinellus*); and
- Pygmy Bluetongue (*Tiliqua adelaidensis*).

None of the threatened species would be solely dependent on the resources available within the limited Site footprint, and the risk of significant impacts to the listed species is considered unlikely given the retention of the nearby swampland vegetation, care taken to relocate boulders / rocks, and the rehabilitation / revegetation of disturbed areas as part of the Project.

The main potential impacts of the Project that will need to be considered within the Remedial Action Plan include:

- Impacts to hydrology, sedimentation controls should be implemented during remediation and revegetation works;
- Soil or water contamination from incidents/spills; and
- Transport of weeds on site.

Based on the investigations undertaken to date, the following recommendations are provided to minimise impact on the biodiversity values at the Site that may occur as a result of the Project:

- Where access tracks are required, it is recommended that boulders be relocated by hand where possible to minimise impact to reptile habitat.
- Clearing or trimming of vegetation should be restricted to the minimum amount required as listed in Section 4.3.
- All Project vehicles should be limited to previously cleared areas and tracks. There should be no driving or parking of vehicles on retained vegetation.
- Where disturbance has occurred, revegetation and rehabilitation should occur with species native to the Site. A monitoring plan should be developed to the evaluate success of the rehabilitation.
- Strict hygiene protocols should be established to mitigate the potential spread of weeds or pathogens in relation to the Project; and
- Develop and maintain appropriate sediment and erosion control measures intended to mitigate direct and indirect impacts into the retained habitats.

7. REFERENCES

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1. This report is based solely on the scope of work described in P0606253 (Scope of Work) and performed by ERM Environmental Resources Management Australia Pty Ltd (ERM) for Engie (the Client). The Scope of Work was governed by a contract between ERM and the Client (Contract).
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APPENDIX A APPENDIX A THE PLAINS R.E.P.: OSOM ROUTE STUDY – ARES 2024

ARES
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The Plains R.E.P.

OSOM Route Study

Date:	March 2024
Client:	Aref Taleb
	Engie Aust & NZ
Type:	Physical Survey
Rev:	7



Silverton WF

Silverton WF is located 600 klms from the Port of Entry and had several challenges, including gradients in excess of 25 degrees.

The Plains R.E.P.

Route Study

“

The Plains Renewable Energy Park is a newly proposed large-scale development that aims to harness wind and solar energy to provide cheap, reliable and clean electricity for homes and businesses in NSW. The renewable energy park will include the construction of an integrated wind and solar farm and will operate alongside agricultural activities.

— engie.com.au/home/assets/wind/the-plains

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Introduction

The Plains Renewable Energy Park (REP) is a proposed renewable energy development located in the south western part of New South Wales. The Wind Farm will have a maximum installed capacity of up to 1.5GW as well as up to 400MWac of solar and up to 4hr at 400MW of battery storage.

The proposed project is located roughly 10km south of Hay, in the NSW South-West Renewable Energy Zone (REZ) which lies alongside the future Project EnergyConnect (Robertstown-to-Wagga Wagga) 330kV transmission line.

Following the Desktop Survey, Ares have been tasked to undertake physical Route Surveys from the chosen port of Adelaide to site. The purpose of the study is to determine the pinch points along the route, perform swept path analysis and give best estimates of modifications and works required to enable cargo to be brought to site.

The study is designed for those involved in the project that have a limited knowledge of transportation, including a comprehensive outline of the routes and actions required to achieve delivery.





01

Overview

Biala WF

Two prime movers transporting a Base Tower Section for the Biala Wind Farm.

Project Overview

The Plains Renewable Energy Park is a proposed renewable energy development located in the south western region of New South Wales. The Project will consist of up to 1.5GW of wind turbines in the South West Renewable Energy Zone.

Scope of Survey

The Plains REP is located in the western Riverina region of New South Wales, approximately 10 kilometres south of the town of Hay.

Following the initial Desktop Survey, the preferred port of import was identified as the **Port of Adelaide**. ARES was commissioned to physically drive the routes to identify, check and measure any pinch points en route, including any new issues or route options that were not apparent in the desktop analysis.

The physical route survey for Adelaide was conducted between April 18-21. The entire blade route was driven and examined except for the section of Cobb Hwy between Mossgiel and Booligal, which was closed by TfNSW due to recent flooding and associated repair works. (This is noted in the report.) The tower route was then driven from Adelaide to Whyte Yarcowie, whereupon it joins up with the blade route.

Following the physical examination of the routes, ARES performed swept path analyses of the critical pinch points along the routes using a combination of drone imagery shot during the survey and aerial imagery from Nearmap. The aim of the swept paths is to highlight the extent of any modifications required at each pinch point as well as any encroachment into private land by either the equipment or the cargo (e.g. blade tip).

ARES also performed swept path analysis of four proposed site entrances as part of our scope of works.

Ports of Import

The Port of Adelaide has seen several large wind farm projects pass through it in recent years, including Port Augusta and Silverton, and is currently being used for the Goyder project. It has a proven capability to handle large break bulk vessels such as those used for wind projects.

Storage is available in various areas around the port, as depicted on the right. Blades will need to be stored at Berths 18/20 due to their length. The storage areas are fenced and security is provided by the port.

One of the biggest advantages of Adelaide Port is its connections to the road network. Port River Expressway is only a kilometre away, with links to the North-South Motorway (able to take most oversize loads north out of Adelaide Metro) and Port Wakefield Rd (designated overheight route). The routes out are relatively clear of obstructions and cater well for truck traffic.

The only downside to the use of Adelaide for wind farm cargo is that the region north of Adelaide has a number of proposed wind projects likely to also utilise Adelaide as their port of import - e.g. Goyder Stage 2, Carmody's Hill, Twin Creek, Crystal Brook. Depending on the timing of The Plains REP, the port may become congested when playing host to more than a single wind farm at a time.





Above: Storage areas at Adelaide Port (in red). **Below:** Components stored at Adelaide Port by ARES for the Silverton WF project.

Transport Methodology

The Plains will feature next generation wind turbines with some of the largest blades and tower sections in the market.

Transport Envelope

The cargo dimensions assumed for this project are listed on the opposing page. These represent the Goldwind GWH175 8MW wind turbine platform with its 86m blade, along with the anticipated diameter (6.31m) of a steel tower for this larger machine. By comparison, the current generation of wind turbines has blades at around 80m long and towers at less than 6m in diameter.

A key assumption here is that the blade will have its tip support frame positioned at 50m from the blade root, based on the information provided by the client and OEM. This will result in quite a large rear overhang of 36m. Should this tip frame position change, the swept paths of the blades will need to be re-assessed.

Tower sizes and dimensions are usually not finalised until a much later stage of the project. We have provided estimates for the largest base tower section as well as the longest top tower section that can be reasonably expected for a wind turbine of this size. The mid tower section dimensions will fall somewhere in between these extremes.

Besides the wind turbine components, there will be a few other oversize overmass deliveries to the wind farm, particularly the main transformers for the substations. These tend to be overmass loads ranging from 150 to 300 ton depending on size. No sizing information is available at present for the transformers and hence we have not considered these any further at this stage.

Equipment

The change in cargo size is relatively small compared with current wind turbines and hence equipment required to transport them should be readily available.

Blades can be transported on extendable trailers which are currently being used, although if the tip frame spacing changes to something larger than about 55m then these trailers would need to be modified.

Other options for blade transport include a jinker style trailer or a fixed length blade trailer with removeable extension beams, both of which are in relatively common use for overlength applications. A blade lifter/ manipulator trailer has not been considered in this report as the approval pathway to use such a trailer on the road is unknown and considered too risky.

The base towers at a diameter of up to 6.31m will pose issues especially with respect to height. These will have to be transported on either “bookend” style trailers or low platform trailers to keep overall height as low as possible - this will minimize the amount of power lines which will need to be lifted.

The top tower sections are expected to be very similar to those currently in the market and should pose no issues for transport.

Cargo Dimensions

Component	Qty	Length (m)	Width (m)	Height (m)	Weight (t)
Nacelle	188	9.9	5.0	4.2	41.6
Drivetrain	188	8.2	4.1	4.2	106.0
Hub	188	5.1	4.5	4.2	52.0
Blade	564	86.0	4.8	3.7	32.0
Tower Base	188	10.0	6.3	6.3	110.0
Tower Top	188	36.0	4.3	4.3	80.0

Note: mid tower sections will typically fall in between the weights and dimensions of the base and top sections. There will likely be 5-6 of these mid sections per turbine, or an additional 940-1,128 OSOM deliveries for the project.

Overall Dimensions

Component	Equipment	O/A Length (m)	O/A Width (m)	O/A Height (m)	O/A Weight (t)
Nacelle	PM 2R8 4R8	25.9	5.0	4.9	84.0
Drivetrain	PM 10R8	31.3	4.3	5.0	168.0
Hub	PM 2R8 4R8	25.9	4.5	4.9	94.0
Blade	PM 6R8	97.4	4.8	4.7	86.0
Tower Base	PM 5R8-5R8 (Bookends)	39.1	6.3	6.7	192.0
Tower Top	PM 8R8 EXT	45.3	4.3	5.3	143.0

Note: mid tower sections will be transported on either low loaders or platform trailers.

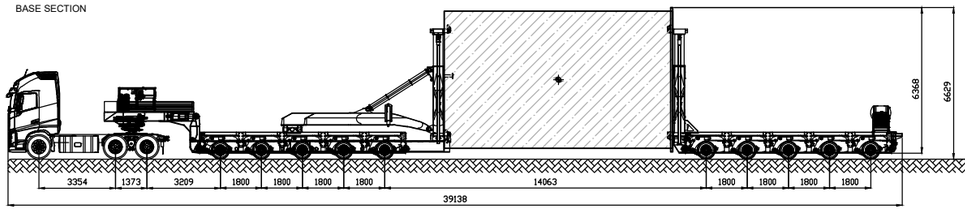
The equipment schematic on the next page shows how these components will be delivered for the project.

Axle Loads

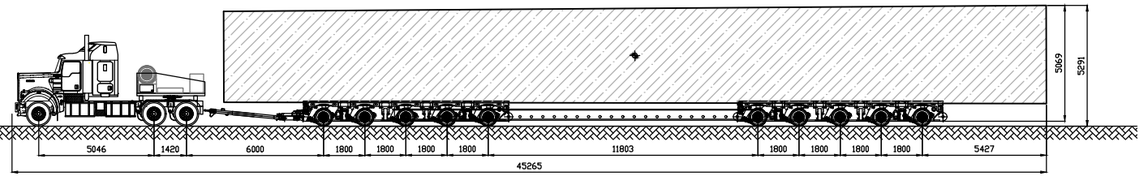
Axle loads will be up to 14 tons per row at 4.3m width. Axle spacings are shown in the equipment schematic overleaf.

Equipment Schematic

BASE SECTION

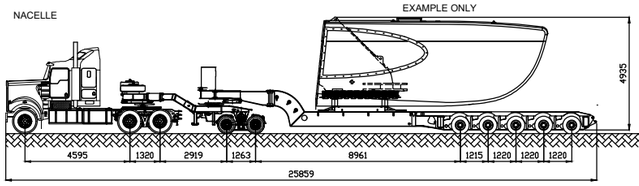


TOP SECTION



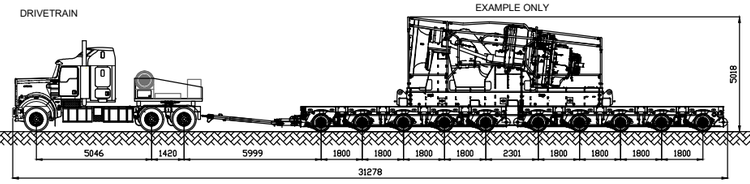
NACELLE

EXAMPLE ONLY



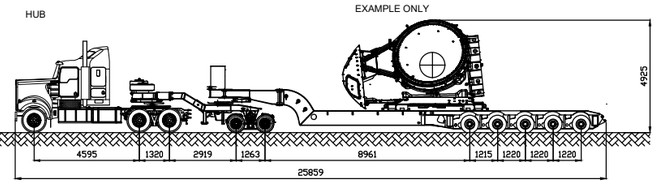
DRIVETRAIN

EXAMPLE ONLY

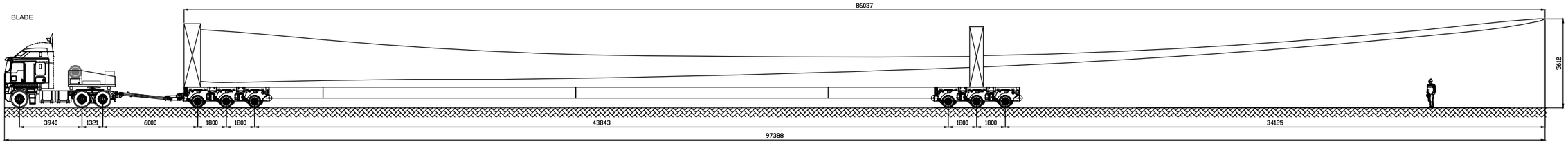


HUB

EXAMPLE ONLY

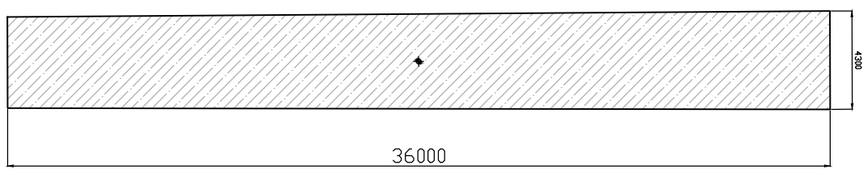


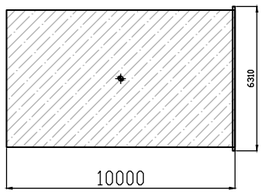
BLADE



Note: Goldwind documentation notes blade tip droops by 739mm so transport height will be 4,873mm.

Tower Specifications





REV	DATE	DESCRIPTION	DRN	CHK	APP	REFERENCE DRAWINGS

DRAWING NOTES:

ALL DIMENSIONS ARE IN mm UNLESS NOTED OTHERWISE (UNO) ALL WEIGHTS ARE IN t (METRIC TONNES) UNO ALL DETAILS ARE PROVISIONAL AND SUBJECT TO CONFIRMATION LASHINGS CALCULATIONS AS PER RESTRAINT GUIDELINES

TECHNICAL NOTES:

WEIGHT, DIMENSIONS AND COG POSITION TO BE CONFIRMED BY CLIENT STRUCTURAL INTEGRITY TO BE CHECKED BY CLIENT OPERATIONAL DIAGRAMS AND MANUAL MUST BE OBSERVED HYDRAULIC STABILITY REFERS TO STATIC LOAD ONLY STABILITY PROVISIONAL UNTIL COG CONFIRMED

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DRAWN BY:	
DRAWN DATE:	
CHECKED BY:	

CUSTOMER:	Engie	SIZE:
PROJECT:	The Plains R.E.P.	SCALE NTS
DRAWING TITLE:	Equipment Schematic	SHEET NO:
DRAWING NAME:	ENGIE_THEPLAINS_R1.DWG	REV



Project Timing

The Plains REP is scheduled to commence construction in 2025, with wind turbine component deliveries commencing around **Q4 2027**. Please note, these dates are subject to change and should be treated as indicative at this stage.

The proposed construction run rate is 2 complete turbines per week. We anticipate total duration of OSOM transport to be approximately **2 years**.

With 12-13 major OSOM components per turbine, this would mean a total of up to **26 oversized deliveries per week** or **4-5 deliveries per day** to site, spread over six days (Mon-Sat).

The proposed weekly delivery schedule is shown in the table below (subject to change due to resourcing, operational and permit requirements).

Component	Mon	Tue	Wed	Thu	Fri	Sat
Nacelle	●			●		
Drivetrain		●			●	
Hub			●			●
Blades	●	●	●	●	●	●
Tower Section 1	●			●		
Tower Section 2	●			●		
Tower Section 3		●			●	
Tower Section 4		●			●	
Tower Section 5		●			●	
Tower Section 6			●			●
Tower Section 7			●			●

Daily Schedule

A sample journey is provided below to illustrate how a component would be transported to site.

Day 1

START: PORT ADELAIDE

04.00hrs	Depart Port Adelaide
05.00hrs	Gawler
06.30hrs	Burra
07.30hrs	Terowie
09.00hrs	Yunta (rest break)
11.30hrs	NSW Border
12.30hrs	Layover Broken Hill

FINISH: BROKEN HILL

Total Distance:	520 km
Work Time:	8.5 hrs

Day 2

START: BROKEN HILL

05.00hrs	Depart Broken Hill
06.00hrs	Clear Broken Hill
08.30hrs	Wilcannia (rest break)
11.30hrs	Ivanhoe
13.30hrs	Booligal
14.30hrs	Layover Hay

FINISH: HAY

Total Distance:	590 km
Work Time:	9.5 hrs

Day 3

START: HAY

05.30hrs	Depart Hay
06.00hrs	Clear Hay
07.00hrs	Arrive Site Entrance
11.00hrs	Component offloaded
11.30hrs	Return Journey commences

FINISH: THE PLAINS REP

Total Distance:	25 km
Work Time:	6+ hrs

NOTES:

- Departure times subject to transport authority and Police approval.
- Return journey via Mildura (subject to permits and approvals)
- Times are indicative only and will change depending on traffic conditions and operational considerations.

Route Overview

ARES' Desktop Survey assessed routes from a number of different Ports of Import, as depicted in the below Routes Overview. One route was selected for a physical survey and detailed assessment - Adelaide.

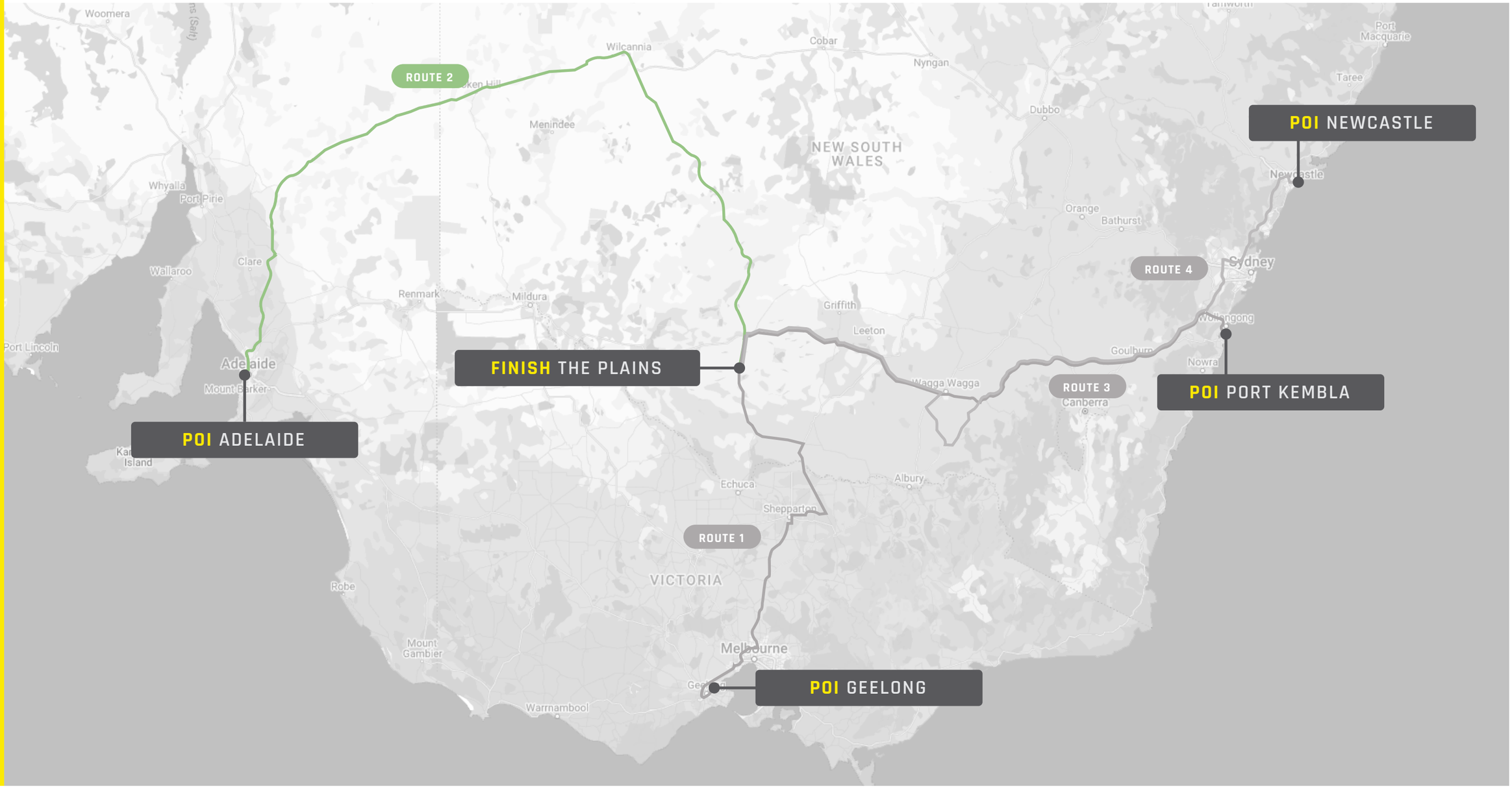
The results of the assessments for the selected route is presented in more detail in the following section.

ROUTE 1 **Geelong to The Plains -** Distance: 560km - not assessed further

ROUTE 2 **Adelaide to The Plains -** Distance: 1,130km

ROUTE 3 **Port Kembla to The Plains** - Distance: 715km - not assessed further

ROUTE 4 **Newcastle to The Plains** - Distance: 1,024km (blades only)





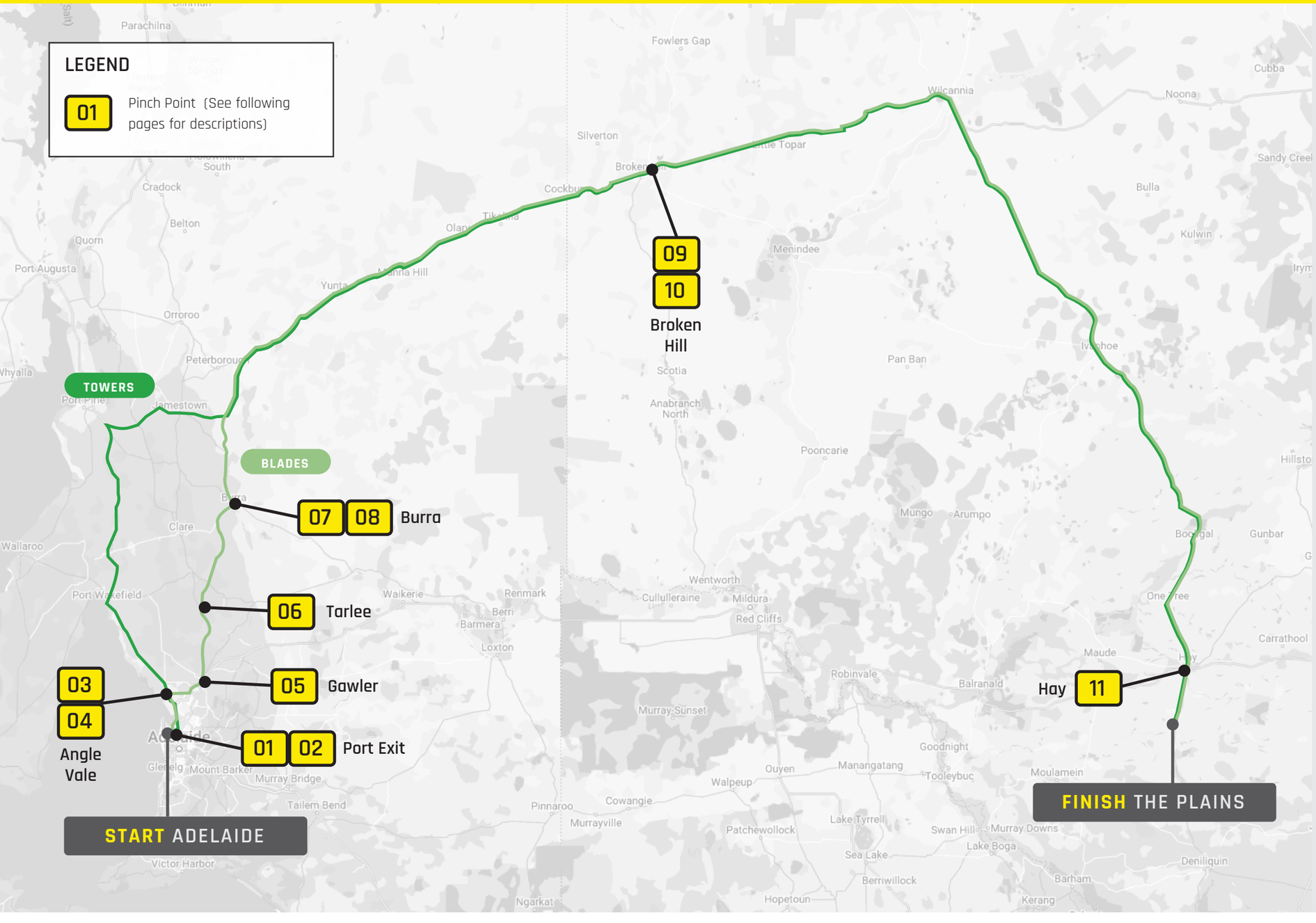
02

Adelaide to The Plains REP

Murra Warra WF

A blade trailer loaded with a 70m Senvion blade skilfully negotiates the township of Nhill for the Murra Warra Stage 1 Wind Farm.

Adelaide to The Plains - Overview



BLADE ROUTE

	START - Port Adelaide
0.0 KM	Ocean Steamers Rd
0.1 KM	Eastern Pde
1.0 KM	Port River Expy
4.4 KM	North-South Mwy
19.3 KM	Port Wakefield Hwy
26.8 KM	Angle Vale Rd
39.7 KM	North-South Mwy
49.9 KM	Horrocks Hwy
89.9 KM	Barrier Hwy
156.3 KM	(Burra bypass)
160.3 KM	Barrier Hwy
510.9 KM	(Broken Hill bypass)
515.1 KM	Barrier Hwy
729.1 KM	Cobb Hwy
1,133.8 KM	**FINISH - The Plains REP**

TOWER ROUTE

	START - Port Adelaide
0.0 KM	Ocean Steamers Rd
0.1 KM	Eastern Pde
1.0 KM	Port River Expy
9.4 KM	Port Wakefield/Augusta Hwy
201.7 KM	Wilkins Hwy
249.0 KM	(Jamestown Bypass)
254.0 KM	Wilkins Hwy
254.8 KM	Jamestown-Yarcowie/Whyte Rd
279.8 KM	Barrier Hwy
576.8 KM	(Broken Hill bypass)
582.6 KM	Barrier Hwy
796.6 KM	Cobb Hwy
1,201.3 KM	**FINISH - The Plains REP**

Adelaide to The Plains REP

General Route Notes

Road Quality

Almost the entire transport route will be along state highways, which are generally designed to a higher specification and able to handle heavier and higher volumes of traffic.

The routes will be entirely on asphalt. There are sections of the Cobb Hwy between Wilcannia and Ivanhoe which are currently being upgraded from gravel to asphalt - this is scheduled to be complete in 2023-24 and well ahead of any deliveries for The Plains.

Width-wise there is only one area of note which will require extra vigilance - sections of the Cobb Hwy either side of Ivanhoe are quite narrow with negligible shoulders. With loads at up to 6.3m wide, oncoming traffic will have to pull off the road surface completely to let loads past. If there have been recent rains, the ground may be soft and cars may become bogged.

Rest Stops

Being on main highways, there are ample truck parking areas and service areas for rest breaks along the routes (refer to following page). However, it is worth noting that the section between Broken Hill and Hay is quite remote with limited amenities and mobile phone coverage. We recommend that a service vehicle with spare parts, tyres etc. accompanies the larger loads to ensure any breakdowns can be addressed in a timely manner.

Overhead Structures

There are only a few overhead structures of note along the overheight route for towers:

- Hanson Rd overpass of Port River Expy (6.0m clearance, bypass via off- and on-ramps
- N-S Motorway overpass of Port River Expy (7.2m clearance - no issues)
- Gantries for highway VMS signboards at various locations in Adelaide metro (bypassable)
- Copper Coast Hwy overpass of Augusta Hwy at Port Wakefield (7.6m clearance - no issues)

For the blades, which are expected to be around 5.0m loaded height, there are two bridges on the North-South Motorway which are at around 5.3m height. These can be bypassed by taking Port Wakefield Rd and then Angle Vale Rd.

Overhead Power Lines

In general, a travel height below around 5.5m is not an issue with respect to power lines. For this project, most towers will be travelling at more than 6m so there will likely need to be quite a few lines requiring permanent lifting, subject to detailed surveys from the power authorities (SA Power Networks, Endeavour Energy, Essential Energy). High load escorts will also likely be required to accompany these loads.

Bridges and Culverts

Axle loads will be limited to 14 tons per axle by South Australian regulations. This should be well within design specifications for bridges, culverts and other structures on major state roads and highways. There are small sections of the route which deviate off state roads, such as the Burra and Jamestown bypasses. These will need liaison with the local council to ascertain any load limits on structures that are crossed.



Above: Typical construction of Cobb Hwy with minimal shoulder.

Rail Crossings

There are numerous rail crossings along the route which are detailed on pages 28-32. These will need written approval from the rail authority or asset owner before they can be crossed. Current rail authority advice from ARTC and Aurizon on crossing and track supervision requirements has been attached as Appendices to this report.

Approvals

Works on major arterial highways in South Australia require engineering design by an engineering consultant (from a pre-approved list) and final sign off by Department of Infrastructure and Transport (DIT).

Modifications to NSW State Roads will require a Works Authorisation Deed (WAD) signed between the project developer and Transport for NSW (TfNSW). Designs will need to be done by a pre-approved engineering consultant and signed off by TfNSW prior to construction.



Above:

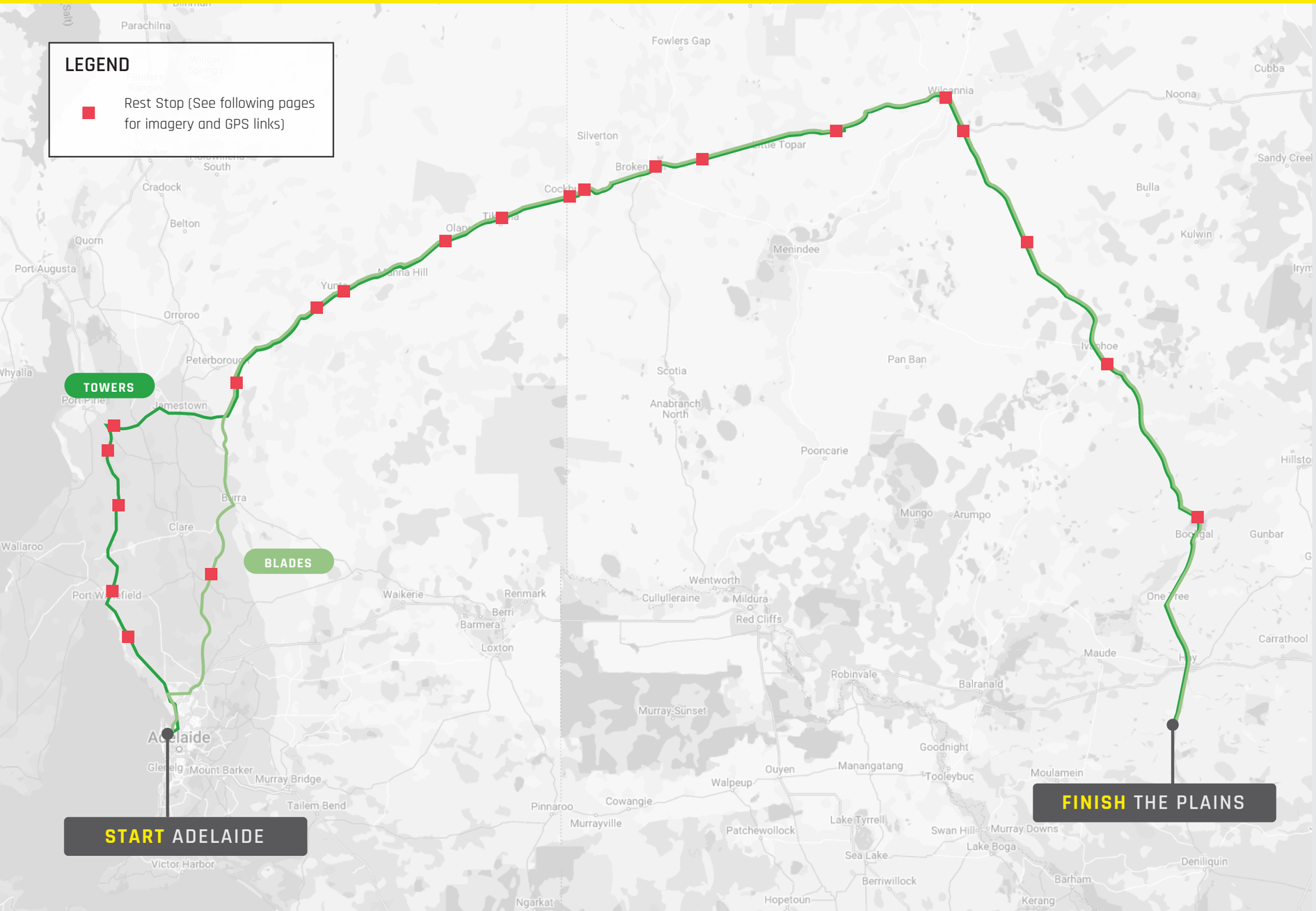
Hanson Rd overpass of Port River Expressway - 6.0m clearance.

Below:

Penfield Rd overpass (Hamel Bridge) on North-South Motorway - 5.3m clearance.



Adelaide to The Plains - Rest Stops



BLADE ROUTE

No.	KP	Rest Stop Name
01	106	Parking Bay north of Saddleworth
02	222	Woodcutters Rd Parking Area
03	257	Barrier Hwy Parking, Nackara
04	311	Yunta Rest Area
05	371	Truck Parking, Outalpa
06	418	Barrier Hwy Parking, Tikalina
07	460	Cockburn Rest Stop
08	473	Thackaringa Hills Rest Stop
09	514	Round Hills Rest Stop
10	542	Mount Gipps Rest Stop
11	644	Dolo Hills Rest Stop
12	704	Wilcannia
13	724	Cobb Hwy Parking
14	796	Half Way Tree
15	895	Cobb Hwy, Abbotsford Bore
16	1006	Bairds Truck Stop

TOWER ROUTE

No.	KP	Rest Stop Name
17	76	Parking Area south of Inkerman
18	93	Parking Area north of Port Wakefield
19	151	Truck Parking, Hope Gap
20	183	Truck Parking, Merriton
21	201	Wilkins Hwy Parking

01 Saddleworth
GPS: https://maps.app.goo.gl/amy98A8UPwXED7zz5



02 Woodcutters Rd
GPS: https://maps.app.goo.gl/wm1Go6BDxUvZnZfA9



03 Nackara
GPS: https://maps.app.goo.gl/tkR9CTZBoQZWbqgS8



04 Yunta
GPS: https://maps.app.goo.gl/TuKPbNirz11m6h8v9



05 Outalpa
GPS: https://maps.app.goo.gl/dQsSTBXeoML7JGwb7



06 Tikalina
GPS: https://maps.app.goo.gl/6yz8FFHtiShVZojC8



07 Cockburn
GPS: https://maps.app.goo.gl/kbJVbTTMhCQLbqLR7



08 Thackaringa Hills
GPS: https://maps.app.goo.gl/j7wMpqWmQYbZN4ut8



09 Round Hills
GPS: https://maps.app.goo.gl/UUc9gzBhCnwQvJ5d6



10 Mount Gipps
GPS: https://maps.app.goo.gl/SjzMWq4X4fZRhwCj8



11 Dolo Hills
GPS: https://maps.app.goo.gl/s5Bz4N76STjryYcw5



12 Wilcannia
GPS: https://maps.app.goo.gl/PwfcctgC8eXHMY1f9



13 Cobb Hwy
GPS: https://maps.app.goo.gl/Z18L6vR3fdNxDaDh8



14 Half Way Tree
GPS: https://maps.app.goo.gl/ZRTPS3SjxQt2KuzM6



15 Abbotsford Bore
GPS: https://maps.app.goo.gl/NXP9SSX4AbBDc1fp7



16 Bairds Truck Stop
GPS:



17 Inkerman

GPS: https://maps.app.goo.gl/5xmUhQURrNNnFimX8



18 Port Wakefield

GPS: https://maps.app.goo.gl/mjnyJLmNGiF2uQCt9



19 Hope Gap

GPS: https://maps.app.goo.gl/YPe27My9iBPJxzLR7



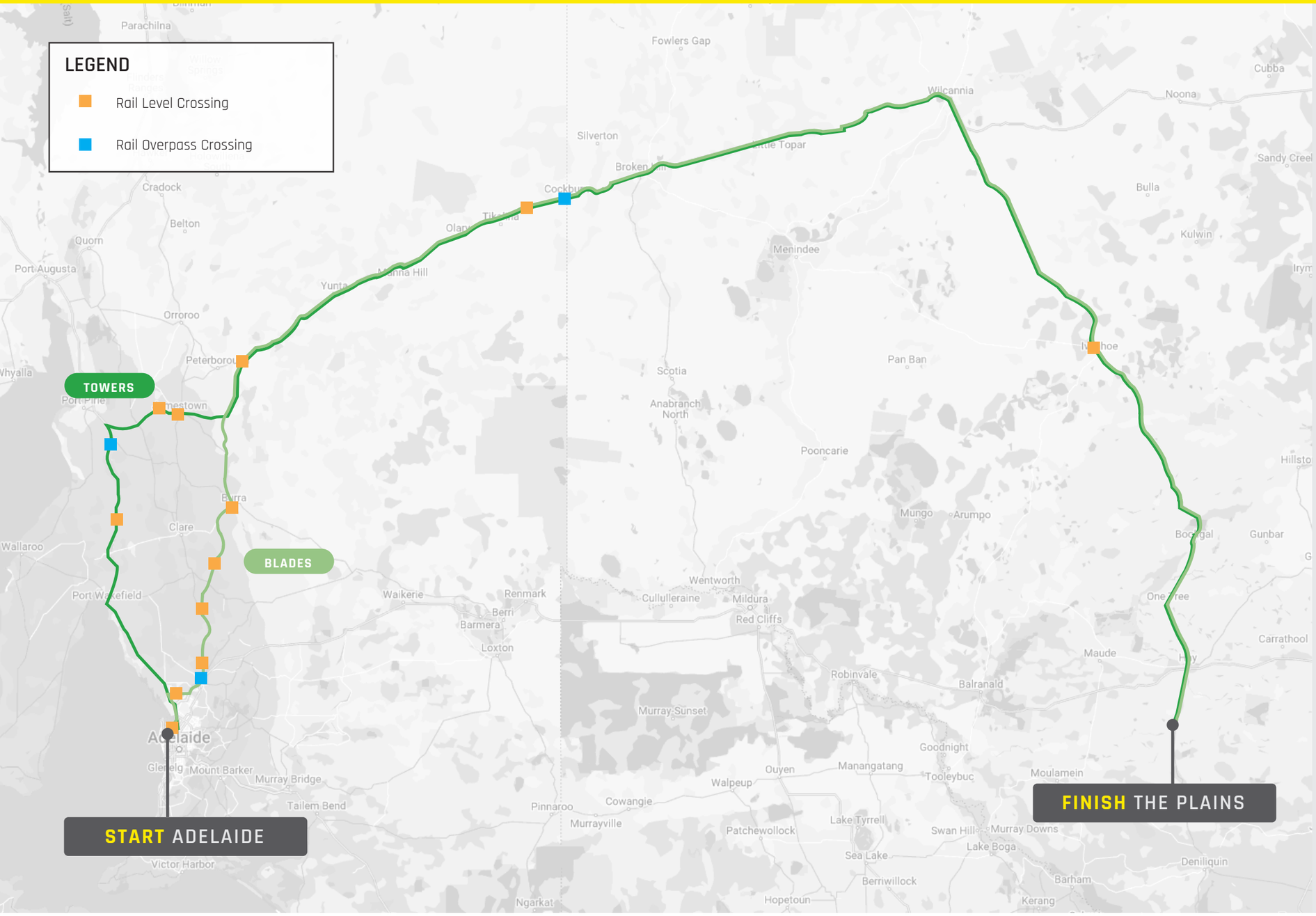
20 Merriton

GPS: https://maps.app.goo.gl/yd6VKAG9r35uDa5j6



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Adelaide to The Plains - Rail Crossings



BLADE ROUTE

No.	KP	Rail Crossing Name
01	0.1	Eastern Pde, Port Adelaide (1)
02	0.2	Eastern Pde, Port Adelaide (2)
03	28	Angle Vale Rd, Angle Vale
04	47	Northern Expy, Gawler
05	56	Horrocks Hwy, Roseworthy
06	84	Horrocks Hwy, Tarlee
07	118	Barrier Hwy, Manoora
08	157	Copperhouse Rd, Burra
09	246	Barrier Hwy, Ucolta
10	429	Barrier Hwy, Mingary
11	463	Cockburn Overpass
12	894	Cobb Hwy, Ivanhoe

TOWER ROUTE

No.	KP	Rail Crossing
13	140	Augusta Hwy, Snowtown
14	194	Crystal Brook Overpass
15	239	Wilkins Hwy, Caltowie
16	250	Appila Rd, Jamestown
17	253	OD5 Rd, Jamestown

01 Eastern Pde, Port Adelaide (1)
GPS: https://maps.app.goo.gl/NLtkDkxAziDvKZxH9
Type: Level Crossing
Asset Owner: ARTC
Line: Port Flat Track



02 Eastern Pde, Port Adelaide (2)
GPS: https://maps.app.goo.gl/QXV4cxQD7ZDxnNZE9
Type: Level Crossing
Asset Owner: ARTC
LIne: Gillman-Eastern Parade 01



03 Angle Vale Rd, Angle Vale
GPS: https://maps.app.goo.gl/XzmNkYtGehup7nb8A
Type: Level Crossing
Asset Owner: ARTC
LIne: Adelaide-Crystal Brook



04 Northern Expy, Gawler (DISUSED)
GPS: https://maps.app.goo.gl/kHouKukUksSxRjjRA
Type: Overpass
Asset Owner: Aurizon
Line: Gawler-Kapunda



05 Horrocks Hwy, Roseworthy (DISUSED)
GPS: https://maps.app.goo.gl/38LDwxZZiQUSM84F6
Type: Level Crossing
Asset Owner: Aurizon
Line: Gawler-Kapunda



06 Horrocks Hwy, Tarlee (DISUSED)
GPS: https://maps.app.goo.gl/AhQq1kVdXcLsgoY49
Type: Level Crossing
Asset Owner: Aurizon
Line: Hamley Bridge-Burra



07 Barrier Hwy, Manoora (DISUSED)
GPS: https://maps.app.goo.gl/y1WhadV8Q1WWJzxb9
Type: Level Crossing
Asset Owner: Aurizon
Line: Hamley Bridge-Burra



08 Copperhouse Rd, Burra (DISUSED)
GPS: https://maps.app.goo.gl/XhTT9H9PTbSxR2jE8
Type: Level Crossing
Asset Owner: Aurizon
Line: Hamley Bridge-Burra



09 Barrier Hwy, Ucolta
GPS: https://maps.app.goo.gl/dCJrps53zSmsd8DH8
Type: Level Crossing
Asset Owner: ARTC
Line: Crystal Brook-Broken Hill



10 Barrier Hwy, Mingary
GPS: https://maps.app.goo.gl/SxHYc2JEMAgrH7WA8
Type: Level Crossing
Asset Owner: ARTC
Line: Crystal Brook-Broken Hill



11 Cockburn Overpass
GPS: https://maps.app.goo.gl/Hn9NDQ9SJh1bxSDe9
Type: Overpass
Asset Owner: ARTC
Line: Crystal Brook-Broken Hill



12 Cobb Hwy, Ivanhoe
GPS: https://maps.app.goo.gl/rTktcuGQ8A6di5m36
Type: Level Crossing
Asset Owner: ARTC
Line: Orange-Broken Hill



13 Augusta Hwy, Snowtown
GPS: https://maps.app.goo.gl/noTPs5VuHYZQUUJJ9
Type: Level Crossing
Asset Owner: Aurizon
Line: Snowtown-Bute



14 Crystal Brook Overpass
GPS: https://maps.app.goo.gl/vMxwDcbXS8kwasXo6
Type: Overpass
Asset Owner: ARTC
Line: Crystal Brook-Broken Hill



15 Wilkins Hwy, Caltowie
GPS: https://maps.app.goo.gl/CTW6XcAJ19ZdBc8f7
Type: Level Crossing
Asset Owner: ARTC
Line: Crystal Brook-Broken Hill



16 Appila Rd, Jamestown
GPS: https://maps.app.goo.gl/6eZNpsC3n42zsX5V6
Type: Level Crossing
Asset Owner: ARTC
Line: Crystal Brook-Broken Hill



17 OD5 Rd, Jamestown
GPS: https://maps.app.goo.gl/WCjZUf9xmYH1WP5TA
Type: Level Crossing
Asset Owner: ARTC
Line: Crystal Brook-Broken Hill



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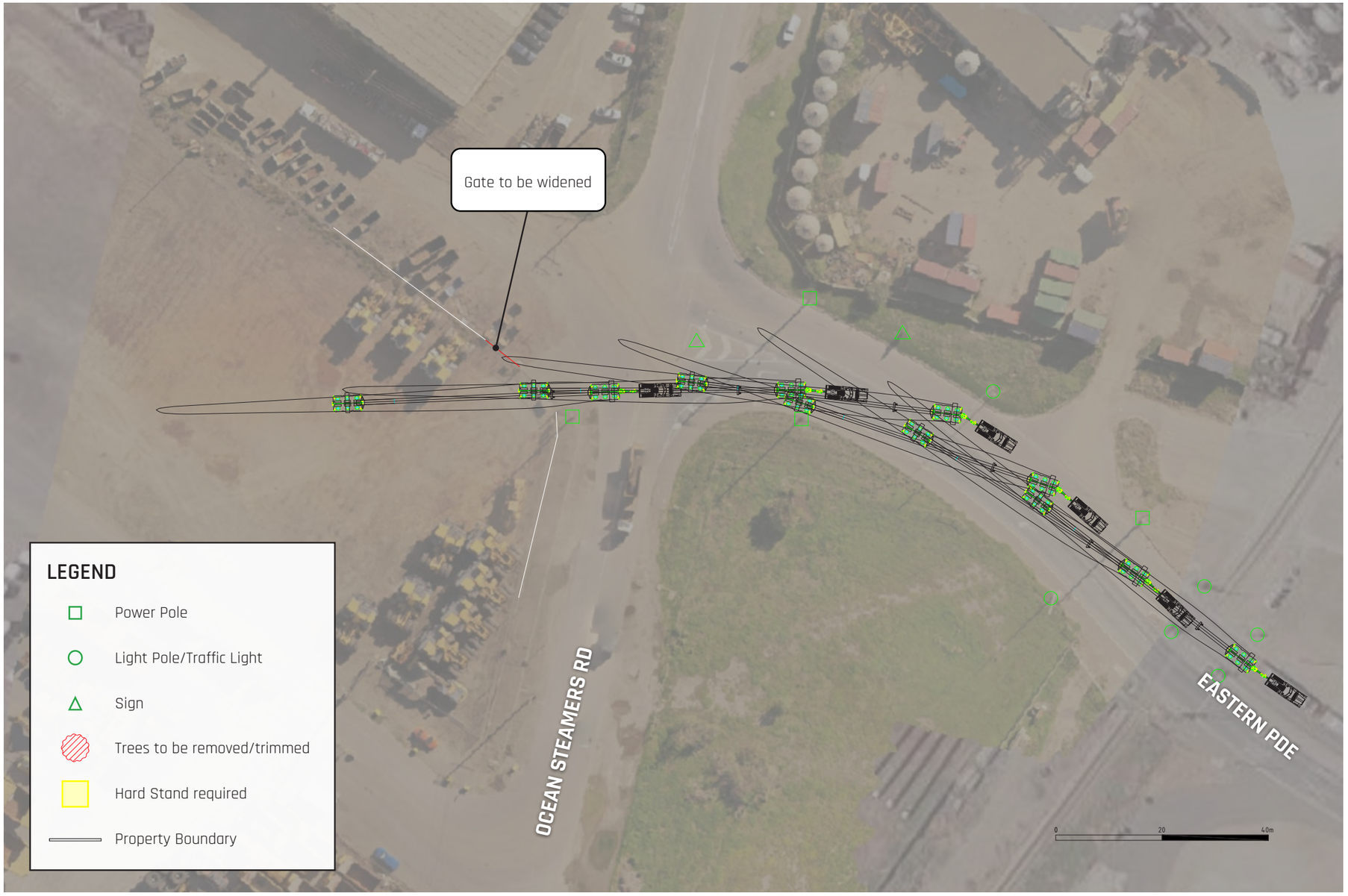
01

RIGHT TURN

Ocean Steamers Rd & Eastern Pde

Blades will have to exit from the existing gate on the north-east side of the Berth 18/20 storage area. This gate will need to be widened or fence made removeable (see red segment on diagram) to accommodate the longer blades. Flinders Port approval will be required for these works. Cargo will have to be stored away from the gate to allow room for blades to manoeuvre.

The turn will need to be made very carefully due to close clearances to traffic furniture on all sides and to be able to straighten up sufficiently for the railway crossing, but no other modifications are required.



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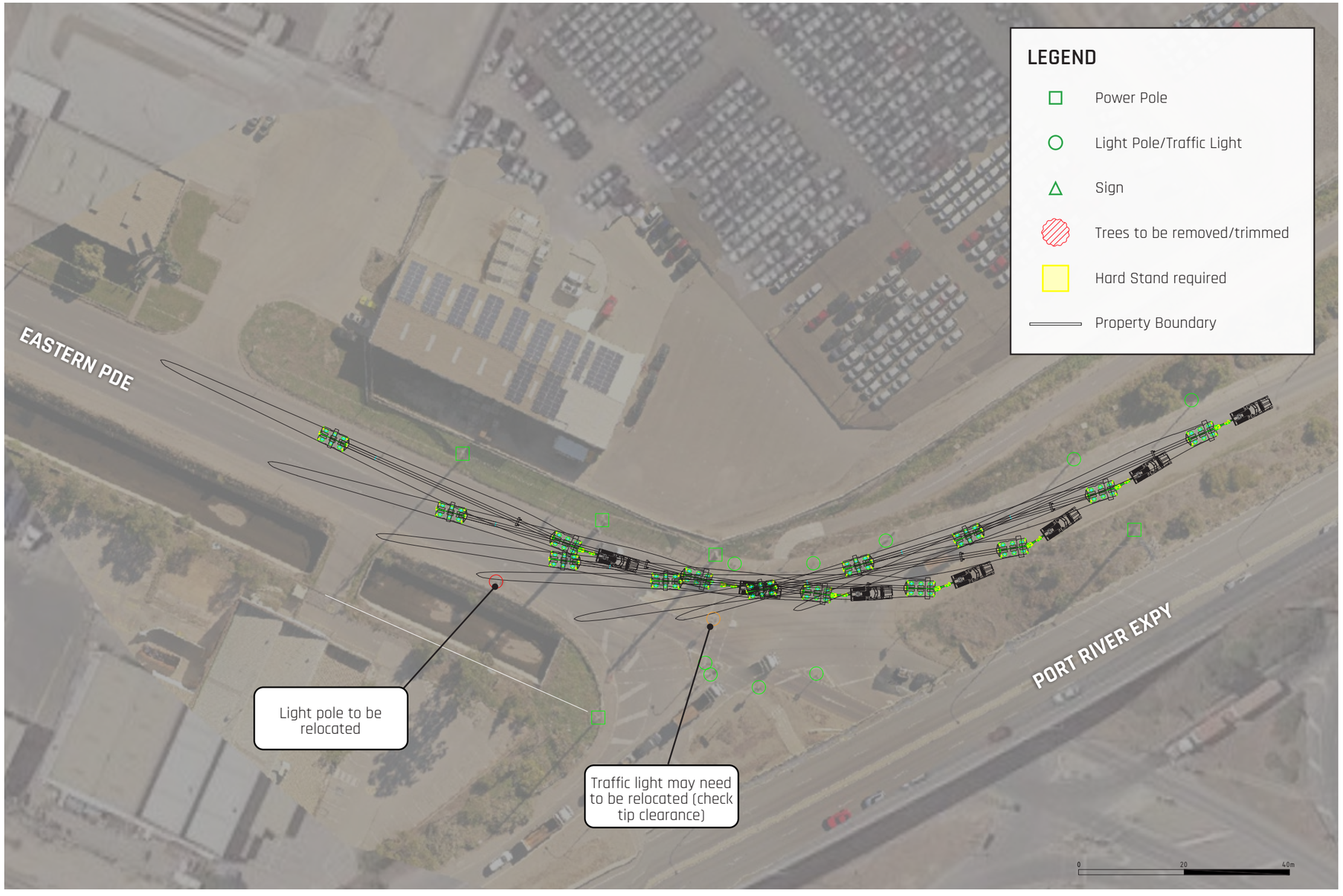
02

LEFT TURN

Eastern Pde & Port River Expy

The turn onto Port River Expressway is very tight with some tall powerlines and poles in the vicinity which are to be avoided. The rear of the blade trailer will run out very wide onto the opposite footpath, requiring the relocation of one light pole as well as the possible relocation of one of the traffic lights in the intersection.

The blade tip can be kept clear of the trees to the south and will not stray into private property.



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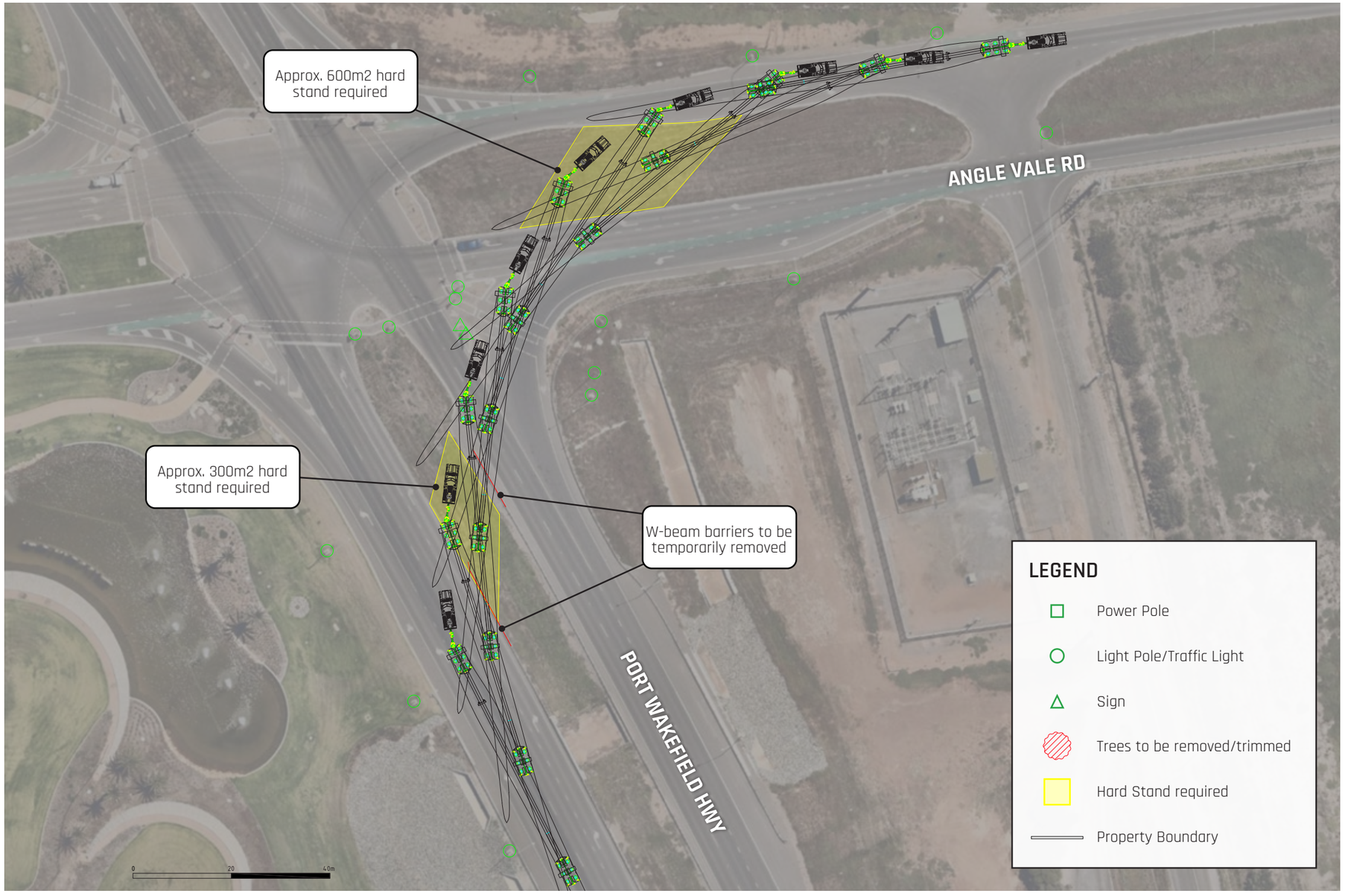
03

RIGHT TURN

Port Wakefield Hwy & Angle Vale Rd

This intersection has recently been upgraded to make Angle Vale Rd dual carriageway, giving a bit more room for blades making the turn. W-beam barriers will need to be removed along Port Wakefield Hwy to allow blades to cut across the median strip, taking care to avoid the drain in the middle. The blade will then cut across the median strip on Angle Vale Rd to cross over to the correct side of the road.

Minor civil works will be required to make the median strips trafficable for truck and trailer wheels as shown in yellow on the right.



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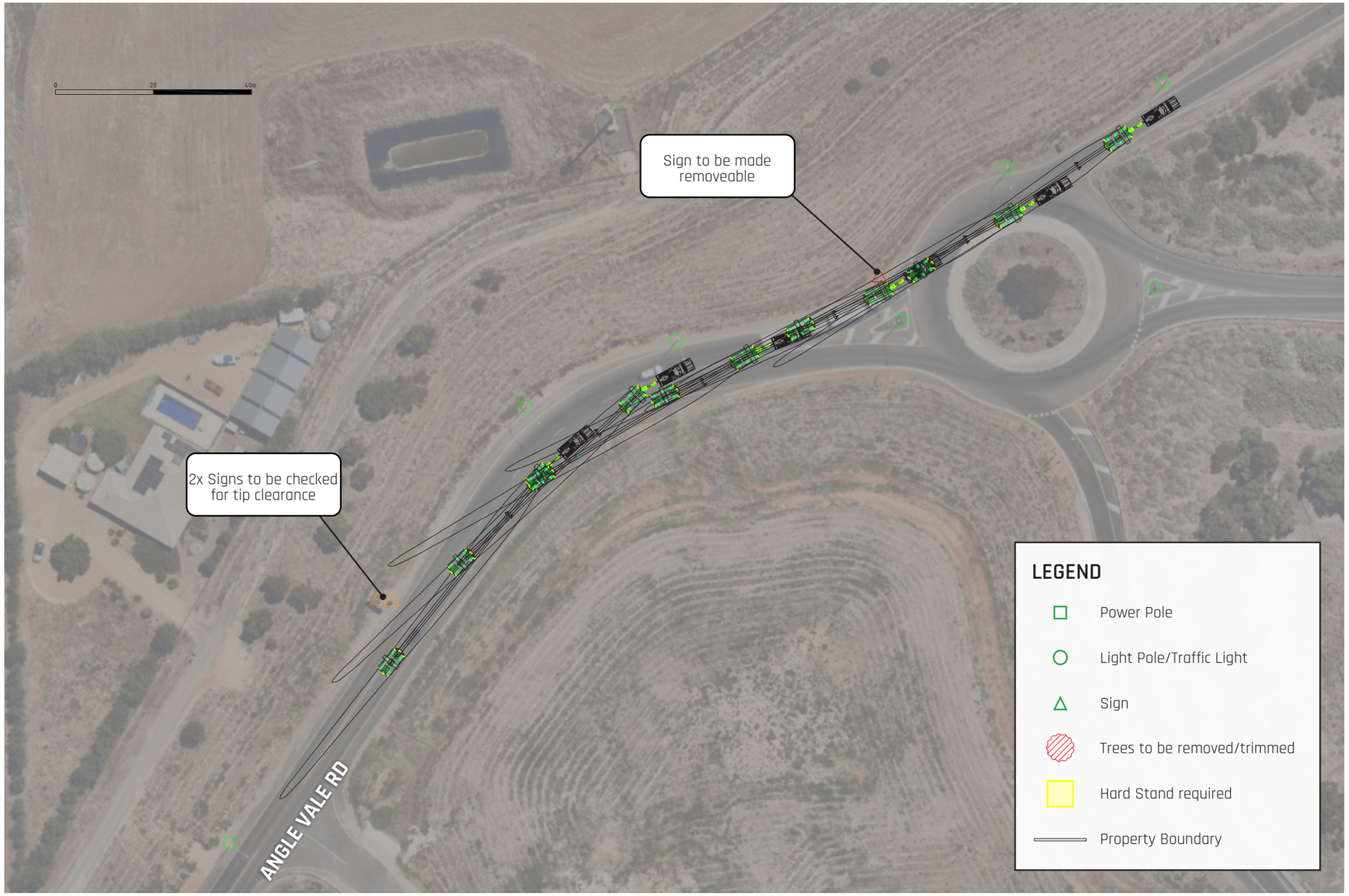
LEFT TURN

Angle Vale Rd & North-South Mwy

This combination of corners to get back onto the North-South Motorway is quite tight and will require traffic to be stopped in both directions, but can be done with only minimal modifications.

Care will be required on the approach as there are power poles and trees to the south of Angle Vale Rd which need to be avoided. The rear trailer will have to be manually steered to keep it on the road surface as it navigates around the roundabout and to avoid the light poles.

A sign will need to be made removeable and another two (in orange) checked during a trial run for blade tip clearance.



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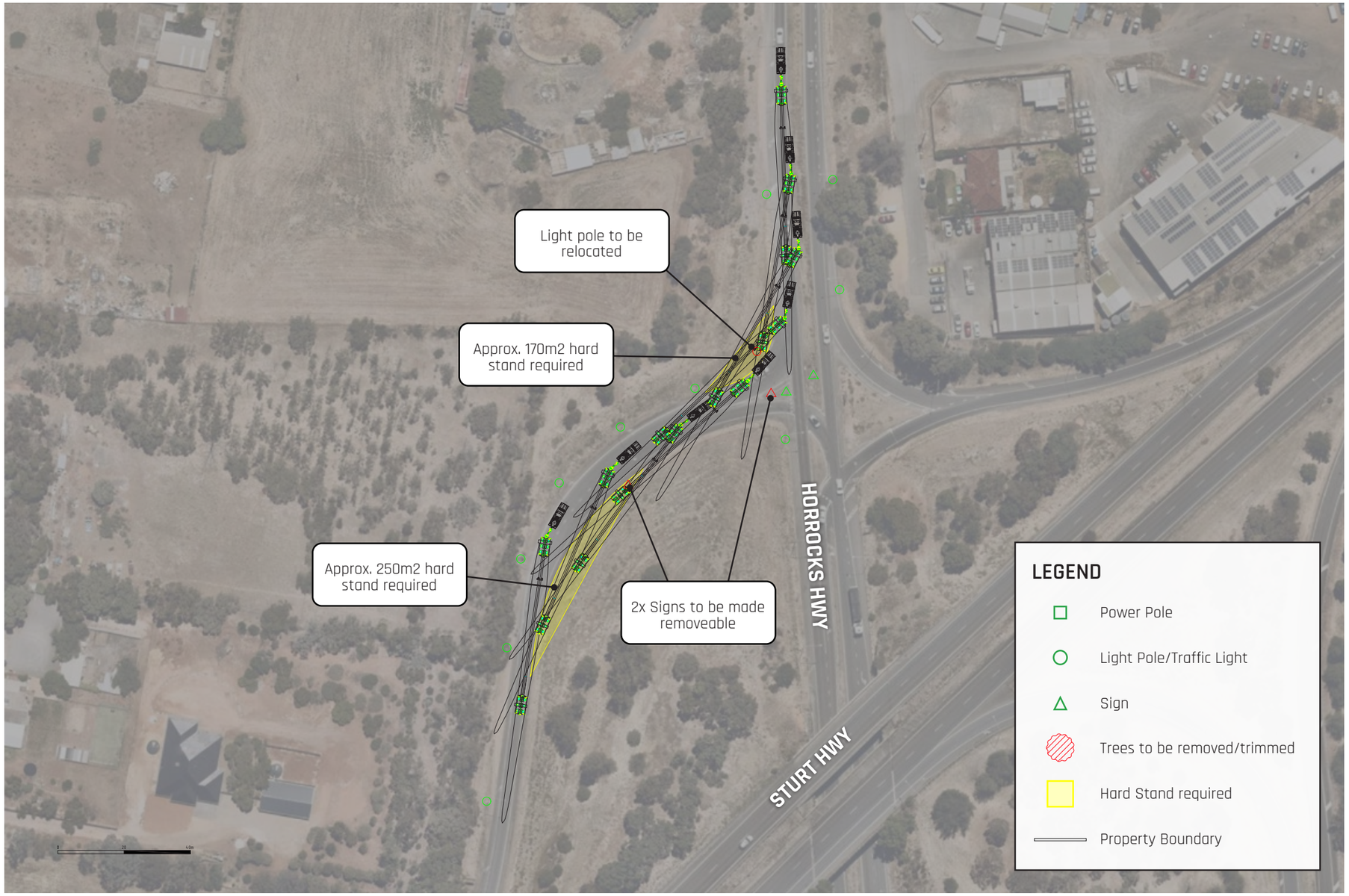
05

LEFT TURN
Sturt Hwy &
Horrocks Hwy

The offramp into this intersection has a moderate downhill gradient with embankments on either side. The blade trailer's rear wheels will have to travel on the eastern embankment, meaning hard stand material will need to be put down with possible earthworks required to level the ground. Further hardstand is required on the inside of the corner merging onto Horrocks Hwy.

Rear tip clearance with the ground will need to be checked during a trial run, if this is an issue the tip frame can be put onto spacers for additional clearance.

One light pole and a few signs will need to be relocated or removed.



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Pinch Point

06

LEFT TURN
Horrocks Hwy,
Tarlee

There is a left hand turn at the town of Tarlee on the Horrocks Hwy to cross a disused railway line. This can be taken by blades conventionally with no issues, however the police escorts will have to hold oncoming traffic whilst the blade completes the turn as the combination will take up both lanes.

Tree trimming is likely required on overhanging branches leading up to this turn (not shown).



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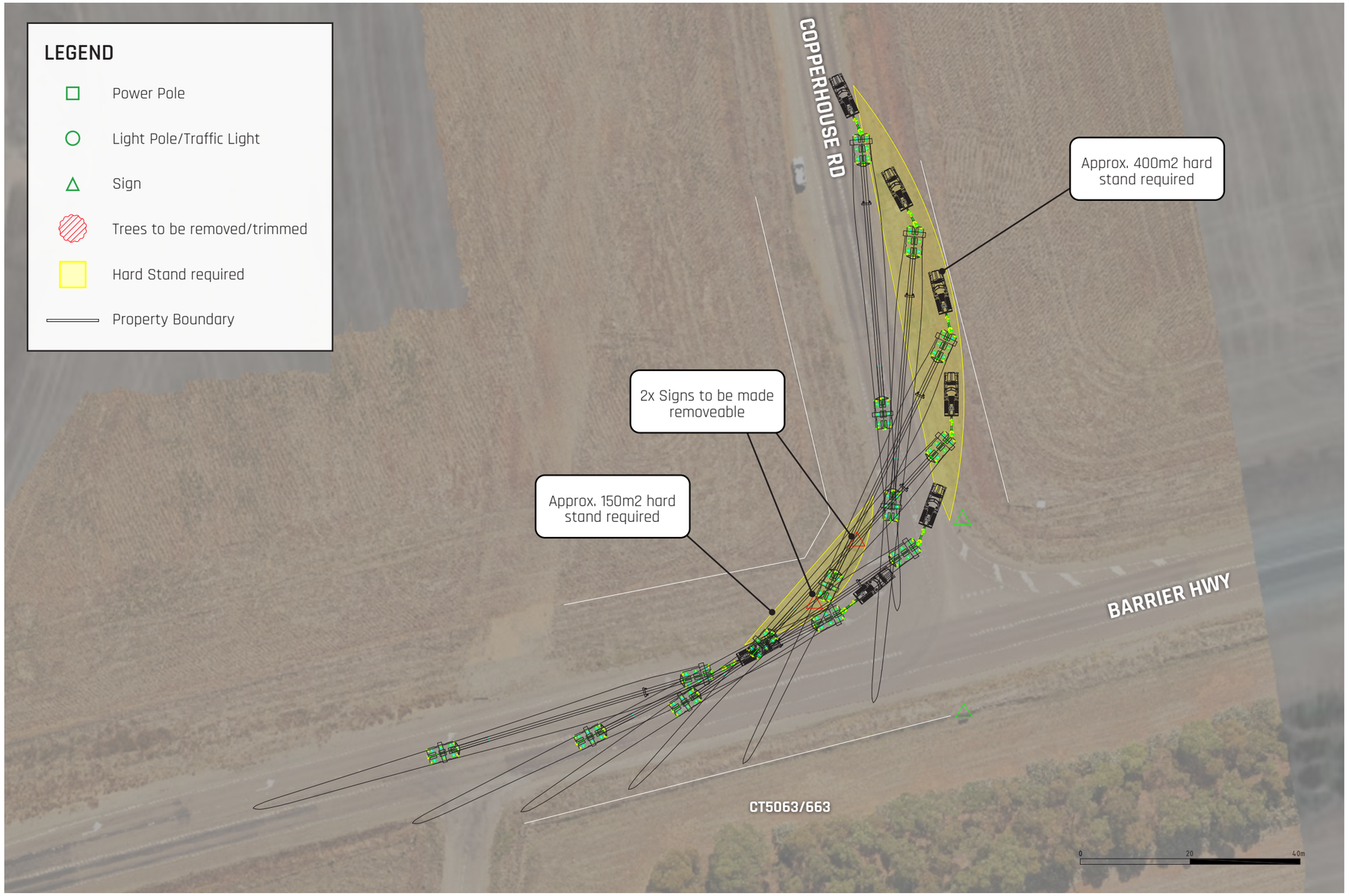
07

LEFT TURN

Barrier Hwy & Copperhouse Rd

The heavy vehicle bypass of Burra town is via Copperhouse Rd. It is primarily designed for B-double traffic and more work will be required to get the blades around.

Loads will have to hug the inside fenceline on turning in, then swing out as wide as possible to the other side of the road. Hard stand material will need to be placed where the wheels run off the existing road surface. Two signs will need to be made removeable.



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DRAWING NAME:	Route Survey	REV

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Pinch Point

08

LEFT TURN
Copperhouse St
& West St

The left turn at the Bon Accord Hotel on the Burra bypass route will present some problems due to the large rear overhang. Taking this turn conventionally will require tree trimming and/or removal to the south, with the tip swing intruding into private property (CT6105/151).

Some hard stand material is required where the truck and trailer wheels leave the existing road surface. The transport combination may also need permission to travel on private property (Bon Accord Hotel).



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DRAWING NAME:	Route Survey	REV

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Pinch Point

09

MAJOR TOWN

Route Options through Broken Hill

Getting through the town of Broken Hill is a major challenge for this project. Cargo will arrive from the south-west via the Barrier Hwy and needs to exit via the Silver City and Barrier Hwys to the north-east. ARES assessed three main options to get blades through Broken Hill:

- **New Bypass Option:** Build new track turning off the Barrier Hwy west of Broken Hill which roughly follows existing dirt tracks and links up with Gaffney St
- Two options through the town itself were assessed but found to be non-feasible due to swept path issues.

As going through the town itself is not feasible with the sheer length of the blades, the only realistic option is to build a new bypass track.



Pinch Point

09A

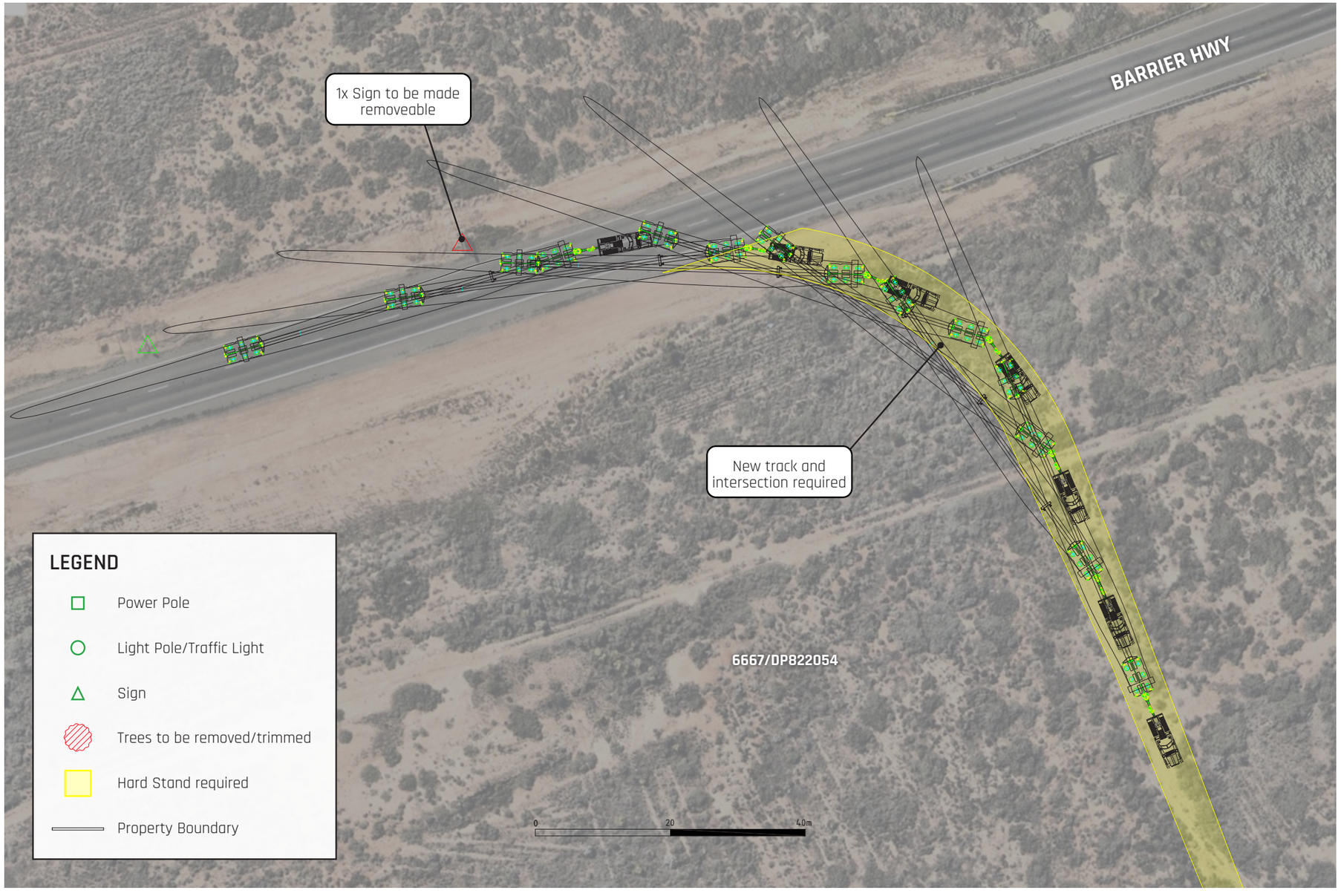
RIGHT TURN

Barrier Hwy approx.
2.4km from Broken Hill

The proposed bypass makes use of existing tracks which come off the Barrier Hwy at around 2.4km west of Broken Hill town. There is no existing intersection and a new one will have to be designed and constructed.

The swept path analysis on the right shows the extent of civil works required for the 86m blade to make this turn. One sign will need to be made removeable.

As the Barrier Hwy is a state-controlled road, the design and construction of this intersection will require a Works Authorisation Deed (WAD) and approvals from Transport for NSW.



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DRAWING NAME:	Route Survey	REV

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Pinch Point

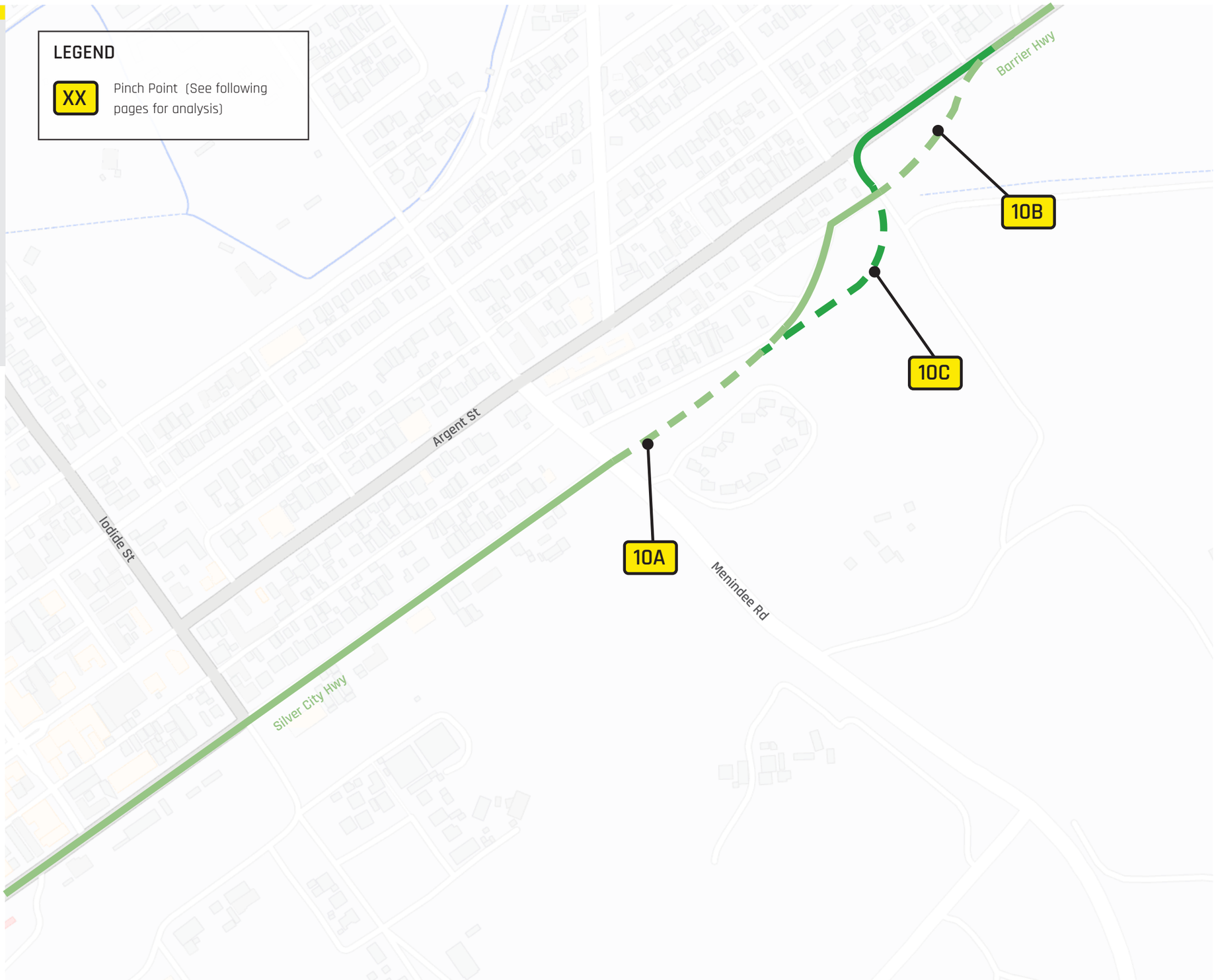
10

RIGHT TURN

Silver City Hwy &
Barrier Hwy

Regardless of which option is chosen from Pinch Point 09, to get back onto the Barrier Hwy to the north-east will require a new track to be built to Sturt St (Pinch Point **10A**), and then a couple of options to get back onto the Barrier Hwy (Pinch Points **10B** and **10C**).

The pinch points are explored in detail in the following pages.



Pinch Point

10A

RIGHT TURN
Crystal St
& Sturt St

The blades will require a temporary track to link the end of Crystal St with Sturt St across Menindee Rd. This will pass through Crown land and will require a moderate amount of civil works to make the surface suitable for a road base.

There is a power pole which can be avoided, and the road sign can be relocated away from the path of the transporter.



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Pinch Point

10B

RIGHT TURN
Chettle St
& Barrier Hwy

A temporary track will need to be built to link the end of Chettle St to the Barrier Hwy/Argent St. This will pass through Crown land near the Perilya Mine, which is non-operational.

The terrain is relatively flat and suitable for a temporary road. There is an existing double gate at the end of Chettle St which may be utilised to access the property. A new gate will have to be put in at the exit point into Barrier Hwy/Argent St.



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DRAWING NAME:	Route Survey	REV	

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Pinch Point

10C

RIGHT TURN

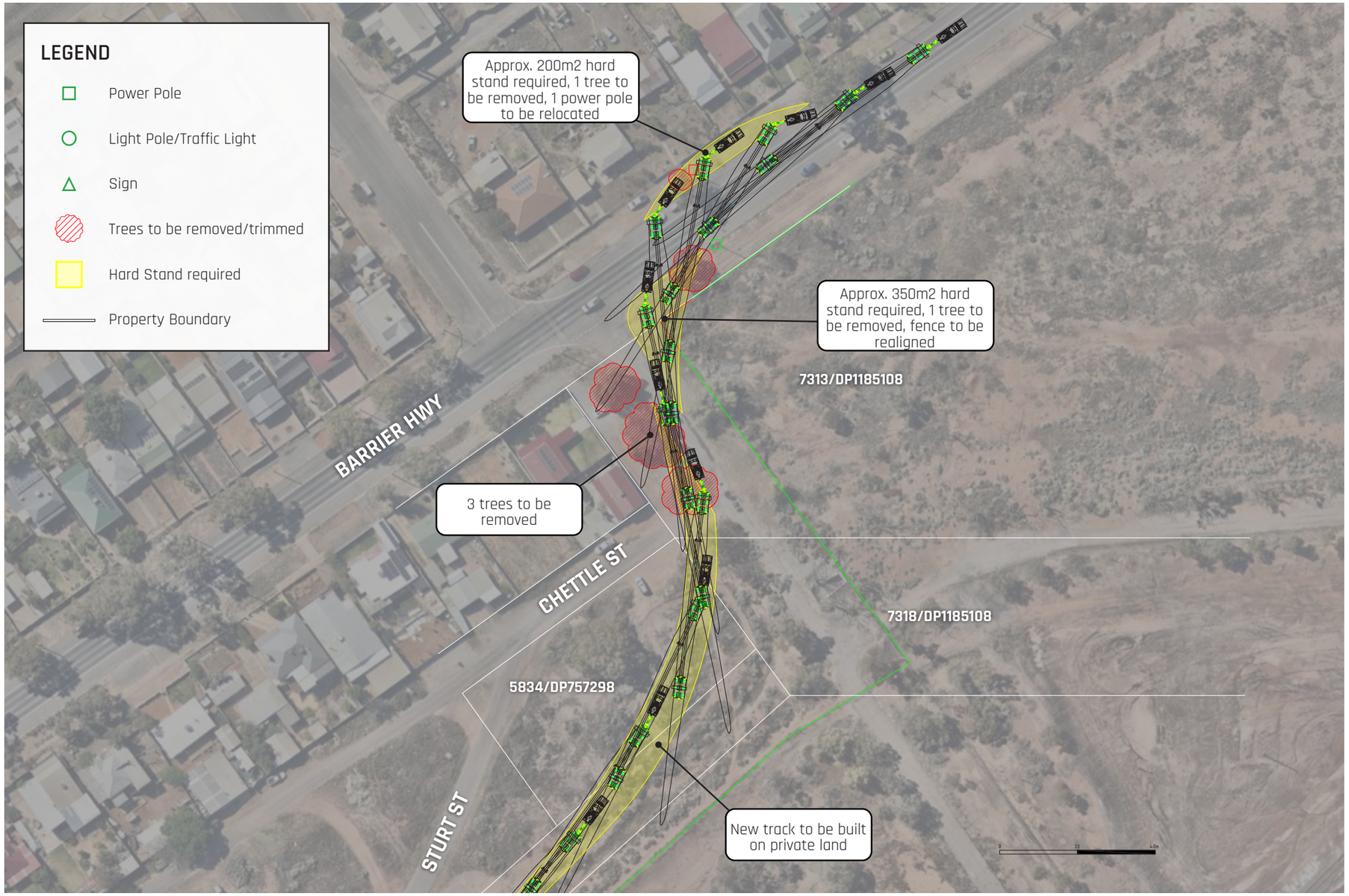
Sturt/Chettle St
& Barrier Hwy

As an alternative to Pinch Point 10B, blades can take a sharper turn to avoid entering into the Perilya Mine-affiliated property (Lot 7313 of DP1185108) as much as possible. Significantly more civil works are required to extend a track from Sturt St, and also at Barrier Hwy.

4-5 trees will also need to be removed, and a power pole will need to be moved.

The track from Sturt St will pass through a separate private property (Lot 5834 of DP757298). Permission will be required from this landowner to build on and transport through their land.

The Perilya Mine property cannot be avoided entirely but the impact will be limited to a small corner of the lot. The fence should be realigned to allow blades to pass through.



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Pinch Point

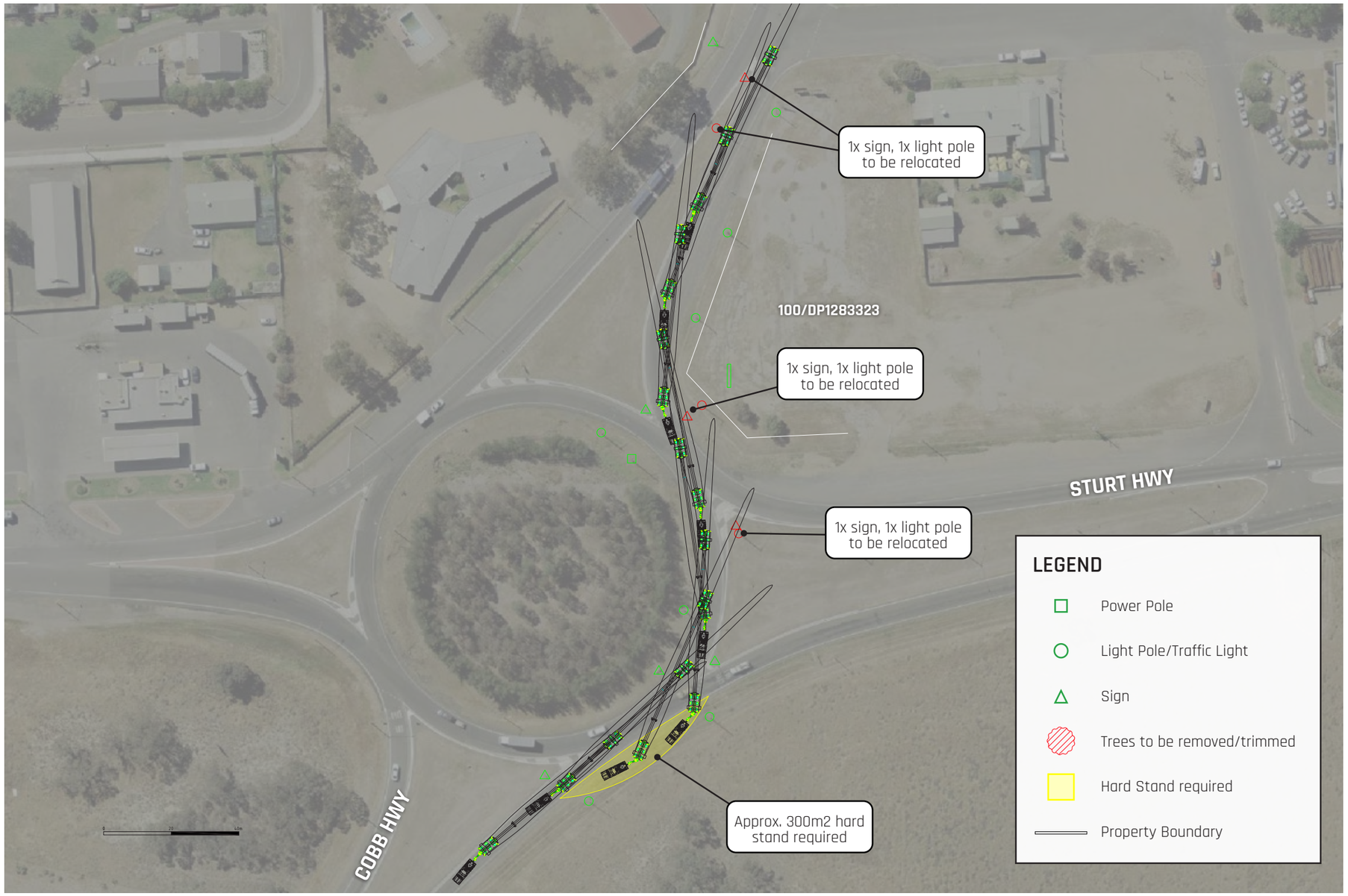
11

ROUNDABOUT
Cobb Hwy
& Sturt Hwy

The roundabout south of Hay will require a moderate amount of work prior to blade transport. Three light poles will need to be removed or relocated, and a number of signs made removeable.

The blade swing slightly overpasses the private property to the east (Lot 100 of DP1283323) which is a proposed service station currently under development. ARES reviewed the development plans and the blade tip should miss the 12m high signboard indicated on the plans.

There is also an option to take the wrong side of the roundabout, but after assessment this results in a similar amount of modifications but with a contraflow movement, which is not desirable. We recommend using the correct side as shown.



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List of Affected Landowners

The lots which either need to be accessed directly by trucks and trailers, or which are in the blade swept path, are listed below.



As part of our scope of work, we have run title searches on all properties or lots that will be affected by the transport route, as noted in the individual Pinch Points on preceding pages. South Australian Certificates of Title were obtained from the SA Integrated Land Information System (SAILIS). New South Wales Certificates of Title were obtained from the NSW Land Registry Services via Infocert.

Land owners are a mixture of the Crown, corporations and individuals.

All Certificates of Title will be provided separately to this report as an Appendix.

South Australia

Title Reference	Address	Pinch Point	Owner(s)
CT5063/663	19 Springbank Rd, Burra	07	Hichick Breeding Company P/L
CT6105/151	44 Copperhouse St, Burra	08	SA Government (DIT)
CT5419/54	LOT98 West St, Burra	08	Colin Alfred Phillips & Pauline Phillips
CT5695/294	LOT98 Cooper St, Burra	08	Regional Council of Goyder

New South Wales

Title Reference	Address	Pinch Point	Owner(s)
6667/DP822054	Pinnacles Rd, Broken Hill	09A	State of NSW
302/DP1242250	Barrier Hwy, Broken Hill	09	Willyama Common Trust
7307/DP1179131	Barrier Hwy, Broken Hill	09	State of NSW
7400/DP1179151	Kanandah Rd, Broken Hill	09	State of NSW
7401/DP1179151	Kanandah Rd, Broken Hill	09	State of NSW
7320/DP1185108	Menindee Rd, Broken Hill	10A	State of NSW
7313/DP1185108	Menindee Rd, Broken Hill	10A/10B/10C	State of NSW
5658/DP757298	Chettle St, Broken Hill	10B	State of NSW
7318/DP1185108	Menindee Rd, Broken Hill	10C	State of NSW
5834/DP757298	Chettle St, Broken Hill	10C	State of NSW
100/DP1283323	397 Moama St, Hay South	11	APC Hay P/L

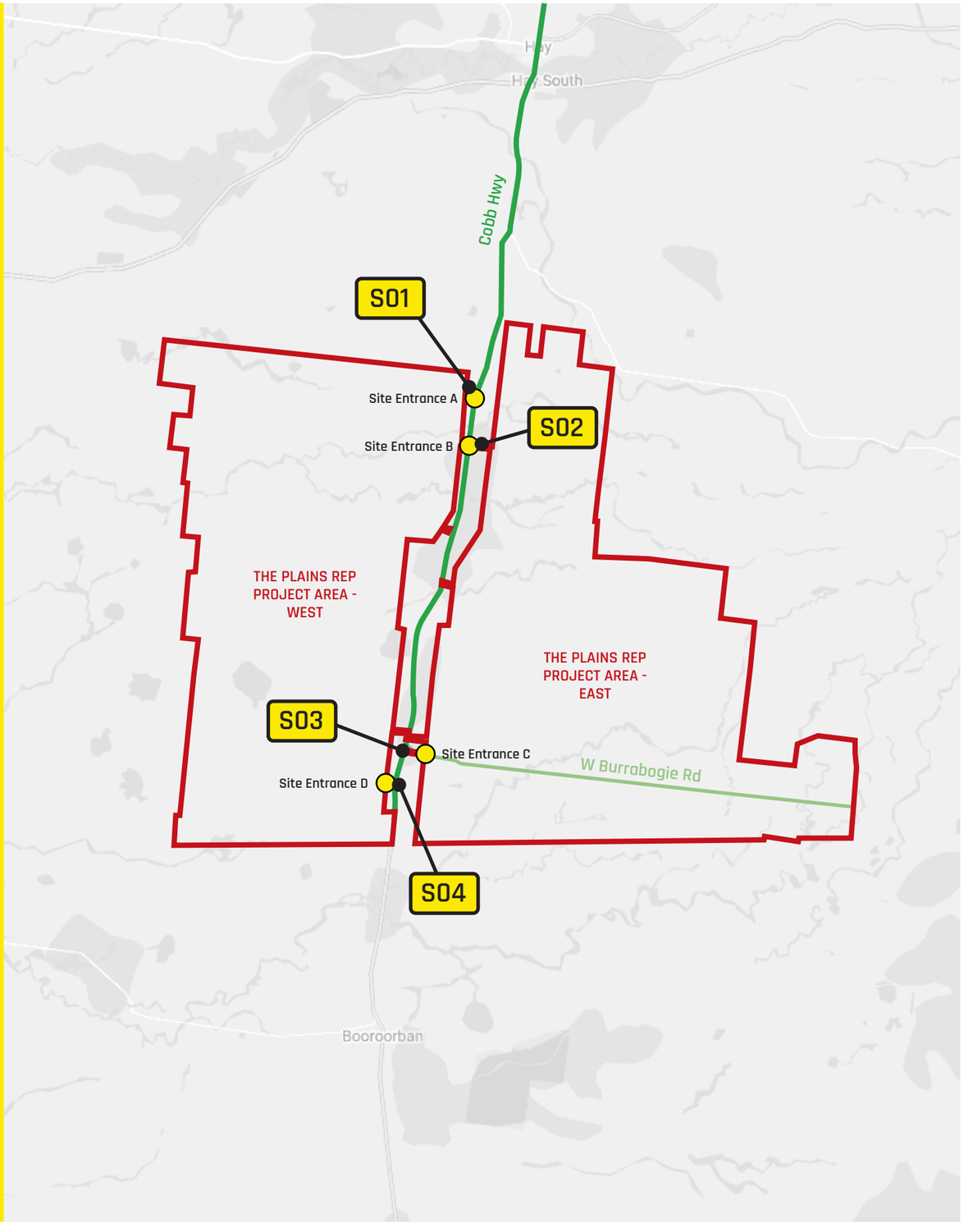
In the course of our searches we also noted a number of lots which seemed to be historical as they laid across existing roads. We have not performed title searches on these but have listed them for completeness below.

Title Reference	Address	Pinch Point
CT6144/634	12 Bishopstone Rd, Davoren Park	04
CT6144/635	12 Bishopstone Rd, Angle Vale	04
CT6144/636	LOT603 Angle Vale Rd, Angle Vale	04
CT5431/458	LOT1 Gawler North Ramp to Adelaide	05
Lots 5653 to 5657, DP757298	Sturt St, Broken Hill	10A/10B



03

Site Entrance Assessment



The Plains Site Entrances

There are four proposed site entrances to The Plains Renewable Energy Park project area, which spans both east and west sides of Cobb Hwy. They are, from north to south:

- Site Entrance A: Northern entrance to western precinct, turning directly off Cobb Hwy
- Site Entrance B: Northern entrance to eastern precinct, turning directly off Cobb Hwy
- Site Entrance C: Southern entrance to eastern precinct, off West Burrabogie Rd
- Site Entrance D: Southern entrance to western precinct, turning directly off Cobb Hwy

ARES examined the routes leading into each site entrance from Cobb Hwy as part of the survey.

SITE ENTRANCE A



SITE ENTRANCE B



SITE ENTRANCE C



SITE ENTRANCE D



Pinch Point

S01

RIGHT TURN
Cobb Hwy &
Site Entrance A

A new intersection will need to be built at this location turning right off the Cobb Hwy.

As the Cobb Hwy is a state road, WAD requirements will apply to modifications here.



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Pinch Point

S02

LEFT TURN
Cobb Hwy &
Site Entrance B

A new intersection will need to be built at this location turning left off the Cobb Hwy.

As the Cobb Hwy is a state road, WAD requirements will apply to modifications here.



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		DRAWING NAME: Route Survey	REV

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Pinch Point

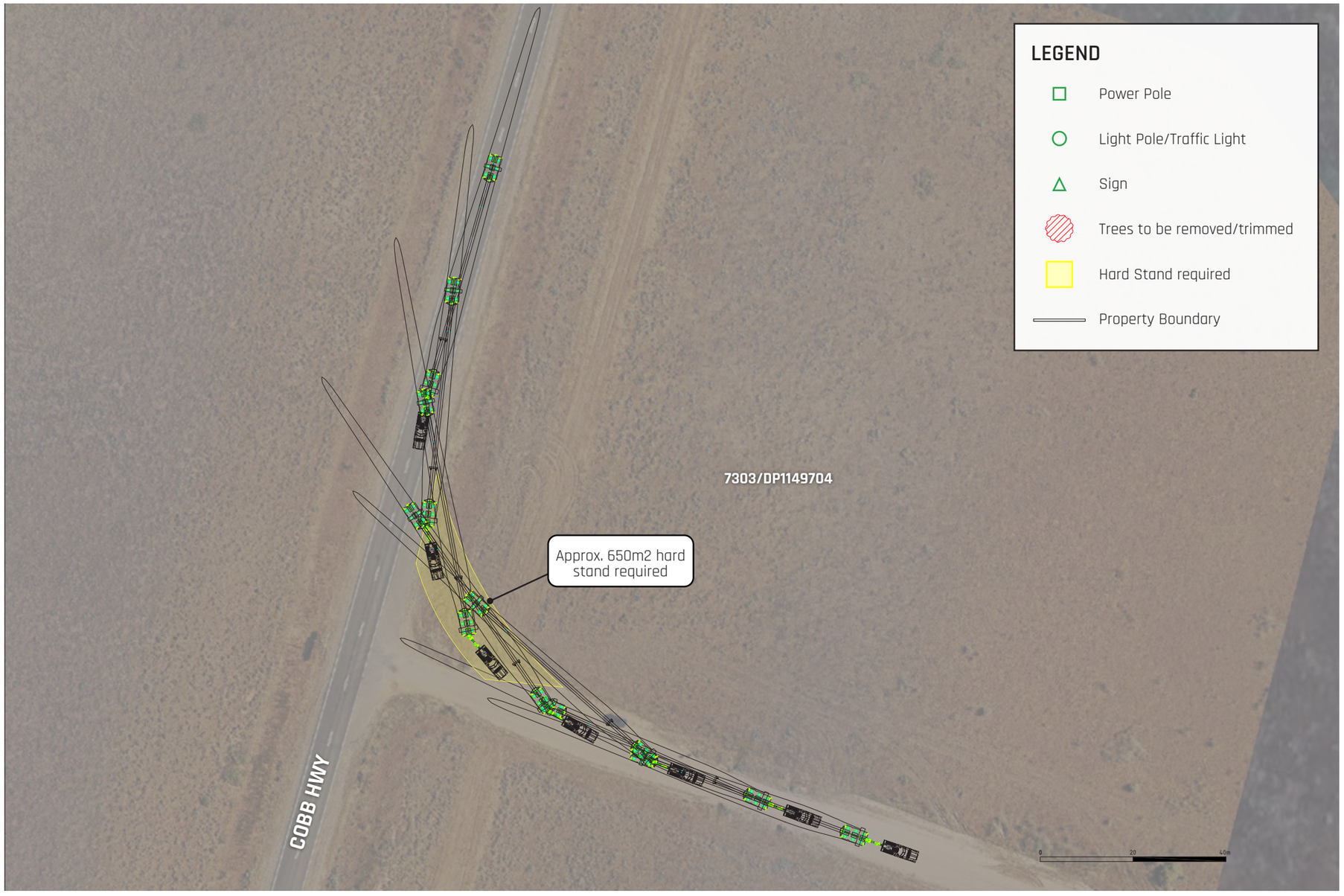
S03

LEFT TURN

Cobb Hwy &
W Burrabogie Rd

Site Entrance C is located at West Burrabogie Rd. The turn from Cobb Hwy onto this road will require some hard stand material to be laid down on the inside of the corner.

As the Cobb Hwy is a state road, WAD requirements will apply to modifications here.



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Pinch Point

S04

RIGHT TURN
Cobb Hwy &
Site Entrance D

A new intersection will need to be built at this location turning right off the Cobb Hwy.

As the Cobb Hwy is a state road, WAD requirements will apply to modifications here.



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04

Conclusion

Warradarge WF

A convoy of 3 blades leaves Henderson Port early in the morning on its way to site.

Conclusion

A brief outline of the report's major findings and any recommendations for actions to progress with the transport feasibility study.

> **...transport of 86m blades and 6.31m towers is feasible to The Plains R.E.P."**

Summary

Following our physical survey and swept path analysis, ARES believe that transport of turbine components including 86m GW86 blades and 6.31m towers is feasible from the **Port of Adelaide** to The Plains Renewable Energy Park.

Blades can be transported using state highways (Horrocks, Barrier and Cobb Hwys) with only minor detours. Modifications will be required at a number of pinch points, and some private land access will be required especially in the Broken Hill area, but there is no physical impediment to the blades along this route when using a conventional blade trailer setup.

For the tower sections, the overheight route from Adelaide is clear of any non-bypassable overhead structures. Overhead powerlines will need to be surveyed to gain an understanding of the quantity of lines requiring permanent lifting.

From a width perspective, travelling at 6.3m wide for such large distances will present challenges, but the quality of the roads being taken (overtaking lanes, rest areas, etc.) will mitigate these risks as much as reasonably practicable.

The Port of Adelaide is well suited to host the components for the project, having processed a number of significant wind projects in the recent past, including Goyder Wind Farm currently. Storage space is sufficient and the only concern would be if multiple wind projects were arriving into the port at the same time.

From the Stage 1 Desktop Assessment, Adelaide stood out as the best single-port solution for The Plains turbine components, and the physical survey and analysis has confirmed that it is an excellent option.

Next Steps

Based on the findings in this route survey, we recommend the following actions:

- Engage with transport authorities (DIT and TfNSW) for preliminary feedback on proposed routes
- Engage power authorities to perform overhead surveys in their respective jurisdictions
- Liaise with land owners affected by proposed routes
- Liaise with local councils along routes

Summary of Road Modifications

The following table lists all required modifications to allow transport of wind turbine components to take place.

Pinch Point	Road/Intersection	Modifications Required	Risk
01	Oceam Steamers Rd & Eastern Pde	Gate to be widened at storage area exit.	Low
02	Eastern Pde & Port River Expy	1 light pole and possibly 1 traffic light to be relocated (subject to blade tip positioning)	Medium
03	Port Wakefield Rd & Angle Vale Rd	Sections of W-beam barrier removed or replaced with removeable bollards, temporary hardstand to be laid down on median strips (approx. 900m2 total)	Medium
04	Angle Vale Rd & N-S Mwy	1 sign to be made removeable, 2 others to be checked for tip clearance	Low
05	Sturt Hwy & Horrocks Hwy	2 signs to be made removeable and 1 light pole to be relocated. Approx. 420m2 of temporary hardstand required.	High
06	Horrocks Hwy	Minor tree trimming south of Tarlee	Low
07	Barrier Hwy & Copperhouse Rd	2 signs to be made removeable, approx. 550m2 of temporary hardstand to be laid down	Medium
08	Copperhouse St & West St	Tree trimming and/or removal, approx. 150m2 of temporary hardstand to be laid down	High
09A/09B	Barrier Hwy @ BHSP	Construction of new temporary gravel bypass track to Gaffney St (approx. 5.5km). Track to be wind farm specification, i.e. min 5.5m width, suitable for min 14 tons per axle loading.	High
09C	Barrier Hwy 2.4km from Broken Hill	Construction of new temporary gravel bypass track to Gaffney St (approx. 3.7km). Track to be wind farm specification, i.e. min 5.5m width, suitable for min 14 tons per axle loading. New intersection off Barrier Hwy required. 1 sign to be moved.	Very High
10A	Crystal St & Sturt St	Temporary gravel track to be built through private land. Track to be wind farm specification, i.e. min 5.5m width, suitable for min 14 tons per axle loading. 1x sign to be made removeable.	High
10B	Chettle St & Barrier Hwy	Temporary gravel track to be built through private land. Track to be wind farm specification, i.e. min 5.5m width, suitable for min 14 tons per axle loading. An egress gate to be installed on Barrier Hwy.	Very High
10C	Sturt/Chettle St & Barrier Hwy	Temporary gravel track to be built through private land. Track to be wind farm specification, i.e. min 5.5m width, suitable for min 14 tons per axle loading. Multiple trees to be removed. 1 power pole to be relocated. Approx. 550m2 of temporary hardstand required. Fence to be realigned.	Very High
11	Cobb Hwy	3 light poles to be relocated, and 3 signs to be made removeable, 300m2 of temporary hardstand to be laid down	High



05

Appendices

Murra Warra WF

Deliveries to Murra Warra included towers up to 5.8m in diameter - the largest ever at the time.

ARTC Rail Crossing Requirements

From: ODL Permits
To: Gillian Etherington
Cc: Ian Wong; ODL Permits
Subject: RE: OSOM Rail enquiry for ARES / JMI
Date: Friday, 1 March 2024 2:06:06 PM
Attachments: image001.png
image002.png
ARTC Tower Route-Rail-Level-Crossing-Permit-Application-Form.pdf
ARTC Blade Route-Rail-Level-Crossing-Permit-Application-Form.pdf

---

Hi Gill

As discussed, ***this information is subject to change***, but as a guide I have listed the crossings being considered for this project and the dimensions limits that may make a difference to the necessary protection requirements from ARTC for the individual crossings.

Road Name	Area / Suburb	ALCAM No.	Track km	Line
Eastern Pde / Grand Trunkway	Gillman	1887	6.768	Dry Creek - Port Flat
Wilkins Hwy	Caltowie	854	60.795	Crystal Brook - Cockburn
Appila Rd	Jamestown	863	71.703	Crystal Brook - Cockburn
OD5 Rd	Jamestown	865	73.481	Crystal Brook - Cockburn
Angle Vale Rd	Virginia	72	36.815	Adelaide - Crystal Brook
Barrier Hwy	Ucolta	901	124.645	Crystal Brook - Cockburn
Barrier Hwy	Mingary	938	309.699	Crystal Brook - Cockburn
Cobb Hwy	Ivanhoe	1040	816.098	Goobang Junction - Broken Hill

Height
There are no overhanging assets at the above listed ARTC level crossings to be considered

Width
The maximum width before requiring a Rail Safety Worker (RSW) present is 6.45m. If you exceed this width, there will be certain crossings listed above that will be required to have a RSW in attendance each time to traverse.

Length
The length varies for each crossing, depending on their current settings. The length increments that may affect the safety requirements are 26m, 30m, 36.5m. Any loads 40m and above will require a RSW in attendance each time you traverse.

Weight
The level crossings listed above are ok for loads up to 150 tonnes, however the maximum axle weight should also be considered. Anything above 16 tonnes per axle will need closer assessment.

Please note that the longer loads (e.g. blades) will be required to provide a Travel Management Plan to ARTC with their permit application, outlining how they intend to traverse each level crossing (e.g. swept path, approach and exit angles)

Please note that if a Stop & Report permit is issued, the loads need to consider a safe location where they can make the call to our network control to gain clearance to traverse the crossings. ARTC are not responsible for these locations, but this needs to be considered when planning so the loads are not blocking the roads while awaiting approval from ARTC Network Control.

Warm Regards

Suzanne Marshall
Project Administrator
Third Party Works

General Enquiries:
P. 08 8112 0300
E. Admin.TPW@artc.com.au

Direct:
P. 08 8217 4435
M. 0484 249 187
E. SMarshall@ARTC.com.au

ODL Permit Applications:
P. 08 8112 0300
E. ODL.permits@artc.com.au

Australian Rail Track Corporation
11 Sir Donald Bradman Drive
Keswick Terminal
Mile End SA 5031

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From: Gillian Etherington <gill@millarinvestments.com.au>
Sent: Thursday, 29 February 2024 4:17 PM
To: ODL Permits <ODL.permits@ARTC.com.au>
Cc: Ian Wong <ian.wong@aresgroup.com.au>
Subject: [EXT] RE: OSOM Rail enquiry for ARES / JMI

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Hi Suzanne,

As discussed, this project has been approved but is still in planning stage.
There will be up to 226 wind turbines, transported in sections from Port of Adelaide to Booroorban, near Hay in NSW.
Please see attached application forms.
One for the Tower high load route – Route ID 1HG7Q-6 v2
One for the Blade long load route – Route ID 1HG7Q-6 v1

Our client is seeking an in-principal approval and/or written advice as to any special requirements (e.g supervision). There are some smaller loads within gazette dimensions also (5m wide, 5m high and 30m long).

Thank You

Aurizon Rail Crossing Requirements

From: Gillian Etherington
To: Ian Wong
Subject: FW: [EXTERNAL SENDER] OSOM Rail enquiry - ARES / JMI
Date: Monday, 18 March 2024 4:37:28 PM
Attachments: image003.png
image004.png
image005.png

Hi Ian,

Please see below from Aurizon.

Only two crossings.
One on Ocean Steamers Rd, pending which berth loads are imported from.
One at Snowtown for the towers up to 50m.

Stop and Report required when exceeding 50 metres.

Kind Regards,

GILLIAN ETHERINGTON
ARES GROUP
P: 1300 243 289 | M: +61 413 109 262
E: gillian.etherington@aresgroup.com.au | W: www.aresgroup.com.au

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From: Sims, Mark <Mark.Sims@aurizon.com.au>
Sent: Monday, March 18, 2024 4:12 PM
To: Gillian Etherington <gill@millarinvestments.com.au>
Subject: RE: [EXTERNAL SENDER] OSOM Rail enquiry - ARES / JMI

Hi Gillian,

Depending on what berth you are departing from on Ocean Steamers road, we have one level crossing that runs into Viterra that may or may not affect your passage.

If you are on the North side and traverse over it then we will need to put in a stop and report in place before crossing as your blade lengths are over 50 meters.

The other active Aurizon level crossing is at Snowtown that will be traversed by your 50 meter towers this is on the limit but should be fine.

AURIZON
Mark Sims
Service Coordinator Bulk South
Bulk
Bulk Central
T 0419032139 / M
1 Kidman Rd , Dry Creek, South Australia 5094
Mark.Sims@aurizon.com.au / aurizon.com.au

I know I choose Safe



From: Gillian Etherington <gill@millarinvestments.com.au>
Sent: Wednesday, 28 February 2024 8:56 AM
To: Sims, Mark <Mark.Sims@aurizon.com.au>
Subject: [EXTERNAL SENDER] OSOM Rail enquiry - ARES / JMI

You don't often get email from gill@millarinvestments.com.au. Learn why this is important

CAUTION - EXTERNAL SENDER: Exercise caution when clicking links or opening attachments. Do not enter your password to unexpected pop-up windows.

Hi Mark,

As recently discussed,
We have been engaged to assist with transport enquiries for a state significant renewable energy project.
We have researched most suitable routes for various oversize components from Port of Adelaide to The Plains, via Broken Hill..
Can you please advise of the Aurizon rail crossing requirements for the routes below?

Route 1 – required for overheight components. Overall width 6.31m, overall height 6.31m, overall length up to 50m.

Ocean Steamers Rd – Rail at Port of Adelaide
Eastern Parade
Port River Expy A9
Salisbury Hwy A9
Port Wakefield Rd/ Princes Hwy A1
Princes Hwy / Augusta Hwy A1- Rail at Snowtown
Wilkins Hwy B79 – Rail at Caltowie
Detour at Jamestown
    Via Apilla Rd – Rail
    Boundary Rd, Princes Hwy, RM Williams Rd
    OD 5 Rd - Rail
Wilkins Hwy B78
Jamestown Whyte-Yarcowie Rd
Whyte Road
Barrier Hwy A32 to Wilcannia - Rail at Ucolta, and Mingary
Cobb Hwy B75 to Booroorban, NSW – Rail at Ivanhoe

Route 2 – required for length. Overall width 5m, overall height 5m, overall length up to **100m**.

Ocean Steamers Rd – Rail at Port of Adelaide
Eastern Parade
Port River Expy A9
Northern Connector
Port Wakefield Rd/ Princes Hwy A1
Angle Vale Rd – Rail at Virginia
Northern Expy M2
Horrocks Hwy / Main Nth Rd B82 – Disused Rail at Roseworthy,
Barrier Hwy A32 – Disused Rail at Tarlee
Detour at Burra
    Via Copperhouse Rd, West St – Disused Rail
Barrier Hwy A32 to Wilcannia – Rail at Ucolta, and Mingary
Cobb Hwy B75 to Booroorban, NSW – Rail at Ivanhoe

I'll also be contacting ARTC.
If you need further information please let me know

Thank You

Kind Regards,

www.aresgroup.com.au

Ares Project Services PTY LTD
L105, 480 StKilda Rd
Melbourne VIC, 3004

P: 1300 243 289
F: +61 3 8560 7020
E: enquiries@aresgroup.com.au
W: www.aresgroup.com.au

APPENDIX B LIKELIHOOD OF OCCURRENCE ASSESSMENT

Identification		Status		Assessment	
Scientific Name	**Common Name**	**SA NPW Act**	**Comm. EPBC Act**	**Habitat Summary**	**Likelihood of Occurrence**
Birds					
Acanthiza iredalei rosinae	Slender-billed Thornbill (Gulf St Vincent)	V	V	Occupies samphire shrublands on narrow coastal saline mudflats often behind mangrove fringes. Appears to be highly selective of particular species of samphire. Although, the subspecies is capable of crossing some gaps of unsuitable habitat, gaps between sub-populations appear to be insurmountable.	Preferred habitat is not present however records indicate that roadsides can be suitable dispersal habitat. No records within the Sites but within species distribution. **Species unlikely to occur.**
Actitis hypoleucos	Common Sandpiper	R	Mi	Migratory, found across the world usually in temperate climates. In Australia, the Common Sandpiper is found in coastal or inland wetlands, both saline or fresh. It is found mainly on muddy edges or rocky shores. The species is often associated with mangroves, and sometimes found in areas of mud littered with rocks or snags. Generally the species forages in shallow water and on bare soft mud at the edges of wetlands but sometimes ventures into grassy areas adjoining wetlands.	Preferred habitat is not present however suitable habitat is present as grassy areas adjoining wetlands. There are records of the species within the locality of the pinch points near the Port of Adelaide. **Species has potential to occur.**
Aphelocephala leucopsis	Southern Whiteface	-	V	The southern whiteface is endemic to Australia and typically inhabits arid open woodlands with a shrubby or grassy understory, as well as grass plains throughout much of the continents south. Not present in Tasmania or in coastal areas of the mainland, this species prefers Acacia woodlands, particularly those dominated by mulga and drought-resistant chenopod shrub species, including saltbush and bluebush. They are considered sedentary; however, atlas records indicate that	Preferred habitat is not present however records indicate that roadsides can be suitable dispersal habitat. No recent records within the Sites but within species distribution. **Species unlikely to occur.**

Identification		Status		Assessment	
				individuals may move into wetter areas outside of their normal range during drought years.	
Biziura lobata menziesi	Musk Duck (Eastern)	R	-	The musk duck inhabits coastal shores, terrestrial wetlands, estuaries and sheltered inshore waters, preferring deep water with plenty of aquatic vegetation. The species is rarely seen on land.	Preferred and/or suitable habitat is not present. There are records of the species within the locality of the pinch points near the Port of Adelaide. **Species unlikely to occur.**
Botaurus poiciloptilus	Australasian Bittern	E	E	Favours permanent freshwater wetlands with tall, dense vegetation, particularly bullrushes (Typha spp.) and spikerushes (Eleocharis spp.). Feeding platforms may be constructed over deeper water from reeds trampled by the bird. Nests are built in secluded places in densely-vegetated wetlands on a platform of reeds.	Preferred and/or suitable habitat is not present. There are no records of the species within the locality of the Sites. **Species unlikely to occur.**
Bubulcus ibis coromandus	Eastern Cattle Egret	R	-	The Cattle Egret is widespread and common according to migration movements and breeding localities surveys. Two major distributions have been located; from north-east Western Australia to the Top End of the Northern Territory and around south-east Australia. Occurs in tropical and temperate grasslands, wooded lands and terrestrial wetlands. Forages away from water on low lying grasslands, improved pastures and croplands, commonly found in cattle fields and other farm areas that contain livestock. Roosts in trees, or amongst ground vegetation in or near lakes and swamps.	Preferred habitat is present as modified grasslands in proximity to water sources. There are a number of records within the locality of pinch points near the Port of Adelaide. **Species is likely to occur.**

Identification		Status		Assessment	
Calidris canutus	Red Knot	-	E, Mi	Mainly inhabits intertidal mudflats, sandflats and sandy beaches of sheltered coasts, in estuaries, bays, inlets, lagoons and harbours; sometimes on sandy ocean beaches or shallow pools on exposed wave-cut rock platforms or coral reefs. Occasionally seen on terrestrial saline wetlands near the coast, such as lakes, lagoons, pools and pans, and recorded on sewage ponds and saltworks, but rarely use freshwater swamps.	Preferred and/or suitable habitat is not present. There are no records of the species within the locality of the Sites. **Species unlikely to occur.**
Calidris ferruginea	Curlew Sandpiper	E	CE, Mi	Generally occupies littoral and estuarine habitats, also occurs in non-tidal swamps, lakes and lagoons on the coast and sometimes inland. It forages in or at the edge of shallow water, occasionally on exposed algal mats or waterweed, or on banks of beach-cast seagrass or seaweed. It roosts on shingle, shell or sand beaches; spits or islets on the coast or in wetlands; or sometimes in salt marsh, among beach-cast seaweed, or on rocky shores.	Preferred and/or suitable habitat is not present. There are no records of the species within the locality of the Sites. **Species unlikely to occur.**
Calidris melanotos	Pectoral Sandpiper	R	Mi	In Australasia, the Pectoral Sandpiper prefers shallow fresh to saline wetlands. The species is found at coastal lagoons, estuaries, bays, swamps, lakes, inundated grasslands, saltmarshes, river pools, creeks, floodplains and artificial wetlands. The species is usually found in coastal or near coastal habitat but occasionally found further inland. It prefers wetlands that have open fringing mudflats and low, emergent or fringing vegetation, such as grass or samphire.	Preferred and/or suitable habitat is not present. There are a number of records within the locality of pinch points near the Port of Adelaide. **Species unlikely to occur.**

Identification		Status		Assessment	
Calidris subminuta	Long-toed Stint	R	Mi	In Australia, the Long-toed Stint occurs in a variety of terrestrial wetlands. They prefer shallow freshwater or brackish wetlands including lakes, swamps, river floodplains, streams, lagoons and sewage ponds. The species is also fond of areas of muddy shoreline, growths of short grass, weeds, sedges, low or floating aquatic vegetation, reeds, rushes and occasionally stunted samphire. It has also been observed at open, less vegetated shores of larger lakes and ponds and is common on muddy frindges of drying ephemeral lakes and swamps. The Long-toed Stint also frequents permanent wetlands such as reserviors and artificial lakes. They are uncommon, but not unknown, at tidal estuaries, saline lakes, saltponds and bore swamps.	Preferred and/or suitable habitat is not present. There is one record within the locality of pinch points near the Port of Adelaide. **Species unlikely to occur.**
Coturnix ypsilophora australis	Brown Quail	V	-	Brown Quail are a rare species found throughout South Australia. They are found in denser, wetter environments than Stubble Quail, such as wet grassland and shrubland, cereal crops, stubble, coastal scrub, or dense vegetation fringing freshwater wetlands. Under favourable conditions the population may irrupt outside of its normal range into semi-arid and arid areas for short periods.	Preferred habitat is not present however suitable habitat is present as grassland in proximity to wetlands. There are records within the locality of the pinch points near the Port of Adelaide. **Species has potential to occur.**
Egretta garzetta nigripes	Little Egret	R	-	The species is an aquatic bird, feeding both on land and in shallow water. Their habitat varies widely, and includes the shores of lakes, rivers, canals, ponds, lagoons, marshes and flooded land, the bird preferring open locations to dense cover. On the coast it inhabits mangrove areas, swamps, mudflats, sandy beaches and reefs. It breeds colonially, often with other species of water birds.	Preferred habitat is not present however suitable habitat is present as grassland in proximity to wetlands. There are records within the locality of the pinch points near the Port of Adelaide. **Species has potential to occur.**

Identification		Status		Assessment	
Falco hypoleucos	Grey Falcon	R	V	The species frequents timbered lowland plains, particularly acacia shrublands that are crossed by tree-lined water courses. It has been observed hunting in treeless areas and frequents tussock grassland and open woodland, especially in winter.	Preferred habitat is not present however suitable habitat is present as treeless areas. There are no records within the locality of the Sites. **Species unlikely to occur.**
Falco subniger	Black Falcon	R	-	The Black Falcon inhabits a diverse range of habitats, ranging from shrublands and grasslands to woodlands and farmlands. The Black Falcon is typically known to occupy locations with streams and wetlands, using dead trees as perches for locating prey. Black falcon nests can be found alongside rivers and creeks.	Preferred habitat is not present however suitable habitat is present as modified grasslands in proximity to water sources. There are records within the locality of the pinch points near the Port of Adelaide. **Species has potential to occur.**
Falcunculus frontatus frontatus	Eastern Shriketit	R	-	Endemic to Australia. It occurs across southern Australia, in northern WA and in the Northern Territory. Occurs predominantly in Eucalypt woodlands and forests. This species has a predilection for Eucalypts with decorticating bark, their preferred foraging substrate, however they will occupy a wide range of woodland/forest communities, including those dominated by stringybarks.	Preferred habitat is not present however suitable habitat is present as small patches of roadside wooded grassland with eucalypts present. There is one record within the locality of the Pinch Point 5. **Species has potential to occur.**
Grantiella picta	Painted Honeyeater	R	V	The species inhabits mistletoes in eucalypt forests/woodlands, riparian woodlands of black box and river red gum, box-ironbark-yellow gum woodlands, acacia-dominated woodlands, paperbarks, casuarinas, callitris, and trees on farmland or gardens. The species prefers woodlands which contain a higher number of mature trees, as these host more mistletoes.	Preferred habitat is not present however suitable habitat is present as small patches of roadside wooded grassland with eucalypts, casuarina and acacia species present. There are no records within the locality of the Sites. **Species is unlikely to occur.**

Identification		Status		Assessment	
Hirundapus caudacutus	White-throated Needletail	-	V, Mi	The species is almost exclusively aerial, from heights of less than 1 m up to more than 1000 m above the ground. Certain preferences are exhibited by the species. Although they occur over most types of habitat, they are probably recorded most often above wooded areas, including open forest and rainforest, and may also fly between trees or in clearings, below the canopy, but they are less commonly recorded flying above woodland. They also commonly occur over heathland, but less often over treeless areas, such as grassland or swamps.	Preferred habitat is not present however suitable habitat is present as small patches of roadside wooded grassland. There are no records within the locality of the Sites. **Species is unlikely to occur.**
Leipoa ocellata	Malleefowl	V	V	Predominantly inhabit mallee communities, preferring the tall, dense and floristically-rich mallee found in higher rainfall (300 - 450 mm mean annual rainfall) areas. Utilises mallee with a spinifex understorey, but usually at lower densities than in areas with a shrub understorey. Less frequently found in other eucalypt woodlands, such as Inland Grey Box, Ironbark or Bimble Box Woodlands with thick understorey, or in other woodlands such dominated by Mulga or native Cypress Pine species. Recently burnt areas are used for foraging, with malleefowl taking advantage of increased herbage, while adjacent unburnt habitats are used for roosting, nesting, and daytime shelter.	Preferred habitat is not present however suitable habitat is present as small patches of roadside wooded grassland. There are no records within the locality of the Sites. **Species is unlikely to occur.**
Lewinia pectoralis pectoralis	Lewin's Rail (Eastern)	V	-	Inhabits ephemeral, fresh to saline wetlands with dense emergent or fringing vegetation, also uses artificial habitats with similar structural features. Prefers undisturbed vegetation along freshwater creeks and swamps with dense native vegetation, especially Typha, Phragmites, Leptospermum, Gahnia spp. and sedges.	Preferred and/or suitable habitat is not present. There are two records within the locality of pinch points near the Port of Adelaide. **Species unlikely to occur.**

Identification		Status		Assessment	
Limosa lapponica baueri	Nunivak Bar-tailed Godwit	R	V	The bar-tailed godwit occurs mainly in coastal habitats such as large intertidal sandflats, banks, mudflats, estuaries, inlets, harbours, coastal lagoons and bays. It has also been recorded in coastal sewage farms and saltworks, saltlakes and brackish wetlands near coasts, sandy ocean beaches, rock platforms, and coral reef-flats. Usually forages near the edge of water or in shallow water, mainly in tidal estuaries and harbours. They prefer exposed sandy or soft mud substrates on intertidal flats, banks and beaches. Does not breed in Australia.	Preferred and/or suitable habitat is not present. There are no records of the species within the locality of the Sites. **Species unlikely to occur.**
Melanodryas cucullata cucullata	South-eastern Hooded Robin	R	E	Prefers lightly wooded country, usually open eucalypt woodland, acacia scrub and mallee, often in or near clearings or open areas. Requires structurally diverse habitats featuring mature eucalypts, saplings, some small shrubs and a ground layer of moderately tall native grasses. Territories range from around 10 ha during the breeding season, to 30 ha in the non-breeding season.	Preferred habitat is not present however suitable habitat is present as small patches of roadside wooded grassland with eucalypt and acacia species. There are no records of the species within the locality of the Sites. **Species is unlikely to occur.**
Motacilla cinerea	Grey Wagtail	-	Mi	The species habitat occurs in artificial and terrestrial arable land, urban areas, temperate grasslands, and inland wetlands such as permanent freshwater lakes, and permanent rivers/ streams/ creeks.	Preferred habitat is present as urban areas with grasslands. There are no records of the species within the locality of the Sites. **Species has potential to occur.**
Motacilla flava	Yellow Wagtail	-	Mi	The species occurs in wet meadows, marshlands, grassy and muddy lakeshores. Also known to occur in arable land near livestock during migration season.	Preferred habitat is not present however suitable habitat is present as grassy land near livestock. There are no records of the species within the locality of the Sites. **Species is unlikely to occur.**

Identification		Status		Assessment	
Myiagra cyanoleuca	Satin Flycatcher	-	Mi	Satin Flycatchers inhabit heavily vegetated gullies in eucalypt-dominated forests and taller woodlands, and on migration, occur in coastal forests, woodlands, mangroves and drier woodlands and open forests. In south-eastern Australia, they occur at elevations of up to 1400 m above sea level.	Preferred and/or suitable habitat is not present. There are no records of the species within the locality of the Sites. **Species unlikely to occur.**
Neophema chrysogaster	Orange-bellied Parrot	E	CE	On the mainland, the Orange-bellied Parrot spends winter mostly within 3 km of the coast in sheltered coastal habitats including bays, lagoons, estuaries, coastal dunes and saltmarshes. The species also inhabits small islands and peninsulas and occasionally saltworks and golf courses. Birds forage in low samphire herbland or taller coastal shrubland. Breeds in forests on the west coast of Tasmania.	Preferred and/or suitable habitat is not present. There are no records of the species within the locality of the Sites. **Species unlikely to occur.**
Neophema chrysostoma	Blue-winged Parrot	V	V	Blue-winged Parrots inhabit a range of habitats from coastal, sub-coastal and inland areas, through to semi-arid zones. They tend to favour grasslands and grassy woodlands and are often found near wetlands both near the coast and in semi-arid zones. The species can also be seen in altered environments such as airfields, golf-courses and paddocks. While on the mainland, mobile flocks feed in saltmarsh and rough pasture in coastal areas. Birds are known to move more than 100 km inland during winter to feed in semi-arid chenopod shrubland and sparse grassland.	Preferred habitat is present as disturbed areas with grasslands and lightly wooded areas in proximity to watercourses. There are no records of the species within the locality of the Sites. **Species has potential to occur.**

Identification		Status		Assessment	
Pedionomus torquatus	Plains-wanderer	E	CE	Plains-wanderers inhabit sparse grasslands with 50% bare ground, with most vegetation less than 5 cm in height and some widely spaced plants up to 30 cm high. The species may occasionally use lower-quality habitat including cereal stubble but cannot persist in an agricultural landscape. Plains-wanderers are sedentary for as long as the habitat remains suitable. The nest is a hollow or 'scrape' that is scratched into the ground and lined with grass. In some instances, nearby grasses may be pulled over the nest to form a concealing cone or tent. The nests are placed amongst native grasses and herbs, or sometimes amongst crops.	Preferred habitat is not present however suitable habitat is present as grassy areas with patches of bare ground. There are no records of the species within the locality of the Sites. **Species is unlikely to occur.**
Pezoporus occidentalis	Night Parrot	E	E	The Night Parrot is known to occur within Spinifex grasslands in stony or sandy areas and samphire and chenopod associations on floodplains, salt lakes and clay pans. Suitable habitat is characterized by the presence of large and dense clumps of Spinifex, and it may prefer mature spinifex that is long and unburnt. The Night Parrot appears to be highly nomadic, moving in response to availability of food and water. The Night Parrot is a nocturnal bird that forages on the ground, becoming active during dusk and generally flies to water to drink prior to foraging. During the day it rests within clumps of spinifex.	Preferred and/or suitable habitat is not present. There are no records of the species within the locality of the Sites. **Species unlikely to occur.**
Plegadis falcinellus	Glossy Ibis	R	Mi	Within Australia, the Glossy Ibis is generally located east of the Kimberley in Western Australia and Eyre Peninsula in South Australia. The Glossy Ibis' preferred habitat for foraging and breeding are freshwater marshes at the edges of lakes and rivers, lagoons, flood-plains, wet meadows, swamps, reservoirs, sewage ponds, rice-fields and cultivated areas under irrigation. The species is occasionally found in coastal locations such as estuaries, deltas, saltmarshes and coastal	Preferred foraging and breeding habitat is not present however preferred roosting habitat is present as trees and shrubs near watercourses. There are two records within the locality of the pinch points near the Port of Adelaide. **Species is likely to occur.**

Identification		Status		Assessment	
				lagoons. Glossy Ibis roost in trees or shrubs usually near, but sometimes far, from water bodies.	
Rostratula australis	Australian Painted Snipe	E	E	Prefers fringes of swamps, dams and nearby marshy areas where there is a cover of grasses, lignum, low scrub or open timber. Forages nocturnally on mud-flats and in shallow water. Nests on the ground amongst tall vegetation, such as grasses, tussocks or reeds.	Preferred and/or suitable habitat is not present. There are no records of the species within the locality of the Sites. **Species unlikely to occur.**
Spatula rhynchotis	Australasian Shoveler	R	-	Shovelers are found in shallow wetlands with abundant emergent vegetation throughout the wetter south and east of the state, and on ephemeral lakes and wetlands inland. They can be found on freshwater, brackish and saline waters including inshore waters and estuaries. They are mainly sedentary but under drought conditions become dispersive and nomadic gathering in large numbers at certain locations.	Preferred and/or suitable habitat is not present. There are multiple records within the locality of pinch points near the Port of Adelaide. **Species unlikely to occur.**
Stagonopleura guttata	Diamond Firetail	V	V	Found in grassy eucalypt woodlands, including Box-Gum Woodlands and Snow Gum Eucalyptus pauciflora Woodlands. Also occurs in open forest, mallee, Natural Temperate Grassland, and in secondary grassland derived from other communities. Often found in riparian areas (rivers and creeks), and sometimes in lightly wooded farmland. Feeds exclusively on the ground, on ripe and partly-ripe grass and herb seeds and green leaves, and on insects (especially in the breeding season). Nests are globular structures built either in the shrubby understorey, or higher up, especially under hawk's or raven's nests. Birds roost in dense shrubs or in smaller nests built especially for roosting.	Preferred habitat is not present however suitable habitat is present as secondary grasslands and grassy eucalypt woodland patches. There are no records of the species within the locality of the Sites. **Species unlikely to occur.**

Identification		Status		Assessment	
Sternula nereis nereis	Australian Fairy Tern	E	V	The Fairy Tern (Australian) nests on sheltered sandy beaches, spits and banks above the high tide line and below vegetation. The subspecies has been found in embayments of a variety of habitats including offshore, estuarine or lacustrine (lake) islands, wetlands and mainland coastline. The bird roosts on beaches at night.	Preferred and/or suitable habitat is not present. There are no records of the species within the locality of the Sites. **Species unlikely to occur.**
Stictonetta naevosa	Freckled Duck	V	-	Freckled Ducks like freshwater lakes and marshes with lots of vegetation, both fringing and emergent. Out of the breeding season they may be found on flood plains and on coastal lagoons, even where the water is brackish or saline, but not on marine or estuarine habitats. Often seen in the south-east of South Australia, on the Fleurieu Peninsula and on ephemeral lakes in the interior. They may disperse more widely in good seasons.	Preferred and/or suitable habitat is not present. There are multiple records within the locality of pinch points near the Port of Adelaide. **Species unlikely to occur.**
Thinornis cucullatus cucullatus	Eastern Hooded Plover	V	V	The hooded plover (eastern) inhabits ocean beaches, particularly wide beaches backed by dunes with large amounts of seaweed, creek mouths and inlet entrances. It may also occur on near-coastal saline and freshwater lakes and lagoons, tidal bays and estuaries, on rock platforms, or on rocky or sandy reefs close to shore.	Preferred and/or suitable habitat is not present. There are no records of the species within the locality of the Sites. **Species unlikely to occur.**
Tringa glareola	Wood Sandpiper	R	Mi	The Wood Sandpiper uses well-vegetated, shallow, freshwater wetlands, such as swamps, billabongs, lakes, pools and waterholes. They are typically associated with emergent, aquatic plants or grass, and dominated by taller fringing vegetation, such as dense stands of rushes or reeds, shrubs, or dead or live trees, especially Melaleuca and River Red Gums Eucalyptus camaldulensis and often with fallen timber. They also frequent inundated grasslands, short herbage or wooded floodplains, where floodwaters are temporary or receding, and irrigated crops.	Preferred habitat is not present however suitable habitat is present as grasslands that can become inundated in proximity to wetlands. There are multiple records within the locality of pinch points near the Port of Adelaide. **Species has potential to occur.**

Identification		Status		Assessment	
Zoothera lunulata halmaturina	South Australian Bassian Thrush	-	E	The subspecies mostly inhabits damp eucalypt forest or woodland. Its habitat consists of densely forested areas and gullies, usually with a thick canopy overhead, a thick understorey of small trees and tall shrubs, and leaf-litter below. In much of the subspecies' range, suitable habitat is confined to creek lines or mallee swales where birds forage for worms among damp leaf litter. Damp habitats have been suggested to be particularly important in summer.	Preferred and/or suitable habitat is not present. There are no records of the species within the locality of the Sites. **Species unlikely to occur.**
Reptiles					
Aprasia pseudopulchella	Flinders Ranges Worm-Lizard	-	V	The Flinders Ranges Worm-lizard is known from the Flinders Ranges of South Australia, extending south to the western slopes and northern and central Mount Lofty Ranges. It is also found in the northern suburbs of Adelaide and the Mount Remarkable National Park. Burrows freely in loose sand and soil, under rocks and litter, occurs in open woodland, native tussock grassland, riparian habitats and rocky isolates. It prefers stony soils, or clay soils with a stony surface, and has been found sheltering beneath stones and rotting stumps. The species is sometimes found under ground debris and logs, or in ant and termite nests.	Preferred and/or suitable habitat is not present. There are no records of the species within the locality of the Sites. **Species unlikely to occur.**
Tiliqua adelaidensis	Pygmy Bluetongue	E	V	Pre-1992 specimens of the Pygmy Blue-tongue Lizard were collected in chenopod and mallee scrublands with compacting or crusty sandy soils associated with hollow mallee lignotubers, low stump hollows, near surface limestone sheets, and large slab floaters. The species was thought to burrow into moisture pockets in limestone sheeting, under outcroppings and slabs, between mallee lignotubers and sheeting, and into insect hollowed lignotubers and trunks. Post-1992 specimens have been found in a variety of habitats, ranging from highly degraded grasslands (dominated by	Preferred habitat is present as grasslands dominated by exotic species with potential to host spider burrows. There are a number of records of the species within the locality of Pinch Point 7. **Species is likely to occur.**

Identification		Status		Assessment	
				exotic grasses) to grasslands with high native biodiversity. The lizard uses empty spider burrows of wolf (lycosid) and trapdoor (mygalomorph) spiders as refuges, basking sites and hunting ambush sites.	
Flora					
Acacia glandulicarpa	Hairy-pod Wattle	E	V	The Hairy-pod Wattle occurs in semi-arid environments with a mean annual rainfall of 400–500 mm. Many sites coincide with gentle slopes at the transition zone between heavy clay/gravel soils on the flats and sandy soils on the rises. The species is generally uncommon, where Buloke is the dominant overstorey tree, and is sparse to absent where Broombush dominates the understorey. The Burra Creek Gorge population occurs in open scrub dominated by Red Mallee (Eucalyptus socialis), Chindoo mallee (E. brachycalyx) and Southern Cypress Pine (Callitris gracilis) and shrubland with an overstorey of Narrow-leaved Hopbush (Dodonaea viscosa subsp. angustissima), Clammy Daisy-bush and Felted Wallaby Bush (Beyeria lechnaultii).	Preferred habitat is not present however suitable habitat is present as open wooded area with eucalypt species in the overstorey. The Burra Creek Gorge population is within proximity to the locality of Pinch Point 8. **Species has potential to occur.**
Acacia iteaphylla	Flinders Ranges Wattle	R	-	Acacia iteaphylla occurs naturally in South Australia extending from the Flinders Ranges across to the Gawler Ranges and the Eyre Peninsula. Grows mainly on hills among rocky outcrops or in valleys along rocky creeks.	Preferred and/or suitable habitat is not present. There are records of the species within the locality of Pinch Points 5 and 8. **Species unlikely to occur.**

Identification		Status		Assessment	
Acacia menzelii	Menzel's Wattle	V	V	Menzel's Wattle is endemic to South Australia, where it occurs discontinuously from Mt Hack (Northern Flinders Ranges) to Brachnia, in the north, near Burra and to the Murray Bridge area in the south. Menzel's Wattle grows in calcareous, loamy substrate, where the average annual rainfall is 350-400 mm. It occurs as scattered shrubs; either on roadsides, or in low, open, shrubby woodland on more rocky sites which have only been partly cleared.	Preferred habitat is present as partly cleared roadsides, the species distribution overlaps with the locality of Pinch Point 8 only. There are no records of the species within this part of the Sites. **Species has potential to occur.**
Acacia pendula	Weeping Myall	V	-	Occurs west of the Great Divide from Emerald in central Queensland, south through New Sales Wales to the Victorian border. Occurrences in South Australia are isolated. Grows mainly on floodplains in fertile alluvial clay (and red earth soils in the south), sometimes dominant in woodland and open woodland.	Preferred habitat is not present however suitable habitat is present as open woodland. There is a record in the locality of Pinch Point 5. **Species has potential to occur.**
Acacia spilleriana	Spiller's Wattle	E	E	Spiller's Wattle is endemic to South Australia and occurs in the northern Mount Lofty Ranges and in the ranges around Burra and Auburn. Its range extends from Burra south to Tarlee and from Mount Templeton in the South Hummocks east to Robertstown. Grows on rocky hills, commonly along watercourses and roadsides. At Burra Gorge plants occur along the creekline and on the rocky slopes of the gorge. Roadside populations generally occur in cleared areas.	Preferred habitat is not present however suitable habitat is present as roadsides throughout cleared areas. There are no records of the species within the locality of the Sites. **Species is unlikely to occur.**
Acacia trineura	Three-nerve Wattle	E	-	Disjunct distribution, occurs on slopes and plains throughout New South Wales and Victoria, collections west of Lucindale in South Australia are assumed to be naturalised. Occurs sometimes near inland water, growing in red earths and clay, often in mallee communities.	Preferred and/or suitable habitat is not present. There is one record of the species within the locality of Pinch Point 6 that is likely a naturalised occurrence. **Species unlikely to occur.**

Identification		Status		Assessment	
Aristida australis		R	-	Restricted to 3 localised regions of South Australia – Southern Lofty, Lake Eyre and Eastern regions - on sandy soils. There is no information available regarding the ecology of the species.	Preferred and suitable habitat is not distinguished for this species. There are two records of the species within the locality of Pinch Point 4. **Species has potential to occur.**
Austrostipa multispiculis	Many-flowered Spear-grass	R	-	Restricted to east and south-eastern South Australia, grows primarily in desert or dry shrubland. No other information regarding the ecology of the species is available.	Suitable habitat is present as dry shrubland, there is a record of this species within the locality of Pinch Point 5. **Species has potential to occur.**
Caladenia argocalla	White-beauty Spider-orchid	E	E	Endemic to the Mount Lofty Ranges, assumed extinct over the southern half of its former range. Prefers open grassy Herbland under light, in mixed eucalypt and Callitris forest. Occurs on hills and slopes in open forest dominated by Casuarina stricta and eucalypt woodlands with a grassy understorey.	Preferred habitat is not present however suitable habitat is present as open wooded areas with eucalypt species in the overstorey. There are no records of the species within the locality of the Sites. **Species unlikely to occur.**
Caladenia tensa	Green-comb Spider-orchid	-	E	Distribution of the species across South Australia is widespread but uncommon, occurring in areas with limited rainfall on red-brown sandy loams on rises in open woodland dominated by Eucalyptus leucoxylon and Callitris preissii. Other habitats include Pine/Box woodland, heathy woodland and mallee woodland with rocky outcrops present.	Preferred habitat is not present however suitable habitat is present as open wooded areas with eucalypt species in the overstorey. There is one record of this species within the locality of Pinch Point 7. **Species has potential to occur.**

Identification		Status		Assessment	
Choretrum chrysanthum	Yellow Sour-bush	R	-	Occurs in south-east South Australia. Semi-parasitic. Occurs on sand, loam and sandy-clay soils in mallee and eucalypt woodland.	Suitable habitat is present as dry shrubland, there is a record of this species within the locality of Pinch Point 5. **Species has potential to occur.**
Codonocarpus pyramidalis	Slender Bell-fruit, Camel Poison	E	V	Occurs as scattered individuals across the Flinders Ranges, Northern Lofty Ranges and eastern South Australia. Grows along the crests of hills and ridges, slopes and along creeks, on loamy sand or sandy clay loam soils.	Preferred and/or suitable habitat is not present as the Sites occurs in flat areas outside of the species distribution. There are no records of the species within the locality of the Sites. **Species is unlikely to occur.**
Dianella longifolia var. grandis	Pale Flax-lily	R	-	Occurs under a variety of overstorey Eucalypt species but is a grassy woodland specialist, e.g., Blue Gum, Candlebark, Manna Gum, Stringybark, and Grey Box. Approximately half of the known distribution occurs within 2 km of confirmed or suspected Phytophthora infestations.	Preferred habitat is not present however suitable habitat is present as open wooded areas with eucalypt species in the overstorey. There is one record of this species within the locality of Pinch Point 6. **Species has potential to occur.**
Dodonaea procumbens	Trailing Hop-bush	V	V	In South Australia this species occurs near Port Lincoln, near Clare and near Burra, in the Mount Lofty Ranges and on Kangaroo Island. This species grows in low-lying, often winter-wet areas in woodland, low open forests, healthland and grasslands, on sands and clays. South Australian populations have been recorded in open Gum woodlands in low lying areas and in native grasslands.	Preferred habitat is not present however suitable habitat is present as open wooded and shrubland areas. There are no records of this species within the locality of the Sites. **Species is unlikely to occur.**

Identification		Status		Assessment	
Dodonaea subglandulifera	Peep Hill Hop-bush	E	E	The Peep Hill Hop-bush occurs in isolated localities in semi-arid areas of south-east South Australia. Occurs primarily on low hills on loamy soils associated with rocky outcrops throughout ranges and plains. Habitat types include low open woodland, open shrubland mallee with variable understorey. The average annual rainfall of the range of the Peep Hill Hop-bush is greater than 100 mm and less than 400 mm.	Preferred habitat is not present however suitable habitat is present as open wooded and shrubland areas. There are no records of this species within the locality of the Sites. **Species is unlikely to occur.**
Euphrasia collina subsp. osborni	Osborn's Eyebright	E	E	The species was once widespread in settled areas and common, but is now reduced to a few localised populations on roadsides, private land and cemeteries in South Australia. The species has generally been recorded as growing in mallee scrubland but has also been found growing in sclerophyll forest and sometimes in sclerophyll woodland. It is also found in heathy openings in wet sclerophyll forest and in a swamp at Mt Compass.	Preferred habitat is not present however suitable habitat is present as open wooded and shrubland areas. There are no records of this species within the locality of the Sites. **Species is unlikely to occur.**
Lachnagrostis limitanea	Spalding Blown-grass	E	E	Endemic to the Northern Lofty Ranges across four populations occupying an area under 1 hectare. The known habitat consists of low-lying, flood-prone clay loam near watercourses in swampy habitat. Associated native species includes rushes, sedges and samphire. The Tarlee subpopulation occurs on a rail reserve north of Tarlee, in the valley of the Gilbert River and is prone to seasonal flooding. The plant association at the site is a mixture of introduced and native grassland species, including Emu-grass (Distichlis distichophylla).	Preferred habitat is not present however suitable habitat is present as grasslands in proximity to watercourses. There is one record of the species within the locality of Pinch Point 6. **Species has potential to occur.**
Leptorhynchos elongatus	Lanky Buttons	E	-	Distribution is widespread but species is uncommon, usually found on sandy to sandy loam soils. Found in dry forest, woodland and grassland. Many records are located within cemeteries.	Preferred habitat is not present however suitable habitat is present as grasslands and lightly wooded areas. There is one record of the species within the locality of Pinch Point 5. **Species has potential to occur.**

Identification		Status		Assessment	
Logania saxatilis	Rock Logania	R	-	Locally frequent in open woodland communities on steep-sided sandstone gorges in crevices of rocky outcrops, in shallow sandy or clay-rich soils. The species tends to occur in disturbed localities with few individuals in each population.	Preferred and/or suitable habitat is not present within the Sites. There is a record of the species within the locality of Pinch Point 8. **Species is unlikely to occur.**
Maireana decalvans	Black Cotton-bush	E	-	This species is found on scattered on heavy seasonally waterlogged soils, clays and other heavy, fertile soils chiefly along the Murray River floodplain downstream of about Echuca, but with more southerly occurrences in the mid-west of the state (e.g. Horsham, Maryborough, St Arnaud) and in the Melbourne-Bacchus Marsh area. Often a coloniser of disturbed ground as a pioneer species.	Preferred habitat is not present however suitable habitat is present as grasslands and lightly wooded areas. There are historic records of the species within the locality of the Sites. **Species has potential to occur.**
Mentha satureioides	Native Pennyroyal	R	-	Native to southern and eastern Australia. Grows in sandy-clay to clay-rich soils, frequently in grassy areas and in open woodland communities.	Preferred habitat is not present however suitable habitat is present as grasslands and lightly wooded areas. There are records of the species within the locality of Pinch Points 6 and 8. **Species has potential to occur.**
Olearia pannosa subsp. pannosa	Silver Daisy-bush	V	V	The silver daisy-bush is endemic to South Australia where it is scattered throughout agricultural areas. Occurs in sandy, flat areas and in hilly, rocky areas in woodland or mallee. On the Eyre Peninsula it has been found in eight mallee, woodland, shrubland and open forest vegetation associations. In the Adelaide and Mount Lofty Ranges area it has been recorded in seven mallee, woodland and shrubland vegetation associations	Preferred habitat is not present however suitable habitat is present as lightly wooded and shrubland areas in proximity to agricultural areas. There are no records of this species within the locality of the Sites. **Species is unlikely to occur.**

Identification		Status		Assessment	
Prasophyllum pallidum	Pale Leek-orchid	R	V	Pale Leek-orchid is known singly or in groups in well-grassed woodland or open forests from the Flinders Ranges to the Northern and Southern Lofty regions of South Australia. Other habitats include heathy woodland low woodland and low open forest.	Preferred habitat is not present however suitable habitat is present as lightly wooded and shrubland areas in proximity to agricultural areas. There are no records of this species within the locality of the Sites. **Species is unlikely to occur.**
Prasophyllum pruinosum	Plum Leek-orchid	E	E	The Plum Leek-orchid is endemic to South Australia, where it has been recorded in the Adelaide and Mount Lofty Ranges Region. Recorded in a range of open woodland habitats usually with an overstorey of Eucalyptus fasciculosa, E. leucoxylon, Acacia leucoxylon and Callitris gracilis. Grows on a range of soil types including sandy loams to heavy clays.	Preferred habitat is not present however suitable habitat is present as lightly wooded and shrubland areas in proximity to agricultural areas. There are no records of this species within the locality of the Sites. **Species is unlikely to occur.**
Prasophyllum validum	Sturdy Leek-orchid	V	V	Very little is known of the biology and ecology of the Sturdy Leek-orchid. Occurs across inland Victoria and South Australia with a major disjunction between the states populations. Tends to grow in drier woodland habitats with a low sparse understorey. In South Australia the species occurs in Eucalyptus cladocalyx woodland with porcupine grass Triodia species understorey, on loamy soils. Some sites were the species persists has been exposed to disturbance by fire, stock grazing and clearing.	Preferred habitat is not present however suitable habitat is present as lightly wooded areas. There are no records of this species within the locality of the Sites and the Sites is outside of the known distribution of the species. **Species is unlikely to occur.**

Identification		Status		Assessment	
Senecio macrocarpus	Large-fruit Fireweed	V	V	Large-fruit Fireweed is currently distributed as one very large population in Messent Conservation Park in South Australia and smaller populations throughout the state. In South Australia, Large-fruit Fireweed occurs most commonly in depressions in low lying closed sedgeland but may occur in sedgeland, herbland, low shrubland to low open woodland where competition from understorey plants is low.	Preferred and/or suitable habitat is not present within the Sites. There are no records of the species within the locality of the Sites. **Species is unlikely to occur.**
Senecio megaglossus	Superb Groundsel	E	V	The species is mostly confined to rocky creek banks, gorges and valley slopes, with past records also including creek beds, drainage lines, erosion gullies, sandhills and arid hills. Grows on a range of soil types including yellow-red-grey-brown coloured loams. A number of sites feature scattered rocks and outcrops of metasiltstone.	Preferred and/or suitable habitat is not present within the Sites. There are no records of the species within the locality of the Sites. **Species is unlikely to occur.**
Swainsona pyrophila	Yellow Swainson-pea	R	V	The Yellow Swainson-pea grows in mallee scrub on sandy or loamy soil and is usually found to germinate only after fire and subsequent rain, although scraping of seed via soil disturbances such as grading can also stimulate germination. The species has been found after fires in a range of areas in South Australia where not previously seen.	Preferred and/or suitable habitat is not present within the Sites. There are no records of the species within the locality of the Sites. **Species is unlikely to occur.**
Tecticornia flabelliformis	Bead Glasswort	V	V	The Bead Glasswort is widespread but scattered in saltmarsh vegetation across southern mainland Australia; the species is recorded in South Australia in the Flinders Lofty Block and Murray Darling Depression bioregions. Generally occurs on the margins of salt lakes, saline flats, evaporation pans and coastal salt marshes and directly behind coastal dunes.	Preferred and/or suitable habitat is not present within the Sites. There are no records of the species within the locality of the Sites. **Species is unlikely to occur.**

Identification		Status		Assessment	
Thelymitra matthewsii	Spiral Sun-orchid	E	V	Thelymitra matthewsii is currently known to occur in Vic., SA and NZ. Throughout its range the species is rare and of sporadic distribution. Favours open forests and woodlands in well-drained sand and clay loams. Requires disturbance and is commonly found in open areas around old quarries, gravel pits, road verges and disused tracks.	Preferred habitat is present as disturbed road verges however there are no records within the Sites. The first 3 pinch points only fall within the known distribution for the species. **Species has potential to occur.**
Threatened Ecological Communities					
Iron-grass Natural Temperate Grassland of South Australia		-	CE	The Iron-grass Natural Temperate Grassland of South Australia ecological community extends from the western bank of the Murray River, through the Lofty Ranges and north to Mount Brown Conservation Park, west of Carrieton. The community occurs on gentle slopes of low hills above 380 m altitude on loams and clay loams. Trees and tall shrubs are generally absent and tussock-forming perennial grasses and Iron-grasses dominate the ground layer. A range of herbaceous plant species occur in the inter-tussock spaces.	Key dominant ground cover species of the ecological community are not present and the nature of the Sites makes it unsuitable to support an ecological community. **Threatened ecological community is unlikely to occur.**
Peppermint Box (Eucalyptus odorata) Grassy Woodland of South Australia		-	CE	This ecological community is dominated by Eucalyptus odorata with other canopy species including E. microcarpa, E. leucoxylon, E. cladocalyx, E. porosa, Allocasuarina verticillata, Callitris glaucophylla and C. preissii. Occurs as an open to dense woodland with the canopy comprised of low trees (5 – 10 m tall). The understorey mainly comprises grasses and herbs. In open sites this is found as a relatively dense and diverse layer, with a sparse layer found under more densely wooded sites. The shrub layer is sparse, with cover up to 30%. Occurs from the southern Flinders Ranges to Lake Alexandrina.	Key dominant canopy species of the ecological community are not present, the physical structure is not present and the nature of the Sites makes it unsuitable to support an ecological community. **Threatened ecological community is unlikely to occur.**

Identification	Status		Assessment	
Subtropical and Temperate Coastal Saltmarsh	-	V	This community occurs within a narrow margin of the coastline within the subtropical and temperate climatic zones from south-east Queensland, following the east and south coastlines up to Shark Bay in Western Australia. In the south, saltmarsh is often the main vegetation-type of the intertidal zone, often associated with estuaries. The community is mainly associated with soft substrate shores of estuaries and embayments on open, low wave energy coasts.	While the Sites is in proximity to, it is not associated with any coastal areas. There is no shoreline or saltmarsh present within the Sites. **Threatened ecological community is unlikely to occur.**

APPENDIX B THE PLAINS WIND FARM – HAUL ROUTE ASSESSMENT: NEW SOUTH WALES BIODIVERSITY DUE DILIGENCE

PREPARED FOR

The Plains Wind Farm – NSW Haul Route Assessment

Biodiversity Due Diligence

DATE
05/04/2024

REFERENCE
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The Plains Wind Farm – NSW Haul Route Assessment

Biodiversity Due Diligence

00667692



Jessica Gardner
Ecologist



Mark Aitkens
Principal Ecologist



Joanne Woodhouse
Principal Consultant/Project Manager



Mark Davey
Partner

Environmental Resources Management
Australia Pty Ltd
Level 14, 207 Kent Street
Sydney NSW 2000

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APPENDIX A THE PLAINS R.E.P.: OSOM ROUTE STUDY VIA ADELAIDE – ARES 2024

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ACRONYMS AND ABBREVIATIONS

Acronyms	Description
NSW	New South Wales
GW	gigawatt
MW	megawatt
AC	Alternating current
DC	Direct current
BESS	Battery energy storage system
hr	hour
km	kilometre
REZ	Renewable Energy Zone
kV	Kilovolt
ERM	Environmental Resources Management Australia Pty Ltd
SA	South Australia
BC Act	Biodiversity Conservation Act 2016
EPBC Act	Commonwealth Environment Protection and Biodiversity Conservation Act 1999
EIS	Environmental Impact Statement
ha	hectares
WTG	Wind turbine generators
PV	Photovoltaic
GWhr	gigawatt hours
m	metres
IBRA	Interim Biogeographic Regionalisation for Australia
OSOM	Over-size over-mass
MNES	Matters of National Environmental Significance
DCCEEW	Commonwealth Department of Climate Change, Energy, the Environment and Water
TEC	Threatened ecological community
BOS	Biodiversity Offsets Scheme
BAM	Biodiversity Assessment Method 2020
SSD	State significant development
SSI	State significant infrastructure

Acronyms	Description
DPIE	Department of Planning, Industry and Environment
BDAR	Biodiversity Development Assessment Report
LLS Act	Local Land Services Act 2013
LGA	Local government area
FM Act	Fisheries Management Act 1994
DPI	Department of Primary Industries
ALA	Atlas of Living Australia
MSES	Matters of State Environmental Significance
DPE	Department of Planning and Environment
PCT	Plant community type
TBDC	The BioNet threatened biodiversity profiles data collection
BAM-C	The Office of Environment and Heritage BAM calculator

1. INTRODUCTION

This Biodiversity Due Diligence Assessment has been prepared on behalf of Engie Australia Pty Ltd (the Applicant) relating to the proposed transport route for the delivery of wind farm components for The Plains Wind Farm (the Project). The Project is located roughly 15 km south of Hay. The blade and tower components of the Project wind turbines will require transport along a transport route between the Port of Adelaide and the Project site, via Broken Hill, NSW.

This report includes assessment of three (3) pinch points identified along the transport route where upgrades or modifications are proposed within New South Wales (NSW) (the Study Area, refer to Figure 1-).

The purpose of this assessment is to characterise the biodiversity values within the indicated areas of each pinch point that may be subject to native vegetation removal. The assessment further aims to identify the occurrence of (or habitat for) any species, populations or ecological communities that are listed as threatened under *Biodiversity Conservation Act 2016* (BC Act) or the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

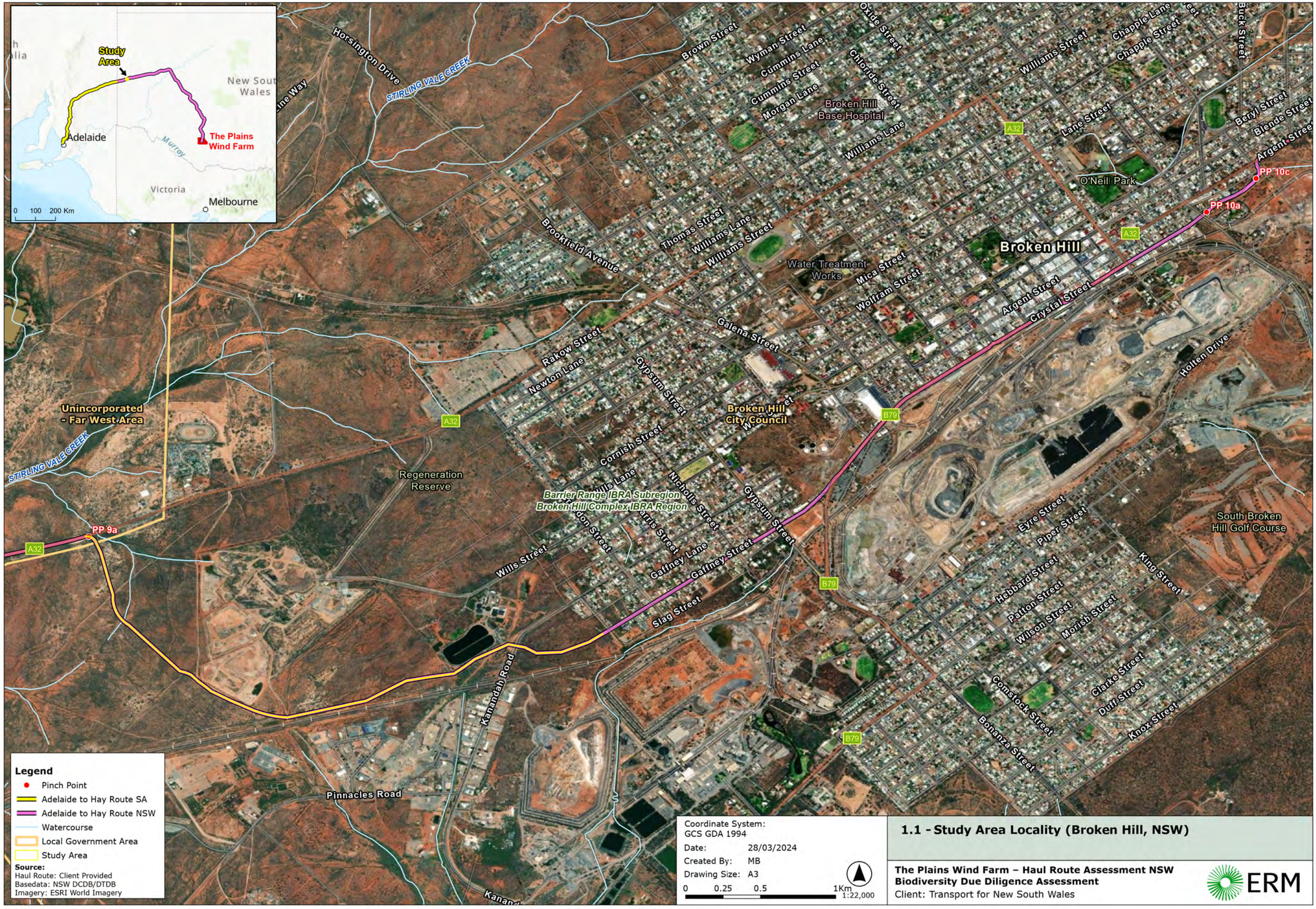
This assessment has been prepared to support the Biodiversity Development Assessment Report (BDAR) associated with the Project. The assessment was informed by a combination of desktop reviews, database searches and fieldwork completed between 17th and 21st July 2023.

1.1 BACKGROUND

The Plains Wind Farm is located near Hay, New South Wales (NSW). The Project will consist of up to 188 wind turbine generators (WTGs) with a proposed height (to tip of vertical blade) of up to 270 m (hub height 180 m, blade length 90 m). The blade and tower components of the wind turbines will require transport on oversize overmass (OSOM) vehicles between the Port of Adelaide and the Project site, via Broken Hill, NSW.

The proposed transport route will head north from Port Adelaide travelling via the Port Wakefield Highway, North-south Motorway, Horrocks Highway, Barrier Highway, then on to the Cobb Highway before finishing at the Project site. The proposed rate of transport of wind turbines during construction is 2 complete turbines per week, the total duration of OSOM transport is estimated to be approximately 2 years.

Eleven (11) pinch points were identified in the transport route assessment (ARES Group, 2024; Appendix A). Three (3) of these pinch points are located in NSW, with the remaining eight (8) in South Australia (SA). This Biodiversity Due Diligence Assessment refers only the pinch points located in NSW, the pinch points located in SA will be discussed within a standalone report, currently being prepared by Environmental Resources Management Australia Pty Ltd (ERM). The locality of the Project and Study Area can be seen in Figure 1-Figure 1- and Figure 1-.



Legend

- Pinch Point
- Adelaide to Hay Route SA
- Adelaide to Hay Route NSW
- Watercourse
- Local Government Area
- Study Area

Source:
Haul Route: Client Provided
Basedata: NSW DCDB/DTDB
Imagery: ESRI World Imagery

Coordinate System:
GCS GDA 1994

Date: 28/03/2024
Created By: MB
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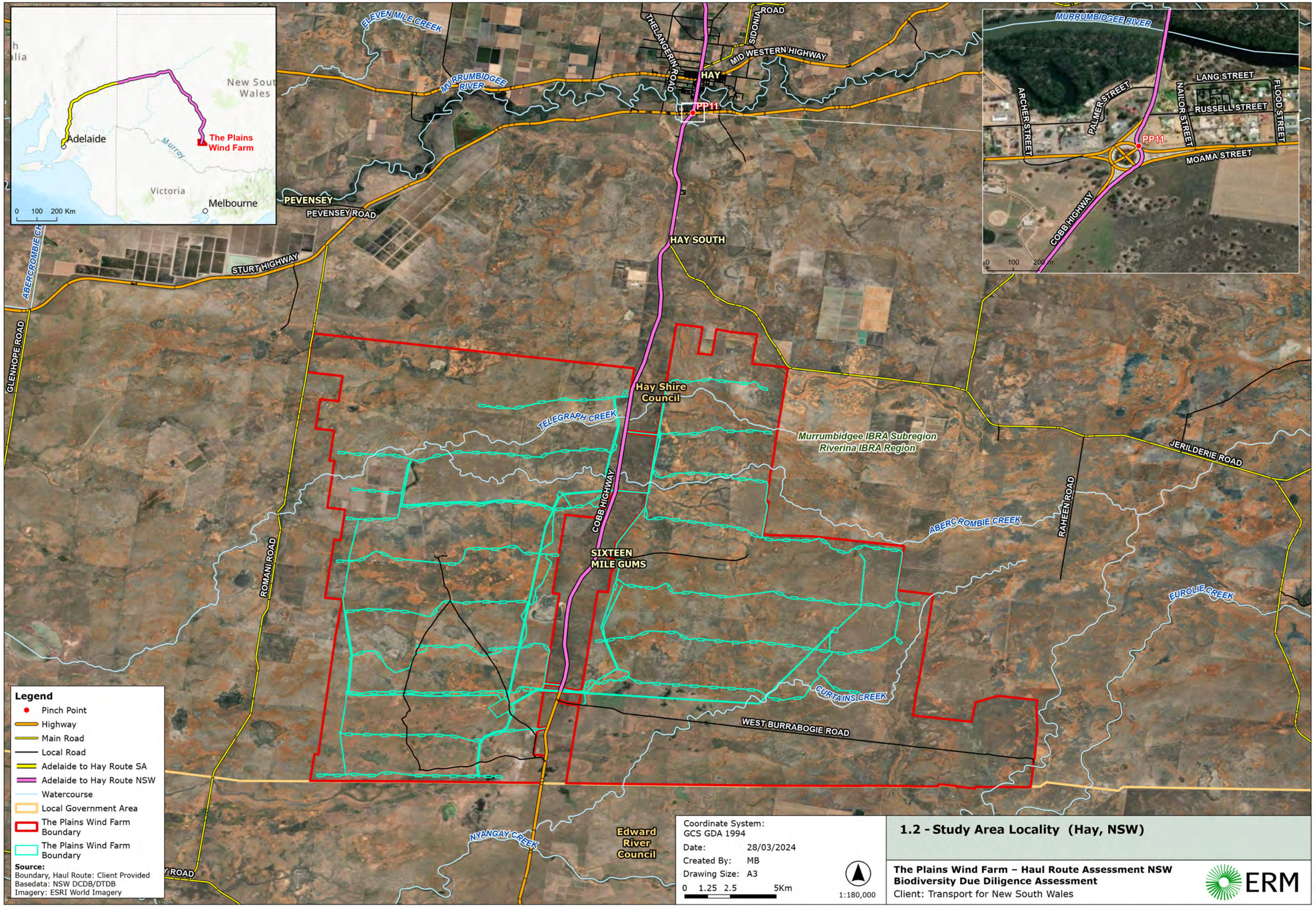
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1.1 - Study Area Locality (Broken Hill, NSW)

The Plains Wind Farm – Haul Route Assessment NSW
Biodiversity Due Diligence Assessment
Client: Transport for New South Wales

ERM

0667692_HaulRoute_NSW_BioDD_R01.aprx



Legend

- Pinch Point
- Highway
- Main Road
- Local Road
- Adelaide to Hay Route SA
- Adelaide to Hay Route NSW
- Watercourse
- Local Government Area
- The Plains Wind Farm Boundary
- The Plains Wind Farm Boundary

Source:
Boundary, Haul Route: Client Provided
Basedata: NSW DCDB/DTDB
Imagery: ESRI World Imagery

Coordinate System: GCS GDA 1994
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1.2 - Study Area Locality (Hay, NSW)

The Plains Wind Farm – Haul Route Assessment NSW
Biodiversity Due Diligence Assessment
Client: Transport for New South Wales

ERM

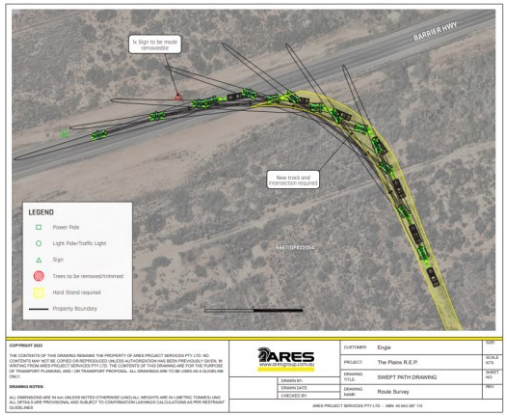
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1.2 HAULAGE ROUTE LOCATION AND JUSTIFICATION

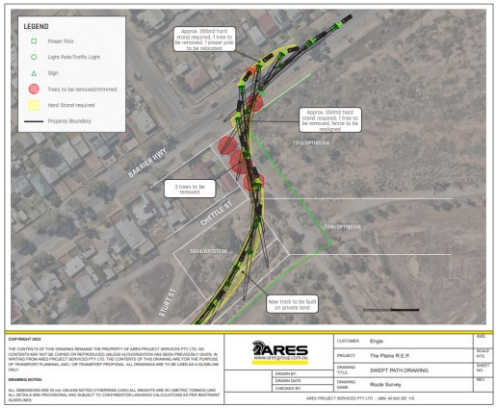
A transport route assessment was undertaken for the Project (ARES Group, 2024; Appendix A). This assessment identified the preferred port for the importation of the Project components as the Port of Adelaide. This port is currently being used by several wind farm projects and has the capacity and laydown area required for the Project. Two routes are proposed from the Port to the Project site; the blade route which requires modification and has 11 pinch points identified and the tower route (Figure 1-1). The tower route has no pinch points and no biodiversity impacts, this route is not discussed further.

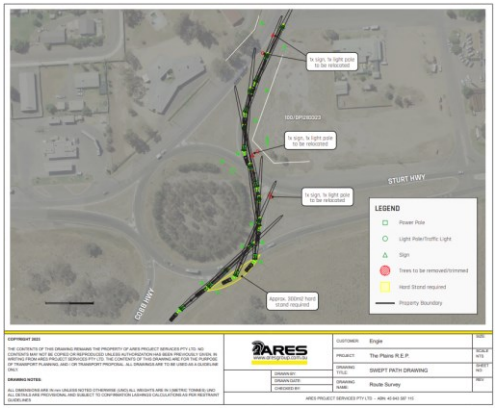
The three NSW pinch points and their respective works required to facilitate blade transport are summarised below in Table 3.1. A full description of the required works is provided within Appendix A.

TABLE 1-1 PINCH POINTS AND SCOPE OF WORKS

Pinch Point	Location and Biodiversity Values	Description of Works	Image from oversize and/or Over Mass (OSOM Route Study (Ares, 2023)	Image from ERM Site Inspection
09A	Right turn: Barrier Hwy 5pprox.. 2.4 km from Broken Hill	Located in the town of Broken Hill, OSOM vehicles will arrive from the south-west via the Barrier Hwy and need to exit via the Silver City and Barrier Hwys to the north-east. The proposed bypass makes use of existing tracks which come off the Barrier Hwy at around 2.4 km west of Broken Hill town. There is no existing intersection. As such a new intersection will have to be designed and constructed. A temporary track will need to be built to link the entry into Barrier Hwy to the exit point toward Gaffney St. This will pass through Crown land near the Broken Hill Community Recycling Centre. Vegetation will need to be removed to establish the intersection and wide existing tracks.		

Pinch Point	Location and Biodiversity Values	Description of Works	Image from oversize and/or Over Mass (OSOM Route Study (Ares, 2023)	Image from ERM Site Inspection
10A	Right turn: Crystal St and Sturt St, Broken Hill NSW	Located in the town of Broken Hill, OSOM vehicles will arrive from the south-west via the Barrier Hwy and need to exit via the Silver City and Barrier Hwys to the north-east. The upgrade will require a temporary track to link the end of Crystal St with Sturt St across Menindee Rd. This will pass through Crown land and will require a moderate amount of civil works to make the surface suitable for a road base. There is a power pole which can be avoided, but a tree will need to be removed along with a few road signs being made removeable. Vegetation will need to be removed from an area of bushes and shrubs adjacent to Sturt Street.		

Pinch Point	Location and Biodiversity Values	Description of Works	Image from oversize and/or Over Mass (OSOM Route Study (Ares, 2023)	Image from ERM Site Inspection
10B	Right turn: Chettle St and Barrier Highway, Broken Hill NSW	A temporary track will need to be built to link the end of Chettle St to the Barrier Hwy/Argent St. This will pass through Crown land near the Junction Mine, which is non-operational. A new gate will have to be put in at the exit point into Barrier Hwy/Argent St Engagement with the Environmental Officer from Perilya Mine confirmed that the area had undergone restoration with some plantings in the area occurring over the past decades.		
10C	Right turn: Sturt/Chettle St and Barrier Hwy	As an alternative to Pinch Point 10B, OSOM vehicles transporting blades can take a sharper turn to avoid entering the Perilya Mine-affiliated property (Lot 7313 of DP1185108) as much as possible. Significantly more civil works are required to extend a track from Sturt St, and also at Barrier Hwy. 4-5 trees will need to be removed, and a power pole will need to be moved. The track from Sturt St will pass through a separate private		N/A

Pinch Point	Location and Biodiversity Values	Description of Works	Image from oversize and/or Over Mass (OSOM Route Study (Ares, 2023)	Image from ERM Site Inspection
		property (Lot 5834 of DP757298). Permission will be required from this landowner to build on and transport through their land. The Perilya Mine property cannot be avoided entirely but the impact will be limited to a small corner of the lot. The fence should be realigned to allow blades to pass through		
11	Roundabout: Cobb Hwy and Sturt Hwy, Hay NSW.	Three light poles will need to be removed or relocated, and a number of signs made removeable. A hard stand will be required of approximately 300 m^2. As OSOM vehicles navigate the roundabout, the blade swing passes over the private property to the east which is a proposed service station currently under development. ARES Group (2024) reviewed the development plans and the blade tip should miss the 12 m high signboard indicated on the plans.		

2. LEGISLATION

Table 2- below provides a description of the relevant legislative context for the Project, and subsequently the proposed transport route. This report addresses the objectives and requirements of the legislation as it relates to the identification of biodiversity and ecological values for the route only.

TABLE 2-1 LEGISLATIVE CONTEXT

Commonwealth Legislation
Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)
The EPBC Act specifies the need for approval by the Commonwealth Minister for the Environment for actions that are likely to have a significant impact on Matters of National Environmental Significance (MNES) as assessed in accordance with the EPBC Significant Impact Guidelines 1.1. The EPBC Act is administered by the Commonwealth Department of Climate Change, Energy, the Environment and Water (DCCEEW) and lists threatened species, ecological communities and other MNES. Any proposed action that is expected to have an impact on MNES must be referred to the Minister for assessment under the EPBC Act, or assessed under the existing bilateral agreement, or accredited process between the Commonwealth and the State of New South Wales.
NSW Statutory Legislation
Biodiversity Conservation Act 2016
With reference to the Project, the BC Act establishes the following: • A list of threatened species of native flora and fauna (excluding fish and marine vegetation) and threatened ecological communities (TECs); • The declaration of Areas of Outstanding Biodiversity Values; and • The Biodiversity Offsets Scheme (BOS) including the 'no net loss' standard. This institutes a biodiversity offset requirement for development that is deemed to have a significant impact on biodiversity values (i.e., retirement of biodiversity credits). The type and number of biodiversity credits is determined by applying the Biodiversity Assessment Method 2020 (BAM). The BOS applies to SSD and state significant infrastructure (SSI) projects, unless the Secretary of the Department of Planning, Housing and Infrastructure determines that the Project is not likely to have a significant impact on biodiversity values. The Applicant has engaged an accredited assessor to apply the BAM to assess the impacts of the proposal on biodiversity values through the preparation of a BDAR. The BDAR will address biodiversity offset obligations under the BOS resulting from the proposal. The assessment undertaken throughout this report will be appended to the BDAR.

NSW Statutory Legislation

Local Land Services Act 2013

The NSW *Local Land Services Act 2013* (LLS Act) regulates the management of vegetation on rural land. The amendments to the LLS Act have resulted in a change to the criteria for native vegetation clearing. There are now three land categories which determine clearing on rural land:

- Category 1 – 'Exempt land' which is not subject to clearing approval under the LLS Act;
- Category 2 – 'Regulated Land' on which clearing of native vegetation may be carried out with or without formal approval in accordance with an 'allowable activity' or 'code' under the LLS Act. Includes the categories of Category 2 – Vulnerable Regulated Land and Category 2 – Sensitive Regulated Land on which vegetation clearing is restricted; and
- 'Excluded Land' – Land not identified on the Transitional Native Vegetation Regulatory (NVR) Map and to which the LLS Act does not apply.

A review of the Draft NVR Map confirms that areas of Category 2 – Regulated Land are present, associated with the PP09A. No Category 1 – Exempt Land is mapped in areas impacted across the remaining Pinch Points.

Biosecurity Act 2015

The NSW *Biosecurity Act 2015* came into effect on 1 July 2017, effectively replacing the NSW Noxious Weeds Act 1993. Under the NSW Biosecurity Act 2015, landholders have a responsibility to control weeds on their property under the provisions of the General Biosecurity Duty.

The General Biosecurity Duty states "Any person who deals with biosecurity matter or a carrier and who knows, or ought reasonably to know, the biosecurity risk posed or likely to be posed by the biosecurity matter, carrier or dealing has a biosecurity duty to ensure that, so far as is reasonably practicable, the biosecurity risk is prevented, eliminated or minimised. The general biosecurity duty applies to all weeds listed in Schedule 3 of the NSW Biosecurity Act 2015. Primary weeds have been identified in different LGAs based on the level of threat infestation they represent and, if the species presents a significant threat, they may be subject to a Biosecurity Control Order under which stricter provisions apply.

Weeds identified within the Study Area may be subject to the General Biosecurity Duty or a Biosecurity Control Order and will need to be managed accordingly. A strategic plan for each WoNS identified in the Study Area will be required to define responsibilities and identify strategies and actions to control the weed species (Centre for Invasive Species Solutions, 2021).

NSW Statutory Legislation
Fisheries Management Act 1994
The NSW *Fisheries Management Act 1994* (FM Act) provides for the conservation, protection and management of fisheries, aquatic systems and habitats in NSW. Like the BC Act, the NSW Fisheries Management Act 1994 lists threatened species, populations and ecological communities of fish and marine vegetation. The Study Area does not consist of aquatic systems, and based on a review of the Department of Primary Industries (DPI) Fisheries NSW Spatial Data Portal does not contain any Key Fish Habitat, habitat for freshwater threatened species or mapped marine vegetation. The FM Act is not further discussed.

3. METHODOLOGY

3.1 DESKTOP REVIEW

The desktop review included analysis of the following online resources:

- Results and communities with potential to occur within a 1 km buffer of the Study Area sites, accessed on 15 August 2023.of the DCCEEW's Protected Matters Search Tool (PMST) identifying MNES including threatened species;
- Atlas of Living Australia (ALA) database flora and fauna records to identify MSES and MNES with potential to occur within a 1 km buffer of the Study Area sites, accessed on 15 and 16 August 2023;
- Interim Biogeographical Regionalisation for Australia (IBRA) and IBRA sub-regions v7 (http://www.environment.gov.au/land/nrs/science/ibra);
- NSW Mitchell Landscapes map and descriptions (NPWS 2003);
- DPE State Vegetation Type Mapping Version C1.1.M1.1 (https://datasets.seed.nsw.gov.au/dataset/nsw-state-vegetation-type-map Accessed 02 July 2023); and
- Local Government databases.

3.2 FIELD SURVEYS

A five-day preliminary vegetation and habitat survey was undertaken between 17th and 21st of July 2023 by one ecologist to assess the entirety of the transport route. The purpose of the field survey was to identify the presence of important biodiversity values within the Study Area, including:

- The likely presence of threatened fauna and flora species;
- Threatened ecological communities; and
- Habitat and resources considered important for threatened species or ecological communities.

Surveys were undertaken via walked transects of the Study Area. Survey methodologies were designed to rapidly assess biodiversity values and to record native and non-native vegetation and features of ecological value present.

The walked transect along the midline of the proposed track modifications and hardstand at PP09 (5.5 m wide) further aimed to target threatened flora species, including the Yellow-Keeled Swainsona (*Swainsona flavicarinata*). Opportunistic sightings of fauna were also recorded throughout the survey period; however, comprehensive and targeted fauna surveys were not undertaken as part of the current survey.

3.3 ASSUMPTIONS AND LIMITATIONS

The field and desktop assessments undertaken provide an overview of the biodiversity values that exist within the Study Area. The field survey was undertaken across the Study Area to gain a general understanding of the types of species and habitat features that occur.

The absence of a species from a database list or observational studies does not confirm its absence from the Study Area, except for targeted surveys. The lack of existing records from databases may indicate a low historic sampling effort in the region, as opposed to an absence of species. Similarly, the timing of the July 2023 survey precludes the detection of a number of species that are typically absent from the area at that time of the year.

4. SITE CONTEXT

4.1 LANDSCAPE FEATURES

Site context features have been identified from an inspection of the transport route pinch point sites along with GIS assessment of available relevant digital mapping layers and aerial imagery. Resulting features identified are provided in Table 4-1.

TABLE 4-1 LANDSCAPE FEATURES

Landscape feature	Description for each pinch point	
	Pinch Point 09 and Pinch Point 10	**Pinch Point 11**
IBRA Bioregions and Subregions	PP09 and PP10 occurs within the Barrier Range IBRA subregion of the Broken Hill Complex IBRA Bioregion.	PP11 occurs within the Murrumbidgee IBRA subregion, of the Riverina IBRA Bioregion
NSW Landscape Regions (Mitchell)	PP09 and PP10 occurs within the Barrier Downs NSW Landscape Region.	PP11 is situated across two NSW Landscape Regions: • Murrumbidgee Scalded Plains; and • Murrumbidgee Channels and Floodplains
Rivers, streams, estuaries and wetlands	No rivers, streams, estuaries or wetlands are present.	No rivers, streams, estuaries or wetlands are present. The Murrumbidgee River is situated in proximity (within 470 m) to PP11; however, is not anticipated to be adversely impacted as a result of the Project.
Habitat connectivity	PP09 is largely situated along existing tracks, bounded by acacia and chenopod shrublands. This vegetation is considered to provide low levels of connectivity. PP10A and PP10B run through disturbed vegetation, with lack of tree vegetation. The connectivity in these habitats is considered low. PP10C will require the removal or trimming of 4-5 trees, the connectivity in these habitats is considered low.	No connectivity values will be disturbed as a result of modifications for PP11.
Karst, caves, crevices, cliffs, rocks or other geological features of significance	No Karst, caves, crevices, cliffs, rocks or other geological features of significance are present.	No Karst, caves, crevices, cliffs, rocks or other geological features of significance are present.
Soil hazard features	A review of the ASC Soil Type Map reveals Sodosols occur across the Pinch Point. Sodosols are texture-contrast soils with impermeable subsoils due to the concentration of sodium. These soils occupy a large area of inland Queensland. Generally, Sodosols have a low-nutrient status and are very vulnerable to erosion and dryland salinity when vegetation is removed.	A search of the ASC Soil Type Map reveals that the Vertosol soil type dominates the Pinch Point 11. Vertosols are categorised as clay soils with shrink-swell properties that exhibit strong cracking when dry and at depth have slickensides and/or lenticular peds. Although many soils exhibit gilgai microrelief, this feature is not used in their definition.
Areas of outstanding biodiversity value	Not applicable.	Not applicable.

5. NATIVE VEGETATION AND THREATENED ENTITIES

5.1 OVERVIEW

Ground-verified vegetation mapping was conducted across the pinch point locations, with some minor changes made to the SVTM (DPE, 2022a).

The vegetation community, condition and the likely impact at each pinch point is further described in **Error! Reference source not found.** below.

TABLE 5-1 PINCH POINT VEGETATION, HABITAT, AND IMPACTS

Pinch Point	Vegetation	Flora, Fauna and Habitat features	Impact
09A	Broadly, the location contains a mix of chenopod and acacia shrublands, with Dillon Bush (*Nitraria billardaria*), Bluebush (*Maireana pyramidata*), Low Bluebush (*Maireana astrotricha*) Bladder Saltbush (*Atriplex versicaria*), Prickly Wattle (*Acacia victoriae)*, *Maireana brevifolia, Sclerolaena* and *Maireana* species present. Sparse *Eremophila* and *Senna* shrubs are also present, with larger patches existing outside the Study Area. Non-native species including Boxthorn (*Lycium ferocissimum*) were also recorded. The vegetation present is mapped on the state vegetation type map (SVTM) (DPE, 2022), and conforms to plant community types (PCTs) as further discussed in Section. 5.2.	Rabbit burrows were observed along the access track. The habitat present was noted as having potential to provide foraging habitat to numerous fauna, including the avian species.	An intersection and temporary track (including track widening and establishment) will be required, this impact results in 0.67 ha of native vegetation removal.
10A	One (1) Chinaberry (*Melia azedarach*) tree is present south of Crystal St. The patch of vegetation along the disturbance path between Menindee Road and Sturt St contains one (1) Eucalyptus tree, along with ground cover largely dominated by *Atriplex nummularia* with bare ground/ sparse ground to dense ground cover of a mix of exotic and native species including *Asphodelus fistulosus, Sclerolaena muricata, Sclerolaena birchii, Maireana villosa* and Prickly Pear. The vegetation present is not generally consistent with the definition of a specific PCT, and does not make up a TEC.	Macropod scats were observed within the patch of vegetation between Menindee Rd and Sturt St, the site likely provides grazing and passage for macropod species. No stick nests, hollows or additional habitat features were observed.	The Chinaberry tree south of Crystal St may require trimming, while the Eucalyptus tree within the patch of vegetation between Menindee Rd and Sturt St will be removed.
10B	Pinch Point 10B contains vegetation south of Agent St. This area has been highly disturbed and is situated within Pirylia Broken Hill North Mine. The site contains young Eucalyptus trees, and occurrences of *Atriplex nummularia, Acacia tetragonophylla,* and *Rhagodia spinescens.* The vegetation present is not generally consistent with the definition of a specific PCT, and does not make up a TEC.	The site would potentially provide foraging habitat for numerous species, with no nests or additional habitat features observed.	A temporary track will need to be built to link the end of Chettle St to the Barrier Hwy/Argent St, with potential to remove or trim Eucalypts and shrubs.

Pinch Point	Vegetation	Flora, Fauna and Habitat features	Impact
11	The center of the roundabout contains planted *Eucalyptus sideroxylon*, with disturbed understory. The median strip to the east of the roundabout is mapped as PCT 164 and to the south is mapped as PCT 13 on the SVTM (DPE, 2022a), however roadside vegetation presents dominated by non-native species, with a drainage feature creating habitat for *Juncus* and *Lomandra* species present. The vegetation across this pinch point does not form part of a PCT or TEC.	Planted trees have potential to provide supplementary nectar for avian species, with no nests or hollows observed. The drainage feature situated within the median strip has potential to provide habitat for amphibian species.	Hardstand required on disturbed roadside vegetation. Planted trees unlikely to be disturbed.

5.2 PLANT COMMUNITY TYPES

As previously discussed in Section 5-1, the transport route was assessed for the presence of native vegetation that aligns with NSW PCTs via desktop review and field based rapid vegetation assessments. It is noted, no plot-based vegetation integrity surveys were undertaken in accordance with the BAM (2020).

Based on a review of the SVTM (DPE, 2022) five (5) PCTs are mapped across the Study Area associated with PP11 and PP09A:

- PCT 13: Black Box - Lignum woodland wetland of the inner floodplains in the semi-arid (warm) climate zone (mainly Riverina Bioregion and Murray Darling Depression Bioregion);
- PCT 128: Nelia tall open shrubland of semi-arid sandplains;
- PCT 136: Prickly Wattle open shrubland of drainage lines on stony rises and plains of the arid climate zone;
- PCT 139: Prickly Wattle tall open shrubland of dunes and sandplains of semi-arid and arid regions;
- PCT 155: Bluebush shrubland on stony rises and downs in the arid and semi-arid zones and
- PCT 164: Cotton Bush open shrubland of the semi-arid (warm) zone.

During the field verification survey, rapid vegetation assessments were completed to determine conformity to the SVTM within the Study Area. The vegetation was observed to broadly align with the SVTM, with minor updates made based on field observations.

No PCTs are mapped across PP10A, PP10B or PP10C. Vegetation surveys confirmed vegetation present is unlikely to form part of a PCT or TEC.

PCT 13 and PCT 164 are mapped across areas of PP11. SVTM provides polygons for PCT 164 and PCT 13 which overlap the South Hay Roundabout existing infrastructure. Additionally, adjacent vegetation to the existing road was observed to be dominated by non-native species, and in areas presented as drainage features creating habitat for *Juncus* and *Lomandra* species. No Cotton Bush (*Maireana aphylla*) nor Black Box (*Eucalyptus floribunda*) were recorded. As such, PCT 13 and PCT 164 are not considered to be present.

Likely PCTs and area within the Study Area are provided in Table 5- and provided in Figure 5-, all associated with PP09A.

TABLE 5-2 PP09A PCTS

PCT ID	PCT Name	Area (ha)
128	Nelia tall open shrubland of semi-arid sandplains	0.02
136	Prickly Wattle open shrubland of drainage lines on stony rises and plains of the arid climate zone	0.04
139	Prickly Wattle tall open shrubland of dunes and sandplains of semi-arid and arid regions	0.08
155	Bluebush shrubland on stony rises and downs in the arid and semi-arid zones	0.53
Total		0.67

The disturbance to 0.67 ha of native vegetation at PP09A is required to be assessed in accordance with the BAM. The disturbance meets the area limits criteria for the streamlined assessment module for small area developments, on the basis that the area of native vegetation to be disturbed is below the maximum clearing area threshold set out in the BAM. Full assessment in accordance with the BAM is provided in the Project BDAR.

5.3 THREATENED ECOLOGICAL COMMUNITIES

Three (3) PCTs mapped on the SVTM with association to PP09A have potential to be associated with TECs listed as Endangered under the BC Act. These include:

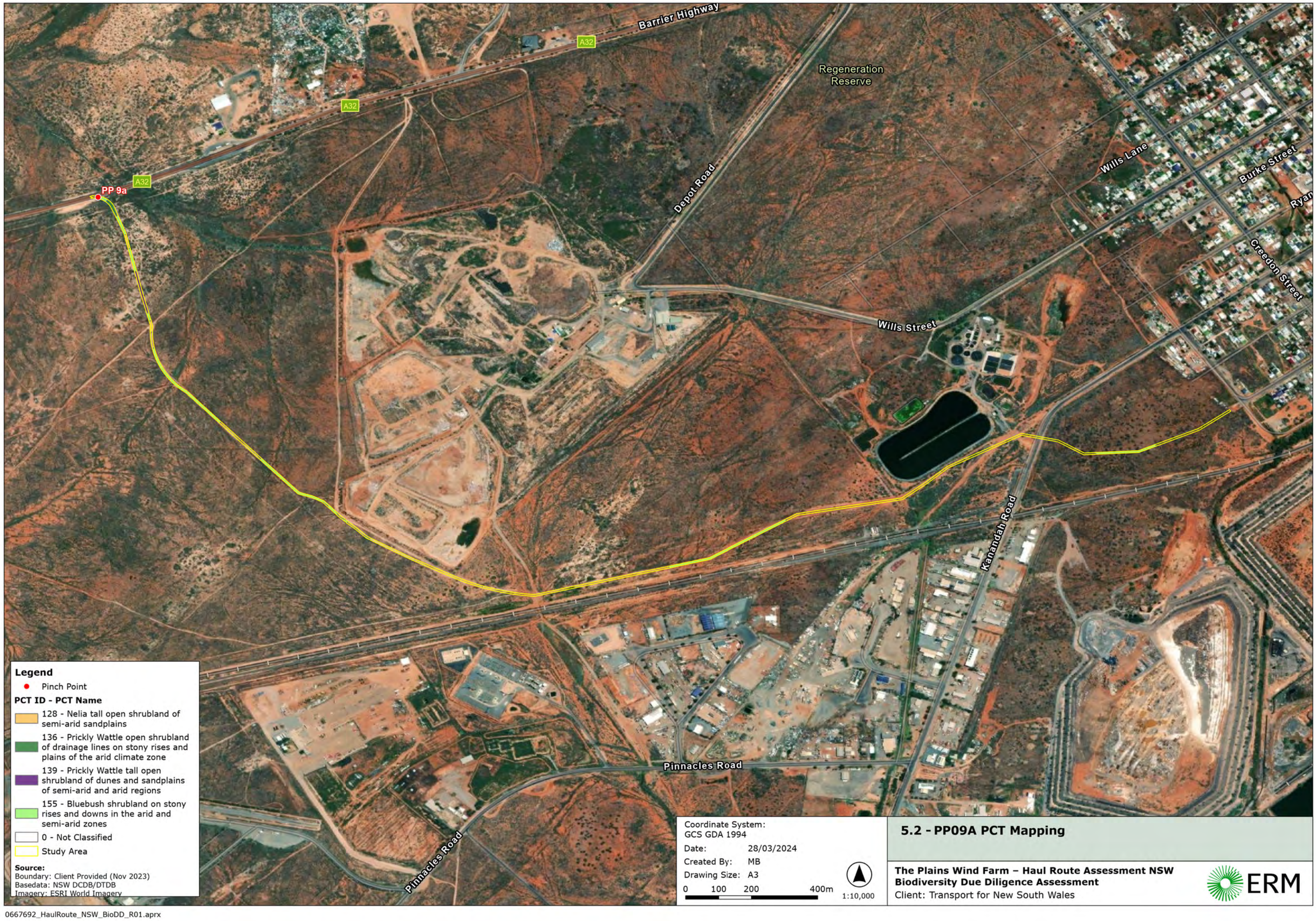
- *Acacia loderi* shrublands (PCT 155, 128 ,139); and
- *Acacia melvillei* shrubland in the Riverina and Murray-Darling Depression bioregions (PCT 128).

Acacia loderi shrublands are a community dominated by the tall shrub or small trees, *Acacia loderi* with a low, diverse understorey dominated by chenopod sub-shrubs, herbs and grasses. Other tree species may occur in association with *Acacia loderi.* During the field survey event, rapid vegetation assessments were conducted across the entirety of the Study Area to identify vegetation present. No occurrences of *Acacia loderi* were recorded, nor communities dominated by the species.

Acacia melvillei Shrubland in the Riverina and Murray-Darling Depression bioregions is a community dominated by *Acacia melvillei*, typically occupying sandhills and undulating sandplains in south-western NSW. The communities shrub/tree layer is dominated by *Acacia melvillei,* either in pure stands or with a range of other less abundant trees or tall shrubs. During the field survey event, rapid vegetation assessments were conducted across the entirety of the Study Area to identify vegetation present. No occurrences of *Acacia melvillei* were recorded, nor communities dominated by the species.

Based on field verification surveys, occurrences of *Acacia loderi* and *Acacia melvillei* are not present within the Study Area.

The vegetation observed across the Study Area does not conform to any TECs listed.



5.2 - PP09A PCT Mapping

The Plains Wind Farm – Haul Route Assessment NSW
Biodiversity Due Diligence Assessment
Client: Transport for New South Wales

ERM

5.4 THREATENED SPECIES

The BAM defines two types of threatened species credits that are used to measure impacts on development sites. The two types of credits are:

- Ecosystem credit species – threatened species whose occurrence can generally be predicted by vegetation surrogates and/or landscape features, or that have a low probability of detection using targeted surveys; and
- Species credit species – threatened species for which vegetation surrogates and/or landscape features cannot reliably predict the likelihood of their occurrence. These species are identified in the TBDC. A targeted survey or an expert report is required to confirm the presence or absence of these species.

The candidate species and ecosystem species lists are auto-generated lists produced by the Office of Environment and Heritage BAM calculator (BAM-C).

Under the streamlined assessment module for small area developments, applied to PP09A, determination of the suite of threatened species likely to occur on or use the site is required according to Section 5.2.1 and 5.2.2 of the BAM. However, further assessment and survey is only required for candidate species credit species identified for the proposal at risk of an SAII associated with the dominant PCT.

A list of ecosystem credit species and candidate credit species for PP09A as advised by the BAM-C are listed in Table 5- and Table 5- respectively. These lists are based on the inputs into the BAM-C of the dominant PCT, PCT 155, assigned a single vegetation zone, and provided a vegetation integrity (VI) score of 100 based on a precautionary approach.

TABLE 5-3 PP09A ECOSYSTEM CREDIT SPECIES

Common name	Scientific name	BC Act	EPBC Act	Species retained for further assessment	Associated PCTs	Sensitivity to gain class
Kultarr	*Antechinomys laniger*	E	-	Yes	128, 136, 139, 155	High
Dusky Woodswallow	*Artamus cyanopterus cyanopterus*	V	-	Yes	128, 136, 139, 155	Moderate
Woma	*Aspidites ramsayi*	V	-	Yes	128, 136, 139, 155	High
Rufous Fieldwren	*Calamanthus campestris*	V	-	Yes	155	Moderate
Pied Honeyeater	*Certhionyx variegatus*	V	-	Yes	128, 136, 139, 155	Moderate

Common name	Scientific name	BC Act	EPBC Act	Species retained for further assessment	Associated PCTs	Sensitivity to gain class
Little Pied Bat	*Chalinolobus picatus*	V	-	Yes	128, 136, 139, 155	High
Spotted Harrier	*Circus assimilis*	V	-	Yes	128, 136, 139, 155	Moderate
Wedgesnout Ctenotus	*Ctenotus brooksi*	V	-	Yes	128, 136, 139, 155	High
White-fronted Chat	*Epthianura albifrons*	V	-	Yes	155	Moderate
Grey Falcon	*Falco hypoleucos*	V	-	Yes	128, 136, 139, 155	Moderate
Black Falcon	*Falco subniger*	V	-	Yes	128, 139, 155	Moderate
Little Eagle (foraging)	*Hieraaetus morphnoides*	V	-	Yes	128, 136, 139, 155	Moderate
Forrest's Mouse	*Leggadina forresti*	V	-	Yes	136, 155	High
Yellow-tailed Plain Slider	*Lerista xanthura*	V	-	Yes	128, 139	High
Pink Cockatoo (foraging)	*Lophochroa leadbeateri*	V	-	Yes	128, 136, 139, 155	Moderate
Dusky Hopping-mouse	*Notomys fuscus*	E	V	Yes	136, 155	High
Flock Bronzewing	*Phaps histrionica*	E	-	Yes	139, 155	High
Bolam's Mouse	*Pseudomys bolami*	E	-	Yes	155	High

Common name	Scientific name	BC Act	EPBC Act	Species retained for further assessment	Associated PCTs	Sensitivity to gain class
Sandy Inland Mouse	*Pseudomys hermannsburgensis*	V	-	Yes	128, 136, 155	High
Ringed Brown Snake	*Pseudonaja modesta*	E	-	Yes	128, 136, 155	Moderate
Redthroat	*Pyrrholaemus brunneus*	V	-	Yes	136, 155	Moderate
Long-haired Rat	*Rattus villosissimus*	V	-	Yes	136, 155	High
Stripe-faced Dunnart	*Sminthopsis macroura*	V	-	Yes	128, 136, 139, 155	High

TABLE 5-4 PP09A CANDIDATE SPECIES

Common name	Scientific name	Listing	status	Species retained for further assessment	Associated PCTs	Sensitivity to gain class	SAII
Showy Indigo	*Indigofera longibractea*	E	-	No	136, 155	High	Yes
Yellow-Keeled Swainsona	*Swainsona flavicarinata*	E	-	Yes	128, 139, 150, 155	High	Yes
Creeping Darling Pea	*Swainsona viridis*	E	-	Yes	155	High	Yes

There are no mapped PCTs associated with the remainder of the Study Area, and subsequently no further ecosystem credit nor species credit species specified for these areas.

5.4.1 SPECIES PRESENCE

Field surveys were limited to opportunistic sightings of fauna and flora, except for targeted flora transects for the Yellow-Keeled Swainsona (*Swainsona flavicarinata*). A search of BioNet Atlas recent (within 20 years) records within proximity (1.5 km) of the Study Area was undertaken.

5.4.1.1 PP09

Threatened species were not identified during targeted and opportunistic field surveys across PP09A. However, three (3) ecosystem credit species have been recorded near the site based on BioNet sightings, including;

- Redthroat (*Pyrrholaemus brunneus*);
- White-fronted Chat (*Epthianura albifrons);* and
- Black Falcon (*Falco subniger*).

Additionally, nearby BioNet records included the recently listed Southern Whiteface (*Aphelocephala leucopsis*). The vegetation present is likely to provide foraging habitat for the above species. Given the small scale of disturbance to native vegetation (0.67 ha), impact to foraging habitat is considered unlikely to result in a significant impact to these species.

5.4.1.2 PP10

Threatened species were not identified during opportunistic surveys across PP10A, PP10B or the optional PP10C. Five (5) species have recently been recorded near the site based on BioNet records, including:

- Pink Cockatoo (*Lophochroa leadbeateri*);
- Western Blue-tongued Lizard (*Tiliqua occipitalis*);
- Little Eagle (*Hieraaetus morphnoides*);
- Spotted Harrier (*Circus assimilis*); and
- Redthroat (*Pyrrholaemus brunneus*).

The vegetation present is likely to provide opportunistic habitat for the above species; however, no breeding habitat in the form of hollow bearing trees, rabbit burrows or raptor nest trees were observed. The temporary disturbance to largely disturbed habitat across PP10 is considered unlikely to result in a significant impact to these species.

5.4.1.3 PP11

Threatened species were not identified during opportunistic surveys across PP11. Based on recent BioNet records within proximity to the site, the following species have been previously identified:

- Brown Treecreeper (eastern subspecies) (*Climacteris picumnus victoriae*);
- Grey-crowned Babbler (eastern subspecies) (*Pomatostomus temporalis temporalis*);
- Yellow Gum (*Eucalyptus leucoxylon subsp. Pruinose*); and
- Black Falcon (*Falco subniger*).

These records are largely associated with the habitat provided along the nearby Murrumbidgee River. It is unlikely the small area of disturbed vegetation within the Study Area, adjacent to the South Hay Roundabout, provides habitat for these listed species.

6. CONCLUSION

The biodiversity investigations and analysis undertaken for the transport route Study Area have identified the presence of PCTs at a single pinch point location. The studies confirm the absence of PCTs across the remainder of the Study Area, and absence of TECs in the entirety of the Study Area.

The presence of four (4) PCTs have been identified at PP09A, including:

- PCT 128 Neila tall open shrubland of semi-arid shrublands;
- PCT 136 Prickly Wattle open shrubland of drainage lines on stony rises and plains of the arid climate zone;
- PCT 139 Prickly Wattle tall open shrubland of dunes and sandplains of semi-arid and arid regions; and
- PCT 155 Bluebush shrubland on stony rises and downs in the arid and semi-arid zones.

Surveys have confirmed the absence of TECs associated with these vegetation communities.

Targeted surveys for one candidate species were completed, with no listed species observations made. Based on the small-scale disturbance, largely along existing tracks and across disturbed vegetation, the transport route is considered unlikely to result in significant impact to threatened species.

Additional targeted surveys will be required in accordance with the BAM for one candidate species across PP09A, the Creeping Darling Pea (*Swainsona viridis*), as detailed in the Project BDAR. The recommended survey period for the species is between September and October.

Mitigation measures and offset obligations in accordance with the BOS are to be presented in the Project BDAR.

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APPENDIX A THE PLAINS R.E.P.: OSOM ROUTE STUDY VIA ADELAIDE – ARES 2024

ARES
www.aresgroup.com.au



www.aresgroup.com.au

The Plains R.E.P.

OSOM Route Study

Date:	March 2024
Client:	Aref Taleb
	Engie Aust & NZ
Type:	Physical Survey
Rev:	7



Silverton WF

Silverton WF is located 600 klms from the Port of Entry and had several challenges, including gradients in excess of 25 degrees.

The Plains R.E.P.

Route Study

The Plains Renewable Energy Park is a newly proposed large-scale development that aims to harness wind and solar energy to provide cheap, reliable and clean electricity for homes and businesses in NSW. The renewable energy park will include the construction of an integrated wind and solar farm and will operate alongside agricultural activities.

— engie.com.au/home/assets/wind/the-plains

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Introduction

The Plains Renewable Energy Park (REP) is a proposed renewable energy development located in the south western part of New South Wales. The Wind Farm will have a maximum installed capacity of up to 1.5GW as well as up to 400MWac of solar and up to 4hr at 400MW of battery storage.

The proposed project is located roughly 10km south of Hay, in the NSW South-West Renewable Energy Zone (REZ) which lies alongside the future Project EnergyConnect (Robertstown-to-Wagga Wagga) 330kV transmission line.

Following the Desktop Survey, Ares have been tasked to undertake physical Route Surveys from the chosen port of Adelaide to site. The purpose of the study is to determine the pinch points along the route, perform swept path analysis and give best estimates of modifications and works required to enable cargo to be brought to site.

The study is designed for those involved in the project that have a limited knowledge of transportation, including a comprehensive outline of the routes and actions required to achieve delivery.





01

Overview

Biala WF

Two prime movers transporting a Base Tower Section for the Biala Wind Farm.

Project Overview

The Plains Renewable Energy Park is a proposed renewable energy development located in the south western region of New South Wales. The Project will consist of up to 1.5GW of wind turbines in the South West Renewable Energy Zone.

Scope of Survey

The Plains REP is located in the western Riverina region of New South Wales, approximately 10 kilometres south of the town of Hay.

Following the initial Desktop Survey, the preferred port of import was identified as the **Port of Adelaide**. ARES was commissioned to physically drive the routes to identify, check and measure any pinch points en route, including any new issues or route options that were not apparent in the desktop analysis.

The physical route survey for Adelaide was conducted between April 18-21. The entire blade route was driven and examined except for the section of Cobb Hwy between Mossgiel and Booligal, which was closed by TfNSW due to recent flooding and associated repair works. (This is noted in the report.) The tower route was then driven from Adelaide to Whyte Yarcowie, whereupon it joins up with the blade route.

Following the physical examination of the routes, ARES performed swept path analyses of the critical pinch points along the routes using a combination of drone imagery shot during the survey and aerial imagery from Nearmap. The aim of the swept paths is to highlight the extent of any modifications required at each pinch point as well as any encroachment into private land by either the equipment or the cargo (e.g. blade tip).

ARES also performed swept path analysis of four proposed site entrances as part of our scope of works.

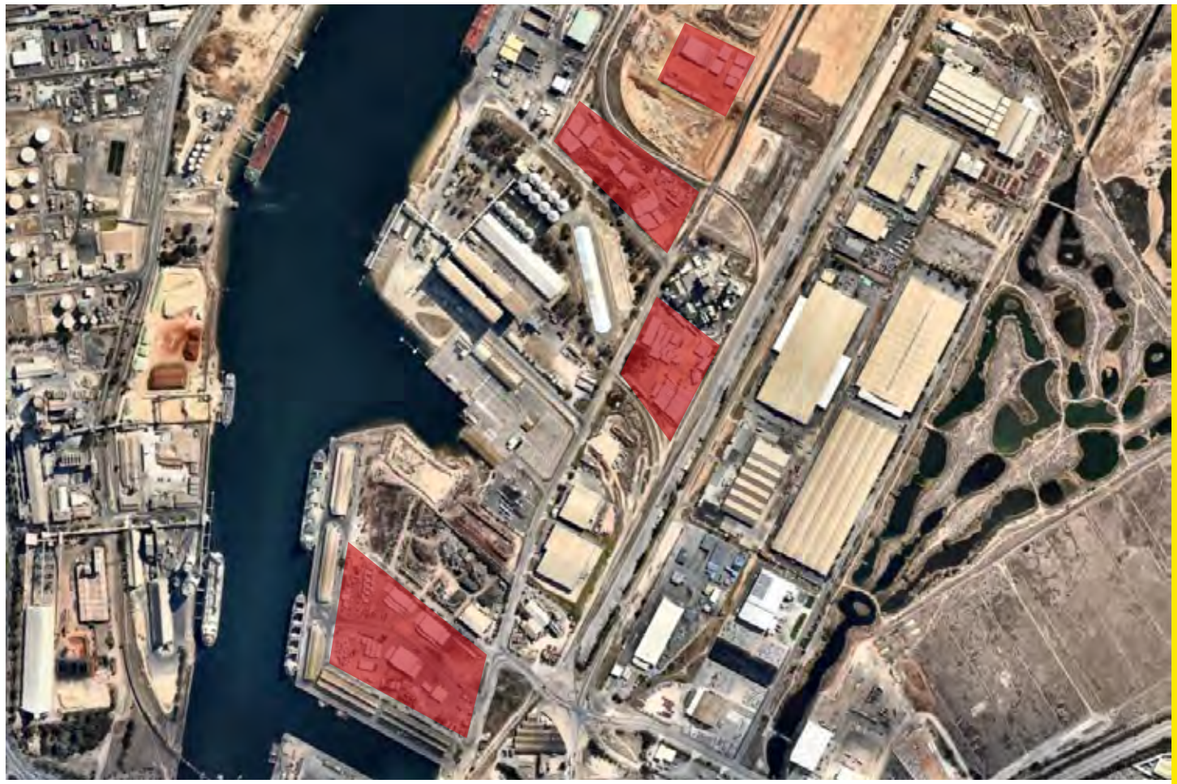
Ports of Import

The Port of Adelaide has seen several large wind farm projects pass through it in recent years, including Port Augusta and Silverton, and is currently being used for the Goyder project. It has a proven capability to handle large break bulk vessels such as those used for wind projects.

Storage is available in various areas around the port, as depicted on the right. Blades will need to be stored at Berths 18/20 due to their length. The storage areas are fenced and security is provided by the port.

One of the biggest advantages of Adelaide Port is its connections to the road network. Port River Expressway is only a kilometre away, with links to the North-South Motorway (able to take most oversize loads north out of Adelaide Metro) and Port Wakefield Rd (designated overheight route). The routes out are relatively clear of obstructions and cater well for truck traffic.

The only downside to the use of Adelaide for wind farm cargo is that the region north of Adelaide has a number of proposed wind projects likely to also utilise Adelaide as their port of import - e.g. Goyder Stage 2, Carmody's Hill, Twin Creek, Crystal Brook. Depending on the timing of The Plains REP, the port may become congested when playing host to more than a single wind farm at a time.





Above: Storage areas at Adelaide Port (in red). **Below:** Components stored at Adelaide Port by ARES for the Silverton WF project.

Transport Methodology

The Plains will feature next generation wind turbines with some of the largest blades and tower sections in the market.

Transport Envelope

The cargo dimensions assumed for this project are listed on the opposing page. These represent the Goldwind GWH175 8MW wind turbine platform with its 86m blade, along with the anticipated diameter (6.31m) of a steel tower for this larger machine. By comparison, the current generation of wind turbines has blades at around 80m long and towers at less than 6m in diameter.

A key assumption here is that the blade will have its tip support frame positioned at 50m from the blade root, based on the information provided by the client and OEM. This will result in quite a large rear overhang of 36m. Should this tip frame position change, the swept paths of the blades will need to be re-assessed.

Tower sizes and dimensions are usually not finalised until a much later stage of the project. We have provided estimates for the largest base tower section as well as the longest top tower section that can be reasonably expected for a wind turbine of this size. The mid tower section dimensions will fall somewhere in between these extremes.

Besides the wind turbine components, there will be a few other oversize overmass deliveries to the wind farm, particularly the main transformers for the substations. These tend to be overmass loads ranging from 150 to 300 ton depending on size. No sizing information is available at present for the transformers and hence we have not considered these any further at this stage.

Equipment

The change in cargo size is relatively small compared with current wind turbines and hence equipment required to transport them should be readily available.

Blades can be transported on extendable trailers which are currently being used, although if the tip frame spacing changes to something larger than about 55m then these trailers would need to be modified.

Other options for blade transport include a jinker style trailer or a fixed length blade trailer with removeable extension beams, both of which are in relatively common use for overlength applications. A blade lifter/ manipulator trailer has not been considered in this report as the approval pathway to use such a trailer on the road is unknown and considered too risky.

The base towers at a diameter of up to 6.31m will pose issues especially with respect to height. These will have to be transported on either “bookend” style trailers or low platform trailers to keep overall height as low as possible - this will minimize the amount of power lines which will need to be lifted.

The top tower sections are expected to be very similar to those currently in the market and should pose no issues for transport.

Cargo Dimensions

Component	Qty	Length (m)	Width (m)	Height (m)	Weight (t)
Nacelle	188	9.9	5.0	4.2	41.6
Drivetrain	188	8.2	4.1	4.2	106.0
Hub	188	5.1	4.5	4.2	52.0
Blade	564	86.0	4.8	3.7	32.0
Tower Base	188	10.0	6.3	6.3	110.0
Tower Top	188	36.0	4.3	4.3	80.0

Note: mid tower sections will typically fall in between the weights and dimensions of the base and top sections. There will likely be 5-6 of these mid sections per turbine, or an additional 940-1,128 OSOM deliveries for the project.

Overall Dimensions

Component	Equipment	O/A Length (m)	O/A Width (m)	O/A Height (m)	O/A Weight (t)
Nacelle	PM 2R8 4R8	25.9	5.0	4.9	84.0
Drivetrain	PM 10R8	31.3	4.3	5.0	168.0
Hub	PM 2R8 4R8	25.9	4.5	4.9	94.0
Blade	PM 6R8	97.4	4.8	4.7	86.0
Tower Base	PM 5R8-5R8 (Bookends)	39.1	6.3	6.7	192.0
Tower Top	PM 8R8 EXT	45.3	4.3	5.3	143.0

Note: mid tower sections will be transported on either low loaders or platform trailers.

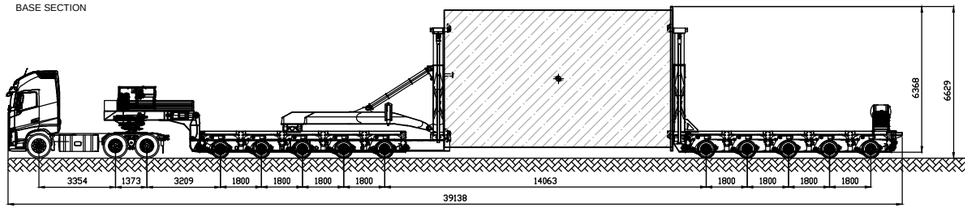
The equipment schematic on the next page shows how these components will be delivered for the project.

Axle Loads

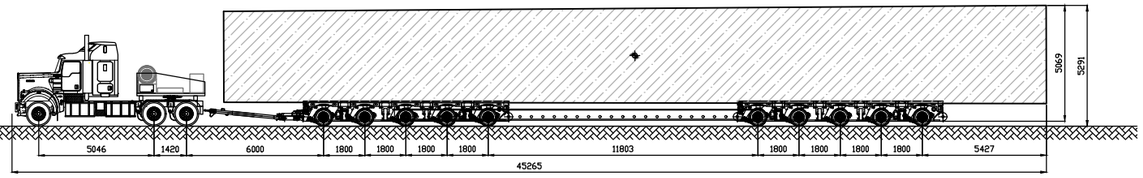
Axle loads will be up to 14 tons per row at 4.3m width. Axle spacings are shown in the equipment schematic overleaf.

Equipment Schematic

BASE SECTION

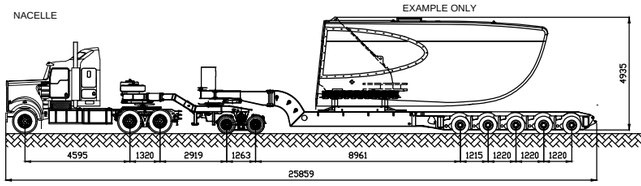


TOP SECTION



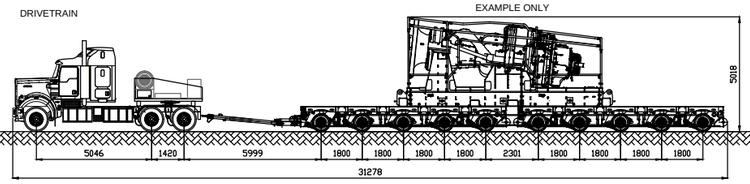
NACELLE

EXAMPLE ONLY



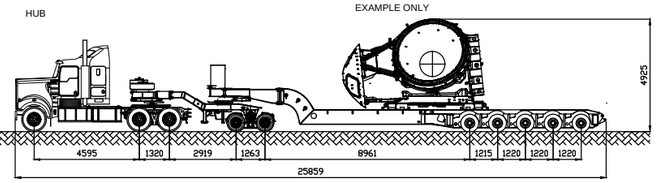
DRIVETRAIN

EXAMPLE ONLY

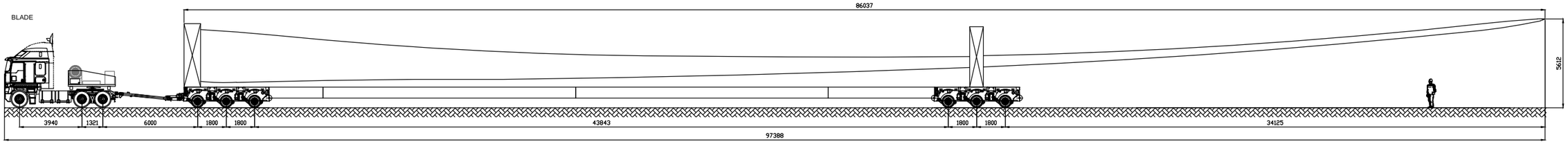


HUB

EXAMPLE ONLY

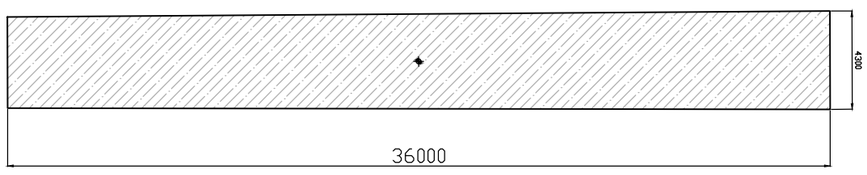


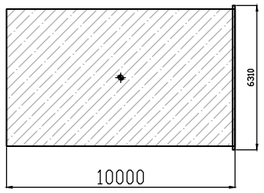
BLADE



Note: Goldwind documentation notes blade tip droops by 739mm so transport height will be 4,873mm.

Tower Specifications





REV	DATE	DESCRIPTION	DRN	CHK	APP	REFERENCE DRAWINGS

DRAWING NOTES:

ALL DIMENSIONS ARE IN mm UNLESS NOTED OTHERWISE (UNO) ALL WEIGHTS ARE IN t (METRIC TONNES) UNO ALL DETAILS ARE PROVISIONAL AND SUBJECT TO CONFIRMATION LASHINGS CALCULATIONS AS PER RESTRAINT GUIDELINES

TECHNICAL NOTES:

WEIGHT, DIMENSIONS AND COG POSITION TO BE CONFIRMED BY CLIENT STRUCTURAL INTEGRITY TO BE CHECKED BY CLIENT OPERATIONAL DIAGRAMS AND MANUAL MUST BE OBSERVED HYDRAULIC STABILITY REFERS TO STATIC LOAD ONLY STABILITY PROVISIONAL UNTIL COG CONFIRMED

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DRAWN BY:	
DRAWN DATE:	
CHECKED BY:	
CUSTOMER:	Engie
PROJECT:	The Plains R.E.P.
DRAWING TITLE:	Equipment Schematic
DRAWING NAME:	ENGIE_THEPLAINS_R1.DWG
SIZE:	
SCALE	NTS
SHEET NO:	
REV	



Project Timing

The Plains REP is scheduled to commence construction in 2025, with wind turbine component deliveries commencing around **Q4 2027**. Please note, these dates are subject to change and should be treated as indicative at this stage.

The proposed construction run rate is 2 complete turbines per week. We anticipate total duration of OSOM transport to be approximately **2 years**.

With 12-13 major OSOM components per turbine, this would mean a total of up to **26 oversized deliveries per week** or **4-5 deliveries per day** to site, spread over six days (Mon-Sat).

The proposed weekly delivery schedule is shown in the table below (subject to change due to resourcing, operational and permit requirements).

Component	Mon	Tue	Wed	Thu	Fri	Sat
Nacelle	●			●		
Drivetrain		●			●	
Hub			●			●
Blades	●	●	●	●	●	●
Tower Section 1	●			●		
Tower Section 2	●			●		
Tower Section 3		●			●	
Tower Section 4		●			●	
Tower Section 5		●			●	
Tower Section 6			●			●
Tower Section 7			●			●

Daily Schedule

A sample journey is provided below to illustrate how a component would be transported to site.

Day 1

START: PORT ADELAIDE

04.00hrs	Depart Port Adelaide
05.00hrs	Gawler
06.30hrs	Burra
07.30hrs	Terowie
09.00hrs	Yunta (rest break)
11.30hrs	NSW Border
12.30hrs	Layover Broken Hill

FINISH: BROKEN HILL

Total Distance:	520 km
Work Time:	8.5 hrs

Day 2

START: BROKEN HILL

05.00hrs	Depart Broken Hill
06.00hrs	Clear Broken Hill
08.30hrs	Wilcannia (rest break)
11.30hrs	Ivanhoe
13.30hrs	Booligal
14.30hrs	Layover Hay

FINISH: HAY

Total Distance:	590 km
Work Time:	9.5 hrs

Day 3

START: HAY

05.30hrs	Depart Hay
06.00hrs	Clear Hay
07.00hrs	Arrive Site Entrance
11.00hrs	Component offloaded
11.30hrs	Return Journey commences

FINISH: THE PLAINS REP

Total Distance:	25 km
Work Time:	6+ hrs

NOTES:

- Departure times subject to transport authority and Police approval.
- Return journey via Mildura (subject to permits and approvals)
- Times are indicative only and will change depending on traffic conditions and operational considerations.

Route Overview

ARES' Desktop Survey assessed routes from a number of different Ports of Import, as depicted in the below Routes Overview. One route was selected for a physical survey and detailed assessment - Adelaide.

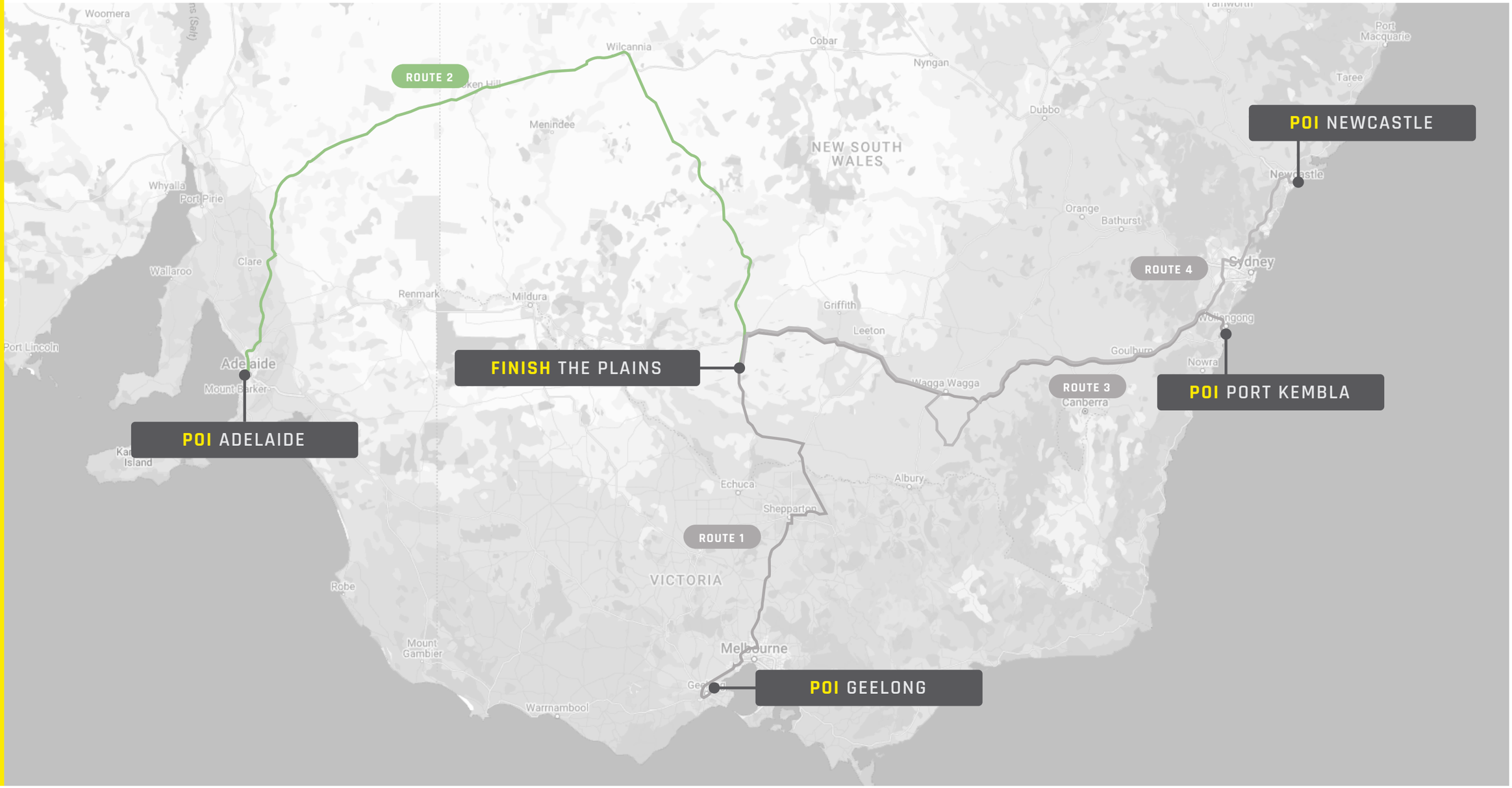
The results of the assessments for the selected route is presented in more detail in the following section.

ROUTE 1 **Geelong to The Plains -** Distance: 560km - not assessed further

ROUTE 2 **Adelaide to The Plains -** Distance: 1,130km

ROUTE 3 **Port Kembla to The Plains** - Distance: 715km - not assessed further

ROUTE 4 **Newcastle to The Plains** - Distance: 1,024km (blades only)





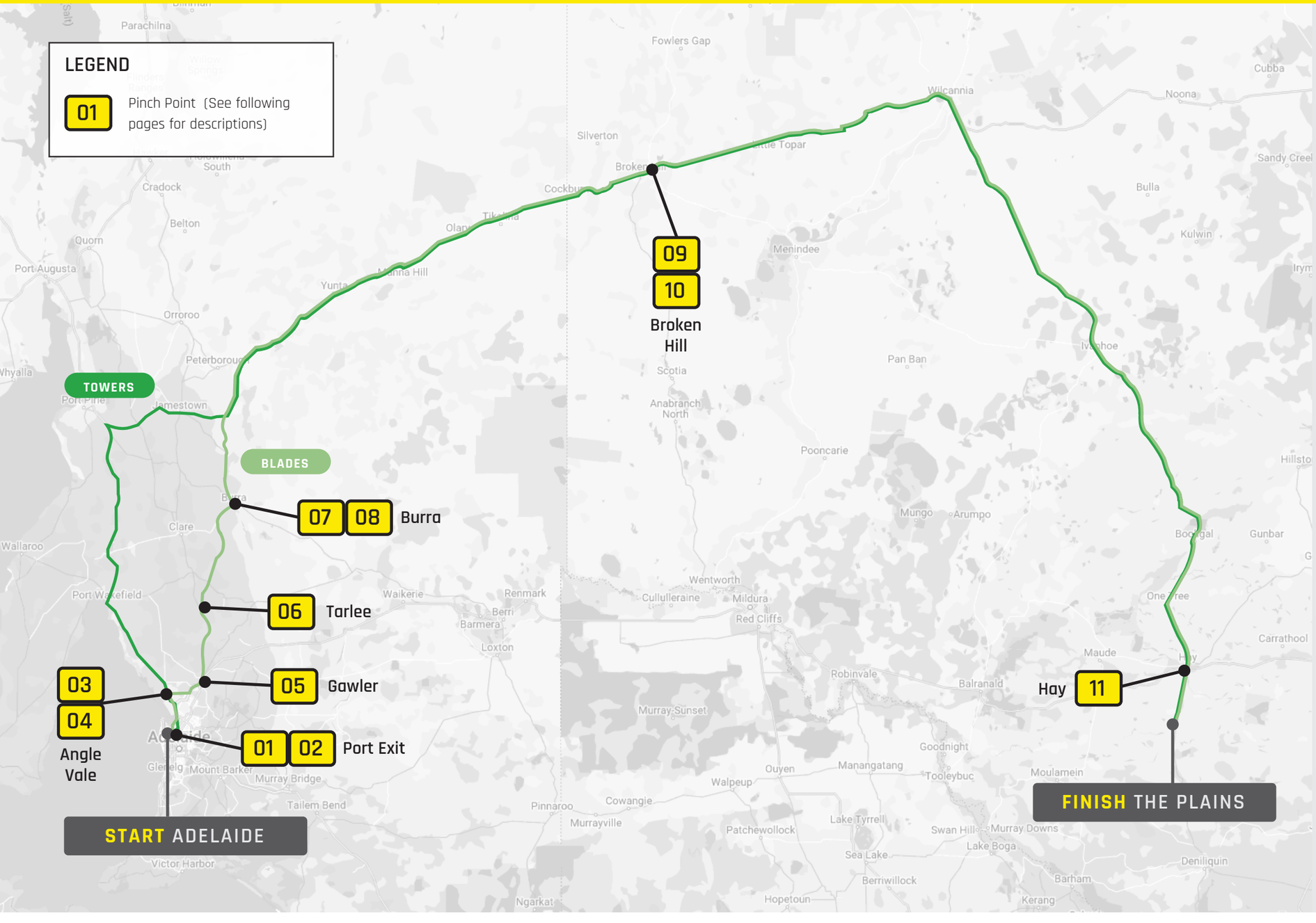
02

Adelaide to The Plains REP

Murra Warra WF

A blade trailer loaded with a 70m Senvion blade skilfully negotiates the township of Nhill for the Murra Warra Stage 1 Wind Farm.

Adelaide to The Plains - Overview



BLADE ROUTE

	START - Port Adelaide
0.0 KM	Ocean Steamers Rd
0.1 KM	Eastern Pde
1.0 KM	Port River Expy
4.4 KM	North-South Mwy
19.3 KM	Port Wakefield Hwy
26.8 KM	Angle Vale Rd
39.7 KM	North-South Mwy
49.9 KM	Horrocks Hwy
89.9 KM	Barrier Hwy
156.3 KM	(Burra bypass)
160.3 KM	Barrier Hwy
510.9 KM	(Broken Hill bypass)
515.1 KM	Barrier Hwy
729.1 KM	Cobb Hwy
1,133.8 KM	**FINISH - The Plains REP**

TOWER ROUTE

	START - Port Adelaide
0.0 KM	Ocean Steamers Rd
0.1 KM	Eastern Pde
1.0 KM	Port River Expy
9.4 KM	Port Wakefield/Augusta Hwy
201.7 KM	Wilkins Hwy
249.0 KM	(Jamestown Bypass)
254.0 KM	Wilkins Hwy
254.8 KM	Jamestown-Yarcowie/Whyte Rd
279.8 KM	Barrier Hwy
576.8 KM	(Broken Hill bypass)
582.6 KM	Barrier Hwy
796.6 KM	Cobb Hwy
1,201.3 KM	**FINISH - The Plains REP**

Adelaide to The Plains REP

General Route Notes

Road Quality

Almost the entire transport route will be along state highways, which are generally designed to a higher specification and able to handle heavier and higher volumes of traffic.

The routes will be entirely on asphalt. There are sections of the Cobb Hwy between Wilcannia and Ivanhoe which are currently being upgraded from gravel to asphalt - this is scheduled to be complete in 2023-24 and well ahead of any deliveries for The Plains.

Width-wise there is only one area of note which will require extra vigilance - sections of the Cobb Hwy either side of Ivanhoe are quite narrow with negligible shoulders. With loads at up to 6.3m wide, oncoming traffic will have to pull off the road surface completely to let loads past. If there have been recent rains, the ground may be soft and cars may become bogged.

Rest Stops

Being on main highways, there are ample truck parking areas and service areas for rest breaks along the routes (refer to following page). However, it is worth noting that the section between Broken Hill and Hay is quite remote with limited amenities and mobile phone coverage. We recommend that a service vehicle with spare parts, tyres etc. accompanies the larger loads to ensure any breakdowns can be addressed in a timely manner.

Overhead Structures

There are only a few overhead structures of note along the overheight route for towers:

- Hanson Rd overpass of Port River Expy (6.0m clearance, bypass via off- and on-ramps
- N-S Motorway overpass of Port River Expy (7.2m clearance - no issues)
- Gantries for highway VMS signboards at various locations in Adelaide metro (bypassable)
- Copper Coast Hwy overpass of Augusta Hwy at Port Wakefield (7.6m clearance - no issues)

For the blades, which are expected to be around 5.0m loaded height, there are two bridges on the North-South Motorway which are at around 5.3m height. These can be bypassed by taking Port Wakefield Rd and then Angle Vale Rd.

Overhead Power Lines

In general, a travel height below around 5.5m is not an issue with respect to power lines. For this project, most towers will be travelling at more than 6m so there will likely need to be quite a few lines requiring permanent lifting, subject to detailed surveys from the power authorities (SA Power Networks, Endeavour Energy, Essential Energy). High load escorts will also likely be required to accompany these loads.

Bridges and Culverts

Axle loads will be limited to 14 tons per axle by South Australian regulations. This should be well within design specifications for bridges, culverts and other structures on major state roads and highways. There are small sections of the route which deviate off state roads, such as the Burra and Jamestown bypasses. These will need liaison with the local council to ascertain any load limits on structures that are crossed.



Above: Typical construction of Cobb Hwy with minimal shoulder.

Rail Crossings

There are numerous rail crossings along the route which are detailed on pages 28-32. These will need written approval from the rail authority or asset owner before they can be crossed. Current rail authority advice from ARTC and Aurizon on crossing and track supervision requirements has been attached as Appendices to this report.

Approvals

Works on major arterial highways in South Australia require engineering design by an engineering consultant (from a pre-approved list) and final sign off by Department of Infrastructure and Transport (DIT).

Modifications to NSW State Roads will require a Works Authorisation Deed (WAD) signed between the project developer and Transport for NSW (TfNSW). Designs will need to be done by a pre-approved engineering consultant and signed off by TfNSW prior to construction.



Above:

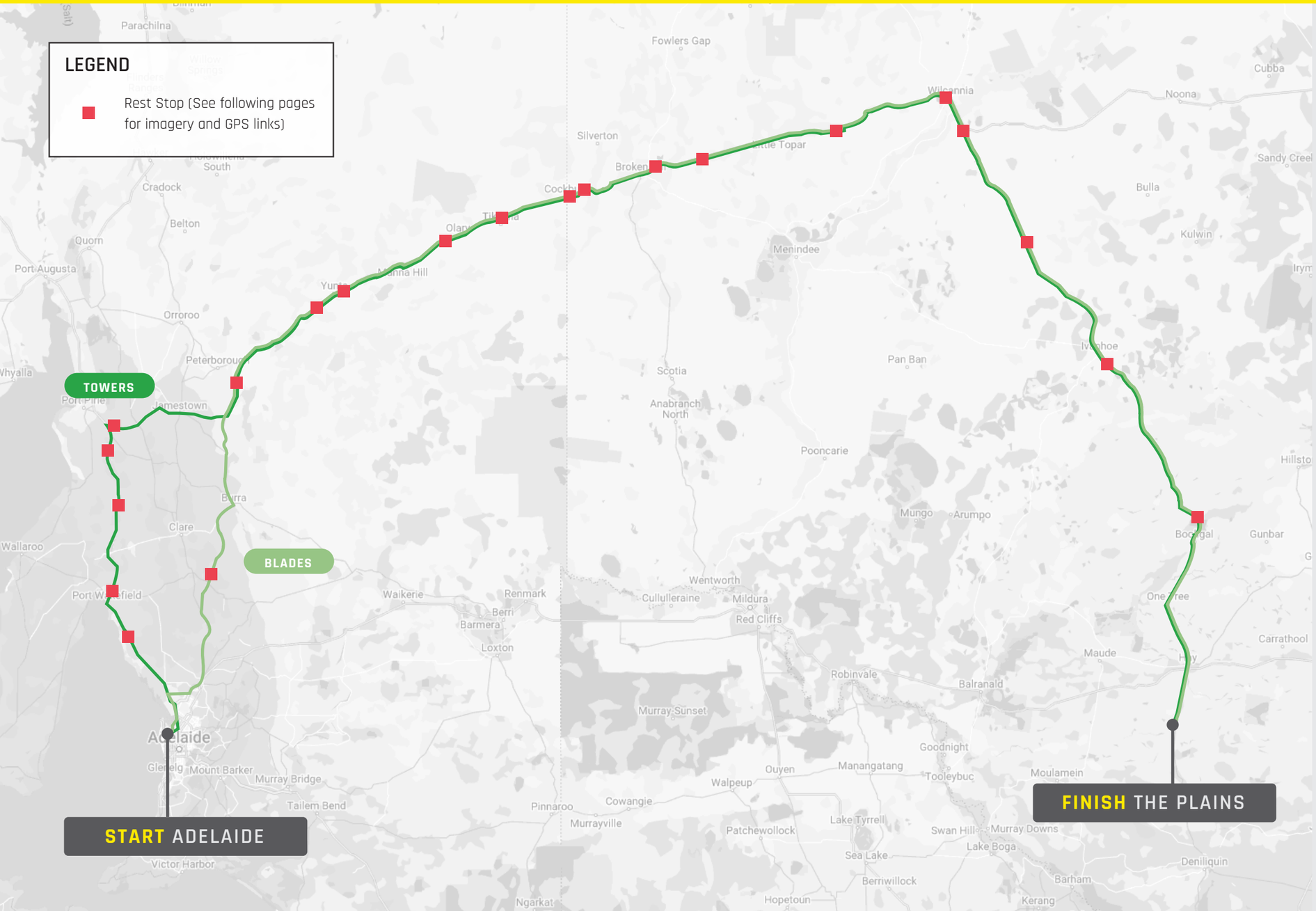
Hanson Rd overpass of Port River Expressway - 6.0m clearance.

Below:

Penfield Rd overpass (Hamel Bridge) on North-South Motorway - 5.3m clearance.



Adelaide to The Plains - Rest Stops



BLADE ROUTE

No.	KP	Rest Stop Name
01	106	Parking Bay north of Saddleworth
02	222	Woodcutters Rd Parking Area
03	257	Barrier Hwy Parking, Nackara
04	311	Yunta Rest Area
05	371	Truck Parking, Outalpa
06	418	Barrier Hwy Parking, Tikalina
07	460	Cockburn Rest Stop
08	473	Thackaringa Hills Rest Stop
09	514	Round Hills Rest Stop
10	542	Mount Gipps Rest Stop
11	644	Dolo Hills Rest Stop
12	704	Wilcannia
13	724	Cobb Hwy Parking
14	796	Half Way Tree
15	895	Cobb Hwy, Abbotsford Bore
16	1006	Bairds Truck Stop

TOWER ROUTE

No.	KP	Rest Stop Name
17	76	Parking Area south of Inkerman
18	93	Parking Area north of Port Wakefield
19	151	Truck Parking, Hope Gap
20	183	Truck Parking, Merriton
21	201	Wilkins Hwy Parking

01 Saddleworth
GPS: https://maps.app.goo.gl/amy98A8UPwXED7zz5



02 Woodcutters Rd
GPS: https://maps.app.goo.gl/wm1Go6BDxUvZnZfA9



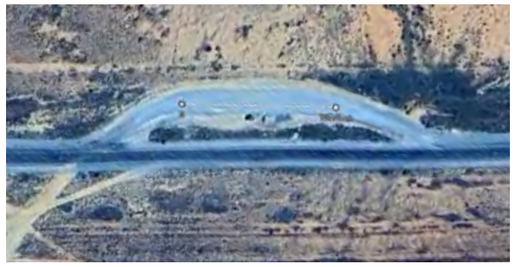
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04 Yunta
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05 Outalpa
GPS: https://maps.app.goo.gl/dQsSTBXeoML7JGwb7



06 Tikalina
GPS: https://maps.app.goo.gl/6yz8FFHtiShVZojC8



07 Cockburn
GPS: https://maps.app.goo.gl/kbJVbTTMhCQLbqLR7



08 Thackaringa Hills
GPS: https://maps.app.goo.gl/j7wMpqWmQYbZN4ut8



09 Round Hills
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10 Mount Gipps
GPS: https://maps.app.goo.gl/SjzMWq4X4fZRhwCj8



11 Dolo Hills
GPS: https://maps.app.goo.gl/s5Bz4N76STjryYcw5



12 Wilcannia
GPS: https://maps.app.goo.gl/PwfcctgC8eXHMY1f9



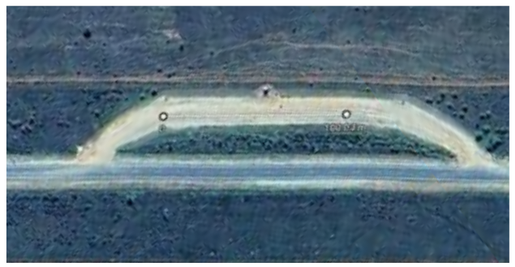
13 Cobb Hwy
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14 Half Way Tree
GPS: https://maps.app.goo.gl/ZRTPS3SjxQt2KuzM6



15 Abbotsford Bore
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16 Bairds Truck Stop
GPS:



17 Inkerman

GPS: https://maps.app.goo.gl/5xmUhQURrNNnFimX8



18 Port Wakefield

GPS: https://maps.app.goo.gl/mjnyJLmNGiF2uQCt9



19 Hope Gap

GPS: https://maps.app.goo.gl/YPe27My9iBPJxzLR7



20 Merriton

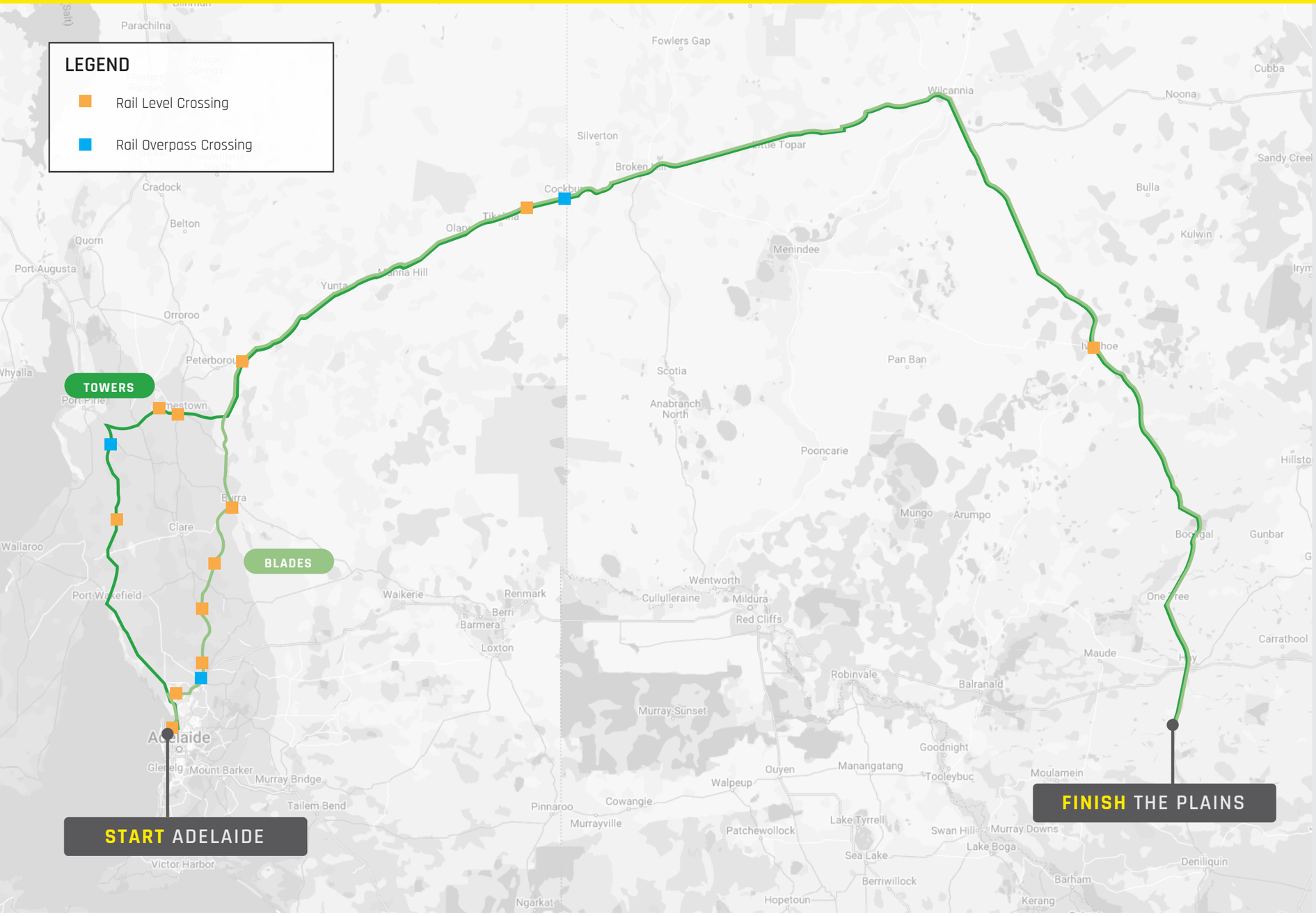
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Adelaide to The Plains - Rail Crossings



BLADE ROUTE

No.	KP	Rail Crossing Name
01	0.1	Eastern Pde, Port Adelaide (1)
02	0.2	Eastern Pde, Port Adelaide (2)
03	28	Angle Vale Rd, Angle Vale
04	47	Northern Expy, Gawler
05	56	Horrocks Hwy, Roseworthy
06	84	Horrocks Hwy, Tarlee
07	118	Barrier Hwy, Manoora
08	157	Copperhouse Rd, Burra
09	246	Barrier Hwy, Ucolta
10	429	Barrier Hwy, Mingary
11	463	Cockburn Overpass
12	894	Cobb Hwy, Ivanhoe

TOWER ROUTE

No.	KP	Rail Crossing
13	140	Augusta Hwy, Snowtown
14	194	Crystal Brook Overpass
15	239	Wilkins Hwy, Caltowie
16	250	Appila Rd, Jamestown
17	253	OD5 Rd, Jamestown

01 Eastern Pde, Port Adelaide (1)
GPS: https://maps.app.goo.gl/NLtkDkxAziDvKZxH9
Type: Level Crossing
Asset Owner: ARTC
Line: Port Flat Track



02 Eastern Pde, Port Adelaide (2)
GPS: https://maps.app.goo.gl/QXV4cxQD7ZDxnNZE9
Type: Level Crossing
Asset Owner: ARTC
LIne: Gillman-Eastern Parade 01



03 Angle Vale Rd, Angle Vale
GPS: https://maps.app.goo.gl/XzmNkYtGehup7nb8A
Type: Level Crossing
Asset Owner: ARTC
LIne: Adelaide-Crystal Brook



04 Northern Expy, Gawler (DISUSED)
GPS: https://maps.app.goo.gl/kHouKukUksSxRjjRA
Type: Overpass
Asset Owner: Aurizon
Line: Gawler-Kapunda



05 Horrocks Hwy, Roseworthy (DISUSED)
GPS: https://maps.app.goo.gl/38LDwxZZiQUSM84F6
Type: Level Crossing
Asset Owner: Aurizon
Line: Gawler-Kapunda



06 Horrocks Hwy, Tarlee (DISUSED)
GPS: https://maps.app.goo.gl/AhQq1kVdXcLsgoY49
Type: Level Crossing
Asset Owner: Aurizon
Line: Hamley Bridge-Burra



07 Barrier Hwy, Manoora (DISUSED)
GPS: https://maps.app.goo.gl/y1WhadV8Q1WWJzxb9
Type: Level Crossing
Asset Owner: Aurizon
Line: Hamley Bridge-Burra



08 Copperhouse Rd, Burra (DISUSED)
GPS: https://maps.app.goo.gl/XhTT9H9PTbSxR2jE8
Type: Level Crossing
Asset Owner: Aurizon
Line: Hamley Bridge-Burra



09 Barrier Hwy, Ucolta
GPS: https://maps.app.goo.gl/dCJrps53zSmsd8DH8
Type: Level Crossing
Asset Owner: ARTC
Line: Crystal Brook-Broken Hill



10 Barrier Hwy, Mingary
GPS: https://maps.app.goo.gl/SxHYc2JEMAgrH7WA8
Type: Level Crossing
Asset Owner: ARTC
Line: Crystal Brook-Broken Hill



11 Cockburn Overpass
GPS: https://maps.app.goo.gl/Hn9NDQ9SJh1bxSDe9
Type: Overpass
Asset Owner: ARTC
Line: Crystal Brook-Broken Hill



12 Cobb Hwy, Ivanhoe
GPS: https://maps.app.goo.gl/rTktcuGQ8A6di5m36
Type: Level Crossing
Asset Owner: ARTC
Line: Orange-Broken Hill



13 Augusta Hwy, Snowtown
GPS: https://maps.app.goo.gl/noTPs5VuHYZQUUJJ9
Type: Level Crossing
Asset Owner: Aurizon
Line: Snowtown-Bute



14 Crystal Brook Overpass
GPS: https://maps.app.goo.gl/vMxwDcbXS8kwasXo6
Type: Overpass
Asset Owner: ARTC
Line: Crystal Brook-Broken Hill



15 Wilkins Hwy, Caltowie
GPS: https://maps.app.goo.gl/CTW6XcAJ19ZdBc8f7
Type: Level Crossing
Asset Owner: ARTC
Line: Crystal Brook-Broken Hill



16 Appila Rd, Jamestown
GPS: https://maps.app.goo.gl/6eZNpsC3n42zsX5V6
Type: Level Crossing
Asset Owner: ARTC
Line: Crystal Brook-Broken Hill



17 OD5 Rd, Jamestown
GPS: https://maps.app.goo.gl/WCjZUf9xmYH1WP5TA
Type: Level Crossing
Asset Owner: ARTC
Line: Crystal Brook-Broken Hill



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Pinch Point

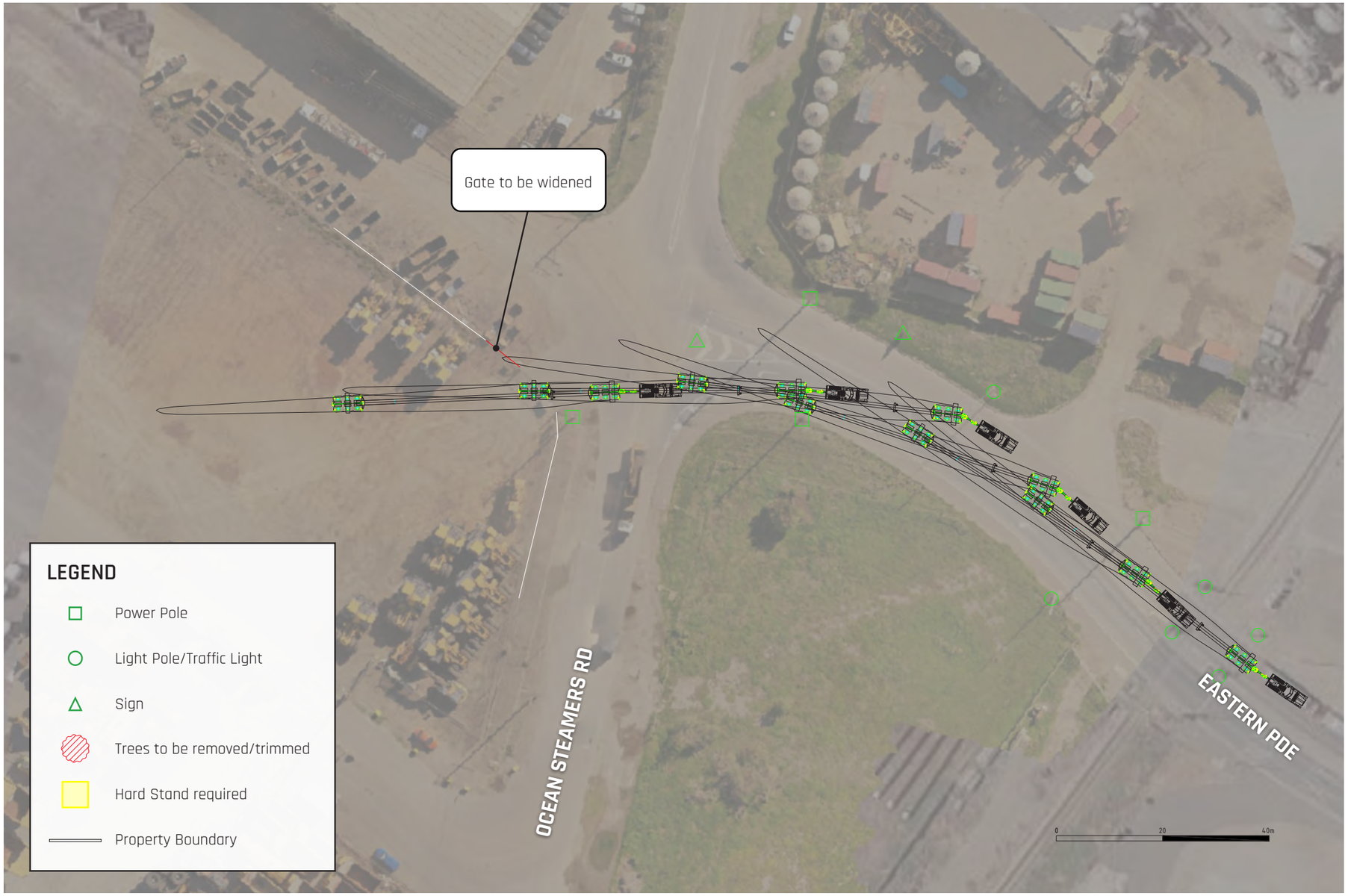
01

RIGHT TURN

Ocean Steamers Rd & Eastern Pde

Blades will have to exit from the existing gate on the north-east side of the Berth 18/20 storage area. This gate will need to be widened or fence made removeable (see red segment on diagram) to accommodate the longer blades. Flinders Port approval will be required for these works. Cargo will have to be stored away from the gate to allow room for blades to manoeuvre.

The turn will need to be made very carefully due to close clearances to traffic furniture on all sides and to be able to straighten up sufficiently for the railway crossing, but no other modifications are required.



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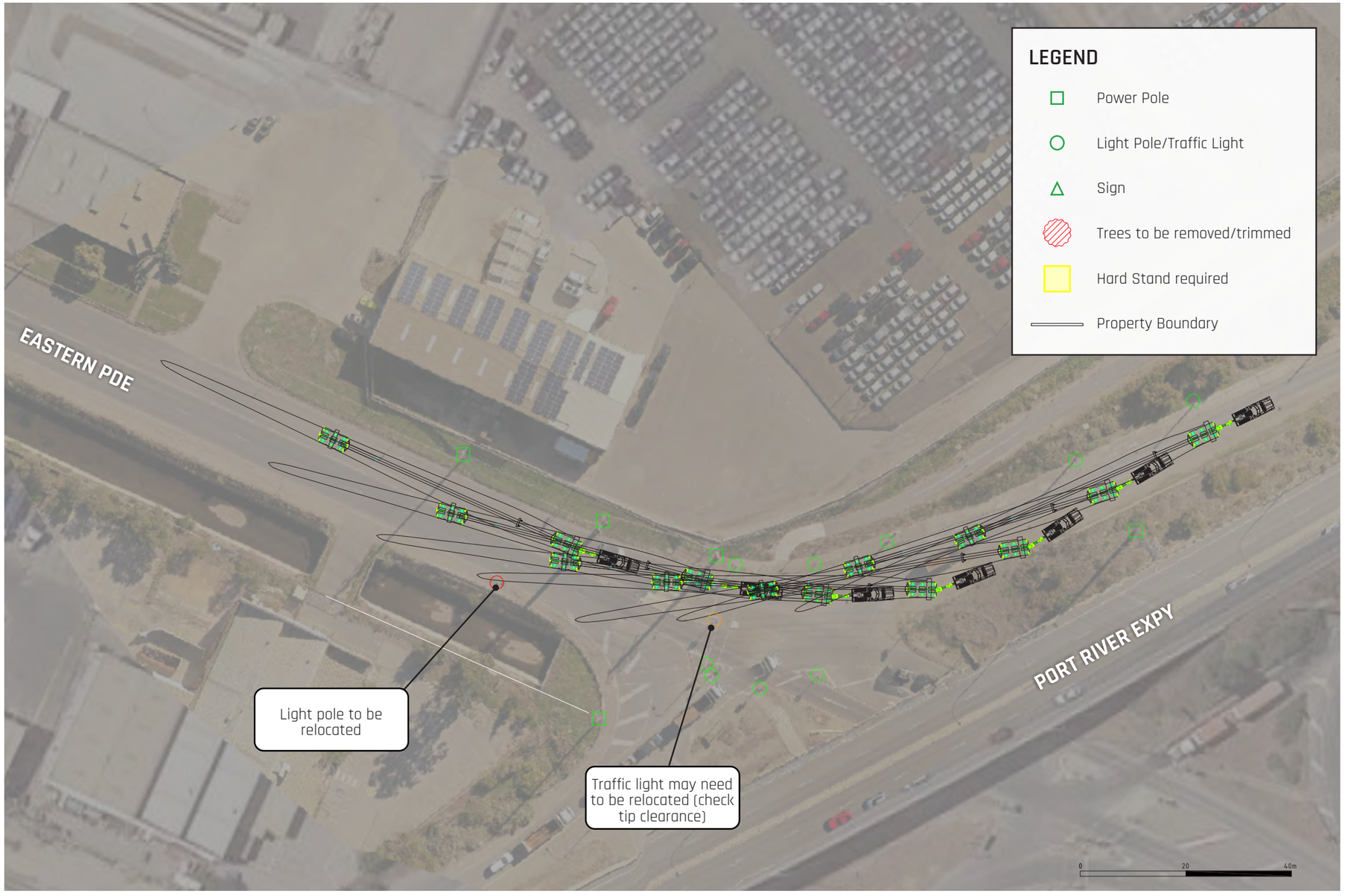
02

LEFT TURN

Eastern Pde & Port River Expy

The turn onto Port River Expressway is very tight with some tall powerlines and poles in the vicinity which are to be avoided. The rear of the blade trailer will run out very wide onto the opposite footpath, requiring the relocation of one light pole as well as the possible relocation of one of the traffic lights in the intersection.

The blade tip can be kept clear of the trees to the south and will not stray into private property.



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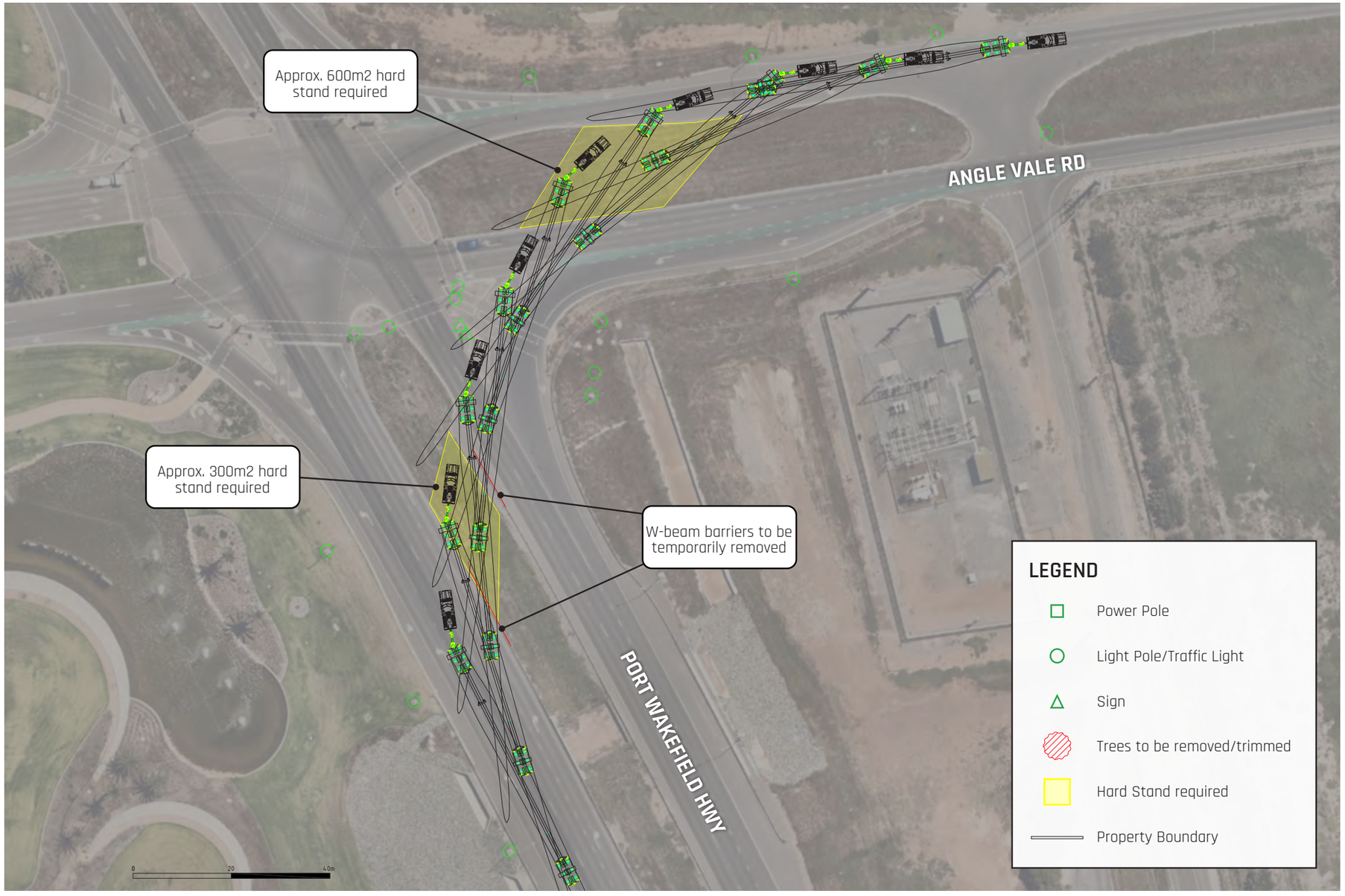
03

RIGHT TURN

Port Wakefield Hwy & Angle Vale Rd

This intersection has recently been upgraded to make Angle Vale Rd dual carriageway, giving a bit more room for blades making the turn. W-beam barriers will need to be removed along Port Wakefield Hwy to allow blades to cut across the median strip, taking care to avoid the drain in the middle. The blade will then cut across the median strip on Angle Vale Rd to cross over to the correct side of the road.

Minor civil works will be required to make the median strips trafficable for truck and trailer wheels as shown in yellow on the right.



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04

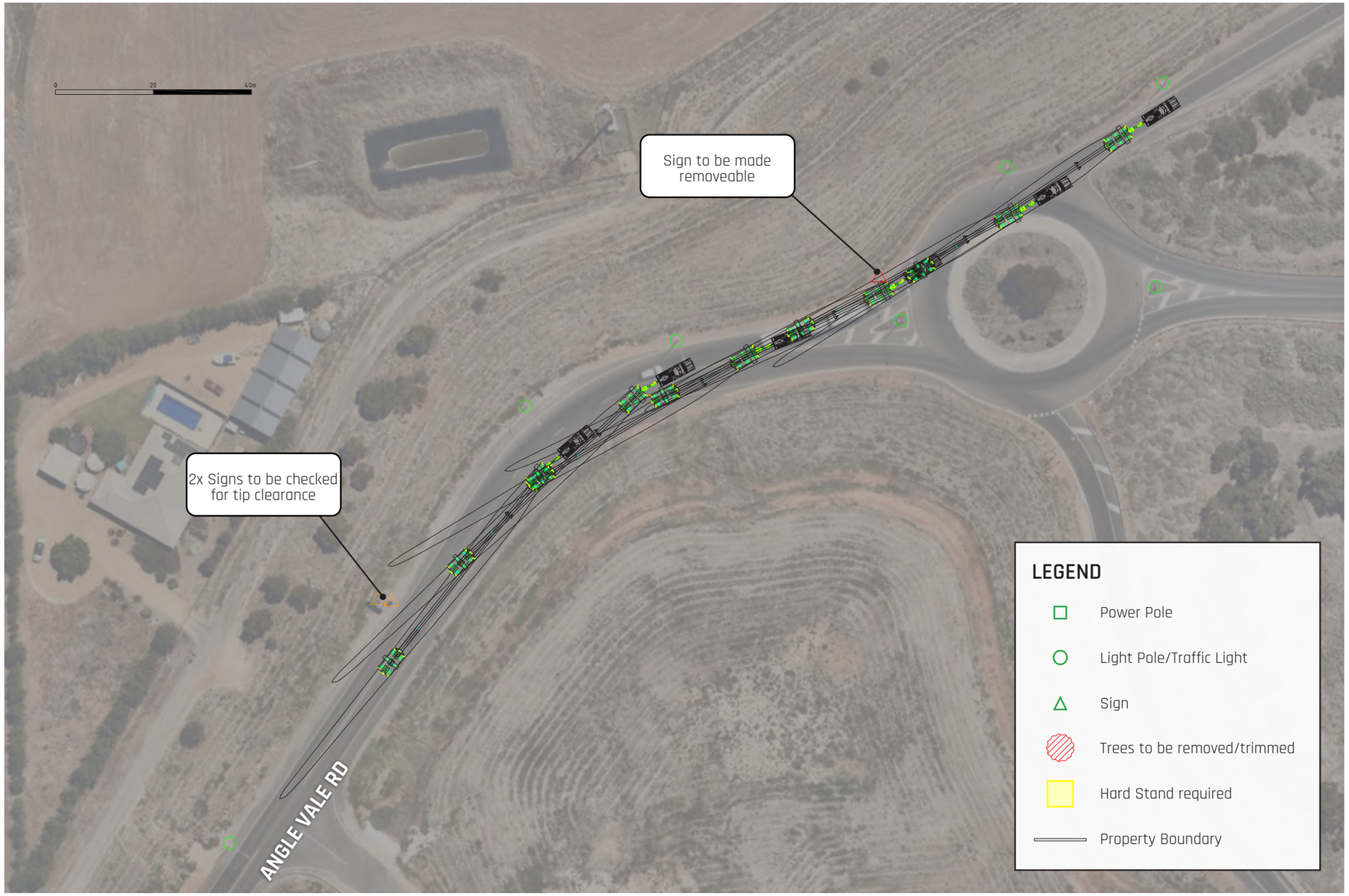
LEFT TURN

Angle Vale Rd & North-South Mwy

This combination of corners to get back onto the North-South Motorway is quite tight and will require traffic to be stopped in both directions, but can be done with only minimal modifications.

Care will be required on the approach as there are power poles and trees to the south of Angle Vale Rd which need to be avoided. The rear trailer will have to be manually steered to keep it on the road surface as it navigates around the roundabout and to avoid the light poles.

A sign will need to be made removeable and another two (in orange) checked during a trial run for blade tip clearance.



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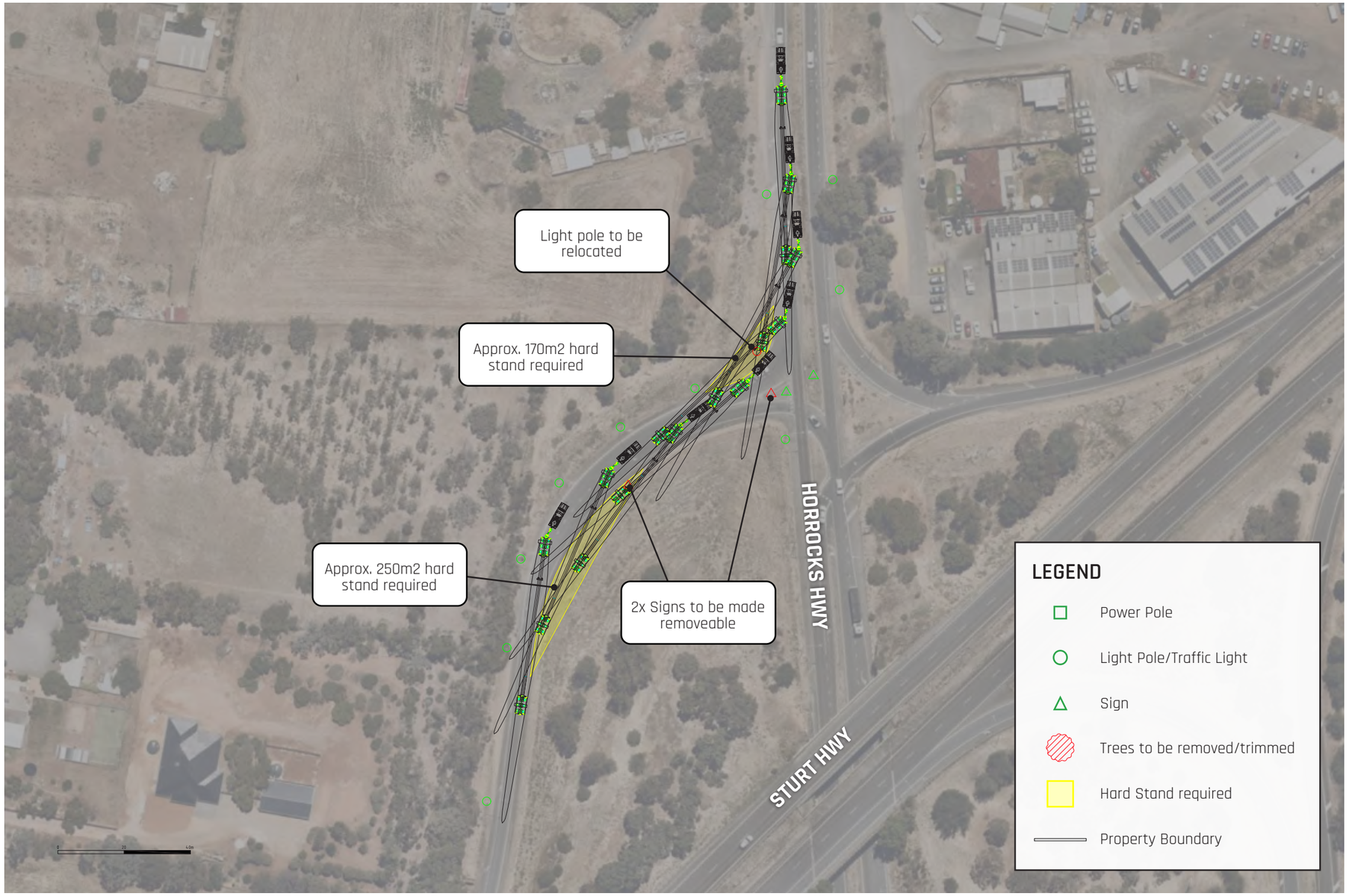
05

LEFT TURN
Sturt Hwy &
Horrocks Hwy

The offramp into this intersection has a moderate downhill gradient with embankments on either side. The blade trailer's rear wheels will have to travel on the eastern embankment, meaning hard stand material will need to be put down with possible earthworks required to level the ground. Further hardstand is required on the inside of the corner merging onto Horrocks Hwy.

Rear tip clearance with the ground will need to be checked during a trial run, if this is an issue the tip frame can be put onto spacers for additional clearance.

One light pole and a few signs will need to be relocated or removed.



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Pinch Point

06

LEFT TURN
Horrocks Hwy,
Tarlee

There is a left hand turn at the town of Tarlee on the Horrocks Hwy to cross a disused railway line. This can be taken by blades conventionally with no issues, however the police escorts will have to hold oncoming traffic whilst the blade completes the turn as the combination will take up both lanes.

Tree trimming is likely required on overhanging branches leading up to this turn (not shown).



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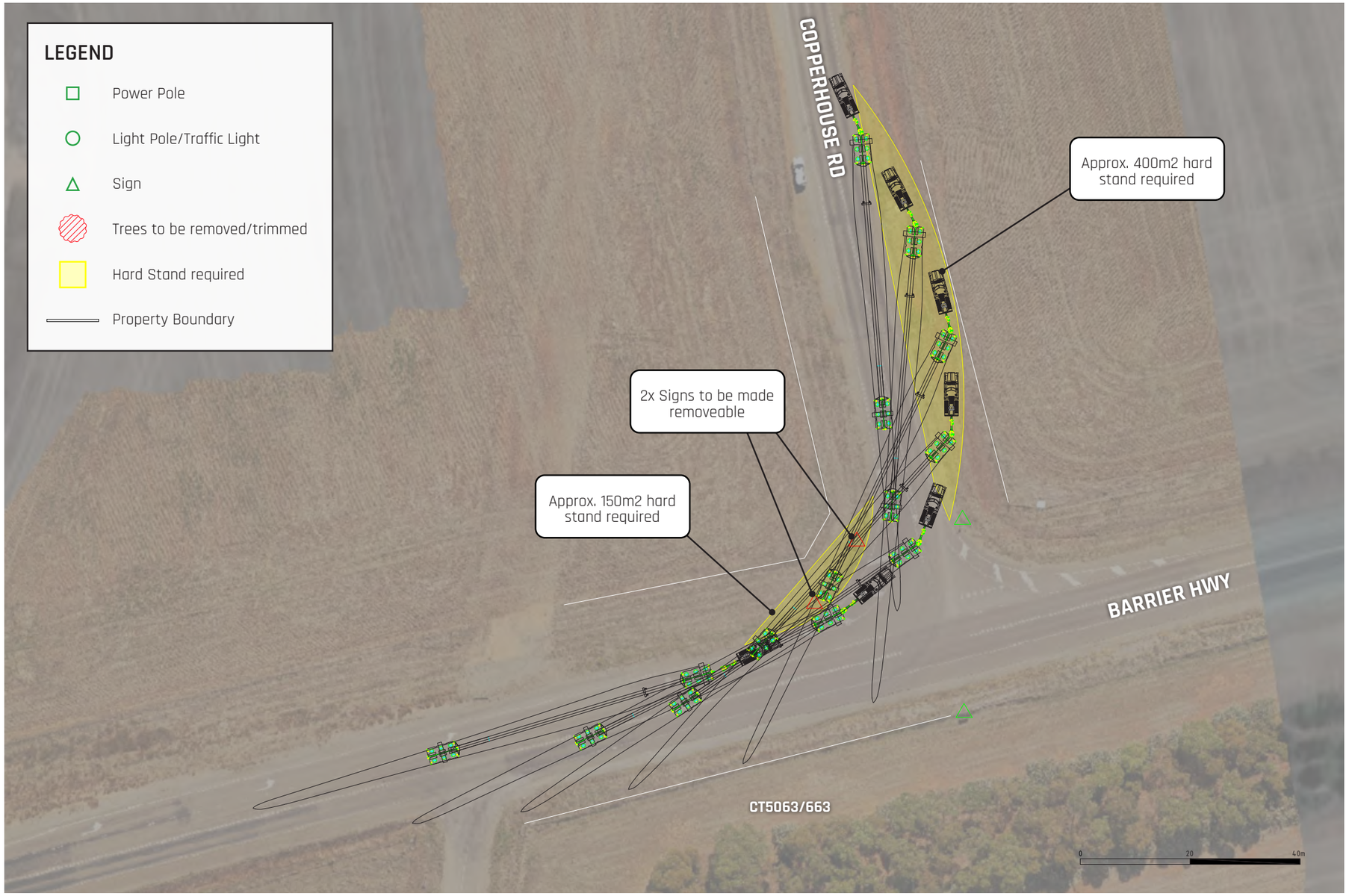
07

LEFT TURN

Barrier Hwy & Copperhouse Rd

The heavy vehicle bypass of Burra town is via Copperhouse Rd. It is primarily designed for B-double traffic and more work will be required to get the blades around.

Loads will have to hug the inside fenceline on turning in, then swing out as wide as possible to the other side of the road. Hard stand material will need to be placed where the wheels run off the existing road surface. Two signs will need to be made removeable.



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Pinch Point

08

LEFT TURN
Copperhouse St
& West St

The left turn at the Bon Accord Hotel on the Burra bypass route will present some problems due to the large rear overhang. Taking this turn conventionally will require tree trimming and/or removal to the south, with the tip swing intruding into private property (CT6105/151).

Some hard stand material is required where the truck and trailer wheels leave the existing road surface. The transport combination may also need permission to travel on private property (Bon Accord Hotel).



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DRAWING NAME:	Route Survey	REV

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Pinch Point

09

MAJOR TOWN

Route Options through Broken Hill

Getting through the town of Broken Hill is a major challenge for this project. Cargo will arrive from the south-west via the Barrier Hwy and needs to exit via the Silver City and Barrier Hwys to the north-east. ARES assessed three main options to get blades through Broken Hill:

- **New Bypass Option:** Build new track turning off the Barrier Hwy west of Broken Hill which roughly follows existing dirt tracks and links up with Gaffney St
- Two options through the town itself were assessed but found to be non-feasible due to swept path issues.

As going through the town itself is not feasible with the sheer length of the blades, the only realistic option is to build a new bypass track.



Pinch Point

09A

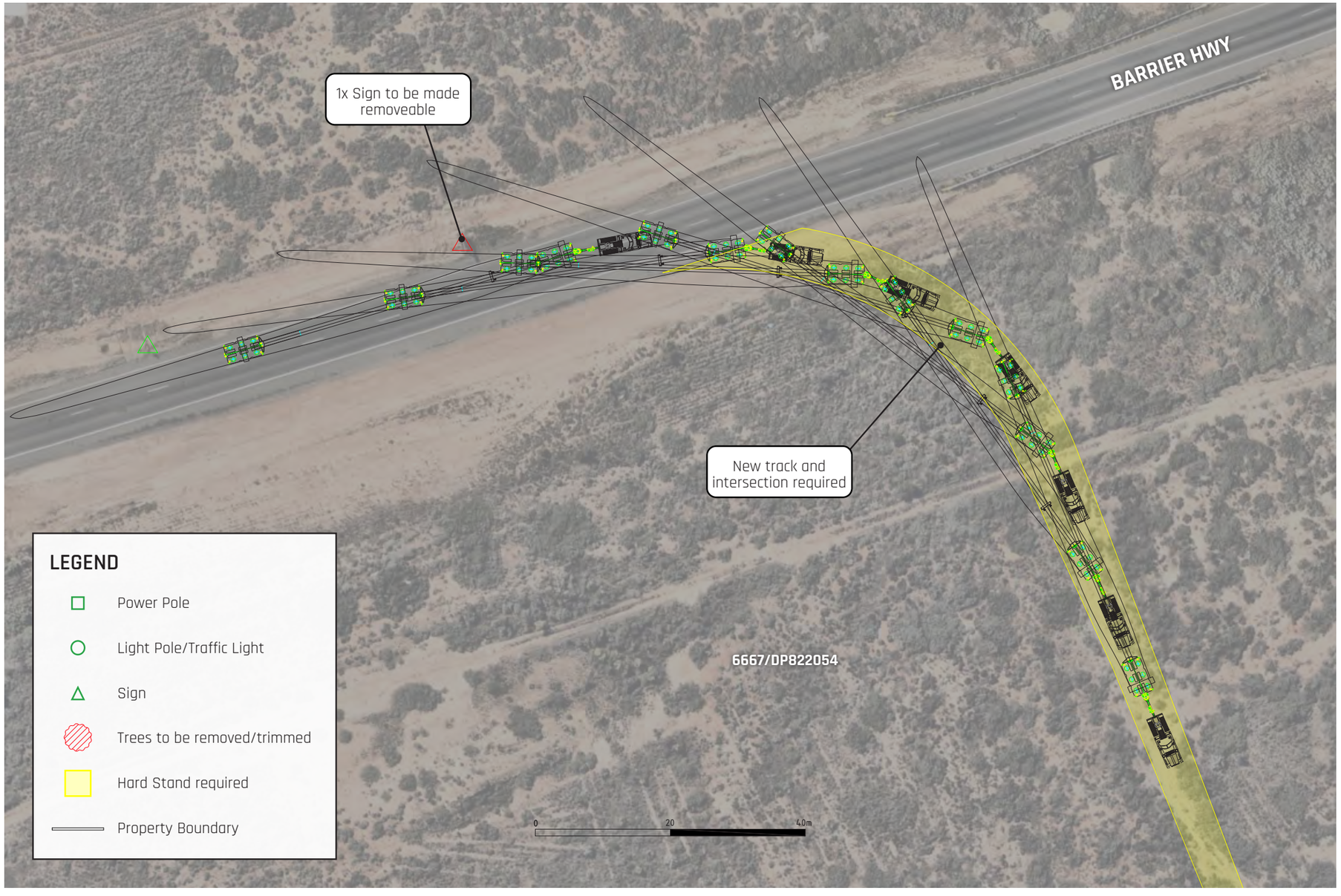
RIGHT TURN

Barrier Hwy approx.
2.4km from Broken Hill

The proposed bypass makes use of existing tracks which come off the Barrier Hwy at around 2.4km west of Broken Hill town. There is no existing intersection and a new one will have to be designed and constructed.

The swept path analysis on the right shows the extent of civil works required for the 86m blade to make this turn. One sign will need to be made removeable.

As the Barrier Hwy is a state-controlled road, the design and construction of this intersection will require a Works Authorisation Deed (WAD) and approvals from Transport for NSW.



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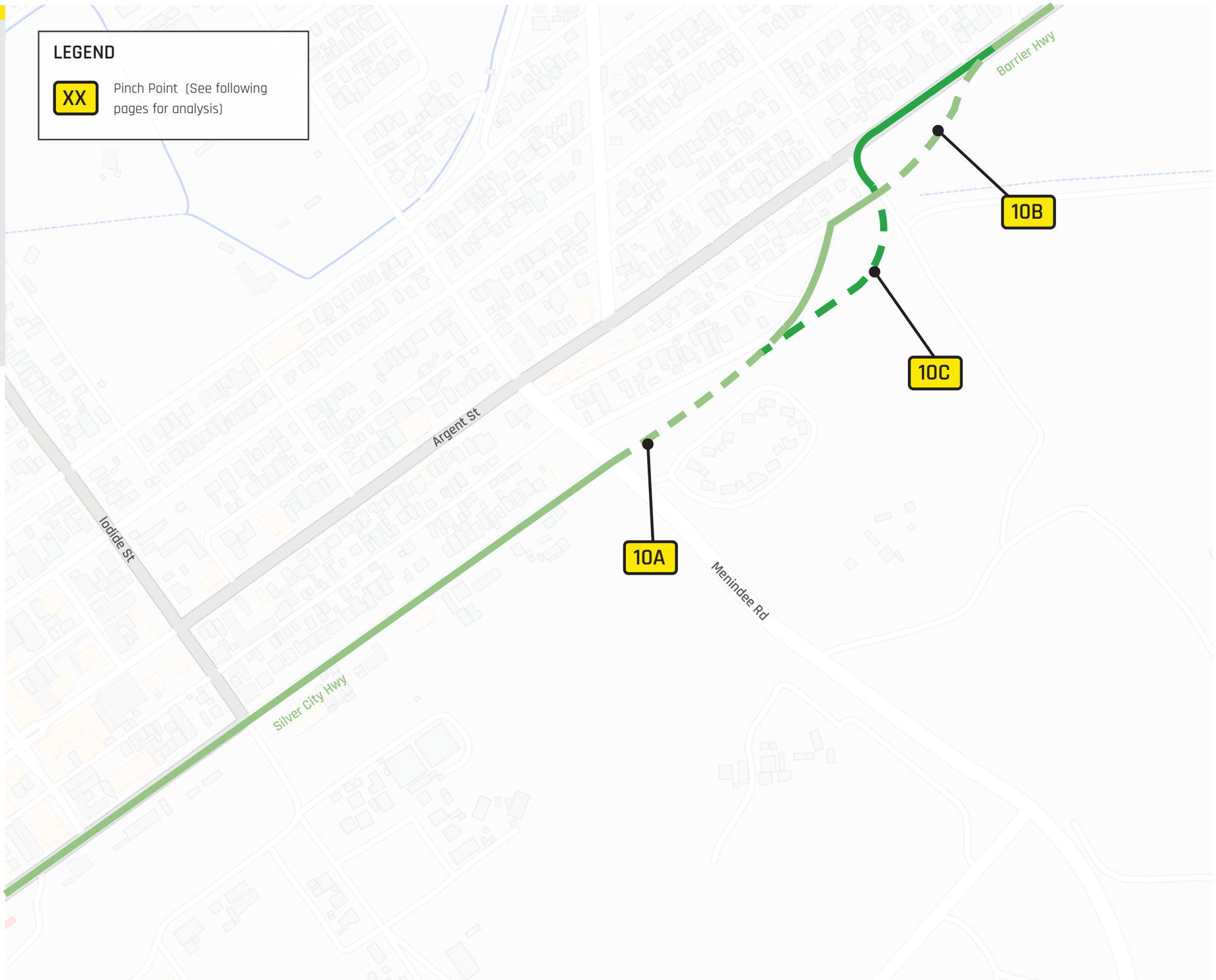
10

RIGHT TURN

Silver City Hwy &
Barrier Hwy

Regardless of which option is chosen from Pinch Point 09, to get back onto the Barrier Hwy to the north-east will require a new track to be built to Sturt St (Pinch Point **10A**), and then a couple of options to get back onto the Barrier Hwy (Pinch Points **10B** and **10C**).

The pinch points are explored in detail in the following pages.



Pinch Point

10A

RIGHT TURN
Crystal St
& Sturt St

The blades will require a temporary track to link the end of Crystal St with Sturt St across Menindee Rd. This will pass through Crown land and will require a moderate amount of civil works to make the surface suitable for a road base.

There is a power pole which can be avoided, and the road sign can be relocated away from the path of the transporter.



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DRAWING NAME:	Route Survey	REV

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Pinch Point

10B

RIGHT TURN
Chettle St
& Barrier Hwy

A temporary track will need to be built to link the end of Chettle St to the Barrier Hwy/Argent St. This will pass through Crown land near the Perilya Mine, which is non-operational.

The terrain is relatively flat and suitable for a temporary road. There is an existing double gate at the end of Chettle St which may be utilised to access the property. A new gate will have to be put in at the exit point into Barrier Hwy/Argent St.



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Pinch Point

10C

RIGHT TURN

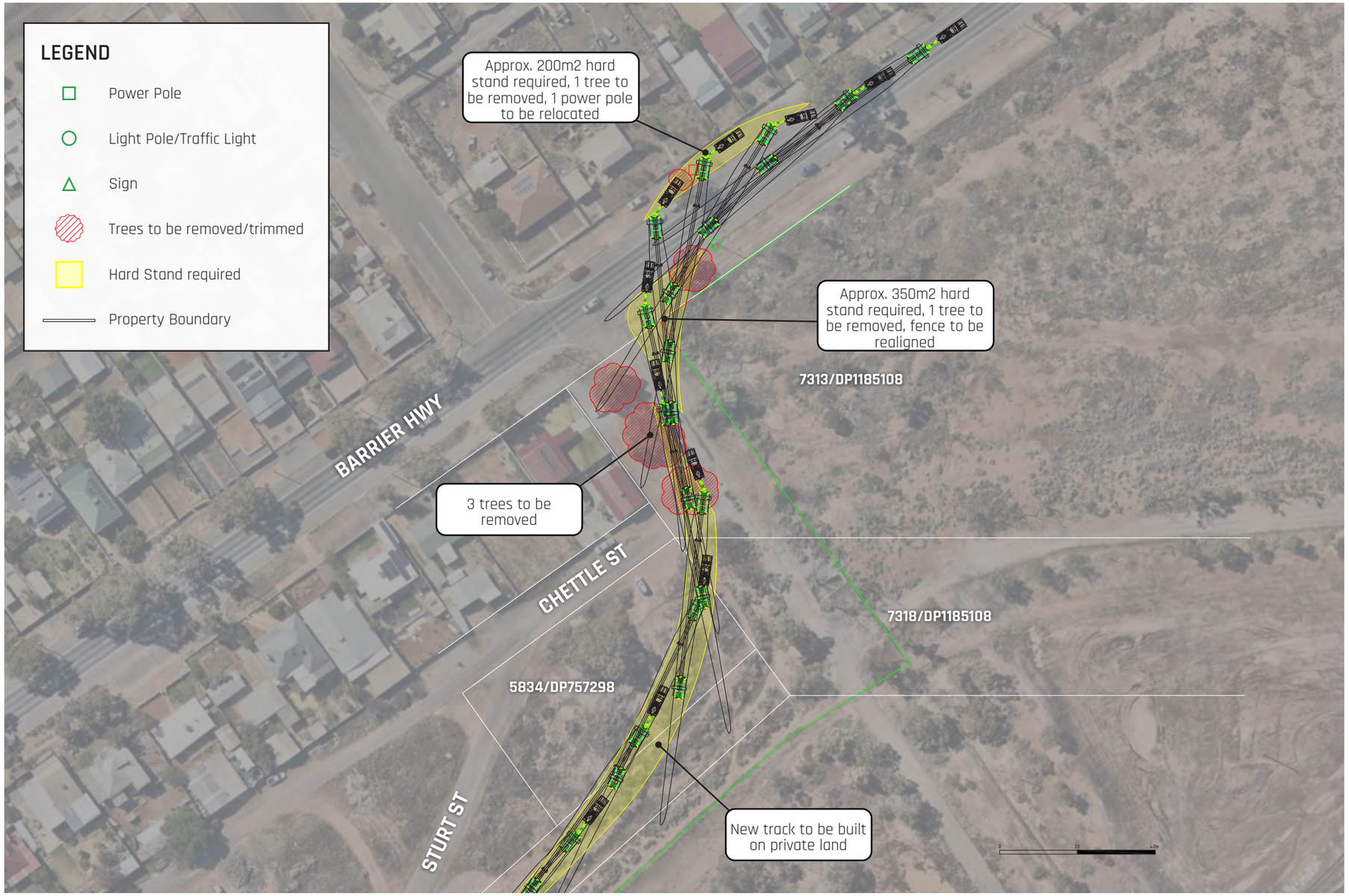
Sturt/Chettle St
& Barrier Hwy

As an alternative to Pinch Point 10B, blades can take a sharper turn to avoid entering into the Perilya Mine-affiliated property (Lot 7313 of DP1185108) as much as possible. Significantly more civil works are required to extend a track from Sturt St, and also at Barrier Hwy.

4-5 trees will also need to be removed, and a power pole will need to be moved.

The track from Sturt St will pass through a separate private property (Lot 5834 of DP757298). Permission will be required from this landowner to build on and transport through their land.

The Perilya Mine property cannot be avoided entirely but the impact will be limited to a small corner of the lot. The fence should be realigned to allow blades to pass through.



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DRAWING NAME:	Route Survey	REV

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Pinch Point

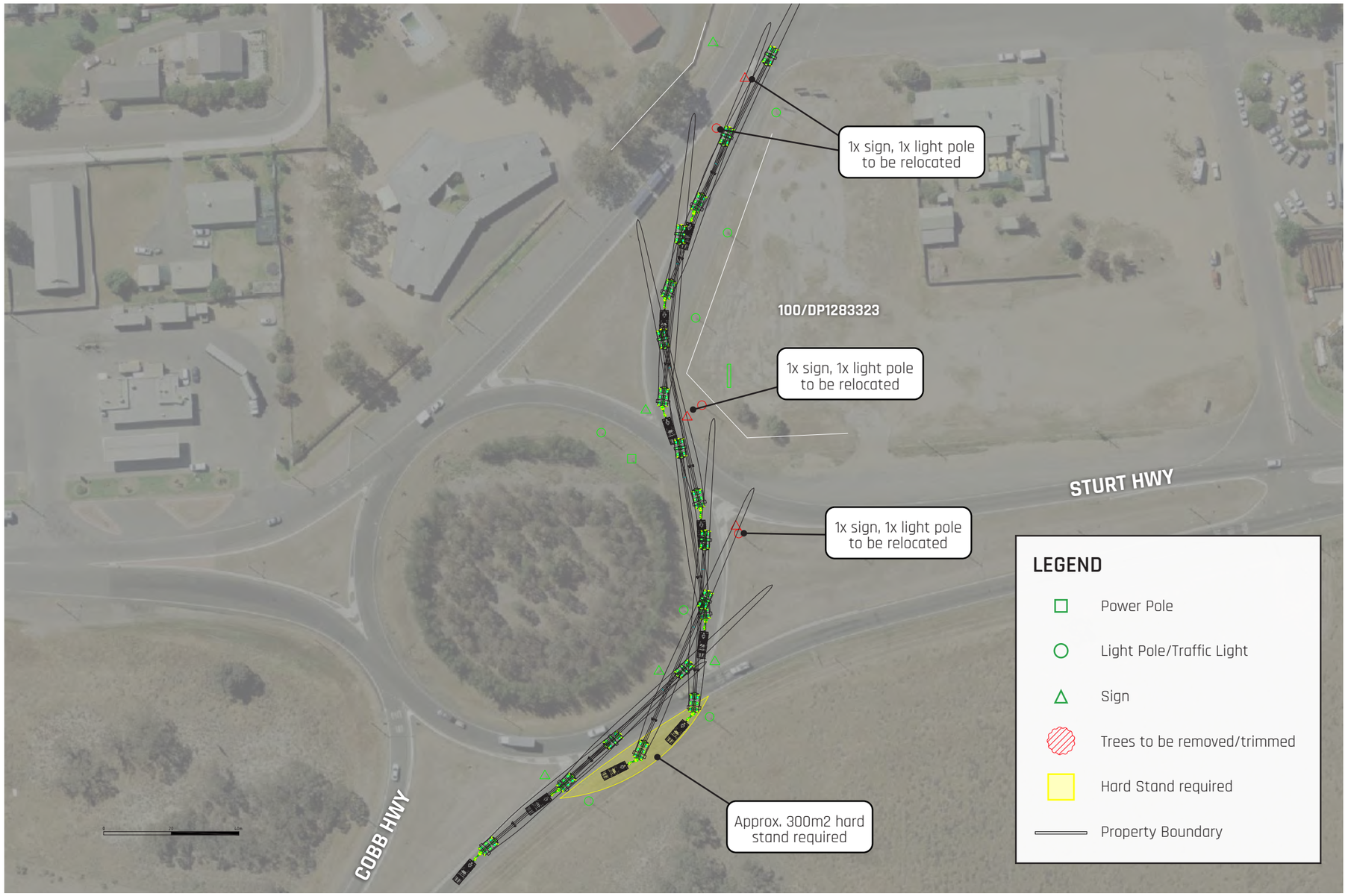
11

ROUNDABOUT
Cobb Hwy
& Sturt Hwy

The roundabout south of Hay will require a moderate amount of work prior to blade transport. Three light poles will need to be removed or relocated, and a number of signs made removeable.

The blade swing slightly overpasses the private property to the east (Lot 100 of DP1283323) which is a proposed service station currently under development. ARES reviewed the development plans and the blade tip should miss the 12m high signboard indicated on the plans.

There is also an option to take the wrong side of the roundabout, but after assessment this results in a similar amount of modifications but with a contraflow movement, which is not desirable. We recommend using the correct side as shown.



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List of Affected Landowners

The lots which either need to be accessed directly by trucks and trailers, or which are in the blade swept path, are listed below.



As part of our scope of work, we have run title searches on all properties or lots that will be affected by the transport route, as noted in the individual Pinch Points on preceding pages. South Australian Certificates of Title were obtained from the SA Integrated Land Information System (SAILIS). New South Wales Certificates of Title were obtained from the NSW Land Registry Services via Infocert.

Land owners are a mixture of the Crown, corporations and individuals.

All Certificates of Title will be provided separately to this report as an Appendix.

South Australia

Title Reference	Address	Pinch Point	Owner(s)
CT5063/663	19 Springbank Rd, Burra	07	Hichick Breeding Company P/L
CT6105/151	44 Copperhouse St, Burra	08	SA Government (DIT)
CT5419/54	LOT98 West St, Burra	08	Colin Alfred Phillips & Pauline Phillips
CT5695/294	LOT98 Cooper St, Burra	08	Regional Council of Goyder

New South Wales

Title Reference	Address	Pinch Point	Owner(s)
6667/DP822054	Pinnacles Rd, Broken Hill	09A	State of NSW
302/DP1242250	Barrier Hwy, Broken Hill	09	Willyama Common Trust
7307/DP1179131	Barrier Hwy, Broken Hill	09	State of NSW
7400/DP1179151	Kanandah Rd, Broken Hill	09	State of NSW
7401/DP1179151	Kanandah Rd, Broken Hill	09	State of NSW
7320/DP1185108	Menindee Rd, Broken Hill	10A	State of NSW
7313/DP1185108	Menindee Rd, Broken Hill	10A/10B/10C	State of NSW
5658/DP757298	Chettle St, Broken Hill	10B	State of NSW
7318/DP1185108	Menindee Rd, Broken Hill	10C	State of NSW
5834/DP757298	Chettle St, Broken Hill	10C	State of NSW
100/DP1283323	397 Moama St, Hay South	11	APC Hay P/L

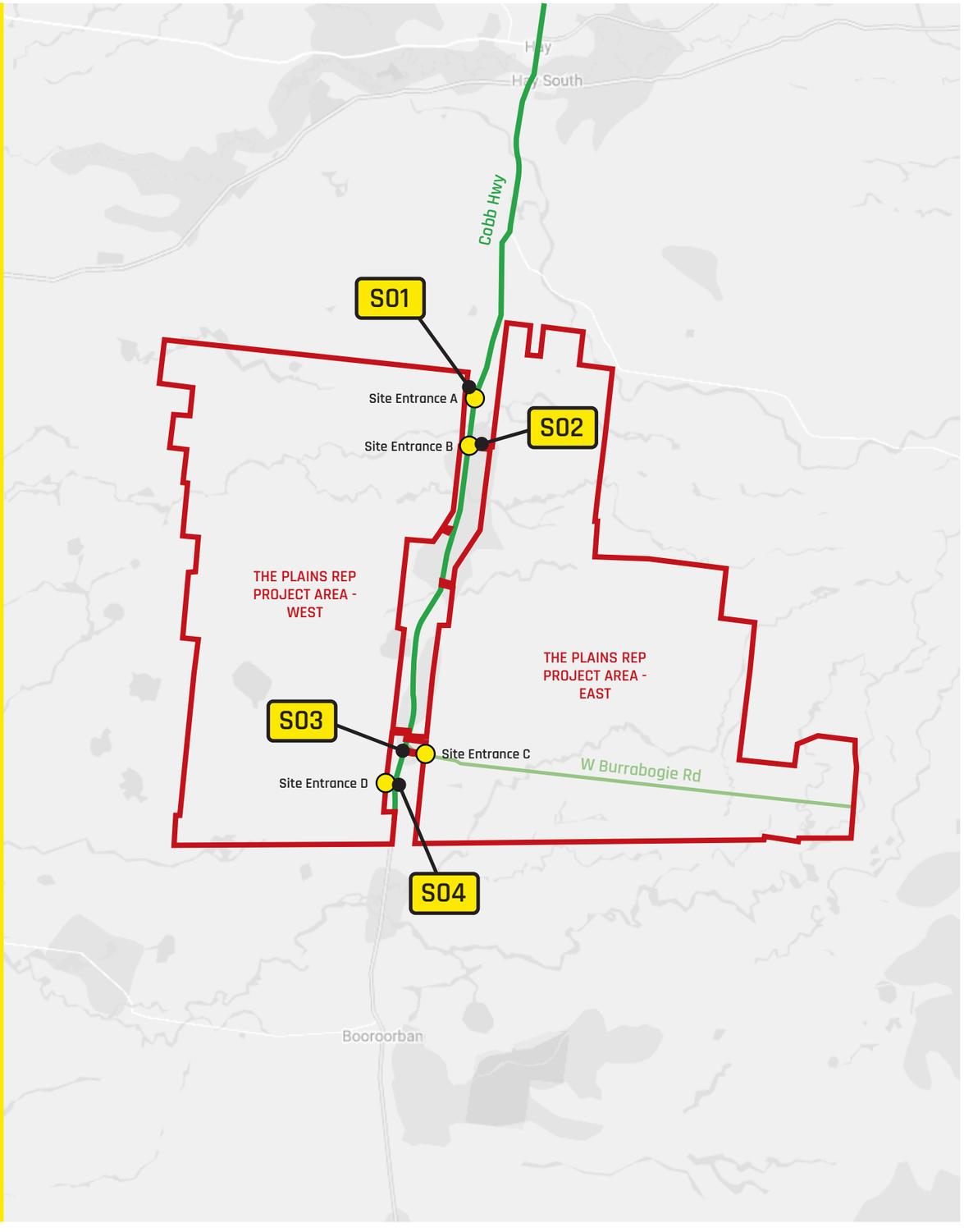
In the course of our searches we also noted a number of lots which seemed to be historical as they laid across existing roads. We have not performed title searches on these but have listed them for completeness below.

Title Reference	Address	Pinch Point
CT6144/634	12 Bishopstone Rd, Davoren Park	04
CT6144/635	12 Bishopstone Rd, Angle Vale	04
CT6144/636	LOT603 Angle Vale Rd, Angle Vale	04
CT5431/458	LOT1 Gawler North Ramp to Adelaide	05
Lots 5653 to 5657, DP757298	Sturt St, Broken Hill	10A/10B



03

Site Entrance Assessment



The Plains Site Entrances

There are four proposed site entrances to The Plains Renewable Energy Park project area, which spans both east and west sides of Cobb Hwy. They are, from north to south:

- Site Entrance A: Northern entrance to western precinct, turning directly off Cobb Hwy
- Site Entrance B: Northern entrance to eastern precinct, turning directly off Cobb Hwy
- Site Entrance C: Southern entrance to eastern precinct, off West Burrabogie Rd
- Site Entrance D: Southern entrance to western precinct, turning directly off Cobb Hwy

ARES examined the routes leading into each site entrance from Cobb Hwy as part of the survey.

SITE ENTRANCE A



SITE ENTRANCE B



SITE ENTRANCE C



SITE ENTRANCE D



Pinch Point

S01

RIGHT TURN
Cobb Hwy &
Site Entrance A

A new intersection will need to be built at this location turning right off the Cobb Hwy.

As the Cobb Hwy is a state road, WAD requirements will apply to modifications here.



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Pinch Point

S02

LEFT TURN
Cobb Hwy &
Site Entrance B

A new intersection will need to be built at this location turning left off the Cobb Hwy.

As the Cobb Hwy is a state road, WAD requirements will apply to modifications here.



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Pinch Point

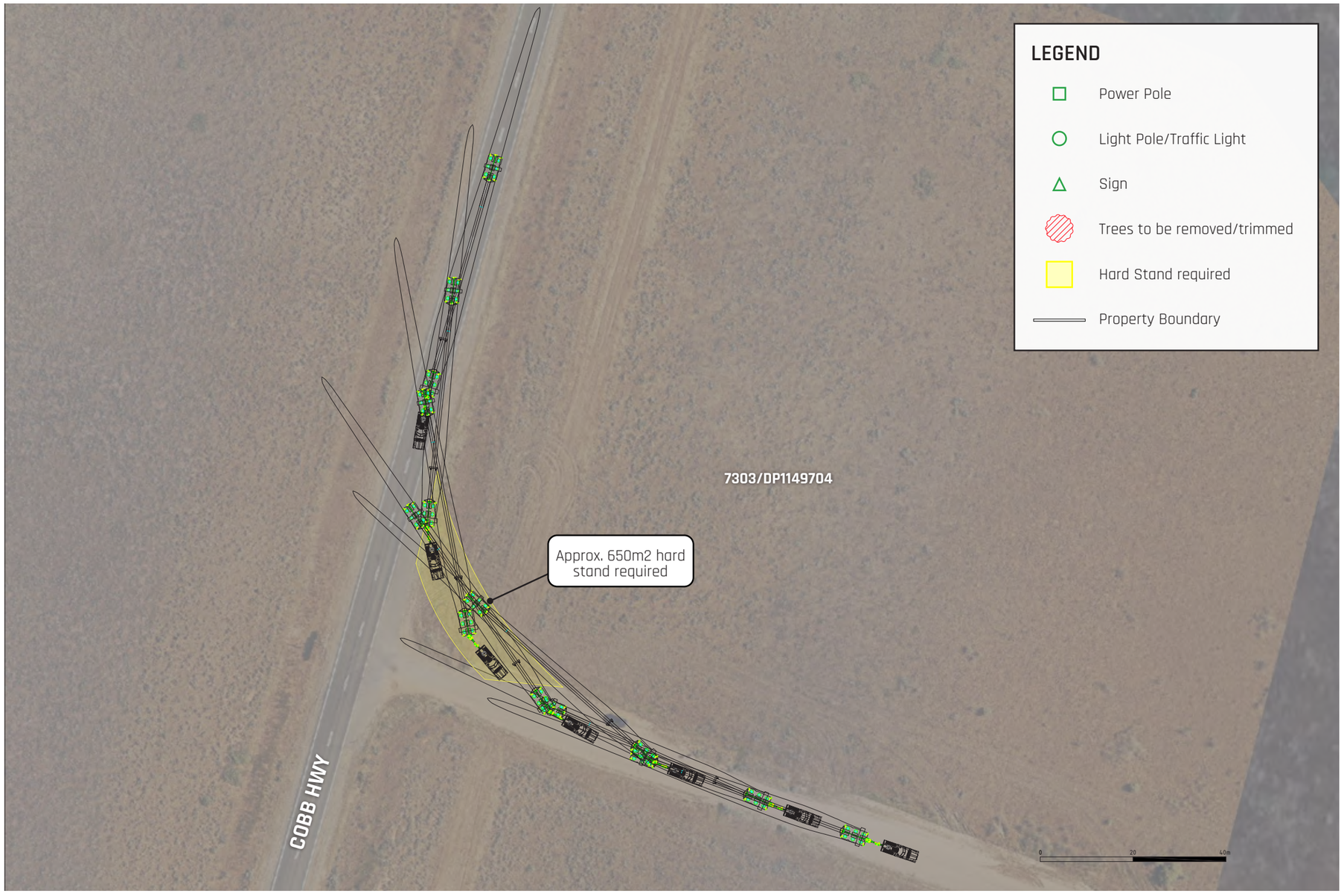
S03

LEFT TURN

Cobb Hwy &
W Burrabogie Rd

Site Entrance C is located at West Burrabogie Rd. The turn from Cobb Hwy onto this road will require some hard stand material to be laid down on the inside of the corner.

As the Cobb Hwy is a state road, WAD requirements will apply to modifications here.



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Pinch Point

S04

RIGHT TURN
Cobb Hwy &
Site Entrance D

A new intersection will need to be built at this location turning right off the Cobb Hwy.

As the Cobb Hwy is a state road, WAD requirements will apply to modifications here.



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04

Conclusion

Warradarge WF

A convoy of 3 blades leaves Henderson Port early in the morning on its way to site.

Conclusion

A brief outline of the report's major findings and any recommendations for actions to progress with the transport feasibility study.

> **...transport of 86m blades and 6.31m towers is feasible to The Plains R.E.P."**

Summary

Following our physical survey and swept path analysis, ARES believe that transport of turbine components including 86m GW86 blades and 6.31m towers is feasible from the **Port of Adelaide** to The Plains Renewable Energy Park.

Blades can be transported using state highways (Horrocks, Barrier and Cobb Hwys) with only minor detours. Modifications will be required at a number of pinch points, and some private land access will be required especially in the Broken Hill area, but there is no physical impediment to the blades along this route when using a conventional blade trailer setup.

For the tower sections, the overheight route from Adelaide is clear of any non-bypassable overhead structures. Overhead powerlines will need to be surveyed to gain an understanding of the quantity of lines requiring permanent lifting.

From a width perspective, travelling at 6.3m wide for such large distances will present challenges, but the quality of the roads being taken (overtaking lanes, rest areas, etc.) will mitigate these risks as much as reasonably practicable.

The Port of Adelaide is well suited to host the components for the project, having processed a number of significant wind projects in the recent past, including Goyder Wind Farm currently. Storage space is sufficient and the only concern would be if multiple wind projects were arriving into the port at the same time.

From the Stage 1 Desktop Assessment, Adelaide stood out as the best single-port solution for The Plains turbine components, and the physical survey and analysis has confirmed that it is an excellent option.

Next Steps

Based on the findings in this route survey, we recommend the following actions:

- Engage with transport authorities (DIT and TfNSW) for preliminary feedback on proposed routes
- Engage power authorities to perform overhead surveys in their respective jurisdictions
- Liaise with land owners affected by proposed routes
- Liaise with local councils along routes

Summary of Road Modifications

The following table lists all required modifications to allow transport of wind turbine components to take place.

Pinch Point	Road/Intersection	Modifications Required	Risk
01	Oceam Steamers Rd & Eastern Pde	Gate to be widened at storage area exit.	Low
02	Eastern Pde & Port River Expy	1 light pole and possibly 1 traffic light to be relocated (subject to blade tip positioning)	Medium
03	Port Wakefield Rd & Angle Vale Rd	Sections of W-beam barrier removed or replaced with removeable bollards, temporary hardstand to be laid down on median strips (approx. 900m2 total)	Medium
04	Angle Vale Rd & N-S Mwy	1 sign to be made removeable, 2 others to be checked for tip clearance	Low
05	Sturt Hwy & Horrocks Hwy	2 signs to be made removeable and 1 light pole to be relocated. Approx. 420m2 of temporary hardstand required.	High
06	Horrocks Hwy	Minor tree trimming south of Tarlee	Low
07	Barrier Hwy & Copperhouse Rd	2 signs to be made removeable, approx. 550m2 of temporary hardstand to be laid down	Medium
08	Copperhouse St & West St	Tree trimming and/or removal, approx. 150m2 of temporary hardstand to be laid down	High
09A/09B	Barrier Hwy @ BHSP	Construction of new temporary gravel bypass track to Gaffney St (approx. 5.5km). Track to be wind farm specification, i.e. min 5.5m width, suitable for min 14 tons per axle loading.	High
09C	Barrier Hwy 2.4km from Broken Hill	Construction of new temporary gravel bypass track to Gaffney St (approx. 3.7km). Track to be wind farm specification, i.e. min 5.5m width, suitable for min 14 tons per axle loading. New intersection off Barrier Hwy required. 1 sign to be moved.	Very High
10A	Crystal St & Sturt St	Temporary gravel track to be built through private land. Track to be wind farm specification, i.e. min 5.5m width, suitable for min 14 tons per axle loading. 1x sign to be made removeable.	High
10B	Chettle St & Barrier Hwy	Temporary gravel track to be built through private land. Track to be wind farm specification, i.e. min 5.5m width, suitable for min 14 tons per axle loading. An egress gate to be installed on Barrier Hwy.	Very High
10C	Sturt/Chettle St & Barrier Hwy	Temporary gravel track to be built through private land. Track to be wind farm specification, i.e. min 5.5m width, suitable for min 14 tons per axle loading. Multiple trees to be removed. 1 power pole to be relocated. Approx. 550m2 of temporary hardstand required. Fence to be realigned.	Very High
11	Cobb Hwy	3 light poles to be relocated, and 3 signs to be made removeable, 300m2 of temporary hardstand to be laid down	High



05

Appendices

Murra Warra WF

Deliveries to Murra Warra included towers up to 5.8m in diameter - the largest ever at the time.

ARTC Rail Crossing Requirements

From: ODL Permits
To: Gillian Etherington
Cc: Ian Wong; ODL Permits
Subject: RE: OSOM Rail enquiry for ARES / JMI
Date: Friday, 1 March 2024 2:06:06 PM
Attachments: image001.png
image002.png
ARTC Tower Route-Rail-Level-Crossing-Permit-Application-Form.pdf
ARTC Blade Route-Rail-Level-Crossing-Permit-Application-Form.pdf

---

Hi Gill

As discussed, ***this information is subject to change***, but as a guide I have listed the crossings being considered for this project and the dimensions limits that may make a difference to the necessary protection requirements from ARTC for the individual crossings.

Road Name	Area / Suburb	ALCAM No.	Track km	Line
Eastern Pde / Grand Trunkway	Gillman	1887	6.768	Dry Creek - Port Flat
Wilkins Hwy	Caltowie	854	60.795	Crystal Brook - Cockburn
Appila Rd	Jamestown	863	71.703	Crystal Brook - Cockburn
OD5 Rd	Jamestown	865	73.481	Crystal Brook - Cockburn
Angle Vale Rd	Virginia	72	36.815	Adelaide - Crystal Brook
Barrier Hwy	Ucolta	901	124.645	Crystal Brook - Cockburn
Barrier Hwy	Mingary	938	309.699	Crystal Brook - Cockburn
Cobb Hwy	Ivanhoe	1040	816.098	Goobang Junction - Broken Hill

Height
There are no overhanging assets at the above listed ARTC level crossings to be considered

Width
The maximum width before requiring a Rail Safety Worker (RSW) present is 6.45m. If you exceed this width, there will be certain crossings listed above that will be required to have a RSW in attendance each time to traverse.

Length
The length varies for each crossing, depending on their current settings. The length increments that may affect the safety requirements are 26m, 30m, 36.5m. Any loads 40m and above will require a RSW in attendance each time you traverse.

Weight
The level crossings listed above are ok for loads up to 150 tonnes, however the maximum axle weight should also be considered. Anything above 16 tonnes per axle will need closer assessment.

Please note that the longer loads (e.g. blades) will be required to provide a Travel Management Plan to ARTC with their permit application, outlining how they intend to traverse each level crossing (e.g. swept path, approach and exit angles)

Please note that if a Stop & Report permit is issued, the loads need to consider a safe location where they can make the call to our network control to gain clearance to traverse the crossings. ARTC are not responsible for these locations, but this needs to be considered when planning so the loads are not blocking the roads while awaiting approval from ARTC Network Control.

Warm Regards

Suzanne Marshall
Project Administrator
Third Party Works

General Enquiries:
P. 08 8112 0300
E. Admin.TPW@artc.com.au

Direct:
P. 08 8217 4435
M. 0484 249 187
E. SMarshall@ARTC.com.au

ODL Permit Applications:
P. 08 8112 0300
E. ODL.permits@artc.com.au

Australian Rail Track Corporation
11 Sir Donald Bradman Drive
Keswick Terminal
Mile End SA 5031

artc.com.au

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Please consider the environment before printing this email

From: Gillian Etherington <gill@millarinvestments.com.au>
Sent: Thursday, 29 February 2024 4:17 PM
To: ODL Permits <ODL.permits@ARTC.com.au>
Cc: Ian Wong <ian.wong@aresgroup.com.au>
Subject: [EXT] RE: OSOM Rail enquiry for ARES / JMI

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If you believe this email is suspicious, please report it with the "Report Phishing" icon in Outlook, or forward to suspiciousemails@artc.com.au.

Hi Suzanne,

As discussed, this project has been approved but is still in planning stage.
There will be up to 226 wind turbines, transported in sections from Port of Adelaide to Booroorban, near Hay in NSW.
Please see attached application forms.
One for the Tower high load route – Route ID 1HG7Q-6 v2
One for the Blade long load route – Route ID 1HG7Q-6 v1

Our client is seeking an in-principal approval and/or written advice as to any special requirements (e.g supervision). There are some smaller loads within gazette dimensions also (5m wide, 5m high and 30m long).

Thank You

Aurizon Rail Crossing Requirements

From: Gillian Etherington
To: Ian Wong
Subject: FW: [EXTERNAL SENDER] OSOM Rail enquiry - ARES / JMI
Date: Monday, 18 March 2024 4:37:28 PM
Attachments: image003.png
image004.png
image005.png

Hi Ian,

Please see below from Aurizon.

Only two crossings.
One on Ocean Steamers Rd, pending which berth loads are imported from.
One at Snowtown for the towers up to 50m.

Stop and Report required when exceeding 50 metres.

Kind Regards,

GILLIAN ETHERINGTON
ARES GROUP
P: 1300 243 289 | M: +61 413 109 262
E: gillian.etherington@aresgroup.com.au | W: www.aresgroup.com.au

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From: Sims, Mark <Mark.Sims@aurizon.com.au>
Sent: Monday, March 18, 2024 4:12 PM
To: Gillian Etherington <gill@millarinvestments.com.au>
Subject: RE: [EXTERNAL SENDER] OSOM Rail enquiry - ARES / JMI

Hi Gillian,

Depending on what berth you are departing from on Ocean Steamers road, we have one level crossing that runs into Viterra that may or may not affect your passage.

If you are on the North side and traverse over it then we will need to put in a stop and report in place before crossing as your blade lengths are over 50 meters.

The other active Aurizon level crossing is at Snowtown that will be traversed by your 50 meter towers this is on the limit but should be fine.

AURIZON
Mark Sims
Service Coordinator Bulk South
Bulk
Bulk Central
T 0419032139 / M
1 Kidman Rd , Dry Creek, South Australia 5094
Mark.Sims@aurizon.com.au / aurizon.com.au

I know I choose Safe



From: Gillian Etherington <gill@millarinvestments.com.au>
Sent: Wednesday, 28 February 2024 8:56 AM
To: Sims, Mark <Mark.Sims@aurizon.com.au>
Subject: [EXTERNAL SENDER] OSOM Rail enquiry - ARES / JMI

You don't often get email from gill@millarinvestments.com.au. Learn why this is important

CAUTION - EXTERNAL SENDER: Exercise caution when clicking links or opening attachments. Do not enter your password to unexpected pop-up windows.

Hi Mark,

As recently discussed,
We have been engaged to assist with transport enquiries for a state significant renewable energy project.
We have researched most suitable routes for various oversize components from Port of Adelaide to The Plains, via Broken Hill..
Can you please advise of the Aurizon rail crossing requirements for the routes below?

Route 1 – required for overheight components. Overall width 6.31m, overall height 6.31m, overall length up to 50m.

Ocean Steamers Rd – Rail at Port of Adelaide
Eastern Parade
Port River Expy A9
Salisbury Hwy A9
Port Wakefield Rd/ Princes Hwy A1
Princes Hwy / Augusta Hwy A1- Rail at Snowtown
Wilkins Hwy B79 – Rail at Caltowie
Detour at Jamestown
Via Apilla Rd – Rail
Boundary Rd, Princes Hwy, RM Williams Rd
OD 5 Rd - Rail
Wilkins Hwy B78
Jamestown Whyte-Yarcowie Rd
Whyte Road
Barrier Hwy A32 to Wilcannia - Rail at Ucolta, and Mingary
Cobb Hwy B75 to Booroorban, NSW – Rail at Ivanhoe

Route 2 – required for length. Overall width 5m, overall height 5m, overall length up to **100m**.

Ocean Steamers Rd – Rail at Port of Adelaide
Eastern Parade
Port River Expy A9
Northern Connector
Port Wakefield Rd/ Princes Hwy A1
Angle Vale Rd – Rail at Virginia
Northern Expy M2
Horrocks Hwy / Main Nth Rd B82 – Disused Rail at Roseworthy,
Barrier Hwy A32 – Disused Rail at Tarlee
Detour at Burra
Via Copperhouse Rd, West St – Disused Rail
Barrier Hwy A32 to Wilcannia – Rail at Ucolta, and Mingary
Cobb Hwy B75 to Booroorban, NSW – Rail at Ivanhoe

I'll also be contacting ARTC.
If you need further information please let me know

Thank You

Kind Regards,

www.aresgroup.com.au

Ares Project Services PTY LTD
L105, 480 StKilda Rd
Melbourne VIC, 3004

P: 1300 243 289
F: +61 3 8560 7020
E: enquiries@aresgroup.com.au
W: www.aresgroup.com.au

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APPENDIX C BAM PLOT DATA

Hunter Ecology

BAM Site – Field Survey Form

Survey Name		Date	Recorders	
Hey Summer		14/2/22	Bart + Lizzie	
Zone:	Datum:	Plot ID: 7		Photo #:
Easting:	Northing:	IBRA region:	Midline bearing ~~from 0 m~~:	
VZ / PCT: 164 [redacted]				

Record easting and northing at 0m on midline. Dimensions (Shape) of 0.04ha base plot.

BAM Attribute (400m² plot)	Sum values	
	Count of native richness	Cover
Trees	0	0
Shrubs	7	51.3
Grasses etc.	5	20.3
Forbs	6	0.8
Ferns	0	0
Other	0	0
High threat weed cover		0

Cover: 0.1, 0.2, 0.3..... 1,2,3,.....,10, 15, 20, 25, ... 100% (foliage cover). *Note: 0.1% cover is approx.. 63x63 cm or a circle about 71 cm diameter, 0.5% approx. 1.4 x 1.4m, 2% cover is approx. 2 x 2m, 5% = 4 x 5m, 25% 10 x 10m*

BAM Attribute (1000m² plot)		
DBH	#Tree Stems Count	#Stems with Hollows
80 + cm		
50 – 79 cm		
30 – 49 cm		
20 – 29 cm		
10 – 19 cm		
5 – 9 cm		
<5 cm		
Length of logs (m) (≥ 10 cm diameter, >50cm in length)	Tally: 0	

Counts apply when the number of tree stems within a size class is ≤ 10. Estimate can be used when > 10 (eg. 10, 20, 30....100, 200). For a multi-stemmed tree, only the largest living stem is included in the count / estimate. Tree stems must be living.

For hollows, count only the presence of a stem containing hollows. For a multi-stemmed tree, only the largest stem is included in the count/estimate. Stems may be dead and may be shrubs.

BAM Attribute (1 x 1 m plots)	Litter cover %					Bare ground cover %					Cryptogam cover %					Rock cover %				
	5	15	25	35	45	5	15	25	35	45	5	15	25	35	45	5	15	25	35	45
Subplot score % in each	2	5	15	60	5	50	60	30	30	55	0	0	0	0	2	0	0	0	0	0
Average of the 5 subplots	7.4					45					0.4					0				

Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10cm in diameter)

Hunter Ecology

PCT 154

BAM Site – Plot Species List

400m² plot: Sheet ___ of ___	Survey Name	Plot ID	Recorders
Date: 14/2/22	Hey Summer	7	Bart + Lissa

GF Code	Top 3 native species in each growth form group: full species name mandatory. All other native and exotic species: full species name where practicable	N, E or HTE	Cover	Stratum (E,M,S,G)	Voucher	Photo #
SG	Maireana aphylla	N	35	S/G		
SG	Nitraria billardierei	N	10	S		
GG	Sporobolus caroli	N	10	G		
SG	Sclerolaena brachyptera	N	1	G		
FG	Atriplex lindleyi	N	0.2	G		
GG	Rhytidosperma caespitosum	N	10	G		
SG	Sclerolaena muricata	N	5	G/S		
GG	Austrostipa scabra	N	0.1	G		
FG	Rodanthe stuartiana	N	0.1	G		
FG	Suda intricata	N	0.2	G		
GG	Chloris truncata	N	0.1	G		
FG	Solanum esuriale	N	0.1	G		
SG	Atriplex vesicaria	N	0.1	G/S		
SG	Atriplex nummularia	N	0.1	S/E		
SG	Maireana pentagona	N	0.1	G		
FG	Craspedia canens	N	0.1	G		
GG	Panicum laevinode	N	0.1	G		
FG	Calotis scabiosifolia	N	0.1	G.		

N: native, **E**:exotic, **HTE**: high threat exotic, **GF** – circle code if 'top 3'

Cover: 0.1, 0.2, 0.3..... 1,2,3,.....,10, 15, 20, 25, ... 100% (foliage cover). *Note: 0.1% cover is approx.. 63x63 cm or a circle about 71 cm diameter, 0.5% approx. 1.4 x 1.4m, 2% cover is approx. 2 x 2m, 5% = 4 x 5m, 25% 10 x 10m*

Abundance: 1, 2, 3, ...10, 20, 30, ... 100, 200,...., 1000

Stratum: E – emergent, C – canopy, M – mid-storey / sub canopy, S – shrub layer, G – ground layer

Hunter Ecology

BAM Site – Field Survey Form

Survey Name		Date	Recorders
Hay Summer		15/2/22	Bart & Lissa
Zone:	Datum:	Plot ID: 8	Photo #:
Easting:	Northing:	IBRA region:	Midline bearing ~~from 0 m~~:
VZ / PCT: 164 - ~~moderately~~ ~~light~~ ~~grazed~~.			

Record easting and northing at 0m on midline. Dimensions (Shape) of 0.04ha base plot.

BAM Attribute (400m² plot)	Sum values	
	Count of native richness	Cover
Trees	0	0
Shrubs	10	52.9
Grasses etc.	5	2.8
Forbs	2	0.3
Ferns	0	0
Other	0	0
High threat weed cover		0

Cover: 0.1, 0.2, 0.3,... 1,2,3,.....,10, 15, 20, 25, ... 100% (foliage cover) *Note: 0.1% cover is approx.. 63x63 cm or a circle about 71 cm diameter, 0.5% approx. 1.4 x 1.4m, 2% cover is approx. 2 x 2m, 5% = 4 x 5m, 25% 10 x 10m*

BAM Attribute (1000m² plot)		
DBH	#Tree Stems Count	#Stems with Hollows
80 + cm		
50 – 79 cm		
30 – 49 cm		
20 – 29 cm		
10 – 19 cm		
5 – 9 cm		
<5 cm		
Length of logs (m) (≥ 10 cm diameter, >50cm in length)	Tally: 0	

Counts apply when the number of tree stems within a size class is ≤ 10. Estimate can be used when > 10 (eg. 10, 20, 30....100, 200). For a multi-stemmed tree, only the largest living stem is included in the count / estimate. Tree stems must be living.

For hollows, count only the presence of a stem containing hollows. For a multi-stemmed tree, only the largest stem is included in the count/estimate. Stems may be dead and may be shrubs.

BAM Attribute (1 x 1 m plots)	Litter cover %					Bare ground cover %					Cryptogam cover %					Rock cover %				
	5	15	25	35	45	5	15	25	35	45	5	15	25	35	45	5	15	25	35	45
Subplot score % in each	50	25	40	30	60	20	15	10	20	10	0	0	0	0	0	0	0	0	0	0
Average of the 5 subplots	41					15					0					0				

Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10cm in diameter)

Hunter Ecology

~~Grassy grazed~~ PCT 164

BAM Site – Plot Species List

400m² plot: Sheet ___ of ___	Survey Name	Plot ID	Recorders
Date: 15/2/22	Way Summer	8	Bart & Lissa

GF Code	Top 3 native species in each growth form group: full species name mandatory. All other native and exotic species: full species name where practicable	N, E or HTE	Cover	Stratum (E,M,S,G)	Voucher	Photo #
SG	Maireana aphylla	N	35	G/S		
GG	Panicum decompositum	N	0.3	G		
GG	Sporobulus caroli	N	2	G		
FG	Sida intricata	N	0.2	G		
SG	Nitraria billardierei	N	1	S		
SG	Sclerolaena brachyptera	N	0.2	G		
SG	Salsola tragus	N	0.1	G		
SG	Rhagodia spinescens	N	0.3	S		
SG	Atriplex vesicaria	N	15	S/G		
SG	Sclerolaena triaspis ~~ed.~~	N	1	G		
GG	Chloris truncata	N	0.2	G		
GG	Enteropogon acicularis	N	0.2	G		
SG	Sclerolaena bicornis	N	0.1	G		
SG	Sclerolaena muricata	N	0.1	G/S		
GG	Rhytidosperm caespitosa	N	0.1	G		
SG	Malacocera tricornis ~~soft~~ hows	N	0.1	G		
FG	Euphorbia drummondii ~~Euph~~	N	0.1	G		
~~—~~	~~Atriplex~~	~~N~~	~~0~~	~~G/S~~		

NB: Leaf litter composed mainly of dried off Lolium perrenne

N: native, E:exotic, **HTE**: high threat exotic, **GF** – circle code if 'top 3'

Cover: 0.1, 0.2, 0.3..... 1,2,3,.....,10, 15, 20, 25, ... 100% (foliage cover). *Note: 0.1% cover is approx.. 63x63 cm or a circle about 71 cm diameter, 0.5% approx. 1.4 x 1.4m, 2% cover is approx. 2 x 2m, 5% = 4 x 5m, 25% 10 x 10m*

Abundance: 1, 2, 3, ...10, 20, 30, ... 100, 200,...., 1000

Stratum: E – emergent, C – canopy, M – mid-storey / sub canopy, S – shrub layer, G – ground layer

Hunter Ecology

BAM Site – Field Survey Form

Survey Name	Date	Recorders
Hay Field Trip for ERM	15 Feb 2022	Lizzie and Bart
Plot ID: 14		~~Photo #~~:
VZ / PCT: 153		

BAM Attribute (400m² plot)	Sum values	
	Count of native richness	Cover
Trees	0	0
Shrubs	9	19.3
Grasses etc.	4	2.3
Forbs	4	1.9
Ferns	0	0
Other	0	0
High threat weed cover		0.1

Cover: 0.1, 0.2, 0.3..... 1,2,3,.....,10, 15, 20, 25, ... 100% (foliage cover). *Note: 0.1% cover is approx. 63x63 cm or a circle about 71 cm diameter, 0.5% approx. 1.4 x 1.4m, 2% cover is approx. 2 x 2m, 5% = 4 x 5m, 25% 10 x 10m*

BAM Attribute (1000m² plot)		
DBH	**#Tree Stems Count**	**#Stems with Hollows**
80 + cm		
50 – 79 cm		
30 – 49 cm		
20 – 29 cm		
10 – 19 cm		
5 – 9 cm		
<5 cm		
Length of logs (m) (≥ 10 cm diameter, >50cm in length)	**Tally:** 0	

Counts apply when the number of tree stems within a size class is ≤ 10. Estimate can be used when > 10 (eg. 10, 20, 30 ... 100, 200). For a multi-stemmed tree, only the largest living stem is included in the count / estimate. Tree stems must be living.

For hollows, count only the presence of a stem containing hollows. For a multi-stemmed tree, only the largest stem is included in the count/estimate. Stems may be dead and may be shrubs.

BAM Attribute (1 x 1 m plots)																				
	Litter cover %					**Bare ground cover %**					**Cryptogam cover %**					**Rock cover %**				
Subplot	5	15	25	35	45	5	15	25	35	45	5	15	25	35	45	5	15	25	35	45
score % in each	30	20	30	25	20	30	40	30	50	40	0	0	0	0	0	0	0	0	0	0
Average of the 5 subplots	25					38					0					0				

Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10cm in diameter)

PCT 153

Hunter Ecology

BAM Site – Plot Species List

400m² plot: Sheet ___ of ___	Survey Name	Plot ID	Recorders
Date: 15 Feb 2022	Hay Field Trip for ERM	14	Lizzie and Bart

GF Code	Top 3 native species in each growth form group. full species name mandatory. All other native and exotic species: full species name where practicable	N, E or HTE	Cover	Stratum (E,M,S,G)	Voucher	Photo #
SG	Maireana pyramidata	N	15	S/G		
GG	Austrostipa scabra	N	2	G		
FG	Maireana pentagona	N	1.5	G		
SG	Atriplex vesicaria	N	0.1	S/G		
SG	Sclerolaena bicornis ~~muricata~~	N	1.5	G		
FG	Dysphania pumilio crumbweed	N	0.2	G		
GG	Sporobolus caroli	N	0.1	G		
SG	Malacocera tricornis ~~tricuspis~~ saltbush	N	0.1	G		
—	Lycium ferocissimum	HTW	0.1	S		
SG	Nitraria billardiera	N	0.3	S		
FG	Euphorbia drummondii ~~sp~~	N	0.1	G		
SG	Maireana aphylla	N	2	G/S		
FG	Einadia nutans	N	0.1	G		
SG	Sclerolaena tricuspis	N	0.1	G		
GG	Eragrostis ~~sp~~ browniii	N	0.1	G		
SG	Rhagodia spinescens	N	0.1	S		
GG	Enteropogon acicularis	N	0.1	G		
SG	Sclerolaena bradyptera	N	0.1	G		

N: native, E:exotic, **HTE**: high threat exotic, **GF** – circle code if 'top 3'

Cover: 0.1, 0.2, 0.3..... 1,2,3,.....,10, 15, 20, 25, ... 100% (foliage cover). *Note: 0.1% cover is approx.. 63x63 cm or a circle about 71 cm diameter, 0.5% approx. 1.4 x 1.4m, 2% cover is approx. 2 x 2m, 5% = 4 x 5m, 25% 10 x 10m*

Abundance: 1, 2, 3, ...10, 20, 30, ... 100, 200,...., 1000

Stratum: E – emergent, C – canopy, M – mid-storey / sub canopy, S – shrub layer, G – ground layer

Hunter Ecology

BAM Site – Field Survey Form

Survey Name	Date	Recorders
Hay Field Trip for ERM	15 Feb 2022	Lizzie and Bart
Plot ID: 16		Photo #:
VZ / PCT: 15 – MODERATE		

BAM Attribute (400m² plot)	Sum values	
	Count of native richness	Cover
Trees	2	20.2
Shrubs	7	35.6
Grasses etc.	6	3.5
Forbs	2	0.3
Ferns	0	0
Other	0	0
High threat weed cover		2

Cover: 0.1, 0.2, 0.3..... 1,2,3,.....,10, 15, 20, 25, ... 100% (foliage cover). *Note 0.1% cover is approx.. 63x63 cm or a circle about 71 cm diameter, 0.5% approx. 1.4 x 1.4m, 2% cover is approx. 2 x 2m, 5% = 4 x 5m, 25% 10 x 10m*

BAM Attribute (1000m² plot)		
DBH	#Tree Stems Count	#Stems with Hollows
80 + cm	1	1
50 – 79 cm	III	III
30 – 49 cm	III	II
20 – 29 cm	1	1
10 – 19 cm		
5 – 9 cm		
<5 cm		
Length of logs (m) (≥ 10 cm diameter, >50cm in length)	Tally: 10m	

Counts apply when the number of tree stems within a size class is ≤ 10. Estimate can be used when > 10 (eg. 10, 20, 30 ....100, 200). For a multi-stemmed tree, only the largest living stem is included in the count / estimate. Tree stems must be living.

For hollows, count only the presence of a stem containing hollows. For a multi-stemmed tree, only the largest stem is included in the count/estimate. Stems may be dead and may be shrubs.

BAM Attribute (1 x 1 m plots)	Litter cover %					Bare ground cover %					Cryptogam cover %					Rock cover %				
	5	15	25	35	45	5	15	25	35	45	5	15	25	35	45	5	15	25	35	45
Subplot score % in each	25	50	40	15	20	20	10	40	15	25	5	0	0	0	0	0	0	0	0	0
Average of the 5 subplots	30					22					1					0				

Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10cm in diameter)

Hunter Ecology

PCT 15

MODERATE

BAM Site – Plot Species List

400m² plot: Sheet ___ of ___	Survey Name	Plot ID	Recorders
Date: 15 Feb 2022	Hay Field Trip for ERM	16	Lizzie and Bart

GF Code	Top 3 native species in each growth form group: full species name mandatory. All other native and exotic species: full species name where practicable	N, E or HTE	Cover	Stratum (E,M,S,G)	Voucher	Photo #
TG	Eucalyptus largiflorens	N	20	C		
SG	Atriplex nummularia	N	30	S		
SG	Rhagodia spinescens	N	2	S		
SG	Enchylaena tomentosa	N	0.2	S/G		
—	Lycium ferocissimum	HTE	2	S		
GG	Enteropogon acicularis	N	3	G		
—	Heliotropie europeum	E	0.1	G		
FG	Dysphania pumilio	N	0.2	G		
SG	Maireana pyramidata	N	3	S/G		
TG	Acacia oswaldii	N	0.2	S		
SG	Scleroleana bicornis	N	0.1	G		
GG	Rhytidosperma caespitosum	N	0.1	G		
SG	Sclerolaena brachyptera	N	0.1	G		
GG	Juncus sp.	N	0.1	G		
GG	Panicum effusum	N	0.1	G		
SG	Nitraria billardierei	N	0.2	S		
FG	Sida corrugata	N	0.1	G		
~~—~~	~~Avena fatua~~	~~E~~	~~0.1~~	~~G~~		
GG	Panicum laevinode	N	0.1	G		
GG	Dactyloctenium radulans	N	0.1	G		

N: native, **E**:exotic, **HTE**: high threat exotic, **GF** – circle code if 'top 3'

Cover: 0.1, 0.2, 0.3….. 1,2,3,……,10, 15, 20, 25, ….. 100% (foliage cover). *Note: 0.1% cover is approx.. 63x63 cm or a circle about 71 cm diameter, 0.5% approx. 1.4 x 1.4m, 2% cover is approx. 2 x 2m, 5% = 4 x 5m, 25% 10 x 10m*

Abundance: 1, 2, 3, ….10, 20, 30, ….. 100, 200,…., 1000

Stratum: E – emergent, C – canopy, M – mid-storey / sub canopy, S – shrub layer, G – ground layer

Hunter Ecology

BAM Site – Field Survey Form

Survey Name	Date	Recorders
Hay Field Trip for ERM	16 Feb 2022	Lizzie and Bart
Plot ID: # 20		~~Photo #:~~
VZ / PCT: 163		

BAM Attribute (400m² plot)	Sum values	
	Count of native richness	Cover
Trees	0	0
Shrubs	5	36.3
Grasses etc.	2	0.2
Forbs	3	0.3
Ferns	0	0
Other	0	0
High threat weed cover	1	5

Cover: 0.1, 0.2, 0.3..... 1,2,3,.....,10, 15, 20, 25, ... 100% (foliage cover). *Note: 0.1% cover is approx.. 63x63 cm or a circle about 71 cm diameter, 0.5% approx. 1.4 x 1.4m, 2% cover is approx. 2 x 2m, 5% = 4 x 5m, 25% 10 x 10m*

BAM Attribute (1000m² plot)		
DBH	#Tree Stems Count	#Stems with Hollows
80 + cm		
50 – 79 cm		
30 – 49 cm		
20 – 29 cm		
10 – 19 cm		
5 – 9 cm		
<5 cm		
Length of logs (m) (≥ 10 cm diameter, >50cm in length)	Tally: 0	

Counts apply when the number of tree stems within a size class is ≤ 10. Estimate can be used when > 10 (eg. 10, 20, 30....100, 200). For a multi-stemmed tree, only the largest living stem is included in the count / estimate. Tree stems must be living.

For hollows, count only the presence of a stem containing hollows. For a multi-stemmed tree, only the largest stem is included in the count/estimate. Stems may be dead and may be shrubs.

BAM Attribute (1 x 1 m plots)	Litter cover %					Bare ground cover %					Cryptogam cover %					Rock cover %				
Subplot	5	15	25	35	45	5	15	25	35	45	5	15	25	35	45	5	15	25	35	45
score % in each	30	10	5	5	20	15	30	60	55	20	0	0	0	0	0	0	0	0	0	0
Average of the 5 subplots	14																			

Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10cm in diameter)

Hunter Ecology

BAM Site – Plot Species List

PCT 163 - [illegible]

400m² plot: Sheet ___ of ___	Survey Name	Plot ID	Recorders
Date: 16 Feb 2022	Hay Field Trip for ERM	20	Lizzie and Bart

GF Code	Top 3 native species in each growth form group: full species name mandatory. All other native and exotic species: full species name where practicable	N, E or HTE	Cover	Stratum (E,M,S,G)	Voucher	Photo #
SG	Nitraria billardierei	N	18	S		
SG	Atriplex semibaccata	N	0.1	S/G		
SG	Atriplex vesicaria	N	20	S/G		
[illegible]	Lycium ferocissimum	HTE	5	S		
SG	Sclerolaena triaspis	N	0.1	G		
FG	Maireana pentagona	N	0.1	G		
GG	Sporobolus caroli	N	0.1	G		
FG	Solanum esuriale	N	0.1	G		
—	Heliotropium europaeum	E	0.1	G		
—	Cucumis myriocarpus paddy	E	0.1	G		
GG	Enteropogon acicularis	N	0.1	G		
SG	Maireana aphylla	N	0.1	S/G		
FG	Aternathera denticulata	N	0.1	G		

- Leaf litter is mainly dried off Lolium perenne + Hordeum.

N: native, **E**:exotic, **HTE**: high threat exotic, **GF** – circle code if 'top 3'

Cover: 0.1, 0.2, 0.3..... 1,2,3,.....,10, 15, 20, 25, ... 100% (foliage cover). *Note: 0.1% cover is approx.. 63x63 cm or a circle about 71 cm diameter, 0.5% approx. 1.4 x 1.4m, 2% cover is approx. 2 x 2m, 5% = 4 x 5m, 25% 10 x 10m*

Abundance: 1, 2, 3, ...10, 20, 30, ... 100, 200,...., 1000

Stratum: E – emergent, C – canopy, M – mid-storey / sub canopy, S – shrub layer, G – ground layer

Hunter Ecology

BAM Site – Field Survey Form

Survey Name	Date	Recorders
Hay Field Trip for ERM	~~15~~ Feb 2022	Lizzie and Bart
Plot ID: 11		~~Photo #:~~
VZ / PCT: 13		

BAM Attribute (400m² plot)	Sum values	
	Count of native richness	Cover
Trees	1	25
Shrubs	~~6~~ 8	45
Grasses etc.	3	0.3
Forbs	1	0.1
Ferns	0	0
Other	0	0
High threat weed cover		2

Cover: 0.1, 0.2, 0.3..... 1,2,3,.....,10, 15, 20, 25, ... 100% (foliage cover). *Note: 0.1% cover is approx.. 63x63 cm or a circle about 71 cm diameter, 0.5% approx. 1.4 x 1.4m, 2% cover is approx. 2 x 2m, 5% = 4 x 5m, 25% 10 x 10m*

BAM Attribute (1000m² plot)		
DBH	#Tree Stems Count	#Stems with Hollows
80 + cm		
50 – 79 cm	///	///
30 – 49 cm	✓ //// ✓	///
20 – 29 cm		
10 – 19 cm		
5 – 9 cm		
<5 cm		
Length of logs (m) (≥ 10 cm diameter, >50cm in length)	Tally: 15	

Counts apply when the number of tree stems within a size class is ≤ 10. Estimate can be used when > 10 (eg. 10, 20, 30....100, 200). For a multi-stemmed tree, only the largest living stem is included in the count / estimate. Tree stems must be living.

For hollows, count only the presence of a stem containing hollows. For a multi-stemmed tree, only the largest stem is included in the count/estimate. Stems may be dead and may be shrubs.

BAM Attribute (1 x 1 m plots)	Litter cover %					Bare ground cover %					Cryptogam cover %					Rock cover %				
	5	15	25	35	45	5	15	25	35	45	5	15	25	35	45	5	15	25	35	45
Subplot score % in each	15	20	30	25	40	80	50	15	25	15	0	0	0	0	0	0	0	0	0	0
Average of the 5 subplots	26					39					0					0				

Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10cm in diameter)

Lots of pig poo everywhere

Hunter Ecology

PCT 13

BAM Site – Plot Species List

400m² plot: Sheet ___ of ___	Survey Name	Plot ID	Recorders
Date: 15 Feb 2022	Hay Field Trip for ERM	11	Lizzie and Bart

GF Code	Top 3 native species in each growth form group: full species name mandatory. All other native and exotic species: full species name where practicable	N, E or HTE	Cover	Stratum (E,M,S,G)	Voucher	Photo #
TG	Eucalyptus largiflorens	N	25	C		
SG	Atriplex ~~nummularia~~ nummularia	N	30	S		
SG	Salsola tragus	N	1	G		
SG	Maireana ~~sp~~ brevifolia	N	0.1	G		
SG	Rhagodia spinescens	N	0.3	S		
	~~Nitraria billardieret~~					
—	Lycium ferocissimum	HTE	2	S		
SG	Enchylaena tomentosa	N	0.5	G		
SG	Muehlenbeckia florulenta/ligna	N	5	S		
SG	Chenopodium nitrariaceum	N	8	S		
GG	Enteropogon acicularis	N	0.1	G		
SG	Sclerolaena bicornis	N	0.1	G		
FG	Einadia nutans	N	0.1	G		
GG	Eragrostis brownii	N	0.1	G		
GG	Lachnagrostis filiformis	N	0.1	G		

N: native, **E**:exotic, **HTE**: high threat exotic, **GF** – circle code if 'top 3'

Cover: 0.1, 0.2, 0.3….. 1,2,3,……,10, 15, 20, 25, ….. 100% (foliage cover). *Note: 0.1% cover is approx.. 63x63 cm or a circle about 71 cm diameter, 0.5% approx. 1.4 x 1.4m, 2% cover is approx. 2 x 2m, 5% = 4 x 5m, 25% 10 x 10m*

Abundance: 1, 2, 3, ….10, 20, 30, ….. 100, 200,…., 1000

Stratum: E – emergent, C – canopy, M – mid-storey / sub canopy, S – shrub layer, G – ground layer

Hunter Ecology

BAM Site – Field Survey Form

Survey Name	Date	Recorders
Hay Field Trip for ERM	15 Feb 2022	Lizzie and Bart
Plot ID: 12		Photo #:
VZ / PCT: 157		

BAM Attribute (400m² plot)	Sum values	
	Count of native richness	Cover
Trees	0	0
Shrubs	4	41.2
Grasses etc.	4	10.3
Forbs	2	0.2
Ferns	0	0
Other	0	0
High threat weed cover		0

Cover: 0.1, 0.2, 0.3..... 1,2,3,.....,10, 15, 20, 25, ... 100% (foliage cover). *Note: 0.1% cover is approx.. 63x63 cm or a circle about 71 cm diameter, 0.5% approx. 1.4 x 1.4m, 2% cover is approx. 2 x 2m, 5% = 4 x 5m, 25% 10 x 10m*

BAM Attribute (1000m² plot)		
DBH	#Tree Stems Count	#Stems with Hollows
80 + cm		
50 – 79 cm		
30 – 49 cm		
20 – 29 cm		
10 – 19 cm		
5 – 9 cm		
<5 cm		
Length of logs (m) (≥ 10 cm diameter, >50cm in length)	Tally: 0	

Counts apply when the number of tree stems within a size class is ≤ 10. Estimate can be used when > 10 (eg. 10, 20, 30....100, 200). For a multi-stemmed tree, only the largest living stem is included in the count / estimate. Tree stems must be living.

For hollows, count only the presence of a stem containing hollows. For a multi-stemmed tree, only the largest stem is included in the count/estimate. Stems may be dead and may be shrubs.

BAM Attribute (1 x 1 m plots)	Litter cover %					Bare ground cover %					Cryptogam cover %					Rock cover %				
	5	15	25	35	45	5	15	25	35	45	5	15	25	35	45	5	15	25	35	45
Subplot score % in each	20	5	10	15	10	60	75	70	50	50	0	0	0	0	0	0	0	0	0	0
Average of the 5 subplots	12					63					0					0				

Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10cm in diameter)

Hunter Ecology

PCT 157

BAM Site – Plot Species List

400m² plot: Sheet ___ of ___	Survey Name	Plot ID	Recorders
Date: 15 Feb 2022	Hay Field Trip for ERM	12	Lizzie and Bart

GF Code	Top 3 native species in each growth form group: full species name mandatory. All other native and exotic species: full species name where practicable	N, E or HTE	Cover	Stratum (E,M,S,G)	Voucher	Photo #
SG	Atriplex vesicaria	N	40	S/G		
GG	Sporobulus caroli	N	10	G		
GG	Rhytidosperma caespitosum	N	0.1	G		
FG	Maireana pentagona	N	0.1	G/S		
GG	Austrostipa scabra	N	0.1	G		
SG	Maireana pyramidata	N	1	G		
FG	Abutilon sp.	N	0.1	G		
GG	Eragrostis australasica	N	0.1	G/S		
SG	Sclerolaena brachyptera	N	0.1	G		
SG	Maireana aphylla	N	0.1	G/S		

N: native, **E**:exotic, **HTE**: high threat exotic, **GF** – circle code if 'top 3'

Cover: 0.1, 0.2, 0.3..... 1,2,3,.....,10, 15, 20, 25, ... 100% (foliage cover). *Note: 0.1% cover is approx.. 63x63 cm or a circle about 71 cm diameter, 0.5% approx. 1.4 x 1.4m, 2% cover is approx. 2 x 2m, 5% = 4 x 5m, 25% 10 x 10m*

Abundance: 1, 2, 3, ...10, 20, 30, ... 100, 200,...., 1000

Stratum: E – emergent, C – canopy, M – mid-storey / sub canopy, S – shrub layer, G – ground layer

Hunter Ecology

BAM Site – Field Survey Form

Survey Name		Date	Recorders	
Hay Summer.		16/2/22	Bart + Lizzie	
Zone:	Datum:	Plot ID: 21		Photo #: ~~Photo #:~~
Easting:	Northing:	IBRA region:	Midline ~~bearing from 0 m:~~	
VZ / PCT: 163 - [redacted]				

Record easting and northing at 0m on midline. Dimensions (Shape) of 0.04ha base plot.

BAM Attribute (400m² plot)	Sum values	
	Count of native richness	Cover
Trees	0	0
Shrubs	7	21.5
Grasses etc.	1	0.1
Forbs	2	0.2
Ferns	0	0
Other	0	0
High threat weed cover	0	

Cover: 0.1, 0.2, 0.3..... 1,2,3,.....,10, 15, 20, 25, ... 100% (foliage cover). *Note: 0.1% cover is approx.. 63x63 cm or a circle about 71 cm diameter, 0.5% approx. 1.4 x 1.4m, 2% cover is approx. 2 x 2m, 5% = 4 x 5m, 25% 10 x 10m*

BAM Attribute (1000m² plot)		
DBH	**#Tree Stems Count**	**#Stems with Hollows**
80 + cm		
50 – 79 cm		
30 – 49 cm		
20 – 29 cm		
10 – 19 cm		
5 – 9 cm		
<5 cm		
Length of logs (m) (≥ 10 cm diameter, >50cm in length)	**Tally:** 0	

Counts apply when the number of tree stems within a size class is ≤ 10. Estimate can be used when > 10 (eg. 10, 20, 30....100, 200). For a multi-stemmed tree, only the largest living stem is included in the count / estimate. Tree stems must be living.

For hollows, count only the presence of a stem containing hollows. For a multi-stemmed tree, only the largest stem is included in the count/estimate. Stems may be dead and may be shrubs.

BAM Attribute (1 x 1 m plots)	Litter cover %					Bare ground cover %					Cryptogam cover %					Rock cover %				
Subplot	5	15	25	35	45	5	15	25	35	45	5	15	25	35	45	5	15	25	35	45
score % in each	50	30	20	35	50	10	20	40	15	15	0	0	0	0	0	0	0	0	0	0
Average of the 5 subplots	37					20					0					0				

Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10cm in diameter)

Hunter Ecology

BAM Site – Plot Species List

BBPCT 153

400m² plot: Sheet ___ of ___	Survey Name	Plot ID	Recorders
Date: 16/2/22	Hay Summer	21	Bart & Missie

GF Code	Top 3 native species in each growth form group: full species name mandatory. All other native and exotic species: full species name where practicable	N, E or HTE	Cover	Stratum (E,M,S,G)	Voucher	Photo #
SG	Nitraria billardierei	N	25	S		
SG	Atriplex vesicaria	N	0.2	G/S		
SG	Atriplex semibaccata	N	0.1	G		
SG	Scleroleana triaspis	N	0.2	G/S		
—	Lycium ferocissimum	HTW	0.1	S/E		
	Xanthium spinosum burr		0.1	G		
—	Heliotrope	E	0.1	G		
FG	Solanum esuriale	N	0.1	G		
SG	sclerolaena brachyptera	N	0.2	G		
GG	Sporobulus caroli	N	0.1	G		
SG	Salsola tragus	N	0.1	G		
FG	Dysphania pumilio comb	N	0.1	G		
SG	Sclerolaena muricata	N	0.2	G/S		

Leaf litter is mainly dried off Lolium perenne + Hordium sp. + Burr Medic

N: native, E:exotic, **HTE**: high threat exotic, **GF** – circle code if 'top 3'

Cover: 0.1, 0.2, 0.3….. 1,2,3,……,10, 15, 20, 25, ….. 100% (foliage cover). *Note: 0.1% cover is approx.. 63x63 cm or a circle about 71 cm diameter, 0.5% approx. 1.4 x 1.4m, 2% cover is approx. 2 x 2m, 5% = 4 x 5m, 25% 10 x 10m*

Abundance: 1, 2, 3, ….10, 20, 30, ….. 100, 200,…., 1000

Stratum: E – emergent, C – canopy, M – mid-storey / sub canopy, S – shrub layer, G – ground layer

Hunter Ecology

BAM Site – Field Survey Form

Survey Name		Date	Recorders
Hay Summer		15/2/22	Berta Lissie
Zone:	Datum:	Plot ID: 22	Photo #:
Easting:	Northing:	IBRA region:	Midline bearing from 0 m:
VZ / PCT: 1164			

Record easting and northing at 0m on midline. Dimensions (Shape) of 0.04ha base plot

BAM Attribute (400m² plot)	Sum values	
	Count of native richness	Cover
Trees	0	0
Shrubs	1	35
Grasses etc.	7	3.4
Forbs	1	0.1
Ferns	0	0
Other	0	0
High threat weed cover	0	0

Cover: 0.1, 0.2, 0.3..... 1,2,3,.....,10, 15, 20, 25, ... 100% (foliage cover). *Note: 0.1% cover is approx.. 63x63 cm or a circle about 71 cm diameter, 0.5% approx. 1.4 x 1.4m, 2% cover is approx. 2 x 2m, 5% = 4 x 5m, 25% 10 x 10m*

BAM Attribute (1000m² plot)		
DBH	#Tree Stems Count	#Stems with Hollows
80 + cm		
50 – 79 cm		
30 – 49 cm		
20 – 29 cm		
10 – 19 cm		
5 – 9 cm		
<5 cm		
Length of logs (m) (≥ 10 cm diameter, >50cm in length)	Tally: 0	

Counts apply when the number of tree stems within a size class is ≤ 10. Estimate can be used when > 10 (eg. 10, 20, 30....100, 200). For a multi-stemmed tree, only the largest living stem is included in the count / estimate. Tree stems must be living.

For hollows, count only the presence of a stem containing hollows. For a multi-stemmed tree, only the largest stem is included in the count/estimate. Stems may be dead and may be shrubs.

BAM Attribute (1 x 1 m plots)	Litter cover %					Bare ground cover %					Cryptogam cover %					Rock cover %				
Subplot	5	15	25	35	45	5	15	25	35	45	5	15	25	35	45	5	15	25	35	45
score % in each	20	35	30	25	15	20	15	15	30	30	0	0	0	0	0	0	0	0	0	0
Average of the 5 subplots	25					22					0					0				

Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10cm in diameter)

Hunter Ecology

PCT 164

BAM Site – Plot Species List

400m² plot: Sheet ___ of ___	Survey Name	Plot ID	Recorders
Date: 16/2/22	Hey Summer	22	Bart + Lizzee

GF Code	Top 3 native species in each growth form group: full species name mandatory. All other native and exotic species: full species name where practicable	N, E or HTE	Cover	Stratum (E,M,S,G)	Voucher	Photo #
SG	Maireana aphylla	N	35	G/S		
GG	Rhytidosperma caespitosum	N	1	G		
GG	Panicum laevopha	N	1	G		
GG	Sporobolus caroli	N	1	G		
GG	Eragrostis australasica	N	0.1	G/S		
FG	Sida ~~intricata~~ cunninghamii	N	0.1	G		
GG	Eragrostis ~~sp.~~ brown ~~sp.~~	N	0.1	G		
~~GG~~	~~Digitaria~~	~~E~~	~~0.1~~	~~G~~		
GG	Chloris truncata	N	0.1	G		
GG	Panicum decomposition	N	0.1	G		

Leaf litter is mainly Lolium perenne.

N: native, **E**:exotic, **HTE**: high threat exotic, **GF** – circle code if 'top 3'
Cover: 0.1, 0.2, 0.3….. 1,2,3,……,10, 15, 20, 25, ….. 100% (foliage cover). *Note: 0.1% cover is approx.. 63x63 cm or a circle about 71 cm diameter, 0.5% approx. 1.4 x 1.4m, 2% cover is approx. 2 x 2m, 5% = 4 x 5m, 25% 10 x 10m*
Abundance: 1, 2, 3, ….10, 20, 30, ….. 100, 200,…., 1000
Stratum: E – emergent, C – canopy, M – mid-storey / sub canopy, S – shrub layer, G – ground layer

Hunter Ecology

BAM Site – Field Survey Form

Survey Name	Date	Recorders
Hay Field Trip for ERM	18 Feb 2022	Lizzie and Bart
Plot ID: 49		~~Photo #:~~
VZ / PCT: 17/24		

BAM Attribute (400m² plot)	Sum values	
	Count of native richness	Cover
Trees	0	0
Shrubs	10	41.1
Grasses etc.	4	8.3
Forbs	5	0.6
Ferns	0	0
Other	0	0
High threat weed cover	0	0.2

Cover: 0.1, 0.2, 0.3….. 1,2,3,……,10, 15, 20, 25, ….. 100% (foliage cover). *Note: 0.1% cover is approx. 63x63 cm or a circle about 71 cm diameter, 0.5% approx. 1.4 x 1.4m, 2% cover is approx. 2 x 2m, 5% = 4 x 5m, 25% 10 x 10m*

BAM Attribute (1000m² plot)		
DBH	#Tree Stems Count	#Stems with Hollows
80 + cm		
50 – 79 cm		
30 – 49 cm		
20 – 29 cm		
10 – 19 cm		
5 – 9 cm		
<5 cm		
Length of logs (m) (≥ 10 cm diameter, >50cm in length)	Tally: 1	

Counts apply when the number of tree stems within a size class is ≤ 10. Estimate can be used when > 10 (eg. 10, 20, 30….100, 200). For a multi-stemmed tree, only the largest living stem is included in the count / estimate. Tree stems must be living.

For hollows, count only the presence of a stem containing hollows. For a multi-stemmed tree, only the largest stem is included in the count/estimate. Stems may be dead and may be shrubs.

BAM Attribute (1 x 1 m plots)	Litter cover %					Bare ground cover %					Cryptogam cover %					Rock cover %				
	5	15	25	35	45	5	15	25	35	45	5	15	25	35	45	5	15	25	35	45
Subplot score % in each	5	15	5	20	5	30	15	50	35	20	0	0	0	0	0	0	0	0	0	0
Average of the 5 subplots	10					30					0					0				

Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10cm in diameter)

Hunter Ecology

pct 17/24

BAM Site – Plot Species List

400m² plot: Sheet ___ of ___	Survey Name	Plot ID	Recorders
Date: 18 Feb 2022	Hay Field Trip for ERM	4a	Lizzie and Bart

GF Code	Top 3 native species in each growth form group: full species name mandatory. All other native and exotic species: full species name where practicable	N, E or HTE	Cover	Stratum (E,M,S,G)	Voucher	Photo #
SG	Chenopodium nitrariaceum	N	20	S		
GG	Eragrostis australasica	N	8	S		
SG	Atriplex ~~bidbidgi~~ semibaccata	N	20	G/S		
GG	~~Enteropogon~~ acicularis	N	0.1	G		
SG	Sclerolaena tricuspis	N	0.1	G		
SG	Sclerolaena brachyptera	N	0.1	G		
FG	Marsilea drummondii Nordoo	N	0.1	G		
—	Heliotrope europaeum	E	0.1	G		
—	Cucumis myriocarpus.	E	0.2	G		
FG	Dysphania pumilio crumb	N	0.1	G		
—	Patersons curse Echium plantagineum ~~E~~ HTW		0.1	G		
SG	Maireana aphylla	N	0.1	G/S		
SG	Muehlenbeckia florulenta Lignum	N	0.5	S		
SG	Sclerolaena diacantha	N	0.1	G		
FG	Sida intricata	N	0.2	G		
FG	Alternanthera denticulata	N	0.1	G		
FG	Sclerolaena muricata	N	0.1	G/S		
—	Bathurst burr Xanthium spinosa	HTW	0.1	G		
GG	Austrostipa ~~sp~~. scabra	N	0.1	G		
GG	Dactyloctenium radulans	N	0.1	G		
SG	Nagoora spinescens	N	0.1	S		
SG	Salsola tragus	N	0.1	G		
SG	Maireana brevifolia	N	0.1	G		

N: native, **E**:exotic, **HTE**: high threat exotic, **GF** – circle code if 'top 3'

Cover: 0.1, 0.2, 0.3..... 1,2,3,.....,10, 15, 20, 25, ... 100% (foliage cover). *Note: 0.1% cover is approx.. 63x63 cm or a circle about 71 cm diameter, 0.5% approx. 1.4 x 1.4m, 2% cover is approx. 2 x 2m, 5% = 4 x 5m, 25% 10 x 10m*

Abundance: 1, 2, 3, ...10, 20, 30, ... 100, 200,...., 1000

Stratum: E – emergent, C – canopy, M – mid-storey / sub canopy, S – shrub layer, G – ground layer

Hunter Ecology

BAM Site – Field Survey Form

Survey Name	Date	Recorders
Hay Field Trip for ERM	18 Feb 2022	Lizzie and Bart
Plot ID: S3		Photo #:
VZ / PCT: 760		

BAM Attribute (400m² plot)	Sum values	
	Count of native richness	Cover
Trees	0	0
Shrubs	3	30.1
Grasses etc.	6	0.6
Forbs	5	0.5
Ferns	0	0
Other	0	0
High threat weed cover	0	0

Cover: 0.1, 0.2, 0.3..... 1,2,3,.....,10, 15, 20, 25, ... 100% (foliage cover). *Note: 0.1% cover is approx. 63x63 cm or a circle about 71 cm diameter, 0.5% approx. 1.4 x 1.4m, 2% cover is approx. 2 x 2m, 5% = 4 x 5m, 25% 10 x 10m*

BAM Attribute (1000m² plot)		
DBH	#Tree Stems Count	#Stems with Hollows
80 + cm		
50 – 79 cm		
30 – 49 cm		
20 – 29 cm		
10 – 19 cm		
5 – 9 cm		
<5 cm		
Length of logs (m) (≥ 10 cm diameter, >50cm in length)	Tally: 0	

Counts apply when the number of tree stems within a size class is ≤ 10. Estimate can be used when > 10 (eg. 10, 20, 30....100, 200). For a multi-stemmed tree, only the largest living stem is included in the count / estimate. Tree stems must be living.

For hollows, count only the presence of a stem containing hollows. For a multi-stemmed tree, only the largest stem is included in the count/estimate. Stems may be dead and may be shrubs.

BAM Attribute (1 x 1 m plots)	Litter cover %					Bare ground cover %					Cryptogam cover %					Rock cover %				
	5	15	25	35	45	5	15	25	35	45	5	15	25	35	45	5	15	25	35	45
Subplot score % in each	60	50	30	50	25	10	5	20	0	15	0	0	0	0	0	0	0	0	0	0
Average of the 5 subplots	43					10					0					0				

Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10cm in diameter)

Hunter Ecology

PCT 160

BAM Site – Plot Species List

400m² plot: Sheet ___ of ___	Survey Name	Plot ID	Recorders
Date: 18 Feb 2022	Hay Field Trip for ERM	53	Lizzie and Bart

GF Code	Top 3 native species in each growth form group: full species name mandatory. All other native and exotic species: full species name where practicable	N, E or HTE	Cover	Stratum (E,M,S,G)	Voucher	Photo #
SG	~~Vittadinia~~ Chenopodium nitrariaceum	N	15	S		
GG	Rhytidosperma caespitosum	N	0.2	G		
—	Cyperus Myriocarpus	E	0.1	G		
FG	Alternanthera denticulata	N	0.1	G		
SG	Muehlenbeckia florulenta	N	15	S		
FG	Vittadinia cuneata	N	0.1	G		
GG	Panicum ~~laevinode~~	N	0.1	G		
SG	Sclerolaena quinqueuspis	N	0.1	G		
FG	Nardoo Marsilea drummondii	N	0.1	G		
GG	Eragrostis ~~sp~~ browniii	N	0.1	G		
GG	Eragrostis australasica	N	0.1	E		
FG	Einadia nutans	N	0.1	G		
GG	Juncus sp.	N	0.1	G		
—	Bathurst burr Xanthium spinosum	HTE	0.1	G		
GG	Panicum decompositum	N	0.1	G		
—	Heliotrope europaeum	E	0.1	G		
GG	~~Eragrostis~~ Lachnagrostis filiformis	N	0.1	G		
FG	Rumex brownii	N	0.1	G		
	+ Leaf litter is dead Rye Grass + Burr Medic					

N: native, **E**:exotic, **HTE**: high threat exotic, **GF** – circle code if 'top 3'

Cover: 0.1, 0.2, 0.3….. 1,2,3,……,10, 15, 20, 25, ….. 100% (foliage cover). *Note: 0.1% cover is approx.. 63x63 cm or a circle about 71 cm diameter, 0.5% approx. 1.4 x 1.4m, 2% cover is approx. 2 x 2m, 5% = 4 x 5m, 25% 10 x 10m*

Abundance: 1, 2, 3, ….10, 20, 30, ….. 100, 200,…., 1000

Stratum: E – emergent, C – canopy, M – mid-storey / sub canopy, S – shrub layer, G – ground layer

Hunter Ecology

BAM Site – Field Survey Form

Survey Name	Date	Recorders
Hay Field Trip for ERM	18 Feb 2022	Lizzie and Bart
Plot ID: S2		Photo #: ~~—~~
VZ / PCT: 160		

BAM Attribute (400m² plot)	Sum values	
	Count of native richness	Cover
Trees	0	0
Shrubs	5	65.3
Grasses etc.	3	0.3
Forbs	3	0.3
Ferns	0	0
Other	0	0
High threat weed cover	0	0

Cover: 0.1, 0.2, 0.3..... 1,2,3,.....,10, 15, 20, 25, ... 100% (foliage cover). *Note: 0.1% cover is approx.. 63x63 cm or a circle about 71 cm diameter, 0.5% approx. 1.4 x 1.4m, 2% cover is approx. 2 x 2m, 5% = 4 x 5m, 25% 10 x 10m*

BAM Attribute (1000m² plot)		
DBH	#Tree Stems Count	#Stems with Hollows
80 + cm		
50 – 79 cm		
30 – 49 cm		
20 – 29 cm		
10 – 19 cm		
5 – 9 cm		
<5 cm		
Length of logs (m) (≥ 10 cm diameter, >50cm in length)	Tally: 0	

Counts apply when the number of tree stems within a size class is ≤ 10. Estimate can be used when > 10 (eg. 10, 20, 30....100, 200). For a multi-stemmed tree, only the largest living stem is included in the count / estimate. Tree stems must be living.

For hollows, count only the presence of a stem containing hollows. For a multi-stemmed tree, only the largest stem is included in the count/estimate. Stems may be dead and may be shrubs.

BAM Attribute (1 x 1 m plots)	Litter cover %					Bare ground cover %					Cryptogam cover %					Rock cover %				
	5	15	25	35	45	5	15	25	35	45	5	15	25	35	45	5	15	25	35	45
Subplot score % in each	30	10	50	30	5	70	60	10	30	10	0	0	0	0	0	0	0	0	0	0
Average of the 5 subplots	23					24					0					0				

Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10cm in diameter)

Hunter Ecology

BAM Site – Plot Species List PCT 150

400m² plot: Sheet ___ of ___	Survey Name	Plot ID	Recorders
Date: 18 Feb 2022	Hay Field Trip for ERM	52	Lizzie and Bart

GF Code	Top 3 native species in each growth form group: full species name mandatory. All other native and exotic species: full species name where practicable	N, E or HTE	Cover	Stratum (E,M,S,G)	Voucher	Photo #
SG	Chenopodium nitrariaceum	N	45	S		
SG	Atriplex semibaccata	N	0.1	G		
SG	Maireana aphylla	N	0.1	G		
SG	Lycium Muehlenbeckia ~~boetia~~ Florulenta	N	20	S		
GG	Eragrostis australasica	N	0.1	S		
FG	Sida corrugata	N	0.1	G		
GG	Enteropogon acicularis	N	0.1	G		
SG	Sclerolaena ~~muricata~~.	N	0.1	S		
GG	Aristida sp.	N	0.1	G		
FG	Nardoo Marsilea drummondii	N	0.1	G		
—	Heliotropium europaeum	E	0.1	G		
FG	Solanum esuriale	N	0.1	G		

N: native, **E**:exotic, **HTE**: high threat exotic, **GF** – circle code if 'top 3'

Cover: 0.1, 0.2, 0.3….. 1,2,3,……,10, 15, 20, 25, ….. 100% (foliage cover). *Note: 0.1% cover is approx.. 63x63 cm or a circle about 71 cm diameter, 0.5% approx. 1.4 x 1.4m, 2% cover is approx. 2 x 2m, 5% = 4 x 5m, 25% 10 x 10m*

Abundance: 1, 2, 3, ….10, 20, 30, ….. 100, 200,…., 1000

Stratum: E – emergent, C – canopy, M – mid-storey / sub canopy, S – shrub layer, G – ground layer

Hunter Ecology

BAM Site – Field Survey Form

Survey Name	Date	Recorders
Hay Field Trip for ERM	18 Feb 2022	Lizzie and Bart
Plot ID: 50		Photo #:
VZ / PCT: 157		

BAM Attribute (400m² plot)	Sum values	
	Count of native richness	Cover
Trees	0	0
Shrubs	4	30.7
Grasses etc.	2	0.2
Forbs	4	0.4
Ferns	0	0
Other	0	0
High threat weed cover	0	0

Cover: 0.1, 0.2, 0.3..... 1,2,3,.....,10, 15, 20, 25, ... 100% (foliage cover). *Note: 0.1% cover is approx.. 63x63 cm or a circle about 71 cm diameter, 0.5% approx. 1.4 x 1.4m, 2% cover is approx. 2 x 2m, 5% = 4 x 5m, 25% 10 x 10m*

BAM Attribute (1000m² plot)		
DBH	#Tree Stems Count	#Stems with Hollows
80 + cm		
50 – 79 cm		
30 – 49 cm		
20 – 29 cm		
10 – 19 cm		
5 – 9 cm		
<5 cm		
Length of logs (m) (≥ 10 cm diameter, >50cm in length)	Tally: 0	

Counts apply when the number of tree stems within a size class is ≤ 10. Estimate can be used when > 10 (eg. 10, 20, 30....100, 200). For a multi-stemmed tree, only the largest living stem is included in the count / estimate. Tree stems must be living.

For hollows, count only the presence of a stem containing hollows. For a multi-stemmed tree, only the largest stem is included in the count/estimate. Stems may be dead and may be shrubs.

BAM Attribute (1 x 1 m plots)	Litter cover %					Bare ground cover %					Cryptogam cover %					Rock cover %				
	5	15	25	35	45	5	15	25	35	45	5	15	25	35	45	5	15	25	35	45
Subplot score % in each	5	20	15	10	10	70	40	30	60	80	0	0	0	0	0	0	0	0	0	0
Average of the 5 subplots	12					56					0					0				

Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10cm in diameter)

Hunter Ecology

BAM Site – Plot Species List

PCT 157.

400m² plot: Sheet ___ of ___	Survey Name	Plot ID	Recorders
Date: 18 Feb 2022	Hay Field Trip for ERM	50	Lizzie and Bart

GF Code	Top 3 native species in each growth form group: full species name mandatory. All other native and exotic species: full species name where practicable	N, E or HTE	Cover	Stratum (E,M,S,G)	Voucher	Photo #
SG	Atriplex vesicaria	N	30			
GG	Eragrostis australasica	N	0.1			
GG	Sporobulus creberi	N	0.1			
FG	Abutilon sp.	N	0.1			
FG	Brachychome sp.	N	0.1			
SG	Nitraria billardierei	N	0.5			
SG	Sclerolaena brachyptera	N	0.1			
FG	Maireana pentagona	N	0.1			
FG	Sida intricata	N	0.1	G		
SG	Sclerolaena triaspis	N	0.1	G		
	Leaf litter is dried off native herbs/grasses					

N: native, **E**:exotic, **HTE**: high threat exotic, **GF** – circle code if 'top 3'

Cover: 0.1, 0.2, 0.3….. 1,2,3,……,10, 15, 20, 25, ….. 100% (foliage cover). *Note: 0.1% cover is approx.. 63x63 cm or a circle about 71 cm diameter, 0.5% approx. 1.4 x 1.4m, 2% cover is approx. 2 x 2m, 5% = 4 x 5m, 25% 10 x 10m*

Abundance: 1, 2, 3, ….10, 20, 30, ….. 100, 200,…., 1000

Stratum: E – emergent, C – canopy, M – mid-storey / sub canopy, S – shrub layer, G – ground layer

Hunter Ecology

BAM Site – Field Survey Form

Survey Name	Date	Recorders
Hay Field Trip for ERM	18 Feb 2022	Lizzie and Bart
Plot ID: S1		~~Photo #:~~
VZ / PCT: 154		

BAM Attribute (400m² plot)	Sum values	
	Count of native richness	Cover
Trees	0	0
Shrubs	4	39.2
Grasses etc.	3	6.2
Forbs	5	0.4
Ferns	0	0
Other	0	0
High threat weed cover	0	0

Cover: 0.1, 0.2, 0.3..... 1,2,3,.....,10, 15, 20, 25, ... 100% (foliage cover). *Note: 0.1% cover is approx.. 63x63 cm or a circle about 71 cm diameter, 0.5% approx. 1.4 x 1.4m, 2% cover is approx. 2 x 2m, 5% = 4 x 5m, 25% 10 x 10m*

BAM Attribute (1000m² plot)		
DBH	#Tree Stems Count	#Stems with Hollows
80 + cm		
50 – 79 cm		
30 – 49 cm		
20 – 29 cm		
10 – 19 cm		
5 – 9 cm		
<5 cm		
Length of logs (m) (≥ 10 cm diameter, >50cm in length)	Tally: 0	

Counts apply when the number of tree stems within a size class is ≤ 10. Estimate can be used when > 10 (eg. 10, 20, 30....100, 200). For a multi-stemmed tree, only the largest living stem is included in the count / estimate. Tree stems must be living.

For hollows, count only the presence of a stem containing hollows. For a multi-stemmed tree, only the largest stem is included in the count/estimate. Stems may be dead and may be shrubs.

BAM Attribute (1 x 1 m plots)	Litter cover %					Bare ground cover %					Cryptogam cover %					Rock cover %				
Subplot	5	15	25	35	45	5	15	25	35	45	5	15	25	35	45	5	15	25	35	45
score % in each	15	20	20	10	15	30	20	40	30	20	0	0	0	0	0	0	0	0	0	0
Average of the 5 subplots	16					28					0					0				

Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10cm in diameter)

Hunter Ecology

BAM Site – Plot Species List

PCT 164.

400m² plot: Sheet ___ of ___	Survey Name	Plot ID	Recorders
Date: 18 Feb 2022	Hay Field Trip for ERM	S1	Lizzie and Bart

GF Code	Top 3 native species in each growth form group: full species name mandatory. All other native and exotic species: full species name where practicable	N, E or HTE	Cover	Stratum (E,M,S,G)	Voucher	Photo #
SG	Maireana aphylla	N	35	S/G		
GH	Sporobolus caroli	N	8	G		
SG	Atriplex nesicaria	N	0.1	G		
SG	Sclerolaena tricuspis	N	4	G		
GG	Rhytidosperm caespitosum	N	2	G		
FG	Sida ~~intricata~~ cunninghamii	N	0.1	G		
FG	Euphorbia drummondii	N	0.1	G		
FG	Solanum esuriale	N	0.3	G		
FG	Maireana pentagona	N	0.2	G		
SG	Sclerolaena brachyptera	N	0.1	G		
GG	~~Enteropogon~~ acicularis	N	0.1	G		
GG	Austrostipa sabica	N	0.1	G		
FG	~~Brachyscheme sp.~~ → Minuria cunninghamii	N	0.1	G		

Leaf litter is mainly dead native daisy types.

N: native, **E**:exotic, **HTE**: high threat exotic, **GF** – circle code if 'top 3'

Cover: 0.1, 0.2, 0.3..... 1,2,3,.....,10, 15, 20, 25, ... 100% (foliage cover). *Note: 0.1% cover is approx.. 63x63 cm or a circle about 71 cm diameter, 0.5% approx. 1.4 x 1.4m, 2% cover is approx. 2 x 2m, 5% = 4 x 5m, 25% 10 x 10m*

Abundance: 1, 2, 3, ...10, 20, 30, ... 100, 200,...., 1000

Stratum: E – emergent, C – canopy, M – mid-storey / sub canopy, S – shrub layer, G – ground layer

Hunter Ecology

BAM Site – Field Survey Form

Survey Name	Date	Recorders
Hay Field Trip for ERM	19 Feb 2022	Lizzie and Bart
Plot ID: 64		Photo #:
VZ / PCT: 164		

BAM Attribute (400m² plot)	Sum values	
	Count of native richness	Cover
Trees	0	0
Shrubs	2	20.1
Grasses etc.	3	0.3
Forbs	9	1.3
Ferns	0	0
Other	0	0
High threat weed cover	0	0

Cover: 0.1, 0.2, 0.3..... 1,2,3,.....,10, 15, 20, 25, ... 100% (foliage cover). *Note: 0.1% cover is approx.. 63x63 cm or a circle about 71 cm diameter, 0.5% approx. 1.4 x 1.4m, 2% cover is approx. 2 x 2m, 5% = 4 x 5m, 25% 10 x 10m*

BAM Attribute (1000m² plot)		
DBH	#Tree Stems Count	#Stems with Hollows
80 + cm		
50 – 79 cm		
30 – 49 cm		
20 – 29 cm		
10 – 19 cm		
5 – 9 cm		
<5 cm		
Length of logs (m) (≥ 10 cm diameter, >50cm in length)	Tally: 0	

Counts apply when the number of tree stems within a size class is ≤ 10. Estimate can be used when > 10 (eg. 10, 20, 30....100, 200). For a multi-stemmed tree, only the largest living stem is included in the count / estimate. Tree stems must be living.

For hollows, count only the presence of a stem containing hollows. For a multi-stemmed tree, only the largest stem is included in the count/estimate. Stems may be dead and may be shrubs.

BAM Attribute (1 x 1 m plots)	Litter cover %					Bare ground cover %					Cryptogam cover %					Rock cover %				
	5	15	25	35	45	5	15	25	35	45	5	15	25	35	45	5	15	25	35	45
Subplot score % in each	20	15	5	15	10	35	50	80	55	55	0	0	0	0	0	0	0	0	0	0
Average of the 5 subplots	13					57					0					0				

Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10cm in diameter)

Hunter Ecology

PCT 164

BAM Site – Plot Species List

400m² plot: Sheet ___ of ___	Survey Name	Plot ID	Recorders
Date: 19 Feb 2022	Hay Field Trip for ERM	64	Lizzie and Bart

GF Code	Top 3 native species in each growth form group: full species name mandatory. All other native and exotic species: full species name where practicable	N, E or HTE	Cover	Stratum (E,M,S,G)	Voucher	Photo #
SG	Maireana aphylla	N	20	S/G		
FG	Rodanthe stuartiana	N	0.3	G		
GG	Austrostipa scabra	N	0.1	G		
GG	Sporobulus caroli	N	0.1	G		
FG	Vittadinea cuneata	N	0.1	G		
GG	Rhytidosperma caespitosum	N	0.1	G		
FG	Brachyscome Minuria cunninghamii	N	0.1	G		
FG	Sida corrugata	N	0.1	G		
FG	Sida intricata	N	0.1	G		
FG	Leiocarpa ~~sp~~ panaetioides	N	0.3	G		
FG	Twin leaf - Zygophyllum ammophilum	N	0.1	G		
FG	Solanum esuriale	N	0.1	G		
FG	Sida ~~sp~~ cunninghammii	N	0.1	G		
SG	Salsola tragus	N	0.1	G		

Hunter Ecology

BAM Site – Field Survey Form

Survey Name	Date	Recorders
Hay Field Trip for ERM	20 Feb 2022	Lizzie and Bart
Plot ID: 69		Photo #:
VZ / PCT: 164		

BAM Attribute (400m² plot)	Sum values	
	Count of native richness	Cover
Trees	0	0
Shrubs	6	40.4
Grasses etc.	4	16.1
Forbs	6	0.6
Ferns	0	0
Other	0	0
High threat weed cover	0	0

Cover: 0.1, 0.2, 0.3..... 1,2,3,.....,10, 15, 20, 25, ... 100% (foliage cover). *Note: 0.1% cover is approx.. 63x63 cm or a circle about 71 cm diameter, 0.5% approx. 1.4 x 1.4m, 2% cover is approx. 2 x 2m, 5% = 4 x 5m, 25% 10 x 10m*

BAM Attribute (1000m² plot)		
DBH	#Tree Stems Count	#Stems with Hollows
80 + cm		
50 – 79 cm		
30 – 49 cm		
20 – 29 cm		
10 – 19 cm		
5 – 9 cm		
<5 cm		
Length of logs (m) (≥ 10 cm diameter, >50cm in length)	Tally: 0	

Counts apply when the number of tree stems within a size class is ≤ 10. Estimate can be used when > 10 (eg. 10, 20, 30....100, 200). For a multi-stemmed tree, only the largest living stem is included in the count / estimate. Tree stems must be living.

For hollows, count only the presence of a stem containing hollows. For a multi-stemmed tree, only the largest stem is included in the count/estimate. Stems may be dead and may be shrubs.

BAM Attribute (1 x 1 m plots)	Litter cover %					Bare ground cover %					Cryptogam cover %					Rock cover %				
	5	15	25	35	45	5	15	25	35	45	5	15	25	35	45	5	15	25	35	45
Subplot score % in each	5	10	15	10	5	30	25	15	20	15	0	0	0	0	0	0	0	0	0	0
Average of the 5 subplots	9					21					0					0				

Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10cm in diameter)

Hunter Ecology

BAM Site – Plot Species List

PCT 154

400m² plot: Sheet ___ of ___	Survey Name	Plot ID	Recorders
Date: 20 Feb 2022	Hay Field Trip for ERM	69	Lizzie and Bart

GF Code	Top 3 native species in each growth form group; full species name mandatory. All other native and exotic species: full species name where practicable	N, E or HTE	Cover	Stratum (E,M,S,G)	Voucher	Photo #
SG	Maireana aphylla	N	30	G/S		
GG	Sporobolus caroli	N	10	G		
~~GG~~	~~Panicum laevinode~~	~~N~~	~~0.1~~	~~G~~		
GG	Austrostipa scabra	N	5	G		
FG	Sida intricata cunninghammii	N	0.1	G		
SG	Sclerolaena triaspis	N	10	G/S		
GG	Rhytidosperma caespitosum	N	1	G		
GG	Poaceae decompositum	N	0.1	G		
SG	Atriplex vesicaria	N	0.1	G/S		
FG	Crassula colorata	N	0.1	G		
FG	Crassula decumbens	N	0.1	G		
FG	Einadia nutans	N	0.1	G		
FG	Maireana pentagona	N	0.1	G		
FG	Solanum esuriale	N	0.1	G		
SG	Nitraria billardierei	N	0.1	S		
SG	Salsola tragus	N	0.1	G		
SG	Sclerolaena brachyptera	N	0.1	G		

+ Lots of dead Rye Grass in Loose Litter

N: native, **E**:exotic, **HTE**: high threat exotic, **GF** – circle code if 'top 3'
Cover: 0.1, 0.2, 0.3….. 1,2,3,……,10, 15, 20, 25, ….. 100% (foliage cover). *Note: 0.1% cover is approx.. 63x63 cm or a circle about 71 cm diameter, 0.5% approx. 1.4 x 1.4m, 2% cover is approx. 2 x 2m, 5% = 4 x 5m, 25% 10 x 10m*
Abundance: 1, 2, 3, ….10, 20, 30, ….. 100, 200,…., 1000
Stratum: E – emergent, C – canopy, M – mid-storey / sub canopy, S – shrub layer, G – ground layer

Hunter Ecology

BAM Site – Field Survey Form

Survey Name	Date	Recorders
Hay Field Trip for ERM	20 Feb 2022	Lizzie and Bart
Plot ID: 70		Photo #:
VZ / PCT: PCT 157		

BAM Attribute (400m² plot)	Sum values	
	Count of native richness	Cover
Trees	0	0
Shrubs	3	24
Grasses etc.	2	10.2
Forbs	1	0.1
Ferns	0	0
Other	0	0
High threat weed cover	0	0

Cover: 0.1, 0.2, 0.3..... 1,2,3,.....,10, 15, 20, 25, ... 100% (foliage cover). *Note: 0.1% cover is approx.. 63x63 cm or a circle about 71 cm diameter, 0.5% approx. 1.4 x 1.4m, 2% cover is approx. 2 x 2m, 5% = 4 x 5m, 25% 10 x 10m*

BAM Attribute (1000m² plot)		
DBH	#Tree Stems Count	#Stems with Hollows
80 + cm		
50 – 79 cm		
30 – 49 cm		
20 – 29 cm		
10 – 19 cm		
5 – 9 cm		
<5 cm		
Length of logs (m) (≥ 10 cm diameter, >50cm in length)	Tally: 0	

Counts apply when the number of tree stems within a size class is ≤ 10. Estimate can be used when > 10 (eg. 10, 20, 30....100, 200). For a multi-stemmed tree, only the largest living stem is included in the count / estimate. Tree stems must be living.

For hollows, count only the presence of a stem containing hollows. For a multi-stemmed tree, only the largest stem is included in the count/estimate. Stems may be dead and may be shrubs.

BAM Attribute (1 x 1 m plots)																				
	Litter cover %					Bare ground cover %					Cryptogam cover %					Rock cover %				
Subplot	5	15	25	35	45	5	15	25	35	45	5	15	25	35	45	5	15	25	35	45
score % in each	5	10	5	10	15	55	40	50	45	10	0	0	0	0	0	0	0	0	0	0
Average of the 5 subplots	9					40					0					0				

Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10cm in diameter)

Hunter Ecology

BAM Site – Plot Species List PCT 157

400m² plot: Sheet ___ of ___	Survey Name	Plot ID	Recorders
Date: 20 Feb 2022	Hay Field Trip for ERM	70	Lizzie and Bart

GF Code	Top 3 native species in each growth form group, full species name mandatory. All other native and exotic species full species name where practicable	N, E or HTE	Cover	Stratum (E,M,S,G)	Voucher	Photo #
SG	Atriplex vesicaria	N	15	G/S		
SG	Maireana aphylla	N	1	G/S		
SG	Sclerolaena bicuspis	N	8	G		
FG	Sida intricata	N	0.1	G		
SG	Sclerolaena brachyptera	N	3	G		
GG	Sporobulus creberi	N	10	G		
GG	Rhytidosperma caespitosum	N	0.2	G		

- Lots of dead Barley Grass in leaf litter

N: native, **E**:exotic, **HTE**: high threat exotic, **GF** – circle code if 'top 3'
Cover: 0.1, 0.2, 0.3….. 1,2,3,……,10, 15, 20, 25, ….. 100% (foliage cover). *Note: 0.1% cover is approx.. 63x63 cm or a circle about 71 cm diameter, 0.5% approx. 1.4 x 1.4m, 2% cover is approx. 2 x 2m, 5% = 4 x 5m, 25% 10 x 10m*
Abundance: 1, 2, 3, ….10, 20, 30, ….. 100, 200,…., 1000
Stratum: E – emergent, C – canopy, M – mid-storey / sub canopy, S – shrub layer, G – ground layer

Hunter Ecology

BAM Site – Plot Species List

PCT 164

400m² plot: Sheet ___ of ___	Survey Name	Plot ID	Recorders
Date: 20 Feb 2022	Hay Field Trip for ERM	72	Lizzie and Bart

GF Code	Top 3 native species in each growth form group (full species name mandatory. All other native and exotic species: full species name where practicable	N, E or HTE	Cover	Stratum (E,M,S,G)	Voucher	Photo #
SG	Maireana aphylla	N	20	G/S		
CG	Austrostipa scabra	N	2	G		
FG	Maireana pentagona	N	10	G		
FG	Calocephalus sonderi ~~tiejgetta~~	N	10	G		
GG	Sporobulus caroli	N	3	G		
GG	Rhytidosperma caespitosum	N	0.1	G		
SG	Salsola tragus	N	0.1	G		
FG	Sida ~~intricata~~ cunninghamii	N	0.1	G		
SG	Sclerolaena brachyptera	N	0.1	G		
SG	Nitraria billardiera	N	0.1	S		
FG	~~Sto~~ Solanum esuriale	N	0.1	G		
GG	Chloris truncata	N	01	G		
~~SAM~~	Lycium ferocissimum 'dying-has been sprayed.	HTW	0.1	S		
FG	Fringe Lily - Thysanotus tuberosus	N	0.1	G		

N: native, E:exotic, HTE: high threat exotic, GF – circle code if 'top 3'
Cover: 0.1, 0.2, 0.3..... 1,2,3,.....,10, 15, 20, 25, ... 100% (foliage cover). *Note: 0.1% cover is approx.. 63x63 cm or a circle about 71 cm diameter, 0.5% approx. 1.4 x 1.4m, 2% cover is approx. 2 x 2m, 5% = 4 x 5m, 25% 10 x 10m*
Abundance: 1, 2, 3, ...10, 20, 30, ... 100, 200,...., 1000
Stratum: E – emergent, C – canopy, M – mid-storey / sub canopy, S – shrub layer, G – ground layer

Hunter Ecology

BAM Site – Field Survey Form

Survey Name	Date	Recorders
Hay Field Trip for ERM	20 Feb 2022	Lizzie and Bart
Plot ID: 73		Photo #: ~~—~~
VZ / PCT: 153		

BAM Attribute (400m² plot)	Sum values	
	Count of native richness	Cover
Trees	0	0
Shrubs	8	26.3
Grasses etc.	4	10.4
Forbs	3	0.3
Ferns	0	0
Other	0	0
High threat weed cover	1	0.1

Cover: 0.1, 0.2, 0.3..... 1,2,3,.....,10, 15, 20, 25, ... 100% (foliage cover). *Note: 0.1% cover is approx.. 63x63 cm or a circle about 71 cm diameter, 0.5% approx. 1.4 x 1.4m, 2% cover is approx. 2 x 2m, 5% = 4 x 5m, 25% 10 x 10m*

BAM Attribute (1000m² plot)		
DBH	#Tree Stems Count	#Stems with Hollows
80 + cm		
50 – 79 cm		
30 – 49 cm		
20 – 29 cm		
10 – 19 cm		
5 – 9 cm		
<5 cm		
Length of logs (m) (≥ 10 cm diameter, >50cm in length)	Tally: 0	

Counts apply when the number of tree stems within a size class is ≤ 10. Estimate can be used when > 10 (eg. 10, 20, 30....100, 200). For a multi-stemmed tree, only the largest living stem is included in the count / estimate. Tree stems must be living.

For hollows, count only the presence of a stem containing hollows. For a multi-stemmed tree, only the largest stem is included in the count/estimate. Stems may be dead and may be shrubs.

BAM Attribute (1 x 1 m plots)	Litter cover %					Bare ground cover %					Cryptogam cover %					Rock cover %				
	5	15	25	35	45	5	15	25	35	45	5	15	25	35	45	5	15	25	35	45
Subplot score % in each	15	30	30	40	10	30	20	30	15	40	0	0	0	0	0	0	0	0	0	0
Average of the 5 subplots	25					27					0					0				

Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10cm in diameter)

Hunter Ecology

BAM Site – Plot Species List PCT 153

400m² plot. Sheet ___ of ___	Survey Name	Plot ID	Recorders
Date: 20 Feb 2022	Hay Field Trip for ERM	73	Lizzie and Bart

GF Code	Top 3 native species in each growth form group full species name mandatory. All other native and exotic species: full species name where practicable	N, E or HTE	Cover	Stratum (E,M,S,G)	Voucher	Photo #
SG	Maireana pyramidata	N	10	S		
SG	Atriplex vesicaria	N	~~10~~ 0.2	G		
GG	Enteropogon acicularis	N	10	G		
SG	Salsola tragus.	N	0.1	G		
GG	Paspalidium constrictum	N	0.2	G		
SG	Sclerolaena diacantha	N	0.5	G		
—	Heliotropa europaeum	E	0.1	G		
FG	Dysphania pumilio.	N	0.1	G		
SG	~~Malacocera~~ Sclerolaena biflora	N	15	G		
SG	sclerolaena tricuspis	N	0.2	G		
SG	Sclerolaena brachyptera	N	0.2	G		
FG	Portulaca oleracea	N	0.1	G		
SG	Atriplex nummularia	N	0.1	S		
—	Lycium ferocissimum	HTW	0.1	S		
GG	Dactyloctenium radulans.	N	0.1	G		
GG	Aristida sp.	N	0.1	G		
FG	Crassula colorata.	N	0.1	G		

Lots of Burr Medic in leaf litter

N: native, **E**:exotic, **HTE**: high threat exotic, **GF** – circle code if 'top 3'

Cover: 0.1, 0.2, 0.3….. 1,2,3,……,10, 15, 20, 25, ….. 100% (foliage cover). *Note: 0.1% cover is approx.. 63x63 cm or a circle about 71 cm diameter, 0.5% approx. 1.4 x 1.4m, 2% cover is approx. 2 x 2m, 5% = 4 x 5m, 25% 10 x 10m*

Abundance: 1, 2, 3, ….10, 20, 30, ….. 100, 200,…., 1000

Stratum: E – emergent, C – canopy, M – mid-storey / sub canopy, S – shrub layer, G – ground layer

Hunter Ecology

BAM Site – Field Survey Form

Survey Name	Date	Recorders
Hay Field Trip for ERM	21 Feb 2022	Lizzie and Bart
Plot ID: 79		Photo #:
VZ / PCT: 153		

BAM Attribute (400m² plot)	Sum values	
	Count of native richness	Cover
Trees	0	0
Shrubs	5	15.7
Grasses etc.	5	2.9
Forbs	4	1.8
Ferns	0	0
Other	0	0
High threat weed cover		0

Cover: 0.1, 0.2, 0.3..... 1,2,3,.....,10, 15, 20, 25, ... 100% (foliage cover). *Note: 0.1% cover is approx.. 63x63 cm or a circle about 71 cm diameter, 0.5% approx. 1.4 x 1.4m, 2% cover is approx. 2 x 2m, 5% = 4 x 5m, 25% 10 x 10m*

BAM Attribute (1000m² plot)		
DBH	#Tree Stems Count	#Stems with Hollows
80 + cm		
50 – 79 cm		
30 – 49 cm		
20 – 29 cm		
10 – 19 cm		
5 – 9 cm		
<5 cm		
Length of logs (m) (≥ 10 cm diameter, >50cm in length)	Tally: 0 m	

Counts apply when the number of tree stems within a size class is ≤ 10. Estimate can be used when > 10 (eg. 10, 20, 30....100, 200). For a multi-stemmed tree, only the largest living stem is included in the count / estimate. Tree stems must be living.

For hollows, count only the presence of a stem containing hollows. For a multi-stemmed tree, only the largest stem is included in the count/estimate. Stems may be dead and may be shrubs.

BAM Attribute (1 x 1 m plots)	Litter cover %					Bare ground cover %					Cryptogam cover %					Rock cover %				
Subplot	5	15	25	35	45	5	15	25	35	45	5	15	25	35	45	5	15	25	35	45
score % in each	15	10	10	30	20	60	70	~~75~~ 30	50		0	0	0	0	0	0	0	0	0	0
Average of the 5 subplots	17					57					0					0				

Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10cm in diameter)

Hunter Ecology

PCT 153

BAM Site – Plot Species List

400m² plot: Sheet ___ of ___	Survey Name	Plot ID	Recorders
Date: 21 Feb 2022	Hay Field Trip for ERM	79	Lizzie and Bart

GF Code	Top 3 native species in each growth form group (full species name mandatory. All other native and exotic species: full species name where practicable	N, E or HTE	Cover	Stratum (E,M,S,G)	Voucher	Photo #
SG	Maireana pyramidata	N	15	S/G		
FG	Minuria cunninghamii	N	0.1	G		
GG	Austrostipa scabra	N	0.2	G		
SG	Atriplex vesicaria	N	0.3	G		
GG	Sporobolus caroli	N	0.1	G		
SG	Sclerolaena tricuspis	N	0.2	G		
GG	Enteropogon acicularis	N	0.5	G		
FG	Maireana pentagona	N	1.5	G		
GG	Chloris truncata	N	2	G		
SG	Sclerolaena brachyptera	N	1	G		
GG	Rhytidosperma caespitosum	N	0.1	G		
SG	Maireana aphylla	N	0.2	G		
FG	Alternanthera denticulata	N	0.1	G		
FG	Crassula decumbens	N	0.1	G		

- Leaf litter is mainly dead native daisy types.
+
some Rye Grass

N: native, **E**:exotic, **HTE**: high threat exotic, **GF** – circle code if 'top 3'
Cover: 0.1, 0.2, 0.3..... 1,2,3,.....,10, 15, 20, 25, ... 100% (foliage cover). *Note: 0.1% cover is approx.. 63x63 cm or a circle about 71 cm diameter, 0.5% approx. 1.4 x 1.4m, 2% cover is approx. 2 x 2m, 5% = 4 x 5m, 25% 10 x 10m*
Abundance: 1, 2, 3, ...10, 20, 30, ... 100, 200,...., 1000
Stratum: E – emergent, C – canopy, M – mid-storey / sub canopy, S – shrub layer, G – ground layer

Hunter Ecology

BAM Site – Field Survey Form

Survey Name	Date	Recorders
Hay Field Trip for ERM	21 Feb 2022	Lizzie and Bart
Plot ID: 80		~~Photo #: 3~~
VZ / PCT: 164		

BAM Attribute (400m² plot)	Sum values	
	Count of native richness	Cover
Trees	0	0
Shrubs	6	21.4
Grasses etc.	5	5.5
Forbs	7	2.7
Ferns	0	0
Other	0	0
High threat weed cover		0

Cover: 0.1, 0.2, 0.3..... 1,2,3,.....,10, 15, 20, 25, ... 100% (foliage cover). *Note: 0.1% cover is approx., 63x63 cm or a circle about 71 cm diameter, 0.5% approx. 1.4 x 1.4m, 2% cover is approx. 2 x 2m, 5% = 4 x 5m, 25% 10 x 10m*

BAM Attribute (1000m² plot)		
DBH	#Tree Stems Count	#Stems with Hollows
80 + cm		
50 – 79 cm		
30 – 49 cm		
20 – 29 cm		
10 – 19 cm		
5 – 9 cm		
<5 cm		
Length of logs (m) (≥ 10 cm diameter, >50cm in length)	Tally: 0	

Counts apply when the number of tree stems within a size class is ≤ 10. Estimate can be used when > 10 (eg. 10, 20, 30....100, 200). For a multi-stemmed tree, only the largest living stem is included in the count / estimate. Tree stems must be living.

For hollows, count only the presence of a stem containing hollows. For a multi-stemmed tree, only the largest stem is included in the count/estimate. Stems may be dead and may be shrubs.

BAM Attribute (1 x 1 m plots)	Litter cover %					Bare ground cover %					Cryptogam cover %					Rock cover %				
Subplot	5	15	25	35	45	5	15	25	35	45	5	15	25	35	45	5	15	25	35	45
score % in each	15	5	15	15	10	50	60	30	25	50	0	0	0	0	0	0	0	0	0	0
Average of the 5 subplots	12					43					0					0				

Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10cm in diameter)

Hunter Ecology

BAM Site – Plot Species List PCT 164

400m² plot: Sheet ___ of ___	Survey Name	Plot ID	Recorders
Date: 21 Feb 2022	Hay Field Trip for ERM	80	Lizzie and Bart

GF Code	Top 3 native species in each growth form group: full species name mandatory. All other native and exotic species: full species name where practicable	N, E or HTE	Cover	Stratum (E,M,S,G)	Voucher	Photo #
SG	Maireana aphylla	N	20	S/G		
SG	Nitraria billardiera	N	1	S		
GG	Chloris truncata	N	~~05~~ 1	G		
GG	Sporobolus caroli	N	5	G		
FG	Sida cunninghamii	N	2	G		
GG	Eragrostis australasica	N	0.1	S		
GG	Rhytidosperma caespitosum	N	0.2	G		
GG	Austrostipa ~~spp~~ scabra	N	0.2	G		
FG	Maireana pentagona	N	0.1	G		
FG	Salsola kali	N	0.2	G		
FG	Euphorbia drummondii	N	0.1	G		
FG	Calotis scabiosifolia	N	0.1	G		
SG	Malacocera ~~tricornis~~	N	0.1	G		
FG	Crassedia crassa	N	0.1	G		
SG	Sclerolaena brachyptera	N	0.1	G		
SG	Atriplex vesicaria	N	0.1	G		
FG	Alternanthera denticulata	N	0.1	G		
SG	Sclerolaena diacantha	N	0.1	G		

N: native, **E**:exotic, **HTE**: high threat exotic, **GF** – circle code if 'top 3'

Cover: 0.1, 0.2, 0.3….. 1,2,3,……,10, 15, 20, 25, ….. 100% (foliage cover). *Note: 0.1% cover is approx.. 63x63 cm or a circle about 71 cm diameter, 0.5% approx. 1.4 x 1.4m, 2% cover is approx. 2 x 2m, 5% = 4 x 5m, 25% 10 x 10m*

Abundance: 1, 2, 3, ….10, 20, 30, ….. 100, 200,…., 1000

Stratum: E – emergent, C – canopy, M – mid-storey / sub canopy, S – shrub layer, G – ground layer

Hunter Ecology

BAM Site – Field Survey Form

Survey Name	Date	Recorders
Hay Field Trip for ERM	20 Feb 2022	Lizzie and Bart
Plot ID: 72		~~Photo #:~~
VZ / PCT: 164		

BAM Attribute (400m² plot)	Sum values	
	Count of native richness	Cover
Trees	0	0
Shrubs	4	20.3
Grasses etc.	4	5.2
Forbs	5	20.3
Ferns	0	0
Other	0	0
High threat weed cover	1	0.1

Cover: 0.1, 0.2, 0.3..... 1,2,3,.....,10, 15, 20, 25, ... 100% (foliage cover). *Note: 0.1% cover is approx.. 63x63 cm or a circle about 71 cm diameter, 0.5% approx. 1.4 x 1.4m, 2% cover is approx. 2 x 2m, 5% = 4 x 5m, 25% 10 x 10m*

BAM Attribute (1000m² plot)		
DBH	#Tree Stems Count	#Stems with Hollows
80 + cm		
50 – 79 cm		
30 – 49 cm		
20 – 29 cm		
10 – 19 cm		
5 – 9 cm		
<5 cm		
Length of logs (m) (≥ 10 cm diameter, >50cm in length)	Tally: 0	

Counts apply when the number of tree stems within a size class is ≤ 10. Estimate can be used when > 10 (eg. 10, 20, 30....100, 200). For a multi-stemmed tree, only the largest living stem is included in the count / estimate. Tree stems must be living.

For hollows, count only the presence of a stem containing hollows. For a multi-stemmed tree, only the largest stem is included in the count/estimate. Stems may be dead and may be shrubs.

BAM Attribute (1 x 1 m plots)																				
	Litter cover %					Bare ground cover %					Cryptogam cover %					Rock cover %				
Subplot	5	15	25	35	45	5	15	25	35	45	5	15	25	35	45	5	15	25	35	45
score % in each	10	20	5	10	15	35	25	50	50	40	1	0	0	0	0	0	0	0	0	0
Average of the 5 subplots	12					40					0.2					0				

Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10cm in diameter)

Hunter Ecology

BAM Site – Field Survey Form

Survey Name	Date	Recorders
Hay Feb 23	23/2/23	Hunter Ecology
VZ / PCT: 24	Plot ID 15	

BAM Attribute (400m² plot)	Sum values	
	Count of native richness	Cover
Trees	0	0
Shrubs	5	10.5
Grasses etc.	9	11.8
Forbs	8	1.7
Ferns	0	0
Other	0	0
High threat weed cover		- 0

Cover: 0.1, 0.2, 0.3..... 1,2,3,.....,10, 15, 20, 25, ... 100% (foliage cover). *Note: 0.1% cover is approx.. 63x63 cm or a circle about 71 cm diameter, 0.5% approx. 1.4 x 1.4m, 2% cover is approx. 2 x 2m, 5% = 4 x 5m, 25% 10 x 10m*

BAM Attribute (1000m² plot)		
DBH	#Tree Stems Count	#Stems with Hollows
80 + cm		
50 – 79 cm		
30 – 49 cm		
20 – 29 cm		
10 – 19 cm		
5 – 9 cm		
<5 cm		
Length of logs (m) (≥ 10 cm diameter, >50cm in length)	Tally: 0m	

Counts apply when the number of tree stems within a size class is ≤ 10. Estimate can be used when > 10 (eg. 10, 20, 30....100, 200). For a multi-stemmed tree, only the largest living stem is included in the count / estimate. Tree stems must be living.

For hollows, count only the presence of a stem containing hollows. For a multi-stemmed tree, only the largest stem is included in the count/estimate. Stems may be dead and may be shrubs.

BAM Attribute (1 x 1 m plots)	Litter cover %					Bare ground cover %					Cryptogam cover %					Rock cover %				
	5	15	25	35	45	5	15	25	35	45	5	15	25	35	45	5	15	25	35	45
Subplot score % in each	80	90	80	70	85	5	0	10	0	0	0	0	0	0	0	0	0	0	0	0
Average of the 5 subplots	81					3					0					0				

Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10cm in diameter)

Hunter Ecology

BAM Site – Plot Species List

400m² plot: Sheet _2_ of _2_	Survey Name	Plot ID	Recorders
Date: 23/2/23	Hey Felo 23	1 S	Hunter Ecology

GF Code	Top 3 native species in each growth form group: full species name mandatory. All other native and exotic species: full species name where practicable	N, E or HTE	Cover	Stratum (E,M,S,G)	Voucher	Photo #
G	Eragrostis australasica	N	3	S		
S	Chenopodium nitrariaceum	N	0.5	S		
G	Rhytidosperma ~~sp~~ caespitosum	N	3	G		
E	Marsilea drummondii	N	10	G		
G	Austrostipa scabra.	N	1	G		
G	Sporobolus caroli	N	1	G		
S	Sclerolaena tricuspis.	N	3	G		
S	Maireana aphylla	N	5	G		
S	Enchylaena tomentosa	N	1	G		
F	Sida ~~sp~~ trichopoda	N	0.1	G		
F	Brachyscome sp.	N	0.1	G		
S	Atriplex vesicaria	N	1	G		
F	Minuria cunninghamii	N	0.2	G		
G	Panicum effusum	N	0.2	G		
F	Solanum esuriale.	N	0.1	G		
G	Panicum laevinode.	N	3	G		
F	Maireana pentagona.	N	0.1	G		
F	Calotis ~~sp~~ scabiosifolia	N	0.1	G		
F	Einadia nutans.	N	0.2	G		
G	Enteropogon acicularis	N	0.2	G		
G	Panicum decompositum	N	0.2	G		
F	Alternanthera denudata	N	0.8	G		
G	Chloris truncata	N	0.2	G		

N: native, **E**:exotic, **HTE**: high threat exotic, **GF** – circle code if 'top 3'

Cover: 0.1, 0.2, 0.3..... 1,2,3,.....,10, 15, 20, 25, ... 100% (foliage cover). *Note: 0.1% cover is approx.. 63x63 cm or a circle about 71 cm diameter, 0.5% approx. 1.4 x 1.4m, 2% cover is approx. 2 x 2m, 5% = 4 x 5m, 25% 10 x 10m*

Hunter Ecology

BAM Site – Field Survey Form

Survey Name	Date	Recorders
Hay Feb 23	23/2/23	Hunter Ecology
VZ / PCT: 157	Plot ID 2S	

BAM Attribute (400m² plot)	Sum values	
	Count of native richness	Cover
Trees	0	0
Shrubs	2	35.2
Grasses etc.	6	22.3
Forbs	1	0.1
Ferns	0	0
Other	0	0
High threat weed cover		- 0

Cover: 0.1, 0.2, 0.3..... 1,2,3,.....,10, 15, 20, 25, ... 100% (foliage cover). *Note: 0.1% cover is approx.. 63x63 cm or a circle about 71 cm diameter, 0.5% approx. 1.4 x 1.4m, 2% cover is approx. 2 x 2m, 5% = 4 x 5m, 25% 10 x 10m*

BAM Attribute (1000m² plot)		
DBH	#Tree Stems Count	#Stems with Hollows
80 + cm		
50 – 79 cm		
30 – 49 cm		
20 – 29 cm		
10 – 19 cm		
5 – 9 cm		
<5 cm		
Length of logs (m) (≥ 10 cm diameter, >50cm in length)	Tally: 0M	

Counts apply when the number of tree stems within a size class is ≤ 10. Estimate can be used when > 10 (eg. 10, 20, 30....100, 200). For a multi-stemmed tree, only the largest living stem is included in the count / estimate. Tree stems must be living.

For hollows, count only the presence of a stem containing hollows. For a multi-stemmed tree, only the largest stem is included in the count/estimate. Stems may be dead and may be shrubs.

BAM Attribute (1 x 1 m plots)																				
	Litter cover %					Bare ground cover %					Cryptogam cover %					Rock cover %				
Subplot	5	15	25	35	45	5	15	25	35	45	5	15	25	35	45	5	15	25	35	45
score % in each	5	40	20	15	10	70	10	20	30	50	0	0	0	0	0	0	0	0	0	0
Average of the 5 subplots	18					36					0					0				

Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10cm in diameter)

Hunter Ecology

BAM Site – Plot Species List

400m² plot: Sheet _2_ of _2_	Survey Name	Plot ID	Recorders
Date: 25/2/23	Hevs Feb 23	2 S	Hunter Ecology

GF Code	Top 3 native species in each growth form group: full species name mandatory. All other native and exotic species: full species name where practicable	N, E or HTE	Cover	Stratum (E,M,S,G)	Voucher	Photo #
S	Atriplex vesicaria	N	35	G		
G	Chloris truncata	N	0.5	G		
G	Sporobolus caroli	N	20	G		
G	Enteropogon acicularis	N	0.5	G		
G	Panicum decompositum	N	0.5	G		
I	Avena (oats)	E	0.1	G		
F	Calocephalus sonderi	N	0.1	G		
G	Rhytidosperma caespitosum	N	0.3	G		
S	Sclerolaena tricuspis	N	0.2	G		
G	Austrostipa scabra	N	0.5	G		

N: native, **E**:exotic, **HTE**: high threat exotic, **GF** – circle code if 'top 3'

Cover: 0.1, 0.2, 0.3..... 1,2,3,.....,10, 15, 20, 25, ... 100% (foliage cover). *Note: 0.1% cover is approx.. 63x63 cm or a circle about 71 cm diameter, 0.5% approx. 1.4 x 1.4m, 2% cover is approx. 2 x 2m, 5% = 4 x 5m, 25% 10 x 10m*

Hunter Ecology

BAM Site – Field Survey Form

Survey Name	Date	Recorders
Hens Feb 23	23/2/23	Hunter Ecology
VZ / PCT: 24	Plot ID	3 S

BAM Attribute (400m² plot)	Sum values	
	Count of native richness	Cover
Trees	0	0
Shrubs	4	1.4
Grasses etc.	6	13.4
Forbs	3	3.7
Ferns	1	10
Other	0	0
High threat weed cover		- 0

Cover: 0.1, 0.2, 0.3..... 1,2,3,.....,10, 15, 20, 25, ... 100% (foliage cover). *Note: 0.1% cover is approx.. 63x63 cm or a circle about 71 cm diameter, 0.5% approx. 1.4 x 1.4m, 2% cover is approx. 2 x 2m, 5% = 4 x 5m, 25% 10 x 10m*

BAM Attribute (1000m² plot)		
DBH	#Tree Stems Count	#Stems with Hollows
80 + cm		
50 – 79 cm		
30 – 49 cm		
20 – 29 cm		
10 – 19 cm		
5 – 9 cm		
<5 cm		
Length of logs (m) (≥ 10 cm diameter, >50cm in length)	Tally: 0M	

Counts apply when the number of tree stems within a size class is ≤ 10. Estimate can be used when > 10 (eg. 10, 20, 30....100, 200). For a multi-stemmed tree, only the largest living stem is included in the count / estimate. Tree stems must be living.

For hollows, count only the presence of a stem containing hollows. For a multi-stemmed tree, only the largest stem is included in the count/estimate. Stems may be dead and may be shrubs.

BAM Attribute (1 x 1 m plots)																				
	Litter cover %					Bare ground cover %					Cryptogam cover %					Rock cover %				
Subplot	5	15	25	35	45	5	15	25	35	45	5	15	25	35	45	5	15	25	35	45
score % in each	90	50	60	70	80	0	10	5	0	5	0	0	0	0	0	0	0	0	0	0
Average of the 5 subplots	70					4					0					0				

Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10cm in diameter)

Hunter Ecology

BAM Site – Plot Species List

400m² plot: Sheet _2_ of _2_	Survey Name	Plot ID	Recorders
Date: 23/2/23	Hay Feb 23	3s	Hunter Ecology

GF Code	Top 3 native species in each growth form group: full species name mandatory. All other native and exotic species: full species name where practicable	N, E or HTE	Cover	Stratum (E,M,S,G)	Voucher	Photo #
G	Eragrostis australasica	N	2			
G	Panicum laevinode	N	10			
E	Marsilea drummondii	N	10			
G	Panicum decompositum	N	0.3			
F	Sida ~~sp~~ trichopoda	N	2			
F	Cucumis myriocarpa	E	0.1			
F	Leiocarpa sp.	N	0.2			
S	Maireana pentagona	N	1.5			
S	Sclerolaena tricuspis	N	0.5			
G	Maireana aphylla	N	0.2			
G	Chloris truncata	N	0.5			
S	Enteropogon acicularis	N	0.1			
S	Malacocerus tricornis	N	0.2			
G	Atriplex vesicaria	N	0.5			
	Eriochloa crebra	N	0.5			

N: native, **E**:exotic, **HTE**: high threat exotic, **GF** – circle code if 'top 3'

Cover: 0.1, 0.2, 0.3..... 1,2,3,.....,10, 15, 20, 25, ... 100% (foliage cover). *Note: 0.1% cover is approx.. 63x63 cm or a circle about 71 cm diameter, 0.5% approx. 1.4 x 1.4m, 2% cover is approx. 2 x 2m, 5% = 4 x 5m, 25% 10 x 10m*

Hunter Ecology

BAM Site – Field Survey Form

Survey Name	Date	Recorders
Hen Feb 23	24/2/23	Hunter Ecology
VZ / PCT: 163	Plot ID 11s	

BAM Attribute (400m² plot)	Sum values	
	Count of native richness	Cover
Trees	-	-
Shrubs	5	27.2
Grasses etc.	3	3
Forbs	3	3.6
Ferns	-	-
Other	-	-
High threat weed cover	-	-

Cover: 0.1, 0.2, 0.3..... 1,2,3,.....,10, 15, 20, 25, ... 100% (foliage cover). *Note: 0.1% cover is approx.. 63x63 cm or a circle about 71 cm diameter, 0.5% approx. 1.4 x 1.4m, 2% cover is approx. 2 x 2m, 5% = 4 x 5m, 25% 10 x 10m*

BAM Attribute (1000m² plot)		
DBH	#Tree Stems Count	#Stems with Hollows
80 + cm		
50 – 79 cm		
30 – 49 cm		
20 – 29 cm		
10 – 19 cm		
5 – 9 cm		
<5 cm		
Length of logs (m) (≥ 10 cm diameter, >50cm in length)	Tally: 0m	

Counts apply when the number of tree stems within a size class is ≤ 10. Estimate can be used when > 10 (eg. 10, 20, 30....100, 200). For a multi-stemmed tree, only the largest living stem is included in the count / estimate. Tree stems must be living.

For hollows, count only the presence of a stem containing hollows. For a multi-stemmed tree, only the largest stem is included in the count/estimate. Stems may be dead and may be shrubs.

BAM Attribute (1 x 1 m plots)	Litter cover %					Bare ground cover %					Cryptogam cover %					Rock cover %				
Subplot	5	15	25	35	45	5	15	25	35	45	5	15	25	35	45	5	15	25	35	45
score % in each	10	5	25	25	40	40	80	25	60	10	0	0	0	0	0	0	0	0	0	0
Average of the 5 subplots	21					43					0					0				

Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10cm in diameter)

Hunter Ecology

BAM Site – Plot Species List

400m² plot: Sheet _2_ of _2_	Survey Name	Plot ID	Recorders
Date: 24 | 2 | 23	Hay Feb 23	11s	Hunter Ecology

GF Code	Top 3 native species in each growth form group: full species name mandatory. All other native and exotic species: full species name where practicable	N, E or HTE	Cover	Stratum (E,M,S,G)	Voucher	Photo #
S	Nitraria billardierei		10	S		
S	Sclerolaena tricuspis		8	G		
S	Malacocerus tricornis		2	G		
S	Maireana aphylla		7	G		
F	Maireana pentagona		3	G		
G	Panicum decompositum		2	G		
F	Sida sp. trichopoda		3.5	G		
G	Panicum laevinode		0.5	G		
F	Calocephalus sonderi		0.1	G		
G	Chloris truncata		0.5	G		
S	Atriplex sp.		0.2	G		
	S - 5 27.2					
	G - 3 3					
	F - 3 3.6					

N: native, **E**:exotic, **HTE**: high threat exotic, **GF** – circle code if 'top 3'

Cover: 0.1, 0.2, 0.3..... 1,2,3,.....,10, 15, 20, 25, ... 100% (foliage cover). *Note: 0.1% cover is approx.. 63x63 cm or a circle about 71 cm diameter, 0.5% approx. 1.4 x 1.4m, 2% cover is approx. 2 x 2m, 5% = 4 x 5m, 25% 10 x 10m*

Hunter Ecology

BAM Site – Field Survey Form

Survey Name		Date	Recorders
Hey Summer		15/2/22	Bart & Lizzie
Zone:	Datum:	Plot ID: 29	Photo #:
Easting:	Northing:	IBRA ~~region~~:	Midline bearing ~~from 0 m~~:
VZ / PCT: 164			

Record easting and northing at 0m on midline. Dimensions (Shape) of 0.04ha base plot.

BAM Attribute (400m² plot)	Sum values	
	Count of native richness	Cover
Trees	0	0
Shrubs	5	30.8
Grasses etc.	3	25.2
Forbs	3	0.3
Ferns	0	0
Other	0	0
High threat weed cover	0	0

Cover: 0.1, 0.2, 0.3..... 1,2,3,.....,10, 15, 20, 25, ... 100% (foliage cover). *Note: 0.1% cover is approx.. 63x63 cm or a circle about 71 cm diameter, 0.5% approx. 1.4 x 1.4m, 2% cover is approx. 2 x 2m, 5% = 4 x 5m, 25% 10 x 10m*

BAM Attribute (1000m² plot)		
DBH	#Tree Stems Count	#Stems with Hollows
80 + cm		
50 – 79 cm		
30 – 49 cm		
20 – 29 cm		
10 – 19 cm		
5 – 9 cm		
<5 cm		
Length of logs (m) (≥ 10 cm diameter, >50cm in length)	Tally: 0	

Counts apply when the number of tree stems within a size class is ≤ 10. Estimate can be used when > 10 (eg. 10, 20, 30....100, 200). For a multi-stemmed tree, only the largest living stem is included in the count / estimate. Tree stems must be living.

For hollows, count only the presence of a stem containing hollows. For a multi-stemmed tree, only the largest stem is included in the count/estimate. Stems may be dead and may be shrubs.

BAM Attribute (1 x 1 m plots)	Litter cover %					Bare ground cover %					Cryptogam cover %					Rock cover %				
	5	15	25	35	45	5	15	25	35	45	5	15	25	35	45	5	15	25	35	45
Subplot score % in each	10	20	15	10	10	35	25	40	30	40	0	0	0	0	0	0	0	0	0	0
Average of the 5 subplots	13					34					0					0				

Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10cm in diameter)

Hunter Ecology

PCT 164

BAM Site – Plot Species List

400m² plot: Sheet ___ of ___ Date: 15/2/22	Survey Name	Plot ID	Recorders
	Hay Summer	29	Bart + Lizzie

GF Code	Top 3 native species in each growth form group: full species name mandatory. All other native and exotic species: full species name where practicable	N, E or HTE	Cover	Stratum (E,M,S,G)	Voucher	Photo #
SG	Maireana aphylla	N	30	S/G		
GG	Sporobulus creberi	N	25	G		
FG	Craspedia canens	N	0.1	G		
GG	Rhytidosperma caespitosum	N	0.1	G		
SG	Nitraria billardierei	N	0.5	S		
FG	Sida intricata	N	0.1	G		
GG	Eragrostis australasica	N	0.1	S		
SG	Sclerolaena tricuspis	N	0.1	G		
FG	Maireana pentagona	N	0.1	G		
SG	Atriplex vesicaria	N	0.1	G		
SG	Sclerolaena brachyptera	N	0.1	G		

N: native, **E**:exotic, **HTE**: high threat exotic, **GF** – circle code if 'top 3'

Cover: 0.1, 0.2, 0.3..... 1,2,3,.....,10, 15, 20, 25, ... 100% (foliage cover). *Note: 0.1% cover is approx.. 63x63 cm or a circle about 71 cm diameter, 0.5% approx. 1.4 x 1.4m, 2% cover is approx. 2 x 2m, 5% = 4 x 5m, 25% 10 x 10m*

Abundance: 1, 2, 3, ...10, 20, 30, ... 100, 200,...., 1000

Stratum: E – emergent, C – canopy, M – mid-storey / sub canopy, S – shrub layer, G – ground layer

Hunter Ecology

BAM Site – Field Survey Form

Survey Name	Date	Recorders
VZ / PCT: Hay Feb 23 17	1-3-23	Hunter Ecology
	Plot ID 40 S	

BAM Attribute (400m² plot)	Sum values	
	Count of native richness	Cover
Trees	-	-
Shrubs	5	49
Grasses etc.	7	12.5
Forbs	4	7.3
Ferns	-	-
Other	-	-
High threat weed cover	-	-

Cover: 0.1, 0.2, 0.3….. 1,2,3,……,10, 15, 20, 25, ….. 100% (foliage cover). *Note: 0.1% cover is approx.. 63x63 cm or a circle about 71 cm diameter, 0.5% approx. 1.4 x 1.4m, 2% cover is approx. 2 x 2m, 5% = 4 x 5m, 25% 10 x 10m*

BAM Attribute (1000m² plot)		
DBH	#Tree Stems Count	#Stems with Hollows
80 + cm		
50 – 79 cm		
30 – 49 cm		
20 – 29 cm		
10 – 19 cm		
5 – 9 cm		
<5 cm		
Length of logs (m) (≥ 10 cm diameter, >50cm in length)	Tally:	

Counts apply when the number of tree stems within a size class is ≤ 10. Estimate can be used when > 10 (eg. 10, 20, 30….100, 200). For a multi-stemmed tree, only the largest living stem is included in the count / estimate. Tree stems must be living.

For hollows, count only the presence of a stem containing hollows. For a multi-stemmed tree, only the largest stem is included in the count/estimate. Stems may be dead and may be shrubs.

BAM Attribute (1 x 1 m plots)	Litter cover %					Bare ground cover %					Cryptogam cover %					Rock cover %				
	5	15	25	35	45	5	15	25	35	45	5	15	25	35	45	5	15	25	35	45
Subplot score % in each	60	20	90	90	90	5	45	0	0	0	0	0	0	0	0	0	0	0	0	0
Average of the 5 subplots	70					10					0					0				

Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10cm in diameter)

Hunter Ecology

BAM Site – Plot Species List

400m² plot: Sheet _2_ of _2_ Date:	Survey Name	Plot ID	Recorders
	Hay Feb 23	40 S	Hunter Ecology

GF Code	Top 3 native species in each growth form group: full species name mandatory. All other native and exotic species: full species name where practicable	N, E or HTE	Cover	Stratum (E,M,S,G)	Voucher	Photo #
S	Muellenbeckia florulenta	N	25	S		
S	Maireana aphylla	N	20	G		
F	Maireana pentagona	N	5	G		
G	Austrostipa scabra	N	8	G		
S	Atriplex leptocarpa	N	3	G		
F	Alternathera denticulata	N	2	G		
G	Eleocharis	N	3	G		
G	Panicum decopositum	N	0.1	G		
G	Chloris truncata	N	0.1	G		
F	Solanum cleariale	N	0.2	G		
S	Einadia nutans	N	0.3	G		
G	Rhytidosperma caespitosum	N	0.8	G		
S	Salsola tragus	N	0.2	G		
G	Sporobolus caroli	N	0.2	G		
F	Silene apetala	N	0.1	G		
G	Juncus	N	0.3	G		
	S 5 49					
	G 7 12.5					
	F 4 7.3					

N: native, **E**:exotic, **HTE**: high threat exotic, **GF** – circle code if 'top 3'

Cover: 0.1, 0.2, 0.3..... 1,2,3,.....,10, 15, 20, 25, ... 100% (foliage cover). *Note: 0.1% cover is approx.. 63x63 cm or a circle about 71 cm diameter, 0.5% approx. 1.4 x 1.4m, 2% cover is approx. 2 x 2m, 5% = 4 x 5m, 25% 10 x 10m*

Hunter Ecology

BAM Site – Field Survey Form

Survey Name	Date	Recorders
VZ / PCT: Hay Feb 23 17	1-3-23	Hunter Ecology
	Plot ID 385	

BAM Attribute (400m² plot)	Sum values	
	Count of native richness	Cover
Trees	-	-
Shrubs	5	13·8
Grasses etc.	5	51
Forbs	5	1·6
Ferns	-	-
Other	-	-
High threat weed cover		- -

Cover: 0.1, 0.2, 0.3….. 1,2,3,……,10, 15, 20, 25, ….. 100% (foliage cover). *Note: 0.1% cover is approx.. 63x63 cm or a circle about 71 cm diameter, 0.5% approx. 1.4 x 1.4m, 2% cover is approx. 2 x 2m, 5% = 4 x 5m, 25% 10 x 10m*

BAM Attribute (1000m² plot)		
DBH	#Tree Stems Count	#Stems with Hollows
80 + cm		
50 – 79 cm		
30 – 49 cm		
20 – 29 cm		
10 – 19 cm		
5 – 9 cm		
<5 cm		
Length of logs (m) (≥ 10 cm diameter, >50cm in length)	Tally:	

Counts apply when the number of tree stems within a size class is ≤ 10. Estimate can be used when > 10 (eg. 10, 20, 30….100, 200). For a multi-stemmed tree, only the largest living stem is included in the count / estimate. Tree stems must be living.

For hollows, count only the presence of a stem containing hollows. For a multi-stemmed tree, only the largest stem is included in the count/estimate. Stems may be dead and may be shrubs.

BAM Attribute (1 x 1 m plots)																				
	Litter cover %					Bare ground cover %					Cryptogam cover %					Rock cover %				
Subplot	5	15	25	35	45	5	15	25	35	45	5	15	25	35	45	5	15	25	35	45
score % in each	20	80	5	50	70	25	5	0	0	5	0	0	0	0	0	0	0	0	0	0
Average of the 5 subplots	45					7					0					0				

Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10cm in diameter)

Hunter Ecology

BAM Site – Plot Species List

400m² plot: Sheet _2_ of _2_ Date: Hay Feb 23	Survey Name	Plot ID	Recorders
	Hay Feb 23	38 S	Hunter Ecology

GF Code	Top 3 native species in each growth form group: full species name mandatory. All other native and exotic species: full species name where practicable	N, E or HTE	Cover	Stratum (E,M,S,G)	Voucher	Photo #
S	Muehlenbeckia floculenta	N	10	S		
G	Enteropogon acicularis	N	10	G		
G	Rhytidosperma caespitosum	N	35	G		
G	Chloris truncata	N	2	G		
S	Maireana aphylla	N	2	G		
G	Panicum laevinode	N	3	G		
S	Sclerolaena muricata	N	1	G		
S	Atriplex leptocarpa	N	0.3	G		
F	Alternanthera denticulata	N	0.2	G		
G	Juncus sp	N	1	G		
F	Solanum esuale	N	0.8	G		
S	Sclerolaena stelligera	N	0.5	G		
F	Teucrium racemosum	N	0.2	G		
F	Calotis scabiosifolia	N	0.2	G		
F	Erodium crinitum	N	0.2	G		
	S S - 13.8					
	G S - 51					
	F S - 1.6					

N: native, **E**:exotic, **HTE**: high threat exotic, **GF** – circle code if 'top 3'

Cover: 0.1, 0.2, 0.3….. 1,2,3,……,10, 15, 20, 25, ….. 100% (foliage cover). *Note: 0.1% cover is approx.. 63x63 cm or a circle about 71 cm diameter, 0.5% approx. 1.4 x 1.4m, 2% cover is approx. 2 x 2m, 5% = 4 x 5m, 25% 10 x 10m*

Hunter Ecology

BAM Site – Field Survey Form

Survey Name	Date	Recorders
Hey Feb 23	1/3/23	Hunter Ecology
VZ / PCT: 724	Plot ID 32s	

BAM Attribute (400m² plot)	Sum values	
	Count of native richness	Cover
Trees	- -	-
Shrubs	1	2
Grasses etc.	7	54
Forbs	4	2.2
Ferns	1	20
Other	- -	-
High threat weed cover	-	- -

Cover: 0.1, 0.2, 0.3..... 1,2,3,.....,10, 15, 20, 25, ... 100% (foliage cover). *Note: 0.1% cover is approx.. 63x63 cm or a circle about 71 cm diameter, 0.5% approx. 1.4 x 1.4m, 2% cover is approx. 2 x 2m, 5% = 4 x 5m, 25% 10 x 10m*

BAM Attribute (1000m² plot)		
DBH	#Tree Stems Count	#Stems with Hollows
80 + cm		
50 – 79 cm		
30 – 49 cm		
20 – 29 cm		
10 – 19 cm		
5 – 9 cm		
<5 cm		
Length of logs (m) (≥ 10 cm diameter, >50cm in length)	Tally: 0m	

Counts apply when the number of tree stems within a size class is ≤ 10. Estimate can be used when > 10 (eg. 10, 20, 30....100, 200). For a multi-stemmed tree, only the largest living stem is included in the count / estimate. Tree stems must be living.

For hollows, count only the presence of a stem containing hollows. For a multi-stemmed tree, only the largest stem is included in the count/estimate. Stems may be dead and may be shrubs.

BAM Attribute (1 x 1 m plots)	Litter cover %					Bare ground cover %					Cryptogam cover %					Rock cover %				
	5	15	25	35	45	5	15	25	35	45	5	15	25	35	45	5	15	25	35	45
Subplot score % in each	5	10	15	5	10	80	60	60	70	50	0	0	0	0	0	0	0	0	0	0
Average of the 5 subplots	9					64					0					0				

Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10cm in diameter)

Hunter Ecology

BAM Site – Plot Species List

400m² plot: Sheet _2_ of _2_	Survey Name	Plot ID	Recorders
Date: 1/3/23	Hey Feb 23	32s	Hunter Ecology

GF Code	Top 3 native species in each growth form group: full species name mandatory. All other native and exotic species: full species name where practicable	N, E or HTE	Cover	Stratum (E,M,S,G)	Voucher	Photo #
G	Eragrostis australasica	N	30	S		
E	Marsilea drummondii	N	20	G		
G	Panicum laevinode	N	5 40	G		
G	Chloris truncata.	N	0.5	G		
F	Mauremia pentagona.	N	1	G		
F	Sida trichopoda.	N	1	G		
G	Sporobolus creberi	N	3	G		
G	Enteropogon acicularis	N	0.2	G		
S	Mauremia aphylla	N	2	G		
G	Austrostipa scabra	N	0.2	G		
G	Eragrostis sp.	N	0.1	G		
F	Alternanthera denticulata	N	0.1	G		
F	Crassula decumbens-	N	0.1	G		
	S 1 - 2					
	G 7 - 54					
	F 4 - 2.2					
	E - 20					

N: native, **E**:exotic, **HTE**: high threat exotic, **GF** – circle code if 'top 3'

Cover: 0.1, 0.2, 0.3….. 1,2,3,……,10, 15, 20, 25, ….. 100% (foliage cover). *Note: 0.1% cover is approx.. 63x63 cm or a circle about 71 cm diameter, 0.5% approx. 1.4 x 1.4m, 2% cover is approx. 2 x 2m, 5% = 4 x 5m, 25% 10 x 10m*

Hunter Ecology

BAM Site – Field Survey Form

Survey Name	Date	Recorders
Hwy Feb 23	1/3/23	Hunter Ecology
VZ / PCT: ~~160~~ 17	Plot ID	3/5

BAM Attribute (400m² plot)	Sum values	
	Count of native richness	Cover
Trees	-	-
Shrubs	9	4 4
Grasses etc.	3	0.5
Forbs	-	-
Ferns	-	-
Other	-	-
High threat weed cover		- 0.5

Cover: 0.1, 0.2, 0.3..... 1,2,3,.....,10, 15, 20, 25, ... 100% (foliage cover). *Note: 0.1% cover is approx.. 63x63 cm or a circle about 71 cm diameter, 0.5% approx. 1.4 x 1.4m, 2% cover is approx. 2 x 2m, 5% = 4 x 5m, 25% 10 x 10m*

BAM Attribute (1000m² plot)		
DBH	#Tree Stems Count	#Stems with Hollows
80 + cm		
50 – 79 cm		
30 – 49 cm		
20 – 29 cm		
10 – 19 cm		
5 – 9 cm		
<5 cm		
Length of logs (m) (≥ 10 cm diameter, >50cm in length)	Tally: 0M	

Counts apply when the number of tree stems within a size class is ≤ 10. Estimate can be used when > 10 (eg. 10, 20, 30....100, 200). For a multi-stemmed tree, only the largest living stem is included in the count / estimate. Tree stems must be living.

For hollows, count only the presence of a stem containing hollows. For a multi-stemmed tree, only the largest stem is included in the count/estimate. Stems may be dead and may be shrubs.

BAM Attribute (1 x 1 m plots)	Litter cover %					Bare ground cover %					Cryptogam cover %					Rock cover %				
	5	15	25	35	45	5	15	25	35	45	5	15	25	35	45	5	15	25	35	45
Subplot score % in each	15	20	40	10	~~25~~ 45	60	40	30	0	60	0	0	0	0	0	0	0	0	0	0
Average of the 5 subplots	34					38					0					0				

Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10cm in diameter)

Hunter Ecology

BAM Site – Plot Species List

400m² plot: Sheet _2_ of _2_	Survey Name	Plot ID	Recorders
Date: 1/3/23	Hay Feb 23	31s	Hunter Ecology

GF Code	Top 3 native species in each growth form group: full species name mandatory. All other native and exotic species: full species name where practicable	N, E or HTE	Cover	Stratum (E,M,S,G)	Voucher	Photo #
S	Chenopodium nitrariaceum	N	20	S		
S	Sclerolaena muricata	N	2	G		
S	Muehlenbeckia	N	10	S		
S	Maireana appila	N	2	G		
S	Nitraria billardierei	N	3	S G		
S	Atriplex pseudocampanulata	N	0.2	G		
S	Atriplex leptocarpa	N	4	G		
G	Salsola tragus australis	N	0.5	G		
G	Juncus sp.	N	0.2	G		
G	Enteropogon acicularis	N	0.1	G		
—	Lycium ferocissimum	HTW	0.5	S		
—	Heliotrope europaeum	E	0.2	G		
S	Rhagodia spinescens	N	0.5	S		
G	Panicum decompositum	N	0.2	G		
	S 4 - 44					
	G 3 0.5					

N: native, **E**:exotic, **HTE**: high threat exotic, **GF** – circle code if 'top 3'

Cover: 0.1, 0.2, 0.3..... 1,2,3,.....,10, 15, 20, 25, ... 100% (foliage cover). *Note: 0.1% cover is approx.. 63x63 cm or a circle about 71 cm diameter, 0.5% approx. 1.4 x 1.4m, 2% cover is approx. 2 x 2m, 5% = 4 x 5m, 25% 10 x 10m*

Hunter Ecology

BAM Site – Field Survey Form

Survey Name	Date	Recorders
	23/2/23	Hunter Ecology
VZ / PCT: 160	Plot ID 5s	

BAM Attribute (400m² plot)	Sum values	
	Count of native richness	Cover
Trees	0	0
Shrubs	3	23.2
Grasses etc.	4	9.2
Forbs	7	2
Ferns	1	10
Other	0	0
High threat weed cover		0

Cover: 0.1, 0.2, 0.3..... 1,2,3,.....,10, 15, 20, 25, ... 100% (foliage cover). *Note: 0.1% cover is approx.. 63x63 cm or a circle about 71 cm diameter, 0.5% approx. 1.4 x 1.4m, 2% cover is approx. 2 x 2m, 5% = 4 x 5m, 25% 10 x 10m*

BAM Attribute (1000m² plot)		
DBH	#Tree Stems Count	#Stems with Hollows
80 + cm		
50 – 79 cm		
30 – 49 cm		
20 – 29 cm		
10 – 19 cm		
5 – 9 cm		
<5 cm		
Length of logs (m) (≥ 10 cm diameter, >50cm in length)	Tally: 6m	

Counts apply when the number of tree stems within a size class is ≤ 10. Estimate can be used when > 10 (eg. 10, 20, 30....100, 200). For a multi-stemmed tree, only the largest living stem is included in the count / estimate. Tree stems must be living.

For hollows, count only the presence of a stem containing hollows. For a multi-stemmed tree, only the largest stem is included in the count/estimate. Stems may be dead and may be shrubs.

BAM Attribute (1 x 1 m plots)	Litter cover %					Bare ground cover %					Cryptogam cover %					Rock cover %				
	5	15	25	35	45	5	15	25	35	45	5	15	25	35	45	5	15	25	35	45
Subplot score % in each	60	80	90	60	80	10	10	10	15	0	0	0	0	0	0	0	0	0	0	0
Average of the 5 subplots	74					9					0					0				

Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10cm in diameter)

Hunter Ecology

BAM Site – Plot Species List

400m² plot: Sheet _2_ of _2_	Survey Name	Plot ID	Recorders
Date: 23/2/23	Hay Feb 23	5 s	Hunter Ecology

GF Code	Top 3 native species in each growth form group: full species name mandatory. All other native and exotic species: full species name where practicable	N, E or HTE	Cover	Stratum (E,M,S,G)	Voucher	Photo #
S	Chenopodium nitrariaceum	N	15	S		
S	Muehlenbeckia florulenta	N	8	S		
F	Centipeda thespidioides	N	0.5	G		
F	Sida sp Trichopoda	N	0.2	G		
E	Marsilea drummondii	N	10	G		
S	Scleroaena muricata	N	0.2	G		
G	Panicum decompositum	N	5	G		
F	Euphorbia drummondii	N	0.2	G		
F	Sida corrugata	N	0.1	G		
—	Heliotrope, eureaopicum	E	0.1	G		
F	Goodenia fascicularis	N	0.1	G		
G	Eleocharis sp.	N	3	G		
F	Solanum esuriale	N	0.8	G		
G	Panicum laevinode	N	1	G		
G	Enteropogon acicularis	N	0.2	G		
F	Maireana pentagona	N	0.1	G		

N: native, **E**:exotic, **HTE**: high threat exotic, **GF** – circle code if 'top 3'

Cover: 0.1, 0.2, 0.3..... 1,2,3,.....,10, 15, 20, 25, ... 100% (foliage cover). *Note: 0.1% cover is approx.. 63x63 cm or a circle about 71 cm diameter, 0.5% approx. 1.4 x 1.4m, 2% cover is approx. 2 x 2m, 5% = 4 x 5m, 25% 10 x 10m*

Hunter Ecology

Solar Farm

BAM Site – Field Survey Form

Survey Name	Date	Recorders
Hay Feb 23	23/2/23	Hunter Ecology
VZ / PCT: 163	Plot ID 7s	

BAM Attribute (400m² plot)	Sum values	
	Count of native richness	Cover
Trees	0	0
Shrubs	6	19
Grasses etc.	4	42.5
Forbs	1	2
Ferns	0	0
Other	0	0
High threat weed cover		- 0

Cover: 0.1, 0.2, 0.3..... 1,2,3,.....,10, 15, 20, 25, ... 100% (foliage cover). *Note: 0.1% cover is approx.. 63x63 cm or a circle about 71 cm diameter, 0.5% approx. 1.4 x 1.4m, 2% cover is approx. 2 x 2m, 5% = 4 x 5m, 25% 10 x 10m*

BAM Attribute (1000m² plot)		
DBH	#Tree Stems Count	#Stems with Hollows
80 + cm		
50 – 79 cm		
30 – 49 cm		
20 – 29 cm		
10 – 19 cm		
5 – 9 cm		
<5 cm		
Length of logs (m) (≥ 10 cm diameter, >50cm in length)	Tally: 0m	

Counts apply when the number of tree stems within a size class is ≤ 10. Estimate can be used when > 10 (eg. 10, 20, 30....100, 200). For a multi-stemmed tree, only the largest living stem is included in the count / estimate. Tree stems must be living.

For hollows, count only the presence of a stem containing hollows. For a multi-stemmed tree, only the largest stem is included in the count/estimate. Stems may be dead and may be shrubs.

BAM Attribute (1 x 1 m plots)	Litter cover %					Bare ground cover %					Cryptogam cover %					Rock cover %				
	5	15	25	35	45	5	15	25	35	45	5	15	25	35	45	5	15	25	35	45
Subplot score % in each	80	15	30	60	70	5	30	20	15	10	0	0	0	0	0	0	0	0	0	0
Average of the 5 subplots	51					16					0					0				

Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10cm in diameter)

Hunter Ecology

BAM Site – Plot Species List

400m² plot: Sheet _2_ of _2_	Survey Name	Plot ID	Recorders
Date: 23/2/23	May Feb 23	7s	Hunter Ecology

GF Code	Top 3 native species in each growth form group: full species name mandatory. All other native and exotic species: full species name where practicable	N, E or HTE	Cover	Stratum (E,M,S,G)	Voucher	Photo #
S	Nitraria billardierei	N	10	S/G		
S	Maireana aphylla	N	2	G		
G	Rhytidosperma caespitosum	N	20	G		
G	Dactyloctenium radulans	E	1	G		
S	Atriplex leptocarpa	N	1.5	G		
G	Chloris truncata	N	1	G		
S	Sclerolaena tricuspis	N	5	G		
S	Sclerolaena muricata	N	0.5	G		
S	Sclerolaena stelligera	N	0.5	G		
G	Sporobolus caroli	N	20	G		
F	Maireana pentagona	N	2	G		

N: native, **E**:exotic, **HTE**: high threat exotic, **GF** – circle code if 'top 3'

Cover: 0.1, 0.2, 0.3….. 1,2,3,……,10, 15, 20, 25, ….. 100% (foliage cover). *Note: 0.1% cover is approx.. 63x63 cm or a circle about 71 cm diameter, 0.5% approx. 1.4 x 1.4m, 2% cover is approx. 2 x 2m, 5% = 4 x 5m, 25% 10 x 10m*

Hunter Ecology

BAM Site – Field Survey Form

Survey Name	Date	Recorders
Hay Feb 23	24/2/23	Hunter Ecology
VZ / PCT: 24	Plot ID 12s	

BAM Attribute (400m² plot)	Sum values	
	Count of native richness	Cover
Trees	-	-
Shrubs	3	4.7
Grasses etc.	4	41.8
Forbs	-	-
Ferns	-	-
Other	-	-
High threat weed cover	-	-

Cover: 0.1, 0.2, 0.3..... 1,2,3,.....,10, 15, 20, 25, ... 100% (foliage cover). *Note: 0.1% cover is approx.. 63x63 cm or a circle about 71 cm diameter, 0.5% approx. 1.4 x 1.4m, 2% cover is approx. 2 x 2m, 5% = 4 x 5m, 25% 10 x 10m*

BAM Attribute (1000m² plot)		
DBH	#Tree Stems Count	#Stems with Hollows
80 + cm		
50 – 79 cm		
30 – 49 cm		
20 – 29 cm		
10 – 19 cm		
5 – 9 cm		
<5 cm		
Length of logs (m) (≥ 10 cm diameter, >50cm in length)	Tally: 0m	

Counts apply when the number of tree stems within a size class is ≤ 10. Estimate can be used when > 10 (eg. 10, 20, 30....100, 200). For a multi-stemmed tree, only the largest living stem is included in the count / estimate. Tree stems must be living.

For hollows, count only the presence of a stem containing hollows. For a multi-stemmed tree, only the largest stem is included in the count/estimate. Stems may be dead and may be shrubs.

BAM Attribute (1 x 1 m plots)																				
	Litter cover %					Bare ground cover %					Cryptogam cover %					Rock cover %				
Subplot	5	15	25	35	45	5	15	25	35	45	5	15	25	35	45	5	15	25	35	45
score % in each	80	30	80	25	50	5	30	5	20	20	0	0	0	0	0	0	0	0	0	0
Average of the 5 subplots	53					16					0					0				

Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10cm in diameter)

Hunter Ecology

BAM Site – Plot Species List

400m² plot: Sheet _2_ of _2_ Date:	Survey Name	Plot ID	Recorders
	Hey Feb 23	12s	Hunter Ecology

GF Code	Top 3 native species in each growth form group: full species name mandatory. All other native and exotic species: full species name where practicable	N, E or HTE	Cover	Stratum (E,M,S,G)	Voucher	Photo #
G	Eragrostis australasica	N	30	S		
G	Eleocharis	N	10	G		
E	Marstea drummondii	N	40	G		
G	Panicum laxinode	N	1	G		
G	Panicum decompositum	N	0.8	G		
S	Nitraria billardieresi	N	4	S		
S	Maireana aphylla	N	0.5	G		
S	Sclerolaena stelligera	N	0.2	G		
-	Sisymbrium erysimoides	E	0.1	G		
	G-3 4.7					
	G-4 41.8					
	E-1					

N: native, **E**:exotic, **HTE**: high threat exotic, **GF** – circle code if 'top 3'

Cover: 0.1, 0.2, 0.3..... 1,2,3,.....,10, 15, 20, 25, ... 100% (foliage cover). *Note: 0.1% cover is approx.. 63x63 cm or a circle about 71 cm diameter, 0.5% approx. 1.4 x 1.4m, 2% cover is approx. 2 x 2m, 5% = 4 x 5m, 25% 10 x 10m*

Hunter Ecology

BAM Site – Field Survey Form

Survey Name	Date	Recorders
Hey Feb 23	1/3/23	Hunter Ecology
VZ / PCT: 163	Plot ID 335	

BAM Attribute (400m² plot)	Sum values	
	Count of native richness	Cover
Trees	-	-
Shrubs	4	8.6
Grasses etc.	4	12.2
Forbs	3	5.2
Ferns	1	3
Other	-	-
High threat weed cover		- -

Cover: 0.1, 0.2, 0.3..... 1,2,3,.....,10, 15, 20, 25, ... 100% (foliage cover). *Note: 0.1% cover is approx.. 63x63 cm or a circle about 71 cm diameter, 0.5% approx. 1.4 x 1.4m, 2% cover is approx. 2 x 2m, 5% = 4 x 5m, 25% 10 x 10m*

BAM Attribute (1000m² plot)		
DBH	#Tree Stems Count	#Stems with Hollows
80 + cm		
50 – 79 cm		
30 – 49 cm		
20 – 29 cm		
10 – 19 cm		
5 – 9 cm		
<5 cm		
Length of logs (m) (≥ 10 cm diameter, >50cm in length)	Tally: OM	

Counts apply when the number of tree stems within a size class is ≤ 10. Estimate can be used when > 10 (eg. 10, 20, 30....100, 200). For a multi-stemmed tree, only the largest living stem is included in the count / estimate. Tree stems must be living.

For hollows, count only the presence of a stem containing hollows. For a multi-stemmed tree, only the largest stem is included in the count/estimate. Stems may be dead and may be shrubs.

BAM Attribute (1 x 1 m plots)																				
	Litter cover %					Bare ground cover %					Cryptogam cover %					Rock cover %				
	5	15	25	35	45	5	15	25	35	45	5	15	25	35	45	5	15	25	35	45
Subplot score % in each	40	60	~~80~~	70	80	10	5	5	5	0	0	0	0	0	0	0	0	0	0	0
Average of the 5 subplots	66					5					0					0				

Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10cm in diameter)

Hunter Ecology

BAM Site – Plot Species List

400m² plot: Sheet _2_ of _2_	Survey Name	Plot ID	Recorders
Date: 1/3/23	Hey Feb 23	33s	Hunter Ecology

GF Code	Top 3 native species in each growth form group: full species name mandatory. All other native and exotic species: full species name where practicable	N, E or HTE	Cover	Stratum (E,M,S,G)	Voucher	Photo #
S	Nitraria billardierei	N	10	S		
G	Rhytidosperma caespitosum	N	10	G		
F	Sida trichopoda	N	5	G		
E	Marsilea drummondii	N	3	G		
S	Maireana aphylla	N	8	G		
F	Alternanthera denticulata	N	0.1	G		
S	Sclerolaena triaspis	N	0.5	G		
G	Eragrostis australasica	N	1	S		
G	Panicum laevinode	N	1	G		
S	Sclerolaena stelligera	N	0.1	G		
F	Maireana pentagona	N	0.1	G		
G	Enteropogon acicularis	N	0.2	G		
	S 4 - 6.6					
	G 4 - 12.2					
	F 3 - 5.2					
	E 1 - 3					

N: native, **E**:exotic, **HTE**: high threat exotic, **GF** – circle code if 'top 3'
Cover: 0.1, 0.2, 0.3….. 1,2,3,……,10, 15, 20, 25, ….. 100% (foliage cover). *Note: 0.1% cover is approx.. 63x63 cm or a circle about 71 cm diameter, 0.5% approx. 1.4 x 1.4m, 2% cover is approx. 2 x 2m, 5% = 4 x 5m, 25% 10 x 10m*

Hunter Ecology

BAM Site – Field Survey Form

Survey Name	Date	Recorders
Hey Feb 23	1-3-23	Hunter Ecology
VZ / PCT 163	Plot ID 34 S	

BAM Attribute (400m² plot)	Sum values	
	Count of native richness	Cover
Trees	-	-
Shrubs	4	35.4
Grasses etc.	4	13.9
Forbs	4	3.9
Ferns	-	-
Other	-	-
High threat weed cover	-	-

Cover: 0.1, 0.2, 0.3..... 1,2,3,.....,10, 15, 20, 25, ... 100% (foliage cover). *Note: 0.1% cover is approx.. 63x63 cm or a circle about 71 cm diameter, 0.5% approx. 1.4 x 1.4m, 2% cover is approx. 2 x 2m, 5% = 4 x 5m, 25% 10 x 10m*

BAM Attribute (1000m² plot)		
DBH	#Tree Stems Count	#Stems with Hollows
80 + cm		
50 – 79 cm		
30 – 49 cm		
20 – 29 cm		
10 – 19 cm		
5 – 9 cm		
<5 cm		
Length of logs (m) (≥ 10 cm diameter, >50cm in length)	Tally:	

Counts apply when the number of tree stems within a size class is ≤ 10. Estimate can be used when > 10 (eg. 10, 20, 30....100, 200). For a multi-stemmed tree, only the largest living stem is included in the count / estimate. Tree stems must be living.

For hollows, count only the presence of a stem containing hollows. For a multi-stemmed tree, only the largest stem is included in the count/estimate. Stems may be dead and may be shrubs.

BAM Attribute (1 x 1 m plots)																				
	Litter cover %					Bare ground cover %					Cryptogam cover %					Rock cover %				
Subplot	5	15	25	35	45	5	15	25	35	45	5	15	25	35	45	5	15	25	35	45
score % in each	5	5	5	5	5	65	80	70	75	80	0	0	0	0	0	0	0	0	0	0
Average of the 5 subplots	5					74					0					0				

Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10cm in diameter)

Hunter Ecology

BAM Site – Plot Species List

400m² plot: Sheet _2_ of _2_	Survey Name	Plot ID	Recorders
Date: 1/3/23	Hey Feb 23	345	Hunter Ecology

GF Code	Top 3 native species in each growth form group: full species name mandatory. All other native and exotic species: full species name where practicable	N, E or HTE	Cover	Stratum (E,M,S,G)	Voucher	Photo #
S	Nitraria billardierei	N	15	S		
S	Maireana aphylla	N	20	G		
G	Sporobulus caroli	N	5	G		
G	Rhytidosperma caespitosum	N	5	G		
F	Minuria cunninghamii	N	2	G		
S	Atriplex pseudocampulata	N	0.2	G		
G	Austrodanthonia scabra	N	3	G		
F	Maireana pentagona	N	1.5	G		
G	Enteropogon acicularis	N	0.5	G		
S	Sclerolaena tricuspis	N	0.2	G		
-	Oats - Avena	E	0.1	G		
F	Silene apetala	N	0.2	G		
F	Sida trichopoda	N	0.2	G		
	S 4 35.4					
	G 4 13.5					
	F 4 3.9					

N: native, **E**:exotic, **HTE**: high threat exotic, **GF** – circle code if 'top 3'

Cover: 0.1, 0.2, 0.3….. 1,2,3,……,10, 15, 20, 25, ….. 100% (foliage cover). *Note: 0.1% cover is approx.. 63x63 cm or a circle about 71 cm diameter, 0.5% approx. 1.4 x 1.4m, 2% cover is approx. 2 x 2m, 5% = 4 x 5m, 25% 10 x 10m*

Hunter Ecology

BAM Site – Field Survey Form

Survey Name	Date	Recorders
Hay Feb 23	1-3-23	Hunter Ecology
VZ / PCT: 163	Plot ID 35s	

BAM Attribute (400m² plot)	Sum values	
	Count of native richness	Cover
Trees	-	-
Shrubs	5	20.7
Grasses etc.	3	15
Forbs	3	7.5
Ferns	-	-
Other	-	-
High threat weed cover		- -

Cover: 0.1, 0.2, 0.3..... 1,2,3,.....,10, 15, 20, 25, ... 100% (foliage cover). *Note: 0.1% cover is approx.. 63x63 cm or a circle about 71 cm diameter, 0.5% approx. 1.4 x 1.4m, 2% cover is approx. 2 x 2m, 5% = 4 x 5m, 25% 10 x 10m*

BAM Attribute (1000m² plot)		
DBH	#Tree Stems Count	#Stems with Hollows
80 + cm		
50 – 79 cm		
30 – 49 cm		
20 – 29 cm		
10 – 19 cm		
5 – 9 cm		
<5 cm		
Length of logs (m) (≥ 10 cm diameter, >50cm in length)	Tally:	

Counts apply when the number of tree stems within a size class is ≤ 10. Estimate can be used when > 10 (eg. 10, 20, 30....100, 200). For a multi-stemmed tree, only the largest living stem is included in the count / estimate. Tree stems must be living.

For hollows, count only the presence of a stem containing hollows. For a multi-stemmed tree, only the largest stem is included in the count/estimate. Stems may be dead and may be shrubs.

BAM Attribute (1 x 1 m plots)	Litter cover %					Bare ground cover %					Cryptogam cover %					Rock cover %				
Subplot	5	15	25	35	45	5	15	25	35	45	5	15	25	35	45	5	15	25	35	45
score % in each	5	5	5	10	10	80	70	60	80	65	0	0	0	0	0	0	0	0	0	0
Average of the 5 subplots	7					71					0					0				

Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10cm in diameter)

Hunter Ecology

BAM Site – Plot Species List

400m² plot: Sheet _2_ of _2_	Survey Name	Plot ID	Recorders
Date: Hay Feb 23	Hay Feb 23	163	Hunter Ecology

GF Code	Top 3 native species in each growth form group: full species name mandatory. All other native and exotic species: full species name where practicable	N, E or HTE	Cover	Stratum (E,M,S,G)	Voucher	Photo #
S	Nitraria billardierei	N	15	S		
S	Maireana aphylla	N	5	G		
F	Minuria cunninghamii	N	5	G		
G	Sporobolus caroli	N	8	G		
G	Austrostipa scabra	N	2	G		
	Hordeum - Barley grass	E	0.2	G		
G	Rhyl.dosperma sp. ceresoites um	N	5	G		
F	Maireana pentagona	N	2	G		
S	Sclerolaena tricuspis	N	0.3	G		
F	S.da trichopoda	N	0.5	G		
S	Atriplex leptocarpa	N	0.2	G		
S	Atriplex vesicaria	N	0.2	G		
	S 5 - 20 7					
	G 3 - 15					
	F 3 - 7.5					

N: native, **E**:exotic, **HTE**: high threat exotic, **GF** – circle code if 'top 3'

Cover: 0.1, 0.2, 0.3..... 1,2,3,.....,10, 15, 20, 25, ... 100% (foliage cover). *Note: 0.1% cover is approx.. 63x63 cm or a circle about 71 cm diameter, 0.5% approx. 1.4 x 1.4m, 2% cover is approx. 2 x 2m, 5% = 4 x 5m, 25% 10 x 10m*

Hunter Ecology

BAM Site – Field Survey Form

Survey Name	Date	Recorders
Hay Feb 23	1-3-23	Hunter Ecology
VZ / PCT: 24	Plot ID	39s

BAM Attribute (400m² plot)	Sum values	
	Count of native richness	Cover
Trees	-	
Shrubs	4	4.8
Grasses etc.	6	43.5
Forbs	6	3.9
Ferns	1	7
Other	-	-
High threat weed cover	-	- -

Cover: 0.1, 0.2, 0.3..... 1,2,3,.....,10, 15, 20, 25, ... 100% (foliage cover). *Note: 0.1% cover is approx.. 63x63 cm or a circle about 71 cm diameter, 0.5% approx. 1.4 x 1.4m, 2% cover is approx. 2 x 2m, 5% = 4 x 5m, 25% 10 x 10m*

BAM Attribute (1000m² plot)		
DBH	#Tree Stems Count	#Stems with Hollows
80 + cm		
50 – 79 cm		
30 – 49 cm		
20 – 29 cm		
10 – 19 cm		
5 – 9 cm		
<5 cm		
Length of logs (m) (≥ 10 cm diameter, >50cm in length)	Tally:	

Counts apply when the number of tree stems within a size class is ≤ 10. Estimate can be used when > 10 (eg. 10, 20, 30....100, 200). For a multi-stemmed tree, only the largest living stem is included in the count / estimate. Tree stems must be living.

For hollows, count only the presence of a stem containing hollows. For a multi-stemmed tree, only the largest stem is included in the count/estimate. Stems may be dead and may be shrubs.

BAM Attribute (1 x 1 m plots)	Litter cover %					Bare ground cover %					Cryptogam cover %					Rock cover %				
	5	15	25	35	45	5	15	25	35	45	5	15	25	35	45	5	15	25	35	45
Subplot score % in each	90	90	40	25	50	0	0	20	30	40	0	0	0	0	0	0	0	0	0	0
Average of the 5 subplots	59					18					0					0				

Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10cm in diameter)

Hunter Ecology

BAM Site – Plot Species List

400m² plot: Sheet _2_ of _2_	Survey Name	Plot ID	Recorders
Date: Hay Feb23	Hay Feb 23	39 S	Hunter Ecology

GF Code	Top 3 native species in each growth form group. full species name mandatory. All other native and exotic species: full species name where practicable	N, E or HTE	Cover	Stratum (E,M,S,G)	Voucher	Photo #
G	Eragrostis australiasica	N	4	S		
G	Rhytidosperma caespitosum	N	30	G		
S	Sclerolaena muricata	N	4	G		
F	Calotis scabiosifolius	N	0.2	G		
E	Marsellia drummondii	N	7	G		
F	Alternanthera denticulata	N	3	G		
G	Panicum laevinoides	N	5	G		
G	Chloris truncata	N	0.5	G		
S	Atriplex leptocarpa	N	0.5	G		
S	Sclerolaena stelligera	N	0.2	G		
G	Enteropogon acicularis	N	2	G		
G	Juncus sp	N	2	G		
F	Solanum esuriale	N	0.1	G		
F	Maeriana pentagyra	N	0.2	G		
F	Minuartia cunninghamii	N	0.2	G		
F	Sida corrugata	N	0.2	G		
S	Maereana microphylla	N	0.1	G		

S 4 4.8
G 6 43.5
F 6 3.9
E 1 7

N: native, **E**:exotic, **HTE**: high threat exotic, **GF** – circle code if 'top 3'
Cover: 0.1, 0.2, 0.3..... 1,2,3,.....,10, 15, 20, 25, ... 100% (foliage cover). *Note: 0.1% cover is approx.. 63x63 cm or a circle about 71 cm diameter, 0.5% approx. 1.4 x 1.4m, 2% cover is approx. 2 x 2m, 5% = 4 x 5m, 25% 10 x 10m*

Hunter Ecology

BAM Site – Field Survey Form

Survey Name	Date	Recorders
Hevy Feb 23	27/2/23	Hunter Ecology
VZ / PCT: 24	Plot ID: 23 W	

BAM Attribute (400m² plot)	Sum values	
	Count of native richness	Cover
Trees	-	-
Shrubs	6	4·3
Grasses etc.	3	26
Forbs	3	1·2
Ferns	1	8
Other	-	-
High threat weed cover	-	- -

Cover: 0.1, 0.2, 0.3..... 1,2,3,.....,10, 15, 20, 25, ... 100% (foliage cover). *Note: 0.1% cover is approx.. 63x63 cm or a circle about 71 cm diameter, 0.5% approx. 1.4 x 1.4m, 2% cover is approx. 2 x 2m, 5% = 4 x 5m, 25% 10 x 10m*

BAM Attribute (1000m² plot)		
DBH	#Tree Stems Count	#Stems with Hollows
80 + cm		
50 – 79 cm		
30 – 49 cm		
20 – 29 cm		
10 – 19 cm		
5 – 9 cm		
<5 cm		
Length of logs (m) (≥ 10 cm diameter, >50cm in length)	Tally: 0 M	

Counts apply when the number of tree stems within a size class is ≤ 10. Estimate can be used when > 10 (eg. 10, 20, 30....100, 200). For a multi-stemmed tree, only the largest living stem is included in the count / estimate. Tree stems must be living.

For hollows, count only the presence of a stem containing hollows. For a multi-stemmed tree, only the largest stem is included in the count/estimate. Stems may be dead and may be shrubs.

BAM Attribute (1 x 1 m plots)	Litter cover %					Bare ground cover %					Cryptogam cover %					Rock cover %				
	5	15	25	35	45	5	15	25	35	45	5	15	25	35	45	5	15	25	35	45
Subplot score % in each	80	90	90	50	70	0	0	0	10	10	0	0	0	0	0	0	0	0	0	0
Average of the 5 subplots	78					4					0					0				

Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10cm in diameter)

Hunter Ecology

BAM Site – Plot Species List

400m² plot: Sheet _2_ of _2_	Survey Name	Plot ID	Recorders
Date: 27/2/23	Hay Feb 23	23	Hunter Ecology

GF Code	Top 3 native species in each growth form group: full species name mandatory. All other native and exotic species: full species name where practicable	N, E or HTE	Cover	Stratum (E,M,S,G)	Voucher	Photo #
G	Eragrostis australasica	N	8	S		
G	Rhytidosperma caespitosum	N	15	G		
S	Maireana aphylla	N	3	G		
G	Panicum laevinode	N	3	G		
F	Alternanthera denticulata	N	1	G		
S	Sclerolaena stelligera	N	0.1	G		
E	Marsilea drummondii	N	8	G		
S	Sclerolaena triaspis	N	0.2	G		
HT	Euphorbia drummondii	N	0.1	G		
F	Sida trichopoda	N	~~0.5~~ 0.1	G		
S	Maireana microphylla	N	0.8	G		
S	Malacocera tricornis	N	0.1	G		
S	Atriplex leptocarpa	N	0.1	G		

S - 6 - 4.3
G - 3 - 21
F - 3 - 1.2
E - 1 - 8

N: native, **E**:exotic, **HTE**: high threat exotic, **GF** – circle code if 'top 3'
Cover: 0.1, 0.2, 0.3..... 1,2,3,.....,10, 15, 20, 25, ... 100% (foliage cover). *Note: 0.1% cover is approx.. 63x63 cm or a circle about 71 cm diameter, 0.5% approx. 1.4 x 1.4m, 2% cover is approx. 2 x 2m, 5% = 4 x 5m, 25% 10 x 10m*

Hunter Ecology

BAM Site – Field Survey Form

Survey Name	Date	Recorders
Hay Feb 23	27/2/23	Hunter Ecology
VZ / PCT: 44	Plot ID	24 W

BAM Attribute (400m² plot)	Sum values	
	Count of native richness	Cover
Trees	-	-
Shrubs	3	0.5
Grasses etc.	6	30.3
Forbs	5	4.2
Ferns	-	-
Other	-	-
High threat weed cover	-	-

Cover: 0.1, 0.2, 0.3..... 1,2,3,.....,10, 15, 20, 25, ... 100% (foliage cover). *Note: 0.1% cover is approx.. 63x63 cm or a circle about 71 cm diameter, 0.5% approx. 1.4 x 1.4m, 2% cover is approx. 2 x 2m, 5% = 4 x 5m, 25% 10 x 10m*

BAM Attribute (1000m² plot)		
DBH	#Tree Stems Count	#Stems with Hollows
80 + cm		
50 – 79 cm		
30 – 49 cm		
20 – 29 cm		
10 – 19 cm		
5 – 9 cm		
<5 cm		
Length of logs (m) (≥ 10 cm diameter, >50cm in length)	Tally: 0M	

Counts apply when the number of tree stems within a size class is ≤ 10. Estimate can be used when > 10 (eg. 10, 20, 30....100, 200). For a multi-stemmed tree, only the largest living stem is included in the count / estimate. Tree stems must be living.

For hollows, count only the presence of a stem containing hollows. For a multi-stemmed tree, only the largest stem is included in the count/estimate. Stems may be dead and may be shrubs.

BAM Attribute (1 x 1 m plots)	Litter cover %					Bare ground cover %					Cryptogam cover %					Rock cover %				
Subplot	5	15	25	35	45	5	15	25	35	45	5	15	25	35	45	5	15	25	35	45
score % in each	5	5	5	5	5	40	50	70	65	75	0	0	5	0	0	0	0	0	0	0
Average of the 5 subplots	5					62					1					0				

Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10cm in diameter)

Hunter Ecology

BAM Site – Plot Species List

400m² plot: Sheet _2_ of _2_	Survey Name	Plot ID	Recorders
Date: 27/2/23	Hay Feb 23	24	Hunter Ecology

GF Code	Top 3 native species in each growth form group: full species name mandatory. All other native and exotic species: full species name where practicable	N, E or HTE	Cover	Stratum (E,M,S,G)	Voucher	Photo #
G	Austrostipa scabra	N	5	G		
G	Plytidosperma caespitosum	N	15	G		
G	Sporobolus caroli	N	10	G		
F	Sida trichopoda	N	0.5	G		
F	Maireana pentagona	N	2.5	G		
G	Eragrostis sp	N	0.1	G		
G	Chloris truncata	N	0.1	G		
F	Calocephalus sonderi	N	1	G		
—	Hordeum vulgare	E	0.5	G		
S	Salsola australis	N	0.2	G		
F	Crassula colorata	N	0.1	G		
S	Maireana aphylla	N	0.2	G		
S	Sclerolaena brachyptera	N	0.1	G		
G	Eragrostis dielsii	N	0.1	G		
F	Silene apetala	N	0.1	G		
	S-3 0.5					
	G-6 30.3					
	F-5 4.2					

N: native, **E**:exotic, **HTE**: high threat exotic, **GF** – circle code if 'top 3'

Cover: 0.1, 0.2, 0.3..... 1,2,3,.....,10, 15, 20, 25, ... 100% (foliage cover). *Note: 0.1% cover is approx.. 63x63 cm or a circle about 71 cm diameter, 0.5% approx. 1.4 x 1.4m, 2% cover is approx. 2 x 2m, 5% = 4 x 5m, 25% 10 x 10m*

Hunter Ecology

BAM Site – Field Survey Form

Survey Name	Date	Recorders
Hwy Feb 23	27/2/23	Hunter Ecology
VZ / PCT: 44	Plot ID: 25 W	

BAM Attribute (400m² plot)	Sum values	
	Count of native richness	Cover
Trees	-	-
Shrubs	2	1.3
Grasses etc.	4	35.1
Forbs	7	11.6
Ferns	-	-
Other	-	-
High threat weed cover	-	-

Cover: 0.1, 0.2, 0.3..... 1,2,3,.....,10, 15, 20, 25, ... 100% (foliage cover). *Note: 0.1% cover is approx.. 63x63 cm or a circle about 71 cm diameter, 0.5% approx. 1.4 x 1.4m, 2% cover is approx. 2 x 2m, 5% = 4 x 5m, 25% 10 x 10m*

BAM Attribute (1000m² plot)		
DBH	#Tree Stems Count	#Stems with Hollows
80 + cm		
50 – 79 cm		
30 – 49 cm		
20 – 29 cm		
10 – 19 cm		
5 – 9 cm		
<5 cm		
Length of logs (m) (≥ 10 cm diameter, >50cm in length)	Tally: 0m	

Counts apply when the number of tree stems within a size class is ≤ 10. Estimate can be used when > 10 (eg. 10, 20, 30....100, 200). For a multi-stemmed tree, only the largest living stem is included in the count / estimate. Tree stems must be living.

For hollows, count only the presence of a stem containing hollows. For a multi-stemmed tree, only the largest stem is included in the count/estimate. Stems may be dead and may be shrubs.

BAM Attribute (1 x 1 m plots)	Litter cover %					Bare ground cover %					Cryptogam cover %					Rock cover %				
	5	15	25	35	45	5	15	25	35	45	5	15	25	35	45	5	15	25	35	45
Subplot score % in each	15	10	20	25	35	20	50	40	30	25	0	2	1	2	0	0	0	0	0	0
Average of the 5 subplots	21					35					1					0				

Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10cm in diameter)

Hunter Ecology

BAM Site – Plot Species List

400m² plot: Sheet _2_ of _2_	Survey Name	Plot ID	Recorders
Date: 27/2/23	Hey Feb 23	25	Hunter Ecology

GF Code	Top 3 native species in each growth form group: full species name mandatory. All other native and exotic species: full species name where practicable	N, E or HTE	Cover	Stratum (E,M,S,G)	Voucher	Photo #
G	Austrostipa scabra	N	15	G		
G	Rytidosperma caespitosum	N	15	G		
G	Sporobolus caroli	N	5	G		
F	Maireana pentagona	N	3	G		
S	Sclerolaena birchii	N	~~0.5~~ 1	G		
F	Eriochlamys behrii	N	8	G		
S	Salsola australis	N	0.3	G		
F	Silene apetala	N	0.1	G		
G	Chloris truncata	N	0.1	G		
	~~Bare ground~~		~~Bare~~	~~G~~		
F	Calocephalus sonderi	N	0.2	G		
F	Minuria cunninghamii	N	0.1	G		
F	Sida trichopoda	N	0.1	G		
F	Crassula colorata	N	0.1	G		
	S-2 1.3					
	G-4 35.1					
	F-7 11.6					

N: native, **E**:exotic, **HTE**: high threat exotic, **GF** – circle code if 'top 3'

Cover: 0.1, 0.2, 0.3….. 1,2,3,……,10, 15, 20, 25, ….. 100% (foliage cover). *Note: 0.1% cover is approx.. 63x63 cm or a circle about 71 cm diameter, 0.5% approx. 1.4 x 1.4m, 2% cover is approx. 2 x 2m, 5% = 4 x 5m, 25% 10 x 10m*

Hunter Ecology

BAM Site – Field Survey Form

Survey Name	Date	Recorders
Hey Feb 23	27/2/23	Hunter Ecology
VZ / PCT: 44	Plot ID: 25 W	

BAM Attribute (400m² plot)	Sum values	
	Count of native richness	Cover
Trees	-	-
Shrubs	4	0.9
Grasses etc.	5	17.1
Forbs	6	9.3
Ferns	-	-
Other	-	-
High threat weed cover	-	-

Cover: 0.1, 0.2, 0.3 ..... 1,2,3,.....,10, 15, 20, 25, ... 100% (foliage cover). *Note: 0.1% cover is approx.. 63x63 cm or a circle about 71 cm diameter, 0.5% approx. 1.4 x 1.4m, 2% cover is approx. 2 x 2m, 5% = 4 x 5m, 25% 10 x 10m*

BAM Attribute (1000m² plot)		
DBH	#Tree Stems Count	#Stems with Hollows
80 + cm		
50 – 79 cm		
30 – 49 cm		
20 – 29 cm		
10 – 19 cm		
5 – 9 cm		
<5 cm		
Length of logs (m) (≥ 10 cm diameter, >50cm in length)	Tally: 0 m	

Counts apply when the number of tree stems within a size class is ≤ 10. Estimate can be used when > 10 (eg. 10, 20, 30....100, 200). For a multi-stemmed tree, only the largest living stem is included in the count / estimate. Tree stems must be living.

For hollows, count only the presence of a stem containing hollows. For a multi-stemmed tree, only the largest stem is included in the count/estimate. Stems may be dead and may be shrubs.

BAM Attribute (1 x 1 m plots)	Litter cover %					Bare ground cover %					Cryptogam cover %					Rock cover %				
Subplot	5	15	25	35	45	5	15	25	35	45	5	15	25	35	45	5	15	25	35	45
score % in each	5	20	40	50	30	50	55	25	30	40	0	0	0	0	0	0	0	0	0	0
Average of the 5 subplots	29					40					0					0				

Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10cm in diameter)

Hunter Ecology

BAM Site – Plot Species List

400m² plot: Sheet _2_ of _2_	Survey Name	Plot ID	Recorders
Date: 27/2/23	Hay Feb 23	25	Hunter Ecology

GF Code	Top 3 native species in each growth form group: full species name mandatory. All other native and exotic species: full species name where practicable	N, E or HTE	Cover	Stratum (E,M,S,G)	Voucher	Photo #
G	Austrostipa scabra	N	10	G		
G	Rhytidosperma caespitosum	N	4	G		
F	Eriochlamys behrii	N	2	G		
G	Sporobolus creberi	N	2	G		
F	Calocephalus sonderi	N	2	G		
F	Maireana pentagona	N	5	G		
-	Hordeum vulgare.	E	1	G		
G	Chloris truncata	N	1	G		
S	Salsola australis	N	0.2	G		
S	Sclerolaena bicornis	N	0.2	G		
S	Maireana aphylla	N	0.2	G		
S	Sclerolaena brachyptera	N	0.3	G		
F	Winged peppercress *	N	0.1	G	65 plants approx	
F	Catchfly ~~fly~~ Silene apetala	N	0.1	G		
G	Eragrostis dielsii	N	0.1	G		
F	~~Sclerolaena~~ proj. Sida corrugata	N	0.1			
	Lepium monoplacoides					
	S-4 0.9					
	G-5 17.1					
	F-6 9.3					
	Very dense dried off Barley grass					
	Lots of dried off native forbs					

N: native, **E**:exotic, **HTE**: high threat exotic, **GF** – circle code if 'top 3'

Cover: 0.1, 0.2, 0.3….. 1,2,3,……,10, 15, 20, 25, ….. 100% (foliage cover). *Note: 0.1% cover is approx.. 63x63 cm or a circle about 71 cm diameter, 0.5% approx. 1.4 x 1.4m, 2% cover is approx. 2 x 2m, 5% = 4 x 5m, 25% 10 x 10m*

Hunter Ecology

BAM Site – Field Survey Form

Survey Name	Date	Recorders
Hey Feb 23	28/2/23	Hunter Ecology
VZ / PCT: 44	Plot ID 28 W	

BAM Attribute (400m² plot)	Sum values	
	Count of native richness	Cover
Trees	-	-
Shrubs	6	2.9
Grasses etc.	3	62
Forbs	9	4.7
Ferns	-	-
Other	-	-
High threat weed cover	-	-

Cover: 0.1, 0.2, 0.3..... 1,2,3,.....,10, 15, 20, 25, ... 100% (foliage cover). *Note: 0.1% cover is approx.. 63x63 cm or a circle about 71 cm diameter, 0.5% approx. 1.4 x 1.4m, 2% cover is approx. 2 x 2m, 5% = 4 x 5m, 25% 10 x 10m*

BAM Attribute (1000m² plot)		
DBH	#Tree Stems Count	#Stems with Hollows
80 + cm		
50 – 79 cm		
30 – 49 cm		
20 – 29 cm		
10 – 19 cm		
5 – 9 cm		
<5 cm		
Length of logs (m) (≥ 10 cm diameter, >50cm in length)	Tally: 0m	

Counts apply when the number of tree stems within a size class is ≤ 10. Estimate can be used when > 10 (eg. 10, 20, 30....100, 200). For a multi-stemmed tree, only the largest living stem is included in the count / estimate. Tree stems must be living.

For hollows, count only the presence of a stem containing hollows. For a multi-stemmed tree, only the largest stem is included in the count/estimate. Stems may be dead and may be shrubs.

BAM Attribute (1 x 1 m plots)	Litter cover %					Bare ground cover %					Cryptogam cover %					Rock cover %				
Subplot	5	15	25	35	45	5	15	25	35	45	5	15	25	35	45	5	15	25	35	45
score % in each	15	20	20	15	15	50	30	30	50	25	0	0	0	0	0	0	0	0	0	0
Average of the 5 subplots	17					37					0					0				

Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10cm in diameter)

Hunter Ecology

BAM Site – Plot Species List

400m² plot: Sheet _2_ of _2_	Survey Name	Plot ID	Recorders
Date: 28/2/23	Hey Feb 23	28	Hunter Ecology

GF Code	Top 3 native species in each growth form group: full species name mandatory. All other native and exotic species: full species name where practicable	N, E or HTE	Cover	Stratum (E,M,S,G)	Voucher	Photo #
G	Austrostipa scabra	N	30	G		
G	Rhytidosperma caespitosum	N	30	G		
F	Maireana pentagona	N	2	G		
S	Maireana aphylla	N	2	G		
S	Salsola australis	N	0.2	G		
F	Solanum esuriale	N	1	G		
G	Sporobolus creber	N	2	G		
F	~~Brachyscome~~ Haloysperma glutinosum	N	0.5	G		
S	Sclerolaena brachyptera	N	0.2	G		
F	Sida trichopoda	N	0.5	G		
S	Sclerolaena muricata	N	0.2	G		
S	Maireana microphylla	N	0.1	G		
F	Silene apetala	N	0.2	G		
S	~~Sclerolaena~~ Sclerolaena bicornis	N	0.2	G		
F	Crassula colorata	N	20.1	G		
F	Calotis scabiosifolia	N	0.1	G		
F	Teucrium racemosum	N	0.1	G		
F	Zygophyllum glaucum	N	0.1	G		
	S - 6 - 2.9					
	G - 3 - 62					
	F - 9 - 4.7					

N: native, **E**:exotic, **HTE**: high threat exotic, **GF** – circle code if 'top 3'

Cover: 0.1, 0.2, 0.3….. 1,2,3,……,10, 15, 20, 25, ….. 100% (foliage cover). *Note: 0.1% cover is approx.. 63x63 cm or a circle about 71 cm diameter, 0.5% approx. 1.4 x 1.4m, 2% cover is approx. 2 x 2m, 5% = 4 x 5m, 25% 10 x 10m*

Hunter Ecology

BAM Site – Field Survey Form

Survey Name	Date	Recorders
Hey Feb 23	28/2/23	Hunter Ecology
VZ / PCT: 44	Plot ID	29 W

BAM Attribute (400m² plot)	Sum values	
	Count of native richness	Cover
Trees	-	-
Shrubs	3	2.3
Grasses etc.	4	56.2
Forbs	4	4
Ferns	-	-
Other	-	-
High threat weed cover	-	-

Cover: 0.1, 0.2, 0.3 ..... 1,2,3,.....,10, 15, 20, 25, ... 100% (foliage cover). *Note: 0.1% cover is approx.. 63x63 cm or a circle about 71 cm diameter, 0.5% approx. 1.4 x 1.4m, 2% cover is approx. 2 x 2m, 5% = 4 x 5m, 25% 10 x 10m*

BAM Attribute (1000m² plot)		
DBH	#Tree Stems Count	#Stems with Hollows
80 + cm		
50 – 79 cm		
30 – 49 cm		
20 – 29 cm		
10 – 19 cm		
5 – 9 cm		
<5 cm		
Length of logs (m) (≥ 10 cm diameter, >50cm in length)	Tally: 0m	

Counts apply when the number of tree stems within a size class is ≤ 10. Estimate can be used when > 10 (eg. 10, 20, 30....100, 200). For a multi-stemmed tree, only the largest living stem is included in the count / estimate. Tree stems must be living.

For hollows, count only the presence of a stem containing hollows. For a multi-stemmed tree, only the largest stem is included in the count/estimate. Stems may be dead and may be shrubs.

BAM Attribute (1 x 1 m plots)	Litter cover %					Bare ground cover %					Cryptogam cover %					Rock cover %				
	5	15	25	35	45	5	15	25	35	45	5	15	25	35	45	5	15	25	35	45
Subplot score % in each	50	80	80	20	30	15	5	5	15	35	0	0	0	0	0	0	0	0	0	0
Average of the 5 subplots	52					15					0					0				

Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10cm in diameter)

Hunter Ecology

BAM Site – Plot Species List

00m² plot: Sheet _2_ of _2_	Survey Name	Plot ID	Recorders
Date: 28/2/23	Hey Feb 23	29	Hunter Ecology

GF Code	Top 3 native species in each growth form group: full species name mandatory. All other native and exotic species: full species name where practicable	N, E or HTE	Cover	Stratum (E,M,S,G)	Voucher	Photo #
G	Austrostipa scabra.	N	25	G		
G	Rhytidosperma caespitosum	N	30	G		
F	Sida trichopoda	N	2	G		
S	Sclerolaena stelligera	N	0.1	G		
S	Sclerolaena bicornis	N	2	G		
F	Solanum esuriale.	N	1	G		
F	Hedyosperma gutnosum	N	0.8	G		
F	Tuecrium. raemosum	N	0.2			
S	Salsola australis	N	0.2			
G	Sporobolus caroli	N	1			
G	Chlorus truncata	N	0.2			
	S-3 - 2.5					
	G-4 . 56.2					
	F-4 - 4					

N: native, **E**:exotic, **HTE**: high threat exotic, **GF** – circle code if 'top 3'

Cover: 0.1, 0.2, 0.3..... 1,2,3,.....,10, 15, 20, 25, ... 100% (foliage cover). *Note: 0.1% cover is approx.. 63x63 cm or a circle about 71 cm diameter, 0.5% approx. 1.4 x 1.4m, 2% cover is approx. 2 x 2m, 5% = 4 x 5m, 25% 10 x 10m*

BAM Plot Site – Field Survey Form

Survey Name				Date		Recorders	
Plains Wind Farm				5.12.23		LB + JS	
Zone:		Datum:		Plot ID:	23.100		
Easting:		Northing:		VZ/PCT	28	Midline bearing from 0 m:	290°
Site Description							

Record easting and northing (UTM) at 0m on midline. Plot should not be established in ecotone, or within 50m of road/clearing where possible.

BAM Attribute (400m² plot)	Sum values	
GF Code	Count of native richness	Cover
TG - trees		
SG - shrubs		
GG - Grasses and Grass-like		
FG - Forbs		
EG - Ferns		
OG - other		
High threat weed cover		

***Sum values** may be completed after data collection. Not required while in the field. Determined from species data collected from 400m² plot*

Growth form definitions provided in Appendix F of BAM 2020
***Grass-like** = Sedges and rushes*
***Other** = tree fern, palm, cycad, vine, epiphyte and lithophyte, xanthorrhoea*

BAM Attribute (1000m² plot)		
DBH	#Tree Stems Count	#Trees with Hollows
80 + cm *(count)*	0	
50 – 79 cm *(count)*	0	
30 – 49 cm *(count)*	0	
20 – 29 cm *(count)*	3	
10 – 19 cm *(yes/no)*	0	
5 – 9 cm *(yes/no)*	0	
<5 cm *(yes/no)*	0	
Length of logs (m)	Tally:	Total: 0

For a multi-stemmed tree, the largest living stem DBH is included in the count / estimate. Tree stems must be living.

For hollows, count only the presence of trees/stags rooted within the plot containing hollows. Hollow is >5cm, >1m above ground, with appeared depth.

Log must be ≥ 10 cm diameter. Count logs entirely or partly on the ground. Only count length within the plot.

BAM Attribute (1 x 1 m plots)	Litter cover %					Bare ground cover %					Cryptogam cover %					Rock cover %				
Subplot	5	15	25	35	45	5	15	25	35	45	5	15	25	35	45	5	15	25	35	45
score % in each	10	5	5	1	5	25	20	5	10	15	1	1	0	0	1	0	0	0	0	0
Average of the 5 subplots	5.2					15					1					0				

***Litter cover:** the percentage ground cover of all plant material that has **detached** from a plant and forms part of the litter layer on the ground surface (must be on the ground), including leaves, seeds, twigs, branchlets and branches (<10 cm in diameter). Litter from native and exotic species (combined) is recorded for this attribute.*
***Subplots:** Subplots must alternate side of midline - at 5m must be on the right hand side of midline, at 15m on left hand side...*

BAM Site – Plot Species List

400m² plot: Sheet ___ of ___	Survey Name	Plot ID	Recorders
Date: 5th Dec 2023		23.100	LB + JS

GF Code	Record all species in 20x20m plot.	N, E or HTE	Foliage Cover	Abundance	Photo # or voucher #
TG	Acacia oswaldii	N	5	1	
TG	Alectryon oleifolius	N	4	1	
FG	Alternanthera denticulata	N	0.1	5	
SG	Atriplex eardleae	N	0.1	30	
GG	Austrostipa scabra	N	20	800	
SG	Chenopodium nitrariaceum	N	0.2	1	
FG	Cucumis myriocarpus	E	0.1	1	
–	Echium plantagineum	E	0.1	5	
FG	Einadia nutans	N	0.1	10	
GG	Enteropogon acicularis	N	0.1	10	
–	Hordeum vulgare	E	0.1	20	
–	Lycium ferocissimum	HTE	1	3	
SG	Maireana aphylla	N	05	6	
FG	Oxalis perennans	N	0.1	20	
SG	Rhagodia spinescens	N	2	7	
GG	Rytidosperma caespitosum	N	0.2	30	
SG	Sclerolaena bicornis	N	5	200	
SG	Sclerolaena muricata	N	1	6	
SG	Sclerolaena tricuspis	N	0.1	3	
FG	Sida corrugata	N	1	200	
FG	Solanum esuriale	N	0.1	4	
FG	Sonchus spp.	N	0.1	1	
GG	Sporobolus caroli	N	2	300	
FG	Vittadinia cuneata	N	30	400	
–	Vulpia spp.	E	2	600	

GF Code: TG = Tree, SG = Shrub, GG = Grass and grass-like, FG = Forb, EG = Fern, OG = Other. No growth form for E or HTW.
N: native (use PlantNet), **E:** exotic, **HTW:** high threat weed (HTW list provided on gov website).
Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, 4, 5, 10, 15, 20, 25, ...100%; **Note:** 0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m. Include cover of trees not rooted within plot.
Abundance: Count 1, 2, 3 ..., when ≤10, estimate when >10, 20, 30 ... 100, 200, 300 ..., 1000, 2000, 3000 ... (as integer values).

APPENDIX D FAUNA RECORDS ACROSS THE PREP

Common Name	Scientific Name	BC Act	EPBC Act
Birds			
Australian Magpie	*Gymnorhina tibicen*	-	-
Australasian Grebe	*Tachybaptus novaehollandiae*	-	-
Australian Wood Duck	*Chenonetta jubata*	-	-
Australasian Shoveller	*Anas rhynchotis*	-	-
Australasian Pipit	*Anthus novaeseelandiae*	-	-
Banded Lapwing	*Vanellus tricolor*	-	-
Black Falcon	*Faclo subniger*	Vulnerable	-
Black Kite	*Milvus migrans*	-	-
Black Swan	*Cygnus atratus*	-	-
Brown Falcon	*Falco berigora*	-	-
Black-faced Woodswallow	*Artamus cinereus*	-	-
Black-tailed Native Hen	*Tribonyx ventralis*	-	-
Black-winged Stilt	*Himantopus himantopus*	-	-
Blue Bonnet	*Northiella haematogaster*	-	-
Brown Quail	*Coturnix ypsilophora*	-	-
Brown Songlark	*Cincloramphus cruralis*	-	-
Common Starling*	*Sturnus vulgaris*	-	-
Crested Pigeon	*Ocyphaps lophotes*	-	-
Eastern Barn Owl	*Tyto javanica*	-	-
Emu	*Dromaius novaehollandiae*	-	-
Galah	*Eolophus roseicapilla*	-	-
Grey Butcherbird	*Cracticus torquatus*	-	-
Grey Teal	*Anas gracilis*	-	-
Hardhead	*Aythya australis*	-	-
Horsfields Bushlark	*Mirafra javanica*	-	-
Little Raven	*Corvus mellori*	-	-
Magpie-lark	*Grallina cyanoleuca*	-	-
Masked Lapwing	*Vanellus miles*	-	-
Nankeen Kestrel	*Falco cenchroides*	-	-
Australian Owlet Nightjar	*Aegotheles cristatus*	-	-
Pacific Black Duck	*Anas superciliosa*	-	-
Australian Pied Cormorant	*Phalacrocorax varius*	-	-
Pink-eared Duck	*Malacorhynchus membranaceus*	-	-

Common Name	Scientific Name	BC Act	EPBC Act
Plumed Whistling Duck	*Dendrocygna eytoni*	-	-
Rainbow Bee-eater	*Merops ornatus*	-	Marine
Red-kneed Dotteral	*Erythrogonys cinctus*	-	-
Red-rumped Parrot	*Psephotus haematonotus*	-	-
Sacred Kingfisher	*Todiramphus sanctus*	-	-
Sharp-tailed Sandpiper	*Calidris acuminata*	-	Vulnerable
Southern Whiteface	*Aphelocephala leucopsis*	-	Vulnerable
Common Starling	*Sturnus vulgaris*	-	-
Straw-necked Ibis	*Threskiornis spinicollis*	-	-
Torresian Crow?	*Corvus Orru*	-	-
White-fronted Chat	*Epthianura albifrons*	Vulnerable	-
Wedge-tailed Eagle	*Aquila audux*	-	-
Whistling Kite	*Haliastur sphenurus*	-	-
White-faced Heron	*Egretta novaehollandiae*	-	-
White-fronted Chat	*Epthianura albifrons*	Vulnerable	-
White-necked Heron	*Ardea pacifica*	-	-
White-winged Chough	*Corcorax melanorhamphos*	-	-
Welcome Swallow	*Hirundo neoxana*	-	-
Willie Wagtail	*Rhipidura leucophrys*	-	-
Mammals			
Eastern Grey Kangaroo	*Macropus fuliginosus*	-	-
Red Kangaroo	*Macropus rufus*	-	-
European Rabbit*	*Oryctolagus cuniculus*	-	-
White-striped Free-tailed Bat	*Austronomus australis*	-	-
Gould's Wattled Bat	*Chalinolobus gouldii*	-	-
Chocolate Wattled Bat	*Chalinolobus morio*	-	-
Southern Myotis^	*Myotis macropus*	Vulnerable	-
South-Eastern Free-Tailed Bat+	*Ozimops planiceps*	-	-
Corben's Long-Eared Bat^	*Nyctophilus corbeni*	Vulnerable	Vulnerable
Lesser Long-eared Bat^	*Nyctophilus geoffroyi*	-	-

Common Name	Scientific Name	BC Act	EPBC Act
Gould's Long-eared Bat^	*Nyctophilus gouldi*	-	-
Eastern Free-tailed Bat	*Ozimops ridei*	-	-
Yellow-bellied Sheathtail-bat	*Saccolaimus flaviventris*	Vulnerable	Vulnerable
Inland Broad-nosed Bat	*Scotorepens balstoni*	-	-
Little Broad-nosed Bat	*Scotorepens greyii*	-	-
Large Forest Bat	*Vespadelus darlingtoni*	-	-
Southern Forest Bat^	*Vespadelus regulus*	-	-
Little Forest Bat^	*Vespadelus vulturnus*	-	-
Feral Cat*	*Felis Catus*	-	-
European Red Fox*	*Vulpes vulpes*	-	-
Sheep*	*Ovis aries*	-	-
Wild Boar*	*Sus scrofa*	-	-
Cow*	*Bos taurus*	-	-
Reptiles			
Shingleback	*Tiliqua rugosa*	-	-
Eastern Blue-tongue Lizard	*Tiliqua scinoides*	-	-
Ragged Snake-eyed Skink	*Cryptoblepharus pannosus*	-	-
Nobbi Dragon	*Diporiphora nobbi*	-	-
Sand Goanna	*Varanus gouldii*	-	-
Lace Monitor	*Varanus varius*	-	-
Central Bearded Dragon	*Pogona vitticeps*	-	-
Eastern Brown Snake	*Pseudonaja textilis*	-	-

* denotes non-native species;
^ denotes 'possible' record – microbat call is comparable with the named species, with a moderate to high probability of confusion with species of similar calls;

\+ denotes 'probable' record - most likely to be the species named, low probability of confusion with species that use similar calls

APPENDIX E MICROBAT CALL ANALYSIS REPORT SUMMER 2022

Bat Call Analysis Report

The Plains Project

Prepared for ERM

Prepared by:

PO BOX 282
Morayfield Qld 4506

M: 0423 081 428
E: kelly.matthews@greentapesolutions.com.au
W: www.greentapesolutions.com.au

Client Manager: Kelly Matthews
Report Number: ME22022_The Plains

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Document Records - Quality

TITLE	Bat Analysis for the site at Biggenden
FILED AS	ME22022_The Plains

Revision	Date	Prepared by (name/title)	Reviewed by (name/ title)	Approved by (name/title)
Version A	25/04/2022	Kelly Matthews, Principal Ecologist	ERM	Client

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1.0 Introduction

1.1 Background

Green Tape Solutions were commissioned to undertake bat call analysis for The Plains project located north of Deniliquin in New South Wales.

1.2 Scope of Work

The specific scope of works for this report includes the following:

- Outline the methodology used to analyse the microbat call within the subject site; and,
- Present the findings of all of the bat call surveys conducted at the project site;

2.0 Methodology

2.1 Capture Technique

Microbat calls were sampled using eight (8) Anabat Swift detectors (Titley Electronics). Passive monitoring was undertaken from 13 to 24 February 2022. The original call files display Australian Eastern Standard Time. The data was analysed using Anabat Insight.

Monitoring commenced at dusk (approximately 1800 hours) and continued until dawn (approximately 0530 hours). Ultrasonic call monitoring surveys on anabat detectors were conducted using full-spectrum fitted with omnidirectional ultrasonic microphone.

2.2 Call Identification

Anabat recordings were analysed using Anabat software (Anabat Insight). Identifications were made by categorising call shape and frequency, with a species match given in consideration to region, known bat distributions, and habitats present. The focus of the bat surveys was to assess the presence of bat species found within the Project Area, and to assess the potential for rare and threatened species to occur.

Call identification for this dataset was based on call keys and descriptions published for Queensland (Reinhold *et al.*, 2001) and New South Wales (Pennay *et al.*, 2004).

Species' identification was further refined using the probability of occurrence of each species based on their geographic distribution (Churchill, 2008, Van Dyck and Strahan, 2008). Species nomenclature used in this report follows Churchill (2008).

The reliability of identification is as follows:

- **Definite** - one or more calls where there is no doubt about the identification of the species;
- **Probable** - most likely to be the species named, low probability of confusion with species that use similar calls; and,
- **Possible -** call is comparable with the named species, with a moderate to high probability of confusion with species of similar calls.

2.3 National Standard

The format and content of this report complies with the nationally accepted standards for the interpretation and reporting of Anabat and Songmeter data (Reardon, 2003), which is currently available from the Australasian Bat Society at www.ausbats.org.au.

3.0 Results

3.1 Total Species Recorded

The majority of calls were considered to be of medium to good quality calls.

A total of 91,171 sequence files were analysed. A proportion of these files (20,836) in this dataset contained background noise or resulted in poor quality calls that did not provide bat calls for analysis. While some call sequences were recognised as bat calls, the quality was not sufficient to assign species identification.

A summary of the species identified through bat call analysis is provided in **Table 1**.

Table 1: Summary of bat call analysis (QLD)

Species	Biodiversity Act	EPBC Act	SD1	SD2	Anabat 1	Anabat 2	Anabat 6	Anabat 10	Anabat 11	Anabat 12
Austronomus australis	LC	NOC	Definite	Definite						
Chalinolobus gouldii	LC	NOC	Definite	Definite	Definite		Definite		Definite	Definite
Chalinolobus morio	LC	NOC	Definite	Definite			Definite		Definite	
Myotis macropus	V	NOC	Possible	Possible	Possible	Possible	Possible	Possible	Possible	Possible
Nyctophilus sp	V (*N. Coberni and N bifax)*	V (*N. Coberni and N bifax)*	Possible				Possible			
Ozimops planiceps	LC	NOC	Probable	Probable					Definite	
Ozimops ridei	LC	NOC	Probable	Definite			Definite		Definite	
Saccolaimus flaviventris	V	NOC	Definite	Definite						
Scotorepens balstoni	LC	NOC	Definite	Definite			Definite			Probable
Scotorepens greyi	LC	NOC	Definite	Definite			Definite			Probable
Vespadelus darlingtoni	LC	NOC	Probable	Definite		Definite				Definite
Vespadelus regulus	LC	NOC	Possible	Possible	Possible	Probable	Possible	Possible	Possible	Possible
Vespadelus vulturnus	LC	NOC	Possible	Possible	Possible	Possible	Possible	Possible	Possible	Possible

LC: Least Concern, NOC: Not of Concern, V: Vulnerable

3.2 Samples of Calls / Sequences Files

Samples of call extracted from the dataset for each species identified is provided in the following figures

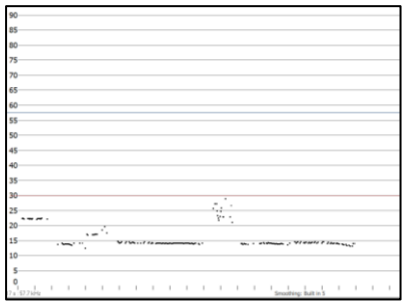
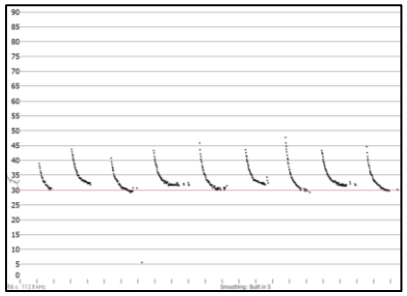
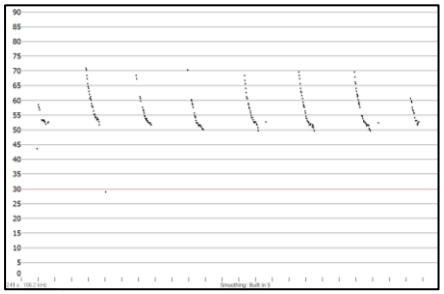
Species	Calls	Known distribution (Extract from Ausbats maps from Australian Bat Society)
Figure 1: *Austronomus australis* This bat is easily recognised by its constant frequency calls range in bandwidth from 10.5 to 15 kHz (Pennay *et al.*, 2004).		
Figure 2: *Chalinolobus gouldii* This species has a curved shape call with characteristic frequency 28 to 34kHz. Pulse alternates in frequency and mostly down-sweeping tail or no tail.		

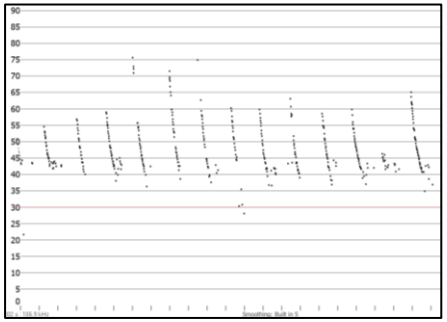
Figure 3: *Chalinolobus morio*



C. morio has a down-sweeping tail curved pulse with characteristic frequency 47.5 to 53 kHz. It has often a very brief characteristic section. Species that overlap in frequency (*V. vulturnus*) but all have up-sweeping tails.



Figure 4: *Myotis macropus*

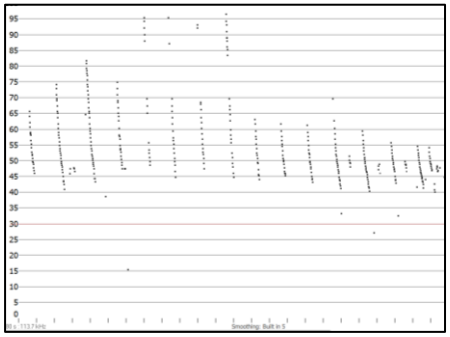


Near-vertical pulse dropping to about 30 to 35-50kHz. *M. macropus* mostly have a pulse interval of less than 75ms and usually have one kink close to the middle so that the second part has a lesser slope than the first (Reinhold, 2001).

This call can be confused with *Nyctophilus spp* calls. The latest have usually a pulse interval greater than 95ms and are slightly more complicated structure with two kinks instead of one.



Figure 5: *Nyctophilus spp*



This species displays a near-vertical pulse, characteristic frequency between 80 and 35KHz (Pennay *et al*, 2004).

The species from this genus cannot be distinguished from each other. There are 3 species that are known to occur in the project area.



N. Corbeni



N. geoffroyi



N. gouldi

Figure 6: ***Ozimops planiceps***

This bat calls between 24 and 29 kHz. These search calls have their energy max around 25-26 kHz.

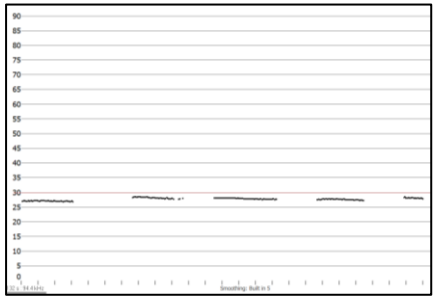




Figure 7: ***Ozimops ridei***

O. ridei calls are flat. Characteristic frequency of this species is between 28 to 36 kHz.

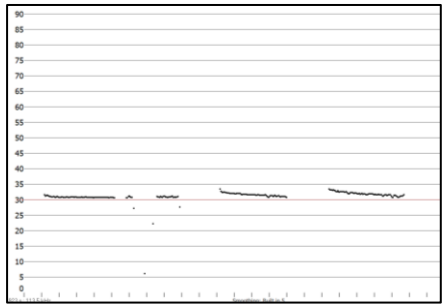




Figure 8: *Saccolaimus flaviventris*

Curved, characteristic frequency 18 to 21.5 kHz. The characteristic frequency does not go above 22 kHz. Other species that could overlap do not occur in this area.

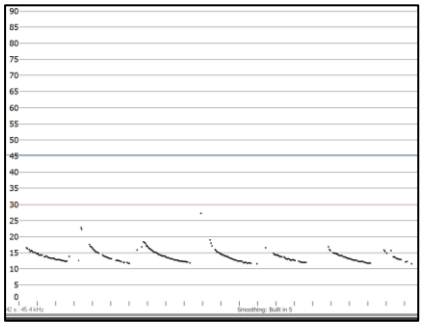




Figure 9: *Scotorepens balstoni*

Pulse of this species is curved with tail variable, but an up-sweeping tail is often more prominent with greater duration. Characteristic frequency 31 to 35 kHz and the frequency of the knee 33 to 37 kHz.

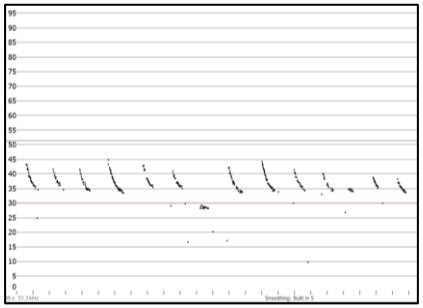




Figure 10: *Scotorepens greyii*

S. greyii has a curved and up-sweeping tail pulse. Its characteristic frequency is between 36 to 41.5 kHz.

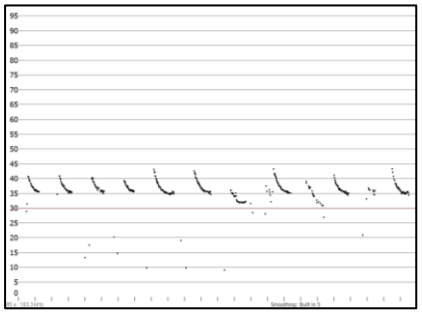




Figure 11: *Vespadelus darlingtoni*

This species call has a curved call with no tail or sometime an up-sweeping tail. The call's characteristic frequency is between 42.5 to 48.5 kHz. Characteristic section is often, but not always, relatively long.

Shorter duration with up-sweeping tails and higher frequencies, cannot be distinguished from *V. regulus* or *V. vulturnus*.

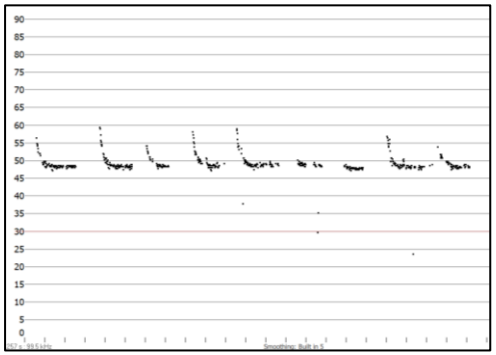
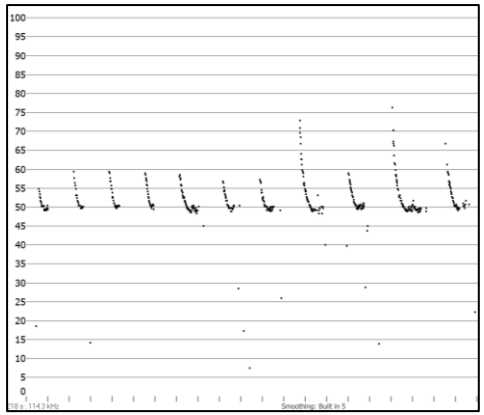




Figure 12: *Vespadelus regulus or Vespadelus vulturnus*

Characteristic frequency varies significantly over distribution from 40 to 55 kHz (n = 95). Call shape also varies between regions (see regional information).





Vespadelus regulus



Vespadelus vulturnus

4.0 References

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APPENDIX F MICROBAT CALL ANALYSIS REPORT SUMMER 2023

Bat Call Analysis Report

The Plains Renewable Energy Park Project (0667692)

Prepared for ERM

Prepared by:

PO BOX 282
Morayfield Qld 4506

M: 0423 081 428
E: kelly.matthews@greentapesolutions.com.au
W: www.greentapesolutions.com.au

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Document Records - Quality

TITLE	Bat Analysis for the site at Hay, NSW
FILED AS	ME22020 Bat Call Analysis_The Plains

Revision	Date	Prepared by (name/title)	Reviewed by (name/ title)	Approved by (name/title)
Version A	5/5/2023	Kelly Matthews, Principal Ecologist	ERM	Client

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1.0 Introduction

1.1 Background

Green Tape Solutions were commissioned to undertake bat call analysis for the Plains Renewable Energy Park project located near Hay, New South Wales.

1.2 Scope of Work

The specific scope of works for this report includes the following:

- Outline the methodology used to analyse the microbat call within the subject site; and,
- Present the findings of all of the bat call surveys conducted at the project site.

2.0 Methodology

2.1 Capture Technique

Microbat calls were sampled using six Anabat Swift detectors (Titley Electronics). Passive monitoring was undertaken from February to March 2023. The original call files display Australian Eastern Standard Time. The data was analysed using Anabat Insight.

Monitoring commenced at dusk (approximately 1800 hours) and continued until dawn (approximately 0530 hours). Ultrasonic call monitoring surveys on anabat detectors were conducted using full-spectrum fitted with omnidirectional ultrasonic microphone.

2.2 Call Identification

Anabat recordings were analysed using Anabat software (Anabat Insight). Identifications were made by categorising call shape and frequency, with a species match given in consideration to region, known bat distributions, and habitats present. The focus of the bat surveys was to assess the presence of bat species found within the Project Area, and to assess the potential for rare and threatened species to occur.

Call identification for this dataset was based on call keys and descriptions published for Queensland (Reinhold *et al.*, 2001) and New South Wales (Pennay *et al.*, 2004).

Species' identification was further refined using the probability of occurrence of each species based on their geographic distribution (Churchill, 2008, Van Dyck and Strahan, 2008). Species nomenclature used in this report follows Churchill (2008).

The reliability of identification is as follows:

- **Definite** - one or more calls where there is no doubt about the identification of the species;
- **Probable** - most likely to be the species named, low probability of confusion with species that use similar calls; and,
- **Possible -** call is comparable with the named species, with a moderate to high probability of confusion with species of similar calls.

2.3 National Standard

The format and content of this report complies with the nationally accepted standards for the interpretation and reporting of Anabat and Songmeter data (Reardon, 2003), which is currently available from the Australasian Bat Society at www.ausbats.org.au.

3.0 Results

3.1 Total Species Recorded

The majority of calls were considered to be of medium to good quality calls.

A total of 45,403 sequence files were analysed. A proportion of the files (12,511) in this dataset contained background noise or resulted in poor quality calls that did not provide bat calls for analysis. While some call sequences were recognised as bat calls, the quality was not sufficient to assign species identification.

Anabats swift numbers 01 and 02 didn't record any identifiable calls.

A summary of the species identified through bat call analysis is provided in **Table 1**.

Table 1: Summary of bat call analysis

Species	Biodiversity Act	EPBC Act	Site 10	Site 14	Site 17	Site 27
Austronomus australis	LC	NOC	Definite			Definite
Chalinolobus gouldii	LC	NOC	Definite	Definite		Definite
Chalinolobus morio	LC	NOC		Probable		Probable
Myotis macropus	V	NOC	Possible		Possible	Possible
Nyctophilus geoffroyi	LC	NOC	Possible		Possible	Possible
Nyctophilus gouldi	LC	NOC	Possible		Possible	Possible
Ozimops ridei	LC	NOC	Definite	Definite	Definite	Definite
Scotorepens balstoni	LC	NOC	Possible	Possible	Possible	Possible
Scotorepens greyii	LC	NOC	Possible	Possible	Possible	Possible
Vespadelus darlingtoni	LC	NOC		Possible		
Vespadelus regulus	LC	NOC	Possible	Possible	Possible	Possible
Vespadelus vulturnus	LC	NOC	Possible	Possible	Possible	Possible

LC: Least Concern, NOC: Not of Concern, V: Vulnerable

3.2 Samples of Calls / Sequences Files

Samples of call extracted from the dataset for each species identified is provided in the following figures

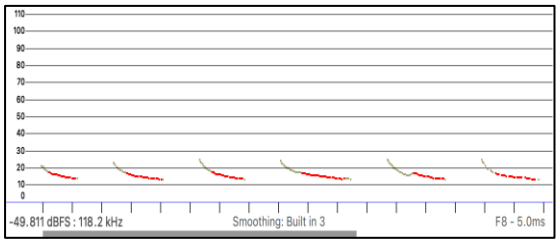
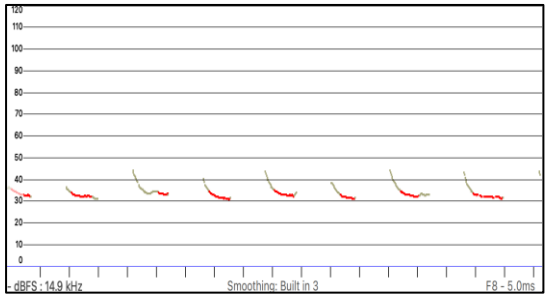
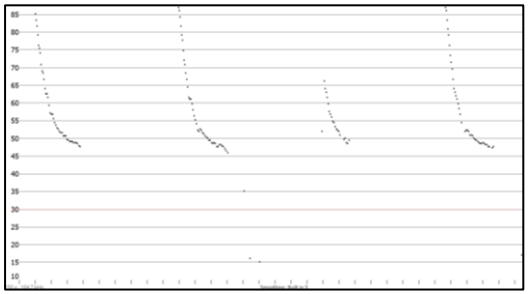
Species	Calls	Known distribution (Extract from Ausbats maps from Australian Bat Society)
Figure 1: *Austronomus australis* Definite call. This bat is easily recognised by its constant frequency calls range in bandwidth from 10.5 to 15 kHz (Pennay *et al.*, 2004).		
Figure 2: *Chalinolobus gouldii* Definite call. This species has a curved shape call with characteristic frequency 28 to 34kHz. Pulse alternates in frequency and mostly down-sweeping tail or no tail.		

Figure 3: *Chalinolobus morio*

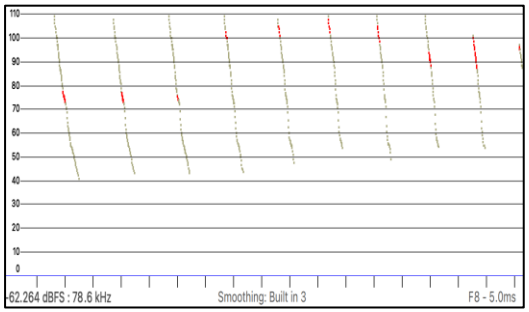


Definite call.

C. morio has a down-sweeping tail curved pulse with characteristic frequency 47.5 to 53 kHz. It has often a very brief characteristic section. Species that overlap in frequency (*Vespadelus troughtoni, V. pumilus* and *V. vulturnus*) but all have up-sweeping tails.



Figure 4: *Myotis macropus*



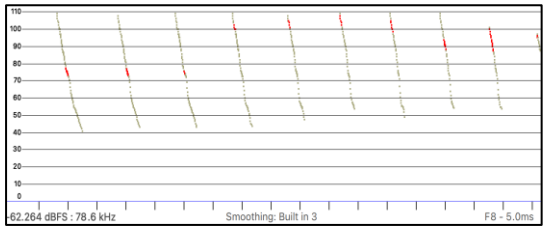
Possible call.

Near-vertical pulse dropping to about 30 to 35-50kHz. *M. macropus* mostly have a pulse interval of less than 75ms and usually have one kink close to the middle so that the second part has a lesser slope than the first (Reinhold, 2001).

This call can be confused with *Nyctophilus spp* calls. The latest have usually a pulse interval greater than 95ms and are slightly more complicated structure with two kinks instead of one.



Figure 5: *Nyctophilus spp*



Possible call.

This species displays a near-vertical pulse, characteristic frequency between 80 and 35KHz



N. geoffroyi

(Pennay *et al*, 2004).

The species from this genus cannot be distinguished from each other. There are 3 species that are known to occur in the project area.



N. gouldi

Figure 6: *Ozimops planiceps*

Definite call.

This bat calls are flat and its characteristic is between 24 and 29 kHz.

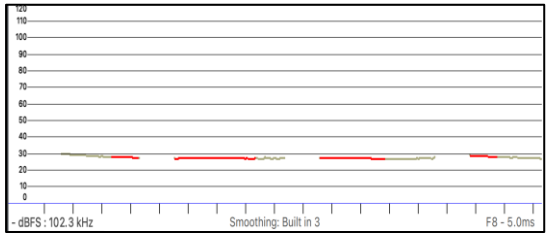




Figure 7: *Ozimops ridei*

Definite call.

O. ridei calls are flat and sometimes a bit curved with frequency a bit lower than 30kHz. Characteristic frequency of this species is between 28 to 36 kHz. Calls in the same frequency range as *Micronomus norfolkensis*, but *O. ridei* calls may jump up to a higher frequency than the surrounding pulses, this does not occur in a regular pattern like in *M. norfolkensis*.

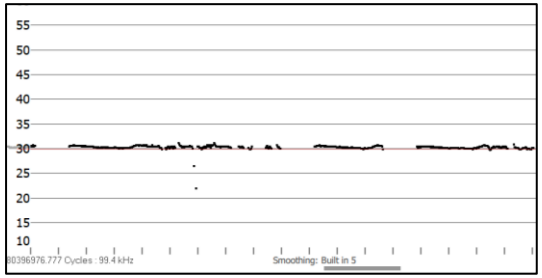




Figure 8: *Scotorepens balstoni*

Possible call.

Pulse of this species is curved with tail variable, but an up-sweeping tail is often more prominent with greater duration. Characteristic frequency 31 to 35 kHz (n = 28) and the frequency of the knee 33 to 37 kHz.

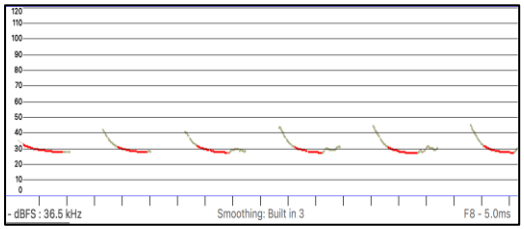




Figure 9: *Scotorepens greyii*

Prossible call.

S. greyii has a curved and up-sweeping tail pulse. Its characteristic frequency is between 36 to 41.5 kHz.

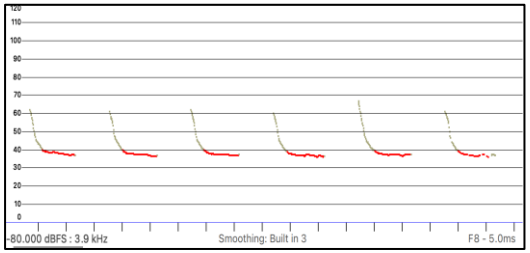
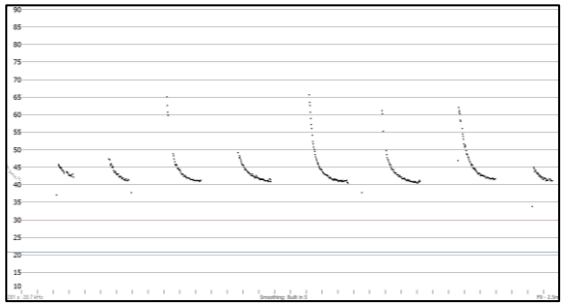




Figure 10: *Vespadelus darlingtoni*



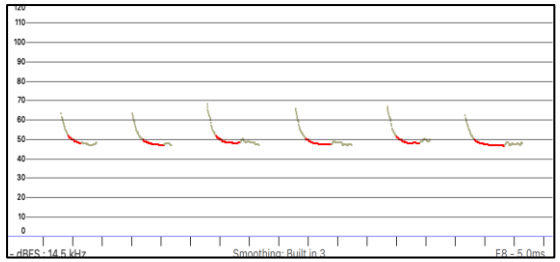


Definite call.

This species call has a curved call with no tail or sometime an up-sweeping tail. The call's characteristic frequency is between 42.5 to 48.5 kHz. Characteristic section is often, but not always, relatively long.

Shorter duration with up-sweeping tails and higher frequencies, cannot be distinguished from *V. regulus* or *V. vulturnus*.

Figure 11: *Vespadelus regulus*





Possible call.

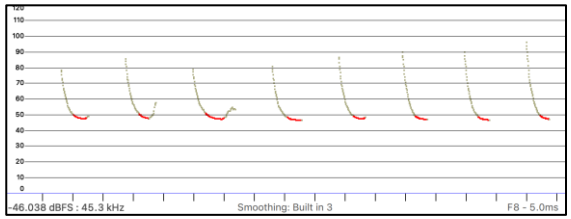
Characteristic frequency varies significantly over distribution from 40 to 55 kHz (n = 95). Call shape also varies between regions (see regional information). Characteristic frequency 45 to 47 kHz (n = 19). Curved with up-sweeping tail.

May overlap with *Vespadelus darlingtoni* calling above 45kHz from the border ranges if sympatric.

Figure 12: *Vespadelus vulturnus*

Curved and up-sweeping tail calls with characteristic frequency between 45 to 53 kHz.

It cannot be distinguished from *V. regulus*, or some *V. darlingtoni* when up-sweeping tail.





4.0 Conclusion

A total of 12 microbat species were either confirmed ‘definite’, ‘probable’ or ‘possible’ within the Project area. All bats identified on the site were expected to be present within the region.

Calls from *Nyctophilus sp* have been confirmed across the project areas. Two species of *Nyctophilus* possibly occur within the Project Area. The call of this species cannot be distinguished from other species in the genus.

Two of the reliably identified call types were only attributable to genus level due to similarities in call characteristics of the following groups:

- Nyctophilus species
    - ✓ Steep, almost-linear linear (FM) call pulses are distinctive from those of other bat calls but cannot be reliably identified to species
    - ✓ Three species potentially occur in the project area (*N. bifax* and *N. gouldi*)
- *Scotorepens greyii* and *S. sanborni*
    - Steep, curvilinear (FM-qCF) pulses with Fc of 37-41 kHz
    - Both Scotorepens spp. are likely to occur in the project area

5.0 References

CHURCHILL, S. 2008. *Australian Bats,* Sydney, Allen and Unwin.

DEWHA 2010. Survey guidelines for Australia's threatened bats. Guidelines for detecting bats listed as threatened under the *Environment Protection and Biodiversity Conservation Act 1999*. *In:* DEPARTMENT OF THE ENVIRONMENT WATER HERITAGE AND THE ARTS (ed.). Canberra.

PENNAY, M., LAW, B. A. & REINHOLD, L. 2004. Bat calls of New South Wales: Region based guide to the echolocation calls of microchiropteran bats. *In:* NSW DEPARTMENT OF ENVIRONMENT AND CONSERVATION (ed.). Hurstville.

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REINHOLD, L., LAW, B., FORD, G. A. & PENNAY, M. 2001. *Key to the Bat Calls of South-east Queensland and North-east New South Wales*, Queensland Department of Natural Resources and Mines.

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APPENDIX G MICROBAT CALL ANALYSIS REPORT SUMMER 2024

Lachlan McRae Fauna Services
ABN: 96 905 438 927
Lmcrae.ecology@gmail.com

MICROBAT CALL ANALYSIS REPORT **01 Feb 2024**

Job #: 009
Project name: Hay Plains Microbat Call Analysis
Client: Sam Sanders/ERM
Location: -34.835478, 144.750472 (Hay Plains, NSW).

1. Introduction

1.1 Background/Disclaimer

The author of this report, Lachlan McRae, has been engaged to undertake microbat echolocation call analysis for ERM. The analysis will determine the presence/absence of microbat species within the audio data set supplied by ERM.

The data necessary for this analysis was provided to the author on a single 256GB SD card. The author was not involved in the data collection. As such, the author makes no claim that the data was collected appropriately.

Microbat call identification works on a probabilistic scale, and it can be almost impossible to be 100% certain of a call identification for many species. As such, the author is only presenting their professional opinion as opposed to an objective truth.

1.2 Analyst experience

The author and analyst, Lachlan McRae, has collected hundreds of microbat reference calls throughout NSW. Countless hours have been spent processing and extracting call metrics from those reference calls to determine identification features for each species. These reference calls now form part of his personal NSW reference call library, which is used to significantly increase the accuracy of microbat call analysis within NSW.

To complement Lachlan's hands-on reference call collection experience, he has also received formal training through Wildlife Acoustics and Titley Scientific's 'Advanced' microbat call analysis courses. He has gone on to have multiple one-on-one trainings with Dave Roberts from Wildlife Acoustics, Julie Dawson (formerly Broken-Brow) from Titley Scientific, and Brad Law from NSW DPI to further validate his analysis skills and discuss advanced concepts beyond the scope of the courses. Lachlan is in regular communication with recognised bat experts such as Brad Law, Chris Corben, and Michael Pennay to ensure he remains at the forefront of the latest techniques and knowledge to identify bat calls.

2. Methods

2.1 Supplied Data

The author was supplied with 51 nights of ultrasonic data from a single acoustic recording device. The recorder was deployed from 24th March 2023 to 13th May 2023.

The recorder deployment information supplied to the author from ERM is as follows:

Table 1 - Acoustic recorder deployment information supplied by ERM.

Recorder Deployment Category	Answer (you can tick more than 1)
Broad habitat type	Open woodland ☑ Dry sclerophyll ☐ Wet sclerophyll ☐ Rainforest ☐ Coastal scrub ☐ Wetland ☐ Open grassland ☐ Street trees ☐ Garden ☐ Other:
Urbanisation level	City ☐ Urban ☐ Suburban ☐ Rural/farmland ☑ Small bush-block ☐ Natural habitat for >1km in all directions ☐
Proximity to a waterbody that is >3m wide/diameter	Overlooking water ☐ Within 200m of water ☐ >200m from water ☑
Proximity to a moderate or large rocky escarpment/cliff line	Directly facing nearby rocky habitat ☐ Within 1km of rocky habitat ☐ Further than 1km from rocky habitat ☑
Clutter category	Amongst forest ☐ Edge of forest ☐ Open area with scattered or no trees ☑

2.2 Analysis Software

Microbat calls were analysed using Titley Scientific's Anabat Insight (version 2.0.8) on MacOS Ventura (version 13.3.1).

2.3 Candidate microbat species

A list of microbat species with potential to occur at the data collection point, based solely on geographic distribution range, was generated using BatMap (Australasian Bat Society, 2024). A radius of 70km from the data collection point was used (Fig. 1)

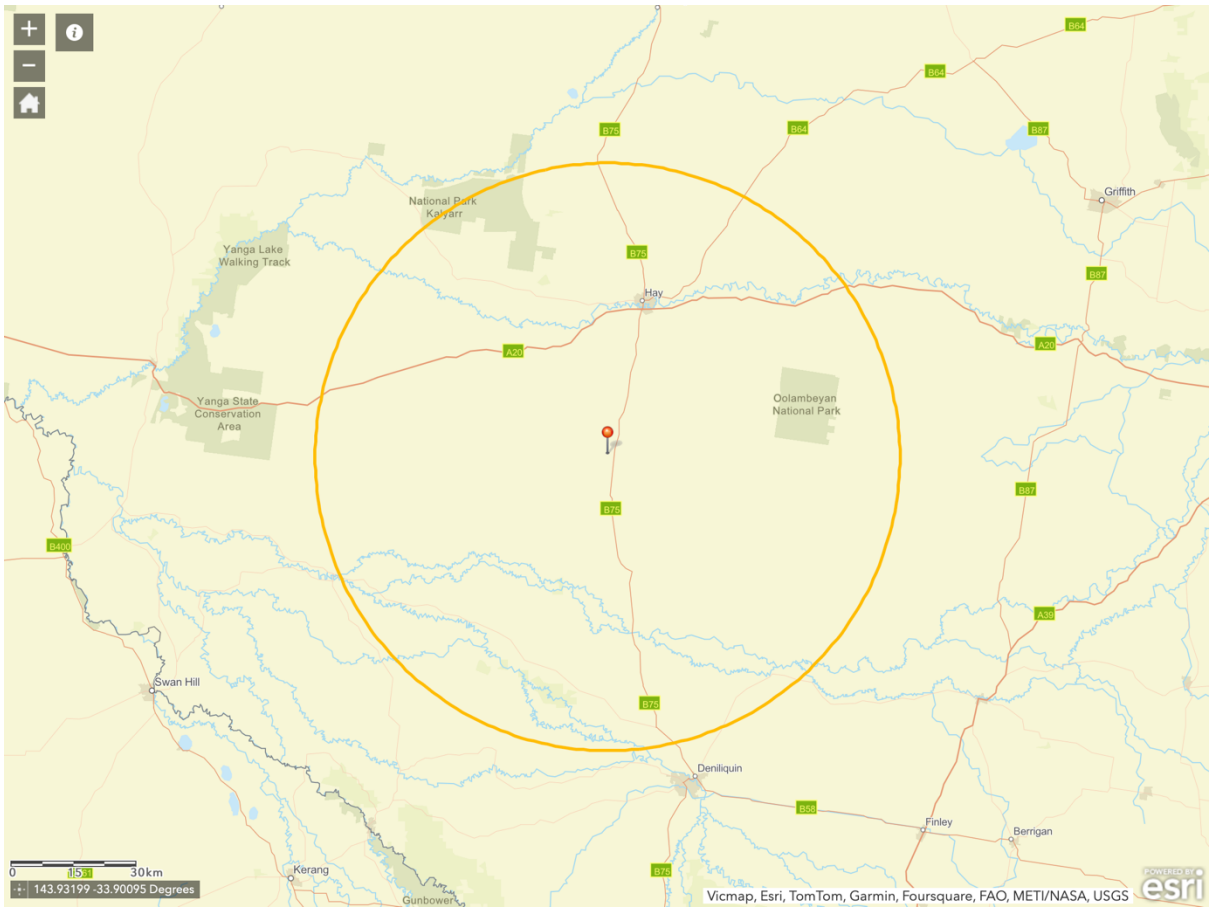


Figure 1 - 70km search distance used to generate a microbat species list with BatMap. Search distance centred on the data collection point at -34.835478, 144.750472 (Hay Plains, NSW).

A total of 16 possible microbat species were generated from BatMap (Table 2).

Table 2 - The list of candidate microbat species produced by BatMap's search tool, with a 70km radius search distance applied from the data collection point at -34.835478, 144.750472 (Hay Plains, NSW).

Common Name	Scientific Name
White-striped Freetail Bat	*Austronomus australis*
Gould's Wattled Bat	*Chalinolobus gouldii*
Chocolate Wattled Bat	*Chalinolobus morio*
Southern Myotis	*Myotis macropus*
Corben's Long-eared Bat	Nyctophilus corbeni
Lesser Long-eared Bat	*Nyctophilus geoffroyi*
Gould's Long-eared Bat	*Nyctophilus gouldi*
Ride's Free-tailed Bat	*Ozimops ridei*
South-Eastern Free-Tailed Bat	*Ozimops planiceps*

Inland Free-Tailed Bat	*Ozimops petersi*
Yellow-bellied Sheathtail Bat	*Saccolaimus flaviventis*
Inland Broad-nosed Bat	*Scotorepens balstoni*
Little Broad-nosed Bat	*Scotorepens greyii*
Large Forest Bat	*Vespadelus darlingtoni*
Southern Forest Bat	*Vespadelus regulus*
Little Forest Bat	*Vespadelus vulturnus*

2.4 Call Identification

Calls were identified to one or more of the 16 species listed above (Table 2) based on 1) *Bat Calls of NSW* by Pennay et al. (2004), 2) reference calls personally collected by Lachlan McRae within NSW, 3) *Bat Calls of Central Eastern NSW* by Chris Corben (2009), 4) call metrics and ID features obtained from discussions with recognised bat experts including Michael Pennay, Brad Law, and Chris Corben, 5) the deployment information outlined in Section 2.1 (Table 1), and 6) the author's understanding of each species' foraging behaviour and habitat requirements (Churchill 2008, Baker & Gynther 2023).

Each call was assigned to one of the following identification confidence categories:

1) **Certain** — no doubt about the identification of the species. This rating is typically reserved for species that do not overlap in characteristic frequency and/or call shape with other species.
2) **High** — small chance of confusion with another species. This rating is typically given if there are other species that overlap in characteristic frequency and call shape.
3) **Moderate** —moderate chance of confusion with another species;
4) **Species Group** — call could more or less equally belong to one of two or more species. Occurs more frequently when calls contain only a few pulses, are of poor quality, and/or if recordings are in zero-crossing as opposed to full-spectrum.

3. Results

A total of ~29,000 files were analysed, of which 466 contained bat calls. A summary of the six species and one species group identified in the Hay Plains data set is provided below in Table 3.

Table 3 - Summary of the results from the supplied Huntingwood, NSW AS01 data set.

Common Name	Scientific Name	BC Act	EPBC Act	ID confidence
White-striped Free-tailed Bat	*Austronomus australis*	-	-	Certain
South-east free-tailed Bat	*Ozimops planiceps*	-	-	High
Gould's Wattled Bat	*Chalinolobus gouldii*	-	-	High
Ride's Free-tailed Bat or Inland Free-tailed Bat	*Ozimops ridei* or *Ozimops petersi*	-	-	High

Inland Broad-nosed Bat	*Scotorepens balstoni*	-	-	Moderate
Little Forest Bat	*Vespadelus vulturnus*	-	-	High
Chocolate Wattled Bat	*Chalinolobus morio*	-	-	High

An example call from each recorded species/species group is shown below in compressed mode. Full spectrum and zero-crossing views are both shown on the same spectrogram.

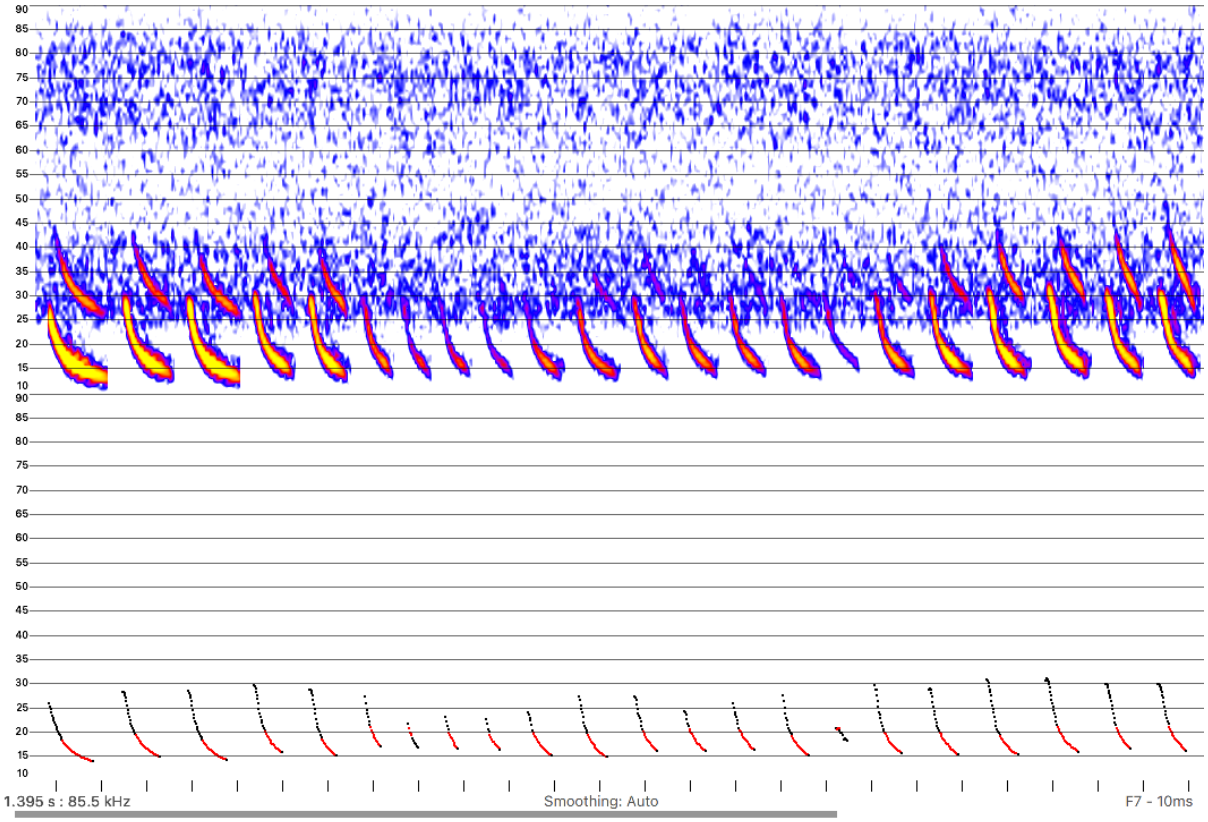


Figure 2 - Austronomus australis.

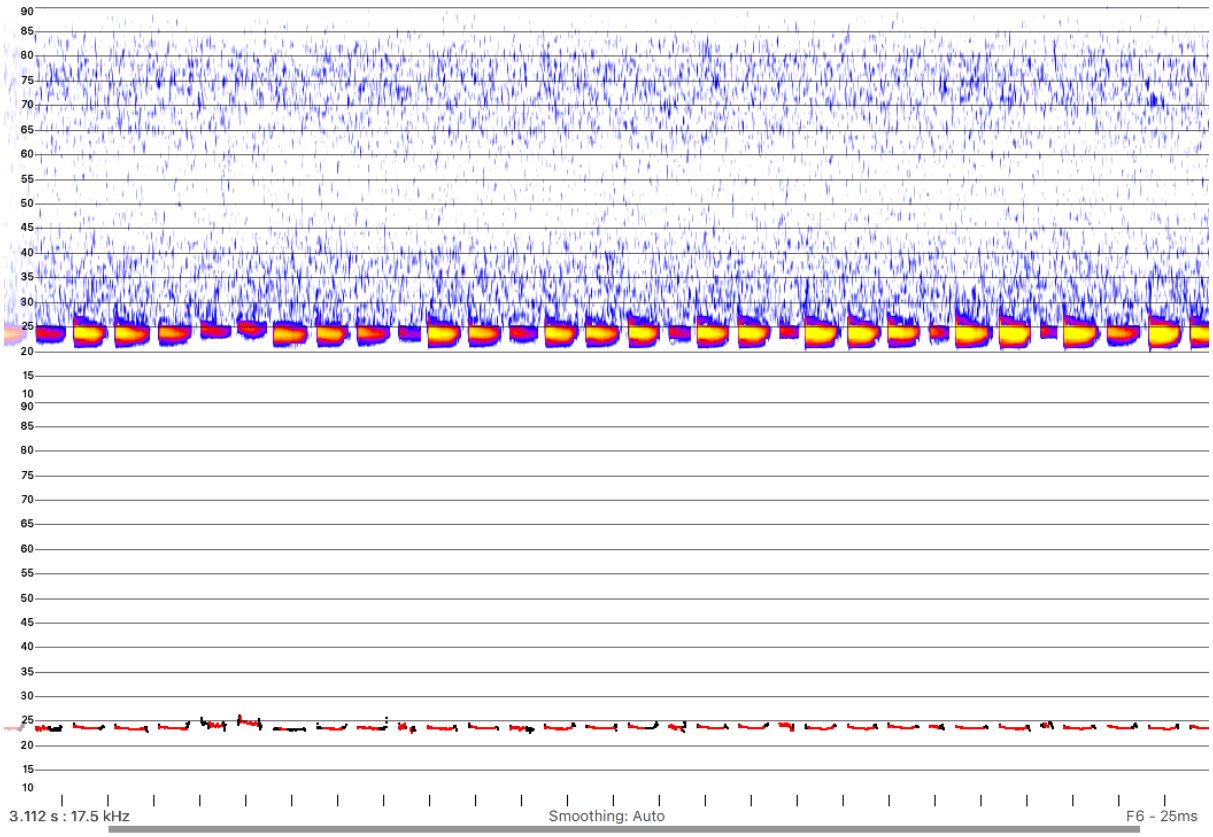


Figure 3: Ozimops planiceps (high confidence ID).

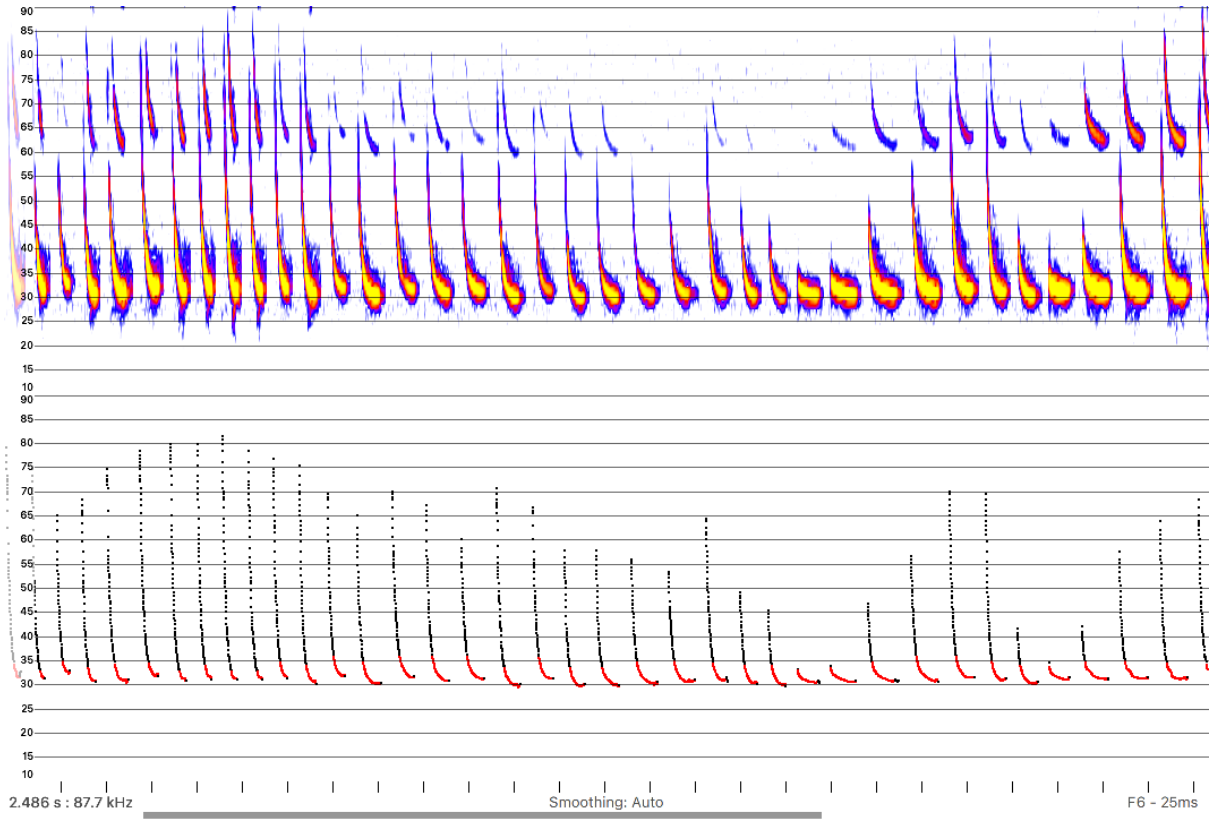


Figure 4 – Chalinolobus gouldii (high confidence ID).

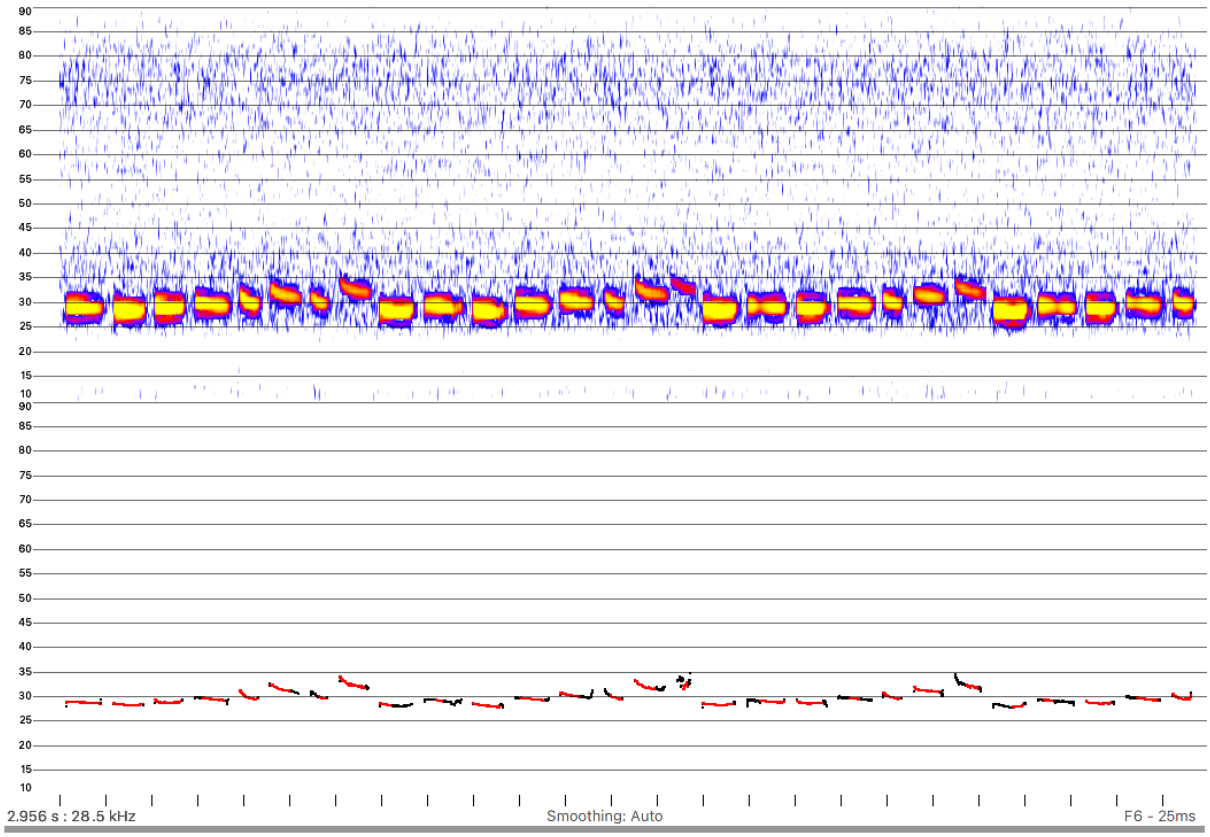


Figure 5: Ozimops ridei or Ozimops petersi (high confidence ID).

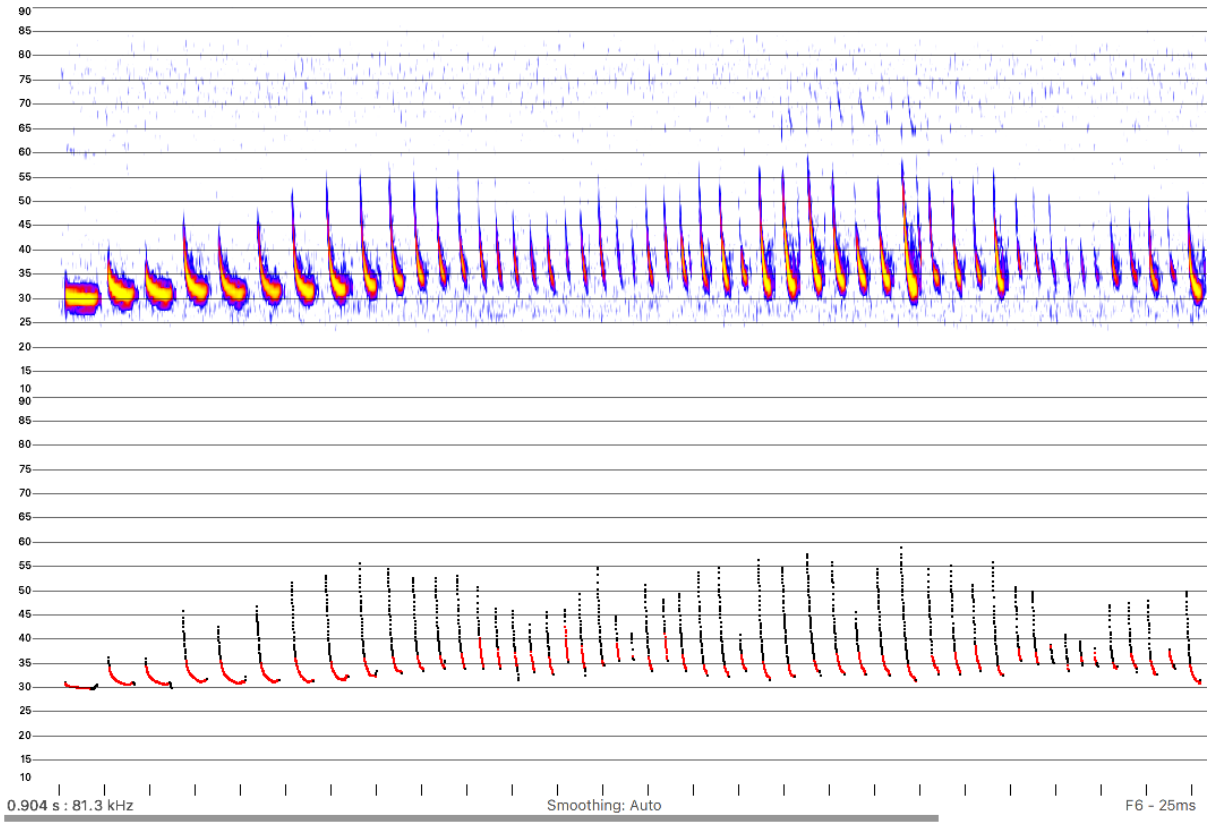


Figure 6 – Scotorepens balstoni (moderate ID confidence)

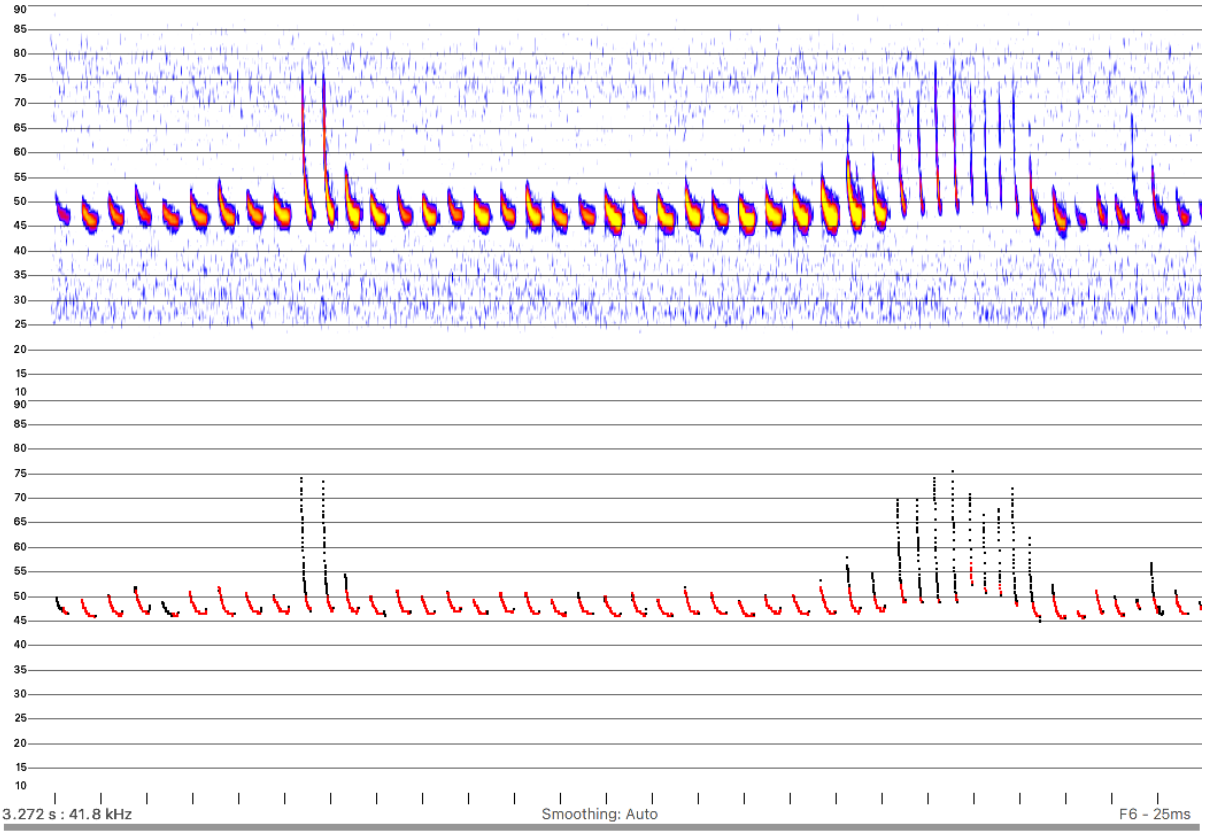


Figure 7: Vespadelus vulturnus (high ID confidence).

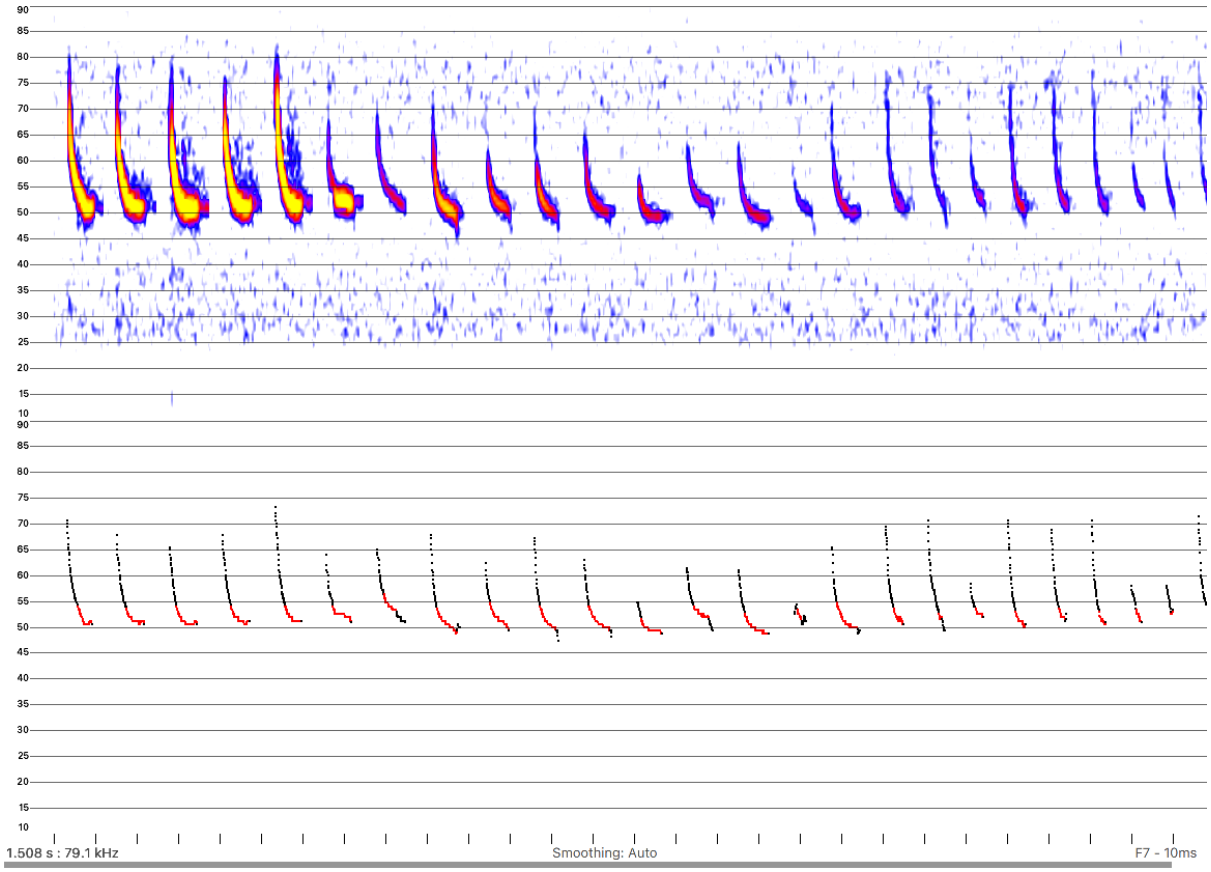


Figure 8 – Chalinolobus morio (high ID confidence).

4. References

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Pennay, M., Law, B. and Reinhold, L. (2004). *Bat Calls of New South Wales*. Department of Environment and Conservation, Hurstville.

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APPENDIX H CREDIT REPORTS (SUBJECT LAND)

BAM Credit Summary Report

Proposal Details

Assessment Id
00034483/BAAS18090/22/00034484

Proposal Name
the Plains Wind Farm

BAM data last updated *
14/03/2024

Assessor Name
Matt J Davis

Report Created
23/04/2024

BAM Data version *
67

Assessor Number
BAAS18090

BAM Case Status
Finalised

Date Finalised
23/04/2024

Assessment Revision
3

Assessment Type
Major Projects

* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

Ecosystem credits for plant communities types (PCT), ecological communities & threatened species habitat

Zone	Vegetation zone name	TEC name	Current Vegetation integrity score	Change in Vegetation integrity (loss / gain)	Area (ha)	Sensitivity to loss (Justification)	Species sensitivity to gain class	BC Act Listing status	EPBC Act listing status	Biodiversity risk weighting	Potential SAII	Ecosystem credits
Black Bluebush low open shrubland of the alluvial plains and sandplains of the arid and semi-arid zones												
6	153_Moderate	Not a TEC	84.6	84.6	18.5	PCT Cleared - 40%	High Sensitivity to Gain			1.50		586
											Subtotal	**586**

Black Box - Lignum woodland wetland of the inner floodplains in the semi-arid (warm) climate zone (mainly Riverina Bioregion and Murray Darling Depression Bioregion)												
1	13_Moderate	Not a TEC	51.1	51.1	2	PCT Cleared - 57%	High Sensitivity to Gain			1.75		45
											Subtotal	**45**
Bladder Saltbush shrubland on alluvial plains in the semi-arid (warm) zone including Riverina Bioregion												
7	157_Moderate	Not a TEC	59.2	59.2	48.4	PCT Cleared - 60%	High Sensitivity to Gain			1.75		1254
											Subtotal	**1254**
Canegrass swamp tall grassland wetland of drainage depressions, lakes and pans of the inland plains												
3	24_Moderate	Not a TEC	47.8	47.8	57.3	PCT Cleared - 20%	High Sensitivity to Gain			1.50		1028
											Subtotal	**1028**
Cotton Bush open shrubland of the semi-arid (warm) zone												
9	164_Moderate	Not a TEC	86.4	86.4	1289.2	PCT Cleared - 8%	High Sensitivity to Gain			1.50		41766
											Subtotal	**41766**

Dillon Bush (Nitre Bush) shrubland of the semi-arid and arid zones												
8	163_Moderate	Not a TEC	76.9	76.9	392.7	PCT Cleared - 26%	High Sensitivity to Gain			1.50		11320
											Subtotal	**11320**
Forb-rich Speargrass - Windmill Grass - White Top grassland of the Riverina Bioregion												
5	44_Moderate	Not a TEC	84.7	84.7	73.6	PCT Cleared - 73%	High Sensitivity to Gain			2.00		3119
											Subtotal	**3119**
Lignum shrubland wetland of the semi-arid (warm) plains (mainly Riverina Bioregion and Murray Darling Depression Bioregion)												
2	17_Moderate	Not a TEC	79.2	79.2	87.1	PCT Cleared - 63%	High Sensitivity to Gain			1.75		3016
											Subtotal	**3016**

White Cypress Pine open woodland of sand plains, prior streams and dunes mainly of the semi-arid (warm) climate zone												
4	28_Low01	Sandhill Pine Woodland in the Riverina, Murray-Darling Depression and NSW South Western Slopes bioregions	35.3	35.3	0.69	Biodiversity Conservation Act listing status	High Sensitivity to Gain	Endangered Ecological Community	Not Listed	2.00		12
											Subtotal	**12**
											Total	**62146**

Species credits for threatened species

Vegetation zone name	Habitat condition (Vegetation Integrity)	Change in habitat condition	Area (ha)/Count (no. individuals)	Sensitivity to loss (Justification)	Sensitivity to gain (Justification)	BC Act Listing status	EPBC Act listing status	Potential SAII	Species credits
Austrostipa wakoolica / A spear-grass (Flora)									
17_Moderate	79.2	79.2	87.1	Biodiversity Conservation Act listing status	Effectiveness of management in controlling threats	Endangered	Endangered	False	3447
								Subtotal	**3447**

Brachyscome papillosa / Mossgiel Daisy (Flora)									
13_Moderate	51.1	51.1	1.2	Biodiversity Conservation Act listing status	Ability to colonise improved habitat	Vulnerable	Vulnerable	False	31
24_Moderate	47.8	47.8	50.6	Biodiversity Conservation Act listing status	Ability to colonise improved habitat	Vulnerable	Vulnerable	False	1211
44_Moderate	84.7	84.7	63.1	Biodiversity Conservation Act listing status	Ability to colonise improved habitat	Vulnerable	Vulnerable	False	2672
157_Moderate	59.2	59.2	35.6	Biodiversity Conservation Act listing status	Ability to colonise improved habitat	Vulnerable	Vulnerable	False	1054
163_Moderate	76.9	76.9	297.6	Biodiversity Conservation Act listing status	Ability to colonise improved habitat	Vulnerable	Vulnerable	False	11440
164_Moderate	86.4	86.4	928.5	Biodiversity Conservation Act listing status	Ability to colonise improved habitat	Vulnerable	Vulnerable	False	40109
								Subtotal	**56517**

Calotis moorei / A burr-daisy (Flora)									
153_Moderate	84.6	84.6	9.4	Geographic Distribution	Ecology or response to management is poorly known	Endangered	Endangered	True	595
157_Moderate	59.2	59.2	35.6	Geographic Distribution	Ecology or response to management is poorly known	Endangered	Endangered	True	1581
								Subtotal	**2176**
Cullen parvum / Small Scurf-pea (Flora)									
44_Moderate	84.7	84.7	72.8	Biodiversity Conservation Act listing status	Ability to colonise improved habitat	Endangered	Not Listed	False	3084
								Subtotal	**3084**
Lepidium monoplocoides / Winged Peppercress (Flora)									
13_Moderate	51.1	51.1	1.2	Biodiversity Conservation Act listing status	Effectiveness of management in controlling threats	Endangered	Endangered	False	31
17_Moderate	79.2	79.2	0.29	Biodiversity Conservation Act listing status	Effectiveness of management in controlling threats	Endangered	Endangered	False	11

24_Moderate	47.8	47.8	50.6	Biodiversity Conservation Act listing status	Effectiveness of management in controlling threats	Endangered	Endangered	False	1211
44_Moderate	84.7	84.7	3.2	Biodiversity Conservation Act listing status	Effectiveness of management in controlling threats	Endangered	Endangered	False	136
153_Moderate	84.6	84.6	9.4	Biodiversity Conservation Act listing status	Effectiveness of management in controlling threats	Endangered	Endangered	False	396
163_Moderate	76.9	76.9	298.5	Biodiversity Conservation Act listing status	Effectiveness of management in controlling threats	Endangered	Endangered	False	11473
164_Moderate	86.4	86.4	4.2	Biodiversity Conservation Act listing status	Effectiveness of management in controlling threats	Endangered	Endangered	False	183
								Subtotal	**13441**

Maireana cheelii / Chariot Wheels (Flora)									
17_Moderate	79.2	79.2	0.66	Biodiversity Conservation Act listing status	Ability to colonise improved habitat	Vulnerable	Vulnerable	False	26
44_Moderate	84.7	84.7	65.2	Biodiversity Conservation Act listing status	Ability to colonise improved habitat	Vulnerable	Vulnerable	False	2763
153_Moderate	84.6	84.6	2.8	Biodiversity Conservation Act listing status	Ability to colonise improved habitat	Vulnerable	Vulnerable	False	118
157_Moderate	59.2	59.2	36.2	Biodiversity Conservation Act listing status	Ability to colonise improved habitat	Vulnerable	Vulnerable	False	1073
163_Moderate	76.9	76.9	0.45	Biodiversity Conservation Act listing status	Ability to colonise improved habitat	Vulnerable	Vulnerable	False	17
164_Moderate	86.4	86.4	931.5	Biodiversity Conservation Act listing status	Ability to colonise improved habitat	Vulnerable	Vulnerable	False	40236
								Subtotal	**44233**

Pedionomus torquatus / Plains-wanderer (Fauna)									
17_Moderate	79.2	79.2	0.71	Environment Protection and Conservation Act listing status	Effectiveness of management in controlling threats	Endangered	Critically Endangered	True	42
24_Moderate	47.8	47.8	1.2	Environment Protection and Conservation Act listing status	Effectiveness of management in controlling threats	Endangered	Critically Endangered	True	43
44_Moderate	84.7	84.7	0.68	Environment Protection and Conservation Act listing status	Effectiveness of management in controlling threats	Endangered	Critically Endangered	True	43
163_Moderate	76.9	76.9	0.24	Environment Protection and Conservation Act listing status	Effectiveness of management in controlling threats	Endangered	Critically Endangered	True	14

164_Moderate	86.4	86.4	2.5	Environment Protection and Conservation Act listing status	Effectiveness of management in controlling threats	Endangered	Critically Endangered	True	163
								Subtotal	**305**
Swainsona murrayana / Slender Darling Pea (Flora)									
17_Moderate	79.2	79.2	0.01	Biodiversity Conservation Act listing status	Ability to colonise improved habitat	Vulnerable	Vulnerable	False	1
44_Moderate	84.7	84.7	65.3	Biodiversity Conservation Act listing status	Ability to colonise improved habitat	Vulnerable	Vulnerable	False	2765
157_Moderate	59.2	59.2	36	Biodiversity Conservation Act listing status	Ability to colonise improved habitat	Vulnerable	Vulnerable	False	1065
163_Moderate	76.9	76.9	298.7	Biodiversity Conservation Act listing status	Ability to colonise improved habitat	Vulnerable	Vulnerable	False	11482
164_Moderate	86.4	86.4	931.2	Biodiversity Conservation Act listing status	Ability to colonise improved habitat	Vulnerable	Vulnerable	False	40223

								Subtotal	**55536**

BAM Biodiversity Credit Report (Like for like)

Proposal Details

Assessment Id
00034483/BAAS18090/22/00034484

Proposal Name
the Plains Wind Farm

BAM data last updated *
14/03/2024

Assessor Name
Matt J Davis

Assessor Number
BAAS18090

BAM Data version *
67

Proponent Names

Report Created
23/04/2024

BAM Case Status
Finalised

Assessment Revision
3

Assessment Type
Major Projects

Date Finalised
23/04/2024

* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

Potential Serious and Irreversible Impacts

Name of threatened ecological community	Listing status	Name of Plant Community Type/ID
Nil		

Species
Calotis moorei / A burr-daisy
Pedionomus torquatus / Plains-wanderer

Additional Information for Approval

PCT Outside Ibra Added

PCT
164-Cotton Bush open shrubland of the semi-arid (warm) zone

PCTs With Customized Benchmarks

PCT
No Changes

Predicted Threatened Species Not On Site

Name
Polytelis anthopeplus monarchoides / Regent Parrot (eastern subspecies)

Ecosystem Credit Summary (Number and class of biodiversity credits to be retired)

BAM Biodiversity Credit Report (Like for like)

Name of Plant Community Type/ID	Name of threatened ecological community	Area of impact	HBT Cr	No HBT Cr	Total credits to be retired
13-Black Box - Lignum woodland wetland of the inner floodplains in the semi-arid (warm) climate zone (mainly Riverina Bioregion and Murray Darling Depression Bioregion)	Not a TEC	2.0	45	0	45
17-Lignum shrubland wetland of the semi-arid (warm) plains (mainly Riverina Bioregion and Murray Darling Depression Bioregion)	Not a TEC	87.1	0	3016	3016
24-Canegrass swamp tall grassland wetland of drainage depressions, lakes and pans of the inland plains	Not a TEC	57.3	0	1028	1028
28-White Cypress Pine open woodland of sand plains, prior streams and dunes mainly of the semi-arid (warm) climate zone	Sandhill Pine Woodland in the Riverina, Murray-Darling Depression and NSW South Western Slopes bioregions	0.7	0	12	12
44-Forb-rich Speargrass - Windmill Grass - White Top grassland of the Riverina Bioregion	Not a TEC	73.6	0	3119	3119
153-Black Bluebush low open shrubland of the alluvial plains and sandplains of the arid and semi-arid zones	Not a TEC	18.5	0	586	586
157-Bladder Saltbush shrubland on alluvial plains in the semi-arid (warm) zone including Riverina Bioregion	Not a TEC	48.4	0	1254	1254
163-Dillon Bush (Nitre Bush) shrubland of the semi-arid and arid zones	Not a TEC	392.7	0	11320	11320
164-Cotton Bush open shrubland of the semi-arid (warm) zone	Not a TEC	1289.2	0	41766	41766

13-Black Box - Lignum woodland wetland of the inner floodplains in the semi-arid (warm) climate zone (mainly Riverina Bioregion and Murray Darling Depression Bioregion)

Like-for-like credit retirement options

Class	Trading group	Zone	HBT	Credits	IBRA region
Inland Floodplain Woodlands This includes PCT's: 13, 15, 16, 83, 438, 454, 630	Inland Floodplain Woodlands >=50% and <70%	13_Moderate	Yes	45	Murrumbidgee, Darling Depression, Lachlan, Lachlan Plains, Lower Slopes, Murray Fans, Robinvale Plains and South Olary Plain. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

17-Lignum shrubland wetland of the semi-arid (warm) plains (mainly Riverina Bioregion and Murray Darling Depression Bioregion)

Like-for-like credit retirement options

Class	Trading group	Zone	HBT	Credits	IBRA region
Inland Floodplain Shrublands This includes PCT's: 17, 115, 161, 241, 247, 375	Inland Floodplain Shrublands >=50% and <70%	17_Moderate	No	3016	Murrumbidgee, Darling Depression, Lachlan, Lachlan Plains, Lower Slopes, Murray Fans, Robinvale Plains and South Olary Plain. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

17-Lignum shrubland wetland of the semi-arid (warm) plains (mainly Riverina Bioregion and Murray Darling Depression Bioregion)

24-Canegrass swamp tall grassland wetland of drainage depressions, lakes and pans of the inland plains

Like-for-like credit retirement options

Class	Trading group	Zone	HBT	Credits	IBRA region
Inland Floodplain Shrublands This includes PCT's: 17, 24, 25, 115, 160, 161, 240, 241, 247, 261, 271, 375	Inland Floodplain Shrublands <50%	24_Moderate	No	1028	Murrumbidgee, Darling Depression, Lachlan, Lachlan Plains, Lower Slopes, Murray Fans, Robinvale Plains and South Olary Plain. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

28-White Cypress Pine open woodland of sand plains, prior streams and dunes mainly of the semi-arid (warm) climate zone

Like-for-like credit retirement options

Name of offset trading group	Trading group	Zone	HBT	Credits	IBRA region

	Sandhill Pine Woodland in the Riverina, Murray-Darling Depression and NSW South Western Slopes bioregions This includes PCT's: 19, 21, 28, 48, 75	-	28_Low01	No	12	Murrumbidgee, Darling Depression, Lachlan, Lachlan Plains, Lower Slopes, Murray Fans, Robinvale Plains and South Olary Plain. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
44-Forb-rich Speargrass - Windmill Grass - White Top grassland of the Riverina Bioregion	**Like-for-like credit retirement options**					
	Class	Trading group	Zone	HBT	Credits	IBRA region
	Riverine Plain Grasslands This includes PCT's: 44	Riverine Plain Grasslands >=70% and <90%	44_Moderate	No	3119	Murrumbidgee, Darling Depression, Lachlan, Lachlan Plains, Lower Slopes, Murray Fans, Robinvale Plains and South Olary Plain. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

153-Black Bluebush low open shrubland of the alluvial plains and sandplains of the arid and semi-arid zones

Like-for-like credit retirement options

Class	Trading group	Zone	HBT	Credits	IBRA region
Aeolian Chenopod Shrublands This includes PCT's: 151, 152, 153, 154, 222, 225	Aeolian Chenopod Shrublands <50%	153_Moderate	No	586	Murrumbidgee, Darling Depression, Lachlan, Lachlan Plains, Lower Slopes, Murray Fans, Robinvale Plains and South Olary Plain. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

157-Bladder Saltbush shrubland on alluvial plains in the semi-arid (warm) zone including Riverina Bioregion

Like-for-like credit retirement options

Class	Trading group	Zone	HBT	Credits	IBRA region
Riverine Chenopod Shrublands This includes PCT's: 157, 158, 159, 195, 196, 211, 377	Riverine Chenopod Shrublands >=50% and <70%	157_Moderate	No	1254	Murrumbidgee, Darling Depression, Lachlan, Lachlan Plains, Lower Slopes, Murray Fans, Robinvale Plains and South Olary Plain. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

157-Bladder Saltbush shrubland on alluvial plains in the semi-arid (warm) zone including Riverina Bioregion

163-Dillon Bush (Nitre Bush) shrubland of the semi-arid and arid zones

Like-for-like credit retirement options

Class	Trading group	Zone	HBT	Credits	IBRA region
Riverine Chenopod Shrublands This includes PCT's: 157, 158, 159, 163, 164, 168, 195, 196, 211, 212, 216, 236, 254, 377, 466	Riverine Chenopod Shrublands <50%	163_Moderate	No	11320	Murrumbidgee, Darling Depression, Lachlan, Lachlan Plains, Lower Slopes, Murray Fans, Robinvale Plains and South Olary Plain. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

164-Cotton Bush open shrubland of the semi-arid (warm) zone

Like-for-like credit retirement options

Class	Trading group	Zone	HBT	Credits	IBRA region

	Riverine Chenopod Shrublands This includes PCT's: 157, 158, 159, 163, 164, 168, 195, 196, 211, 212, 216, 236, 254, 377, 466	Riverine Chenopod Shrublands <50%	164_Moderate	No	41766	Murrumbidgee, Darling Depression, Lachlan, Lachlan Plains, Lower Slopes, Murray Fans, Robinvale Plains and South Olary Plain. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

Species Credit Summary

Species	Vegetation Zone/s	Area / Count	Credits
Austrostipa wakoolica / A spear-grass	**17_Moderate**	87.1	3447.00
Brachyscome papillosa / Mossgiel Daisy	**13_Moderate, 24_Moderate, 44_Moderate, 157_Moderate, 163_Moderate, 164_Moderate**	1376.7	56517.00
Calotis moorei / A burr-daisy	**153_Moderate, 157_Moderate**	45.0	2176.00
Cullen parvum / Small Scurf-pea	**44_Moderate**	72.8	3084.00
Lepidium monoplocoides / Winged Peppercress	**13_Moderate, 17_Moderate, 24_Moderate, 44_Moderate, 153_Moderate, 163_Moderate, 164_Moderate**	367.4	13441.00

Maireana cheelii / Chariot Wheels	**17_Moderate, 44_Moderate, 153_Moderate, 157_Moderate, 163_Moderate, 164_Moderate**	1036.8	44233.00
Pedionomus torquatus / Plains-wanderer	**17_Moderate, 24_Moderate, 44_Moderate, 163_Moderate, 164_Moderate**	5.4	305.00
Swainsona murrayana / Slender Darling Pea	**17_Moderate, 44_Moderate, 157_Moderate, 163_Moderate, 164_Moderate**	1331.1	55536.00

Credit Retirement Options

Like-for-like credit retirement options

Austrostipa wakoolica / A spear-grass	Spp	IBRA subregion
	Austrostipa wakoolica / A spear-grass	Any in NSW
Brachyscome papillosa / Mossgiel Daisy	Spp	IBRA subregion
	Brachyscome papillosa / Mossgiel Daisy	Any in NSW
Calotis moorei / A burr-daisy	Spp	IBRA subregion
	Calotis moorei / A burr-daisy	Any in NSW

Cullen parvum / Small Scurf-pea	Spp	IBRA subregion
	Cullen parvum / Small Scurf-pea	Any in NSW
Lepidium monoplocoides / Winged Peppercress	Spp	IBRA subregion
	Lepidium monoplocoides / Winged Peppercress	Any in NSW
Maireana cheelii / Chariot Wheels	Spp	IBRA subregion
	Maireana cheelii / Chariot Wheels	Any in NSW
Pedionomus torquatus / Plains-wanderer	Spp	IBRA subregion
	Pedionomus torquatus / Plains-wanderer	Any in NSW
Swainsona murrayana / Slender Darling Pea	Spp	IBRA subregion
	Swainsona murrayana / Slender Darling Pea	Any in NSW

BAM Biodiversity Credit Report (Variations)

Proposal Details

Assessment Id
00034483/BAAS18090/22/00034484

Proposal Name
the Plains Wind Farm

BAM data last updated *
14/03/2024

Assessor Name
Matt J Davis

Assessor Number
BAAS18090

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Proponent Name(s)

Report Created
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Finalised

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3

Assessment Type
Major Projects

Date Finalised
23/04/2024

* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

Potential Serious and Irreversible Impacts

Name of threatened ecological community	Listing status	Name of Plant Community Type/ID
Nil		

Species
Calotis moorei / A burr-daisy
Pedionomus torquatus / Plains-wanderer

Additional Information for Approval

PCT Outside Ibra Added

PCT
164-Cotton Bush open shrubland of the semi-arid (warm) zone

PCTs With Customized Benchmarks

PCT
No Changes

Predicted Threatened Species Not On Site

Name
Polytelis anthopeplus monarchoides / Regent Parrot (eastern subspecies)

Ecosystem Credit Summary (Number and class of biodiversity credits to be retired)

Name of Plant Community Type/ID	Name of threatened ecological community	Area of impact	HBT Cr	No HBT Cr	Total credits to be retired
13-Black Box - Lignum woodland wetland of the inner floodplains in the semi-arid (warm) climate zone (mainly Riverina Bioregion and Murray Darling Depression Bioregion)	Not a TEC	2.0	45	0	45.00
17-Lignum shrubland wetland of the semi-arid (warm) plains (mainly Riverina Bioregion and Murray Darling Depression Bioregion)	Not a TEC	87.1	0	3016	3016.00
24-Canegrass swamp tall grassland wetland of drainage depressions, lakes and pans of the inland plains	Not a TEC	57.3	0	1028	1028.00
28-White Cypress Pine open woodland of sand plains, prior streams and dunes mainly of the semi-arid (warm) climate zone	Sandhill Pine Woodland in the Riverina, Murray-Darling Depression and NSW South Western Slopes bioregions	0.7	0	12	12.00
44-Forb-rich Speargrass - Windmill Grass - White Top grassland of the Riverina Bioregion	Not a TEC	73.6	0	3119	3119.00
153-Black Bluebush low open shrubland of the alluvial plains and sandplains of the arid and semi-arid zones	Not a TEC	18.5	0	586	586.00

157-Bladder Saltbush shrubland on alluvial plains in the semi-arid (warm) zone including Riverina Bioregion	Not a TEC	48.4	0	1254	1254.00
163-Dillon Bush (Nitre Bush) shrubland of the semi-arid and arid zones	Not a TEC	392.7	0	11320	11320.00
164-Cotton Bush open shrubland of the semi-arid (warm) zone	Not a TEC	1289.2	0	41766	41766.00

13-Black Box - Lignum woodland wetland of the inner floodplains in the semi-arid (warm) climate zone (mainly Riverina Bioregion and Murray Darling Depression Bioregion)

Like-for-like credit retirement options

Class	Trading group	Zone	HBT	Credits	IBRA region
Inland Floodplain Woodlands This includes PCT's: 13, 15, 16, 83, 438, 454, 630	Inland Floodplain Woodlands >=50% and <70%	13_Moderate	Yes	45	Murrumbidgee,Darling Depression, Lachlan, Lachlan Plains, Lower Slopes, Murray Fans, Robinvale Plains and South Olary Plain. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

Variation options

Formation	Trading group	Zone	HBT	Credits	IBRA region
Semi-arid Woodlands (Grassy sub-formation)	Tier 3 or higher threat status	13_Moderate	Yes (including artificial)	45	IBRA Region: Riverina, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

17-Lignum shrubland wetland of the semi-arid (warm) plains (mainly Riverina Bioregion and Murray Darling Depression Bioregion)

Like-for-like credit retirement options

Class	Trading group	Zone	HBT	Credits	IBRA region

	Inland Floodplain Shrublands This includes PCT's: 17, 115, 161, 241, 247, 375	Inland Floodplain Shrublands >=50% and <70%	17_Moderate	No	3016	Murrumbidgee,Darling Depression, Lachlan, Lachlan Plains, Lower Slopes, Murray Fans, Robinvale Plains and South Olary Plain. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	Variation options					
	Formation	Trading group	Zone	HBT	Credits	IBRA region
	Freshwater Wetlands	Tier 3 or higher threat status	17_Moderate	No	3016	IBRA Region: Riverina, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
24-Canegrass swamp tall grassland wetland of drainage depressions, lakes and pans of the inland plains	**Like-for-like credit retirement options**					
	Class	Trading group	Zone	HBT	Credits	IBRA region
	Inland Floodplain Shrublands This includes PCT's: 17, 24, 25, 115, 160, 161, 240, 241, 247, 261, 271, 375	Inland Floodplain Shrublands <50%	24_Moderate	No	1028	Murrumbidgee,Darling Depression, Lachlan, Lachlan Plains, Lower Slopes, Murray Fans, Robinvale Plains and South Olary Plain. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	Variation options					
	Formation	Trading group	Zone	HBT	Credits	IBRA region

	Freshwater Wetlands	Tier 4 or higher threat status	24_Moderate	No	1028	IBRA Region: Riverina, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
28-White Cypress Pine open woodland of sand plains, prior streams and dunes mainly of the semi-arid (warm) climate zone	**Like-for-like credit retirement options**					
	Class	Trading group	Zone	HBT	Credits	IBRA region
	Sandhill Pine Woodland in the Riverina, Murray-Darling Depression and NSW South Western Slopes bioregions This includes PCT's: 19, 21, 28, 48, 75	-	28_Low01	No	12	Murrumbidgee,Darling Depression, Lachlan, Lachlan Plains, Lower Slopes, Murray Fans, Robinvale Plains and South Olary Plain. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	Variation options					
	Formation	Trading group	Zone	HBT	Credits	IBRA region
	Semi-arid Woodlands (Shrubby sub-formation)	Tier 3 or higher threat status	28_Low01	No	12	IBRA Region: Riverina, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
44-Forb-rich Speargrass - Windmill Grass - White Top grassland of the Riverina Bioregion	**Like-for-like credit retirement options**					
	Class	Trading group	Zone	HBT	Credits	IBRA region

	Riverine Plain Grasslands This includes PCT's: 44	Riverine Plain Grasslands >=70% and <90%	44_Moderate	No	3119	Murrumbidgee,Darling Depression, Lachlan, Lachlan Plains, Lower Slopes, Murray Fans, Robinvale Plains and South Olary Plain. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	Variation options					
	Formation	Trading group	Zone	HBT	Credits	IBRA region
	Grasslands	Tier 2 or higher threat status	44_Moderate	No	3119	IBRA Region: Riverina, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
153-Black Bluebush low open shrubland of the alluvial plains and sandplains of the arid and semi-arid zones	**Like-for-like credit retirement options**					
	Class	Trading group	Zone	HBT	Credits	IBRA region
	Aeolian Chenopod Shrublands This includes PCT's: 151, 152, 153, 154, 222, 225	Aeolian Chenopod Shrublands <50%	153_Moderate	No	586	Murrumbidgee,Darling Depression, Lachlan, Lachlan Plains, Lower Slopes, Murray Fans, Robinvale Plains and South Olary Plain. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	Variation options					
	Formation	Trading group	Zone	HBT	Credits	IBRA region

	Arid Shrublands (Chenopod sub-formation)	Tier 4 or higher threat status	153_Moderate	No	586	IBRA Region: Riverina, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
157-Bladder Saltbush shrubland on alluvial plains in the semi-arid (warm) zone including Riverina Bioregion	**Like-for-like credit retirement options**					
	Class	Trading group	Zone	HBT	Credits	IBRA region
	Riverine Chenopod Shrublands This includes PCT's: 157, 158, 159, 195, 196, 211, 377	Riverine Chenopod Shrublands >=50% and <70%	157_Moderate	No	1254	Murrumbidgee,Darling Depression, Lachlan, Lachlan Plains, Lower Slopes, Murray Fans, Robinvale Plains and South Olary Plain. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	Variation options					
	Formation	Trading group	Zone	HBT	Credits	IBRA region
	Arid Shrublands (Chenopod sub-formation)	Tier 3 or higher threat status	157_Moderate	No	1254	IBRA Region: Riverina, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
163-Dillon Bush (Nitre Bush) shrubland of the semi-arid and arid zones	**Like-for-like credit retirement options**					
	Class	Trading group	Zone	HBT	Credits	IBRA region

	Riverine Chenopod Shrublands This includes PCT's: 157, 158, 159, 163, 164, 168, 195, 196, 211, 212, 216, 236, 254, 377, 466	Riverine Chenopod Shrublands <50%	163_Moderate	No	11320	Murrumbidgee,Darling Depression, Lachlan, Lachlan Plains, Lower Slopes, Murray Fans, Robinvale Plains and South Olary Plain. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	Variation options					
	Formation	Trading group	Zone	HBT	Credits	IBRA region
	Arid Shrublands (Chenopod sub-formation)	Tier 4 or higher threat status	163_Moderate	No	11320	IBRA Region: Riverina, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
164-Cotton Bush open shrubland of the semi-arid (warm) zone	**Like-for-like credit retirement options**					
	Class	Trading group	Zone	HBT	Credits	IBRA region
	Riverine Chenopod Shrublands This includes PCT's: 157, 158, 159, 163, 164, 168, 195, 196, 211, 212, 216, 236, 254, 377, 466	Riverine Chenopod Shrublands <50%	164_Moderate	No	41766	Murrumbidgee,Darling Depression, Lachlan, Lachlan Plains, Lower Slopes, Murray Fans, Robinvale Plains and South Olary Plain. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	Variation options					
	Formation	Trading group	Zone	HBT	Credits	IBRA region

	Arid Shrublands (Chenopod sub-formation)	Tier 4 or higher threat status	164_Moderate	No	41766	IBRA Region: Riverina, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

Species Credit Summary

Species	Vegetation Zone/s	Area / Count	Credits
Austrostipa wakoolica / A spear-grass	**17_Moderate**	87.1	3447.00
Brachyscome papillosa / Mossgiel Daisy	**13_Moderate, 24_Moderate, 44_Moderate, 157_Moderate, 163_Moderate, 164_Moderate**	1376.7	56517.00
Calotis moorei / A burr-daisy	**153_Moderate, 157_Moderate**	45.0	2176.00
Cullen parvum / Small Scurf-pea	**44_Moderate**	72.8	3084.00
Lepidium monoplocoides / Winged Peppercress	**13_Moderate, 17_Moderate, 24_Moderate, 44_Moderate, 153_Moderate, 163_Moderate, 164_Moderate**	367.4	13441.00
Maireana cheelii / Chariot Wheels	**17_Moderate, 44_Moderate, 153_Moderate, 157_Moderate, 163_Moderate, 164_Moderate**	1036.8	44233.00
Pedionomus torquatus / Plains-wanderer	**17_Moderate, 24_Moderate, 44_Moderate, 163_Moderate, 164_Moderate**	5.4	305.00
Swainsona murrayana / Slender Darling Pea	**17_Moderate, 44_Moderate, 157_Moderate, 163_Moderate, 164_Moderate**	1331.1	55536.00

Credit Retirement Options

Like-for-like options

Austrostipa wakoolica/ A spear-grass	Spp		IBRA region
	Austrostipa wakoolica/A spear-grass		Any in NSW
	Variation options		
	Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
	Flora	Endangered	Murrumbidgee, Darling Depression, Lachlan, Lachlan Plains, Lower Slopes, Murray Fans, Robinvale Plains and South Olary Plain. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
Brachyscome papillosa/ Mossgiel Daisy	Spp		IBRA region
	Brachyscome papillosa/Mossgiel Daisy		Any in NSW
	Variation options		
	Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region

	Flora	Vulnerable	Murrumbidgee, Darling Depression, Lachlan, Lachlan Plains, Lower Slopes, Murray Fans, Robinvale Plains and South Olary Plain. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
Calotis moorei/ A burr-daisy	Spp	IBRA region	
	Calotis moorei/A burr-daisy	Any in NSW	
	Variation options		
	Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
	Flora	Endangered	Murrumbidgee, Darling Depression, Lachlan, Lachlan Plains, Lower Slopes, Murray Fans, Robinvale Plains and South Olary Plain. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
Cullen parvum/ Small Scurf-pea	Spp	IBRA region	
	Cullen parvum/Small Scurf-pea	Any in NSW	
	Variation options		

	Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
	Flora	Endangered	Murrumbidgee, Darling Depression, Lachlan, Lachlan Plains, Lower Slopes, Murray Fans, Robinvale Plains and South Olary Plain. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
Lepidium monoplocoides/ Winged Peppercress	Spp	IBRA region	
	Lepidium monoplocoides/Winged Peppercress	Any in NSW	
	Variation options		
	Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
	Flora	Endangered	Murrumbidgee, Darling Depression, Lachlan, Lachlan Plains, Lower Slopes, Murray Fans, Robinvale Plains and South Olary Plain. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

Maireana cheelii/ Chariot Wheels	Spp		IBRA region
	Maireana cheelii/Chariot Wheels		Any in NSW
	Variation options		
	Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
	Flora	Vulnerable	Murrumbidgee, Darling Depression, Lachlan, Lachlan Plains, Lower Slopes, Murray Fans, Robinvale Plains and South Olary Plain. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
Pedionomus torquatus/ Plains-wanderer	Spp		IBRA region
	Pedionomus torquatus/Plains-wanderer		Any in NSW
	Variation options		
	Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region

	Fauna	Endangered	Murrumbidgee, Darling Depression, Lachlan, Lachlan Plains, Lower Slopes, Murray Fans, Robinvale Plains and South Olary Plain. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
Swainsona murrayana/ Slender Darling Pea	Spp	IBRA region	
	Swainsona murrayana/Slender Darling Pea	Any in NSW	
	Variation options		
	Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
	Flora	Vulnerable	Murrumbidgee, Darling Depression, Lachlan, Lachlan Plains, Lower Slopes, Murray Fans, Robinvale Plains and South Olary Plain. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

APPENDIX I CREDIT REPORTS (HAUL ROUTE DF)

BAM Credit Summary Report

Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00046788/BAAS23027/24/00046789		14/03/2024
Assessor Name	Report Created	BAM Data version *
Lorena Boyle	23/04/2024	67
Assessor Number	BAM Case Status	Date Finalised
BAAS23027	Finalised	23/04/2024
Assessment Revision	Assessment Type	BOS entry trigger
0	Part 4 Developments (Small Area)	BOS Threshold: Biodiversity Values Map

* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

Ecosystem credits for plant communities types (PCT), ecological communities & threatened species habitat

Zone	Vegetation zone name	TEC name	Current Vegetation integrity score	Change in Vegetation integrity (loss / gain)	Area (ha)	Sensitivity to loss (Justification)	Species sensitivity to gain class	BC Act Listing status	EPBC Act listing status	Biodiversity risk weighting	Potential SAII	Ecosystem credits

Bluebush shrubland on stony rises and downs in the arid and semi-arid zones												
1	155_High	Not a TEC	100	100.0	0.67	PCT Cleared - 50%	High Sensitivity to Gain			1.75		29
											Subtotal	**29**
											Total	**29**

Species credits for threatened species

Vegetation zone name	Habitat condition (Vegetation Integrity)	Change in habitat condition	Area (ha)/Count (no. individuals)	Sensitivity to loss (Justification)	Sensitivity to gain (Justification)	BC Act Listing status	EPBC Act listing status	Potential SAII	Species credits
Swainsona viridis / Creeping Darling Pea (Flora)									
155_High	100.0	100.0	0.53	Geographic Distribution	Ecology or response to management is poorly known	Endangered	Not Listed	True	40
								Subtotal	**40**

BAM Biodiversity Credit Report (Like for like)

Proposal Details

Assessment Id
00046788/BAAS23027/24/00046789

Proposal Name

BAM data last updated *
14/03/2024

Assessor Name
Lorena Boyle

Assessor Number
BAAS23027

BAM Data version *
67

Proponent Names

Report Created
23/04/2024

BAM Case Status
Finalised

Assessment Revision
0

Assessment Type
Part 4 Developments (Small Area)

Date Finalised
23/04/2024

BOS entry trigger
BOS Threshold: Biodiversity Values Map

* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

Potential Serious and Irreversible Impacts

Name of threatened ecological community	Listing status	Name of Plant Community Type/ID
Nil		

Species
Swainsona viridis / Creeping Darling Pea

Additional Information for Approval

PCT Outside Ibra Added

None added

PCTs With Customized Benchmarks

PCT
No Changes

Predicted Threatened Species Not On Site

Name
No Changes

Ecosystem Credit Summary (Number and class of biodiversity credits to be retired)

Name of Plant Community Type/ID	Name of threatened ecological community	Area of impact	HBT Cr	No HBT Cr	Total credits to be retired
155-Bluebush shrubland on stony rises and downs in the arid and semi-arid zones	Not a TEC	0.7	0	29	29

BAM Biodiversity Credit Report (Like for like)

155-Bluebush shrubland on stony rises and downs in the arid and semi-arid zones

Like-for-like credit retirement options

Class	Trading group	Zone	HBT	Credits	IBRA region
Gibber Chenopod Shrublands This includes PCT's: 155, 156	Gibber Chenopod Shrublands >=50% and <70%	155_High	No	29	Barrier Range, Barrier Range Outwash and Strzelecki Desert. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

Species Credit Summary

Species	Vegetation Zone/s	Area / Count	Credits
Swainsona viridis / Creeping Darling Pea	**155_High**	0.5	40.00

Credit Retirement Options

Like-for-like credit retirement options

Swainsona viridis / Creeping Darling Pea

Spp	IBRA subregion
Swainsona viridis / Creeping Darling Pea	Any in NSW

BAM Biodiversity Credit Report (Variations)

Proposal Details

Assessment Id

00046788/BAAS23027/24/00046789

Proposal Name

BAM data last updated *

14/03/2024

Assessor Name

Lorena Boyle

Assessor Number

BAAS23027

BAM Data version *

67

Proponent Name(s)

Report Created

23/04/2024

BAM Case Status

Finalised

Assessment Revision

0

Assessment Type

Part 4 Developments (Small Area)

Date Finalised

23/04/2024

BOS entry trigger

BOS Threshold: Biodiversity Values Map

* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

Potential Serious and Irreversible Impacts

Name of threatened ecological community	Listing status	Name of Plant Community Type/ID
Nil		
Species		
Swainsona viridis / Creeping Darling Pea		

Additional Information for Approval

PCT Outside Ibra Added

None added

PCTs With Customized Benchmarks

BAM Biodiversity Credit Report (Variations)

PCT
No Changes

Predicted Threatened Species Not On Site

Name
No Changes

Ecosystem Credit Summary (Number and class of biodiversity credits to be retired)

Name of Plant Community Type/ID	Name of threatened ecological community	Area of impact	HBT Cr	No HBT Cr	Total credits to be retired
155-Bluebush shrubland on stony rises and downs in the arid and semi-arid zones	Not a TEC	0.7	0	29	29.00

155-Bluebush shrubland on stony rises and downs in the arid and semi-arid zones

Like-for-like credit retirement options

Class	Trading group	Zone	HBT	Credits	IBRA region
Gibber Chenopod Shrublands This includes PCT's: 155, 156	Gibber Chenopod Shrublands >=50% and <70%	155_High	No	29	Barrier Range,Barrier Range Outwash and Strzelecki Desert. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

Variation options

Formation	Trading group	Zone	HBT	Credits	IBRA region
Arid Shrublands (Chenopod sub-formation)	Tier 3 or higher threat status	155_High	No	29	IBRA Region: Broken Hill Complex, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

BAM Biodiversity Credit Report (Variations)

Species Credit Summary

Species	Vegetation Zone/s	Area / Count	Credits
Swainsona viridis / Creeping Darling Pea	**155_High**	0.5	40.00

Credit Retirement Options

Like-for-like options

Swainsona viridis/ Creeping Darling Pea	Spp	IBRA region	
	Swainsona viridis/Creeping Darling Pea	Any in NSW	
	Variation options		
	Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
	Flora	Endangered	Barrier Range, Barrier Range Outwash and Strzelecki Desert. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.



APPENDIX J PMST

Australian Government

Department of Agriculture, Water and the Environment

EPBC Act Protected Matters Report

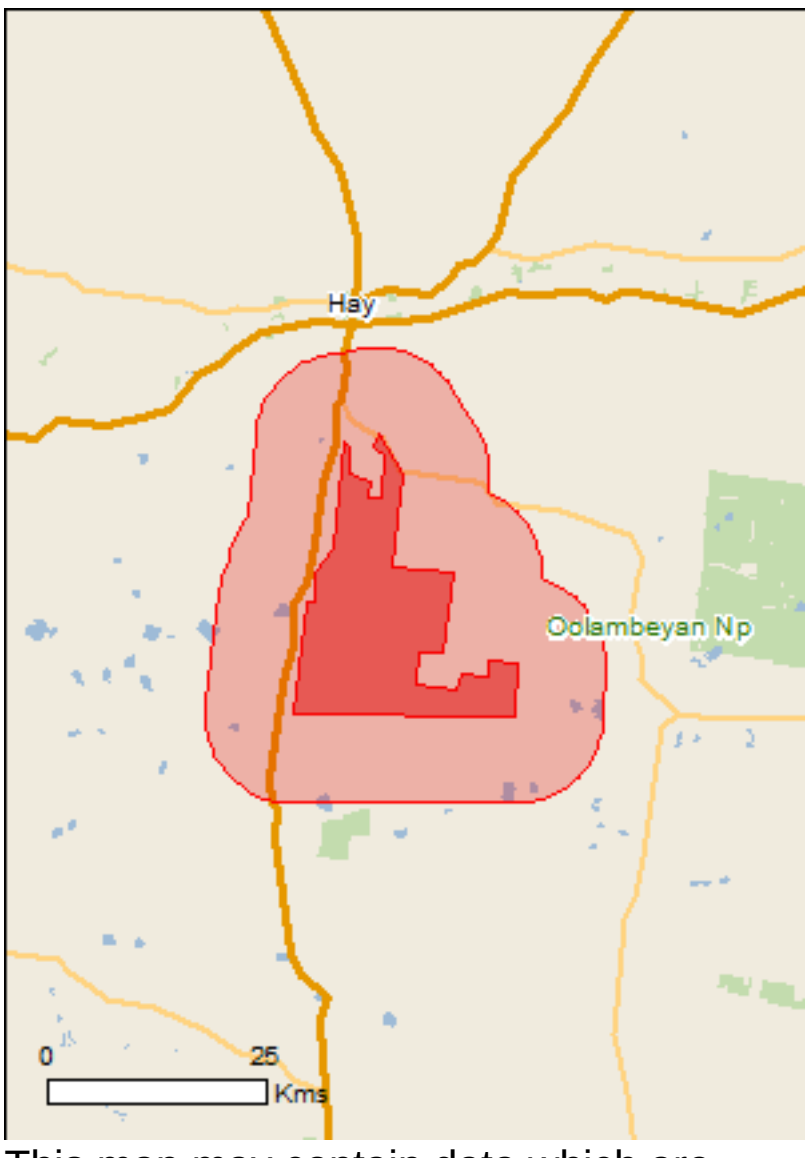
This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

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: 20/07/21 11:00:55

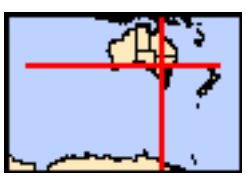
Summary
Details
Matters of NES
Other Matters Protected by the EPBC Act
Extra Information
Caveat
Acknowledgements



This map may contain data which are ©Commonwealth of Australia (Geoscience Australia), ©PSMA 2015

Coordinates

Buffer: 10.0Km



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.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	4
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	4
Listed Threatened Species:	21
Listed Migratory Species:	10

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.

Commonwealth Land:	1
Commonwealth Heritage Places:	None
Listed Marine Species:	15
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None

Extra Information

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

State and Territory Reserves:	1
Regional Forest Agreements:	None
Invasive Species:	20
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Wetlands of International Importance (Ramsar) [Resource Information]

Name	Proximity
Banrock station wetland complex	400 - 500km upstream
Hattah-kulkyne lakes	200 - 300km upstream
Riverland	300 - 400km upstream
The coorong, and lakes alexandrina and albert wetland	400 - 500km upstream

Listed Threatened Ecological Communities [Resource Information]

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.

Name	Status	Type of Presence
Buloke Woodlands of the Riverina and Murray-Darling Depression Bioregions	Endangered	Community may occur within area
Grey Box (Eucalyptus microcarpa) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia	Endangered	Community likely to occur within area
Plains mallee box woodlands of the Murray Darling Depression, Riverina and Naracoorte Coastal Plain Bioregions	Critically Endangered	Community may occur within area
Weeping Myall Woodlands	Endangered	Community likely to occur within area

Listed Threatened Species [Resource Information]

Name	Status	Type of Presence
Birds		
Botaurus poiciloptilus		
Australasian Bittern [1001]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea		
Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Falco hypoleucos		
Grey Falcon [929]	Vulnerable	Species or species habitat likely to occur within area
Grantiella picta		
Painted Honeyeater [470]	Vulnerable	Species or species habitat likely to occur within area
Numenius madagascariensis		
Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pedionomus torquatus		
Plains-wanderer [906]	Critically Endangered	Species or species habitat known to occur within area
Pezoporus occidentalis		
Night Parrot [59350]	Endangered	Extinct within area
Polytelis swainsonii		
Superb Parrot [738]	Vulnerable	Species or species habitat known to occur

Name	Status	Type of Presence
		within area
Rostratula australis		
Australian Painted Snipe [77037]	Endangered	Species or species habitat known to occur within area
Fish		
Galaxias rostratus		
Flathead Galaxias, Beaked Minnow, Flat-headed Galaxias, Flat-headed Jollytail, Flat-headed Minnow [84745]	Critically Endangered	Species or species habitat may occur within area
Maccullochella macquariensis		
Trout Cod [26171]	Endangered	Species or species habitat may occur within area
Maccullochella peelii		
Murray Cod [66633]	Vulnerable	Species or species habitat may occur within area
Macquaria australasica		
Macquarie Perch [66632]	Endangered	Species or species habitat may occur within area
Frogs		
Litoria raniformis		
Growling Grass Frog, Southern Bell Frog, Green and Golden Frog, Warty Swamp Frog, Golden Bell Frog [1828]	Vulnerable	Species or species habitat known to occur within area
Mammals		
Nyctophilus corbeni		
Corben's Long-eared Bat, South-eastern Long-eared Bat [83395]	Vulnerable	Species or species habitat may occur within area
Phascolarctos cinereus (combined populations of Qld, NSW and the ACT)		
Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) [85104]	Vulnerable	Species or species habitat may occur within area
Plants		
Austrostipa wakoolica		
[66623]	Endangered	Species or species habitat may occur within area
Brachyscome papillosa		
Mossgiel Daisy [6625]	Vulnerable	Species or species habitat may occur within area
Lepidium monoplocoides		
Winged Pepper-cress [9190]	Endangered	Species or species habitat known to occur within area
Maireana cheelii		
Chariot Wheels [8008]	Vulnerable	Species or species habitat likely to occur within area
Swainsona murrayana		
Slender Darling-pea, Slender Swainson, Murray Swainson-pea [6765]	Vulnerable	Species or species habitat likely to occur within area

Listed Migratory Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus		
Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Migratory Terrestrial Species		
Motacilla flava		
Yellow Wagtail [644]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Myiagra cyanoleuca		
Satin Flycatcher [612]		Species or species habitat may occur within area
Migratory Wetlands Species		
Actitis hypoleucos		
Common Sandpiper [59309]		Species or species habitat may occur within area
Calidris acuminata		
Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris ferruginea		
Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos		
Pectoral Sandpiper [858]		Species or species habitat may occur within area
Gallinago hardwickii		
Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area
Numenius madagascariensis		
Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Tringa nebularia		
Common Greenshank, Greenshank [832]		Species or species habitat may occur within area

Other Matters Protected by the EPBC Act

Commonwealth Land [Resource Information]

The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.

Name
Commonwealth Land - Australian Telecommunications Corporation

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
Birds		
Actitis hypoleucos		
Common Sandpiper [59309]		Species or species habitat may occur within area
Apus pacificus		
Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea ibis		
Cattle Egret [59542]		Species or species habitat may occur within area
Calidris acuminata		
Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris ferruginea		
Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area

Name	Threatened	Type of Presence
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Chrysococcyx osculans Black-eared Cuckoo [705]		Species or species habitat likely to occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat may occur within area

Extra Information

State and Territory Reserves	[Resource Information]
Name	State
South West Woodland	NSW

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 Resouces Audit, 2001.

Name	Status	Type of Presence
Birds		
Acridotheres tristis Common Myna, Indian Myna [387]		Species or species habitat likely to occur within area
Anas platyrhynchos Mallard [974]		Species or species

Name	Status	Type of Presence
		habitat likely to occur within area
Carduelis carduelis European Goldfinch [403]		Species or species habitat likely to occur within area
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Passer domesticus House Sparrow [405]		Species or species habitat likely to occur within area
Passer montanus Eurasian Tree Sparrow [406]		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Turdus merula Common Blackbird, Eurasian Blackbird [596]		Species or species habitat likely to occur within area
Mammals		
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		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
Lepus capensis Brown Hare [127]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		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 habitat likely to occur within area
Plants		
Asparagus asparagoides Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat likely to occur within area
Lycium ferocissimum African Boxthorn, Boxthorn [19235]		Species or species habitat likely to occur within area
Rubus fruticosus aggregate Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Sagittaria platyphylla Delta Arrowhead, Arrowhead, Slender Arrowhead [68483]		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.

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Coordinates

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Department of Agriculture Water and the Environment
GPO Box 858
Canberra City ACT 2601 Australia
+61 2 6274 1111

Australian Government

Department of Agriculture, Water and the Environment

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.

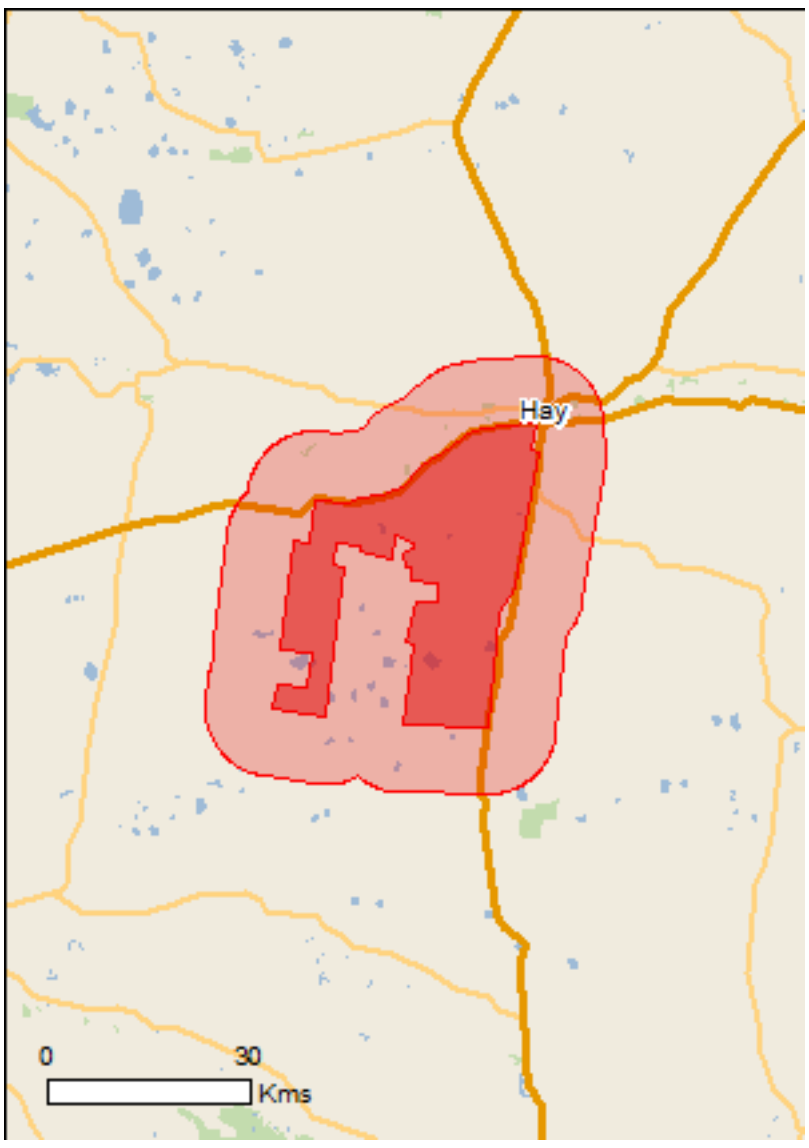
Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

Report created: 20/07/21 10:49:55

Summary
Details
- Matters of NES
- Other Matters Protected by the EPBC Act
- Extra Information

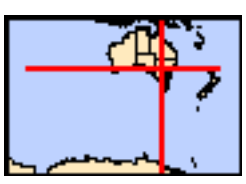
Caveat
Acknowledgements



This map may contain data which are ©Commonwealth of Australia (Geoscience Australia), ©PSMA 2015

Coordinates

Buffer: 10.0Km



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.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	4
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	4
Listed Threatened Species:	25
Listed Migratory Species:	10

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.

Commonwealth Land:	7
Commonwealth Heritage Places:	1
Listed Marine Species:	15
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None

Extra Information

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

State and Territory Reserves:	2
Regional Forest Agreements:	None
Invasive Species:	20
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Wetlands of International Importance (Ramsar) [Resource Information]

Name	Proximity
Banrock station wetland complex	300 - 400km upstream
Hattah-kulkyne lakes	150 - 200km upstream
Riverland	300 - 400km upstream
The coorong, and lakes alexandrina and albert wetland	400 - 500km upstream

Listed Threatened Ecological Communities [Resource Information]

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.

Name	Status	Type of Presence
Buloke Woodlands of the Riverina and Murray-Darling Depression Bioregions	Endangered	Community may occur within area
Grey Box (Eucalyptus microcarpa) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia	Endangered	Community likely to occur within area
Plains mallee box woodlands of the Murray Darling Depression, Riverina and Naracoorte Coastal Plain Bioregions	Critically Endangered	Community may occur within area
Weeping Myall Woodlands	Endangered	Community likely to occur within area

Listed Threatened Species [Resource Information]

Name	Status	Type of Presence
Birds		
Botaurus poiciloptilus		
Australasian Bittern [1001]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea		
Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Falco hypoleucos		
Grey Falcon [929]	Vulnerable	Species or species habitat likely to occur within area
Grantiella picta		
Painted Honeyeater [470]	Vulnerable	Species or species habitat likely to occur within area
Numenius madagascariensis		
Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pedionomus torquatus		
Plains-wanderer [906]	Critically Endangered	Species or species habitat known to occur within area
Pezoporus occidentalis		
Night Parrot [59350]	Endangered	Extinct within area
Polytelis swainsonii		
Superb Parrot [738]	Vulnerable	Species or species habitat known to occur

Name	Status	Type of Presence
		within area
Rostratula australis		
Australian Painted Snipe [77037]	Endangered	Species or species habitat known to occur within area
Fish		
Galaxias rostratus		
Flathead Galaxias, Beaked Minnow, Flat-headed Galaxias, Flat-headed Jollytail, Flat-headed Minnow [84745]	Critically Endangered	Species or species habitat may occur within area
Maccullochella macquariensis		
Trout Cod [26171]	Endangered	Species or species habitat may occur within area
Maccullochella peelii		
Murray Cod [66633]	Vulnerable	Species or species habitat known to occur within area
Macquaria australasica		
Macquarie Perch [66632]	Endangered	Species or species habitat may occur within area
Frogs		
Litoria raniformis		
Growling Grass Frog, Southern Bell Frog, Green and Golden Frog, Warty Swamp Frog, Golden Bell Frog [1828]	Vulnerable	Species or species habitat known to occur within area
Mammals		
Nyctophilus corbeni		
Corben's Long-eared Bat, South-eastern Long-eared Bat [83395]	Vulnerable	Species or species habitat may occur within area
Phascolarctos cinereus (combined populations of Qld, NSW and the ACT)		
Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) [85104]	Vulnerable	Species or species habitat may occur within area
Plants		
Austrostipa metatoris		
[66704]	Vulnerable	Species or species habitat may occur within area
Austrostipa wakoolica		
[66623]	Endangered	Species or species habitat may occur within area
Brachyscome papillosa		
Mossgiel Daisy [6625]	Vulnerable	Species or species habitat known to occur within area
Eleocharis obicis		
a spike rush [15320]	Vulnerable	Species or species habitat may occur within area
Lepidium monoplocoides		
Winged Pepper-cress [9190]	Endangered	Species or species habitat known to occur within area
Maireana cheelii		
Chariot Wheels [8008]	Vulnerable	Species or species habitat likely to occur within area
Solanum karsense		
Menindee Nightshade [7776]	Vulnerable	Species or species habitat may occur within area
Swainsona murrayana		
Slender Darling-pea, Slender Swainson, Murray Swainson-pea [6765]	Vulnerable	Species or species habitat likely to occur within area
Reptiles		
Delma impar		
Striped Legless Lizard, Striped Snake-lizard	Vulnerable	Species or species

Name	Status	Type of Presence
[1649]		habitat may occur within area

Listed Migratory Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus		
Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Migratory Terrestrial Species		
Motacilla flava		
Yellow Wagtail [644]		Species or species habitat may occur within area
Myiagra cyanoleuca		
Satin Flycatcher [612]		Species or species habitat may occur within area
Migratory Wetlands Species		
Actitis hypoleucos		
Common Sandpiper [59309]		Species or species habitat may occur within area
Calidris acuminata		
Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris ferruginea		
Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos		
Pectoral Sandpiper [858]		Species or species habitat may occur within area
Gallinago hardwickii		
Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area
Numenius madagascariensis		
Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Tringa nebularia		
Common Greenshank, Greenshank [832]		Species or species habitat may occur within area

Other Matters Protected by the EPBC Act

Commonwealth Land [Resource Information]

The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.

Name
Commonwealth Land - Australian Postal Commission
Commonwealth Land - Australian Telecommunications Commission
Commonwealth Land - Australian Telecommunications Corporation
Commonwealth Land - Commonwealth Bank of Australia
Commonwealth Land - Commonwealth Trading Bank of Australia
Commonwealth Land - Defence Service Homes Corporation
Commonwealth Land - Telstra Corporation Limited

Commonwealth Heritage Places [Resource Information]

Name	State	Status
Historic		
Hay Post Office	NSW	Listed place

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
Birds		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Chrysococcyx osculans Black-eared Cuckoo [705]		Species or species habitat likely to occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat may occur within area

Extra Information

State and Territory Reserves [Resource Information]

Name	State
Murrumbidgee Valley	NSW
Toogimbie	NSW

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 Resouces Audit, 2001.

Name	Status	Type of Presence
Birds		
Acridotheres tristis Common Myna, Indian Myna [387]		Species or species habitat likely to occur within area
Anas platyrhynchos Mallard [974]		Species or species habitat likely to occur within area
Carduelis carduelis European Goldfinch [403]		Species or species habitat likely to occur within area
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Passer domesticus House Sparrow [405]		Species or species habitat likely to occur within area
Passer montanus Eurasian Tree Sparrow [406]		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Turdus merula Common Blackbird, Eurasian Blackbird [596]		Species or species habitat likely to occur within area
Mammals		
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		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
Lepus capensis Brown Hare [127]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species

Name	Status	Type of Presence
		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 habitat likely to occur within area
Plants		
Asparagus asparagoides Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat likely to occur within area
Lycium ferocissimum African Boxthorn, Boxthorn [19235]		Species or species habitat likely to occur within area
Rubus fruticosus aggregate Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area
Sagittaria platyphylla Delta Arrowhead, Arrowhead, Slender Arrowhead [68483]		Species or species habitat likely to occur within area

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-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
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Department of Agriculture Water and the Environment
GPO Box 858
Canberra City ACT 2601 Australia
+61 2 6274 1111

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Environmental Resources Management Australia Pty Ltd

Level 14, 207 Kent Street
Sydney NSW 2000

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