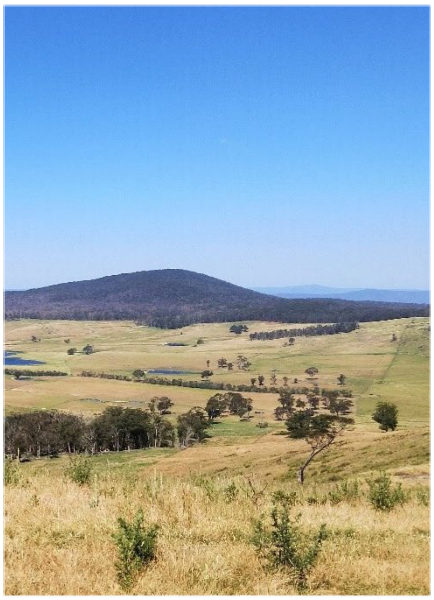
Biodiversity Development Assessment Report

Winterbourne Wind Farm

October 2022

Project Number: 21-570



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Accredited Assessor Declaration

I certify that this report has been prepared on the basis of the requirements of, and information provided under, the Biodiversity Assessment Method and s6.15 of the BC Act. This project has been assessed in accordance with BAM 2020. A full list of staff qualifications and experience can be found in Appendix H of this report. In preparing this assessment I have acted in accordance with the Accredited BAM Assessor Code of Conduct.
I declare that I have considered the circumstances and there is no actual, perceived or potential conflict of interest.
Name: Elizabeth (Beth) Noel
Signature: Noel
Date: 10/10/2022
BAM Assessor Accreditation No: BAAS19015
The development parent case (00022013) and associated child case (00029956) within the BAM Calculator has been finalised as of10/10/2022, with the associated credit report reflected in Revision 16. Please notify NGH when you submit the report and we will submit the BAM-C case to the appropriate regulator.

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Acronyms and abbreviations

AHIMS	Aboriginal Heritage Information Management System
AHIP	Aboriginal Heritage Impact Permit
AOS	Assessment of Significance
AWS	Automatic weather station
BAM	Biodiversity Assessment Method 2020
BC Act	*Biodiversity Conservation Act 2016* (NSW)
BCAR	Biodiversity Certification Assessment Report
BCD	Biodiversity Conservation Division (NSW)
BDAR	Biodiversity Development Assessment Report
Biosecurity Act	*Biosecurity Act 2015* (NSW)
BOM	Australian Bureau of Meteorology
BOS	Biodiversity Offset Scheme
CAMBA	China-Australia Migratory Bird Agreement
CEMP	Construction environmental management plan
Cwth	Commonwealth
DAWE	Department of Agriculture, Water and the Environment (Cwth) (formerly DoEE)
DECCW	(Former) Department of Environment, Climate Change and Water (NSW) (now DPIE)
DoEE	(Former) Department of the Environment and Energy (Cwth) (now DAWE)
DPE	Department of Planning and Environment (NSW) formerly DPIE
DPIE	Department of Planning, Industry and Environment (NSW)
EEC	Endangered ecological community – as defined under relevant law applying to the proposal
EES	Environment, Energy and Science (NSW), Division of DPIE (formerly OEH, and, prior, DECCW)
EIA	Environmental impact assessment
EIS	Environmental impact statement
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Cwth)
EP&A Act	*Environmental Planning and Assessment Act 1979* (NSW)
ESD	Ecologically Sustainable Development
FM Act	*Fisheries Management Act 1994* (NSW)

ha	hectares
Heritage Act	_Heritage Act 1977_ (NSW)
ISEPP	State Environmental Planning Policy (Infrastructure) 2007 (NSW)
JAMBA	Japan-Australia Migratory Bird Agreement
KFH	Key Fish Habitat
km	kilometres
LALC	Local Aboriginal Land Council
m	metres
MW	Megawatt
MWh	Megawatt-hour
NES	Matters of National Environmental Significance under the EPBC Act (_c.f._)
NPW Act	_National Parks and Wildlife Act 1974_ (NSW)
NSW	New south Wales
NV Act	_Native Vegetation Act 2003_ (NSW)
OEH	(Former) Office of Environment and Heritage (NSW) (now EES)
PCT	Plant Community Type
REF	Review of Environmental Factors
REP	Regional Environmental Plan
ROKAMBA	Republic of Korea Migratory Bird Agreement
RSA	Rotor swept area
SEARs	Standard Secretary's Environmental Assessment Requirements
TDBC	Threatened species data base – Office of Environment Heritage NSW Government
WTG	Wind Turbine Generator

Executive summary

Aim of this report

This Biodiversity Development Assessment Report (BDAR) assesses the Winterbourne Wind Farm (the Project) for potential impacts to biodiversity in accordance with the Biodiversity Assessment Method (BAM) 2020, pursuant to the New South Wales *Biodiversity Conservation Act 2016*. The Winterbourne Wind Farm is considered State Significant Development (SSD) in NSW, as defined under the *Environmental Planning and Assessment Act 1979* (EP&A Act). This BDAR addresses the Secretary's Environmental Assessment Requirements (SEARs) for the Project issued in September 2020, as well as Supplementary Secretary's Environmental Assessment Requirements provided by the Federal Department of Agriculture, Water and the Environment (DAWE). It is supported by a Land Category Assessment and Desktop Haulage Route Upgrade Risk Assessment.

The Project

WinterbourneWind Pty Ltd (WinterbourneWind) are proposing to develop the Winterbourne Wind Farm within the New England Renewable Energy Zone. The Project will be located to the north and east northeast from the town of Walcha and is located within the Walcha and Uralla Local Government Areas. The Project will comprise up to 119 wind turbine generators and associated infrastructure, with a combined maximum capacity of approximately 700 megawatts (MW). It will include a battery energy storage system, two substations, approximately 50km of overhead transmission line, and approximately 113km of internal access tracks. The Project will also include minor road upgrades along the haulage route from the Port of Newcastle to the site.

The Project conforms to the definition of a linear-based development under the Biodiversity Assessment Method 2020 and the linear-based development assessment methodology has been used in this assessment.

Survey methodology

The Winterbourne Wind Farm is a large site and surveys were planned and conducted strategically in order to meet the requirements of the Biodiversity Assessment Method (BAM). The final development footprint is a result of many overlapping constraints, of which ecology is one. The development site was surveyed iteratively, during the refinement of the project, to ensure higher biodiversity value areas were first considered for avoidance. Survey methodology started broadly, by verifying plant community types, zone boundaries and higher biodiversity value areas. The survey intensity then increased as the development footprint became more certain. Survey intensity in these areas reflected both habitat value (more focus on areas of higher value that could not be avoided) and accessibility, to achieve sufficient representative data in accordance with the Biodiversity Assessment Method. The following is a summary of the field surveys undertaken:

- BAM plots - 140 total.
- Fauna surveys – surveys were conducted for 27 species credits species.
- Flora surveys - surveys were conducted for 23 species credit species.
- A total of 144 step point transects were conducted to support the Land Category Assessment.
- Vegetation mapping was conducted including exotic and native areas. Vegetation has been classified into zones based on vegetation structure and condition.
- Four Bird Utilisation Surveys (BUS) were completed.

Results

Ten native plant community types were identified within the development site:

- 510: Blakely's Red Gum - Yellow Box grassy woodland of the New England Tableland Bioregion (TEC)
- 526: Mountain Ribbon Gum - Messmate - Broad-leaved Stringybark open forest on granitic soils of the New England Tableland Bioregion
- 534: New England Peppermint grassy woodland on sedimentary or basaltic substrates of the New England Tableland Bioregion (TEC)
- 565: Silvertop Stringybark - Mountain Gum grassy open forest of the New England Tableland Bioregion
- 567: Broad-leaved Stringybark - Yellow Box shrub/grass open forest of the New England Tableland Bioregion (TEC and non TEC)
- 568: Broad-leaved Stringybark shrub/grass open forest of the New England Tableland Bioregion
- 766: Carex sedgeland of the slopes and tablelands
- 970: Narrow-leaved Peppermint - Wattle-leaved Peppermint shrubby open forest of the New England Tableland Bioregion
- 997: New England stringybarks - peppermint open forest of the New England Tableland Bioregion
- 1194: Snow Gum - Mountain Gum - Mountain Ribbon Gum open forest on ranges of the NSW North Coast Bioregion and eastern New England Tableland Bioregion (TEC)

Vegetation integrity ranges from very low in some derived grasslands to very high in more intact forest communities. The latter have been the focus of avoidance strategies since the early planning stages of the project.

Eight target species were verified to be present through surveys:

- Squirrel Glider *Petaurus norfolcensis*
- Koala *Phascolarctos cinereus*
- Greater Glider *Petauroides volans*
- Glossy Black-Cockatoo *Calyptorhynchus lathami*
- Barking Owl *Ninox connivens*
- Narrow-leaved Black Peppermint *Eucalyptus nicholii*
- Bluegrass *Dichanthium setosum.*
- Spotted-tailed Quoll *Dasyurus maculatus*

No species are assumed to be present based on, no survey, or lack of survey effort.

During the public exhibition of the Environmental Impact Statement and the subsequent response to agency and community submissions, the following additional surveys will be completed:

- Additional hollow bearing tree surveys to quantify hollow dependent species habitat.

- Additional camera trapping and hair tubes to confirm lack of detection for Eastern Pygmy Possum and Rufous Bettong. Surveys were done as per proposed methodology, however BCS provided feedback after surveys had commenced that additional survey was required.
- Additional Little Eagle surveys to be conducted during breeding season.

Avoid and minimise strategies

The proposed avoid and minimise measures are in accordance with the development mitigation hierarchy, which aims for a result of 'no net loss' of biodiversity through implementing, in the following order, avoidance, mitigation, rehabilitation/restoration and offsetting. Avoid and minimise strategies have been developed:

- Through site selection and consideration of alternatives
- In consideration of preliminary constraints mapping, detailed ecological surveys and agency consultation.

The Project commits to design, construction and operational strategies to reduce biodiversity impacts. It is important to note that whilst the project is spread over a large area, the actual impact area is small, and the impacts will be addressed through extensive mitigation measures.

The key biodiversity impact for this project is the potential to have ongoing population impacts on birds or bats that are either excluded or injured by operational turbines. Extensive bird and bat utilisation data and risk assessment modelling has been undertaken to ensure that turbine placements minimise potential impacts. A Bird and Bat Adaptive Management Plan will be prepared to identify specific adaptive mitigation measures in the case that impacts are greater than predicted. Wind sector management (operationally shutting down certain turbines) is one method that can be used to limit impacts during higher risk periods.

Offsets

The residual offsets generated, after avoidance, minimisation and mitigation are summarised below.

Table 1-1 Summary of ecosystem credits generated

PCT	TEC	Area	Credits
510-Blakely's Red Gum - Yellow Box grassy woodland	Yes	20.1	592
526-Mountain Ribbon Gum - Messmate - Broad-leaved Stringybark open forest on granitic soils	No	69.4	1085
534-New England Peppermint grassy woodland on sedimentary or basaltic substrates	Yes	14.4	396
565-Silvertop Stringybark - Mountain Gum grassy open forest	No	20	386
567-Broad-leaved Stringybark - Yellow Box shrub/grass open forest (TEC)	Yes	128.9	3325
567-Broad-leaved Stringybark - Yellow Box shrub/grass open forest (non TEC)	No	38.4	1097

PCT	TEC	Area	Credits
568-Broad-leaved Stringybark shrub/grass open forest	No	21.6	248
766-Carex sedgeland of the slopes and tablelands	No	1.6	17
970-Narrow-leaved Peppermint - Wattle-leaved Peppermint shrubby open forest	No	72.8	690
997-New England stringybarks - peppermint open forest	No	16.3	187
1194-Snow Gum - Mountain Gum - Mountain Ribbon Gum open forest on ranges	Yes	23.6	164

Table 1-2 Summary of species credits generated

Species	Area / Count	Credits
Calyptorhynchus lathami / Glossy Black-Cockatoo	33.8	987
Dichanthium setosum / Bluegrass	13.2	180
Eucalyptus nicholii / Narrow-leaved Black Peppermint	13	26
Ninox connivens / Barking Owl	17.7	530
Petauroides volans / Greater Glider	206.5	5694
Petaurus norfolcensis / Squirrel Glider	206.5	5694
Phascolarctos cinereus / Koala	206.9	5709

Further targeted surveys are planned to continue concurrent with the public exhibition of the EIS. If species presumed present cannot be ruled out by targeted surveys prior to the Development's determination, then the retirement of the credits for all entities above will be carried out in accordance with the NSW Biodiversity Offsets Scheme, and will be achieved by either:

a) Retiring credits under the Biodiversity Offsets Scheme based on the like-for-like rules, or
b) Making payments into the Biodiversity Conservation Fund using the offset payments calculator, or
c) Funding a biodiversity action that benefits the threatened species impacted by the development.

Environmental assessment requirements

Secretary's Environmental Assessment Requirements

The Secretary's Environmental Assessment Requirements (SEARs) for the Winterbourne Wind Farm were issued in September 2020 (SSD-10471). A summary of the SEARs requirements and the sections in which they have been addressed are set out in Table 1-3 and Table 1-4.

Table 1-3 SEARs for Biodiversity

Assessment requirements	Section addressed in BDAR
The EIS must assess biodiversity values and the likely biodiversity impacts of the development, including impacts associated with transport route road upgrades and indirect impacts on the Oxley Wild Rivers National Park, in accordance with the Biodiversity Conservation Act 2016 (NSW) (BC Act) and EPBC Act, including a detailed description of the proposed regime for minimising, managing and reporting on the biodiversity impacts of the development over time, and a strategy to offset any residual impacts of the development in accordance with the BC Act;	World Heritage Areas are addressed in Section 7.5.3 This BDAR details avoid and minimise actions in Section 6 and offsetting in Section 10
The EIS must assess the impact of the development on the Oxley Wild Rivers National Park in accordance with the Guidelines for Development Adjoining Land and Water Managed by OEH (OEH 2010);	Section 7.5.3
The EIS must assess the likely impacts on koalas and their habitat in accordance with the requirements of State Environmental Planning Policy No. 44 – Koala Habitat Protection;	Section 1.1.1 Section 7.2 Section 4.2.5 Appendix L.4
The EIS must assess the impact of the project on birds and bats from blade strikes, low air pressure zones at the blade tips (barotrauma), and alteration to movement patterns resulting;	Section 7.3.3

Table 1-4 Agency biodiversity assessment requirements

Assessment requirements	Section addressed in BDAR
The EIS must assess impacts of the Winterbourne Wind Farm on the following threatened species and threatened ecological communities that have been recorded, or are known to occur, within the project boundary: • Narrow-leaved black peppermint (*Eucalyptus nicholii*); • Austral toadflax (*Thesium australe*); • Spotted-tailed quoll (*Dasyurus maculatus*); • Koala (*Phascolarctos cinereus*), • Greater glider (*Petauroides Volans*), • Scarlet robin (*Petrocia boodang*), • New England Peppermint (*Eucalyptus nova-anglica*)	Section 4 Section 5 Section 7 Section 9

Assessment requirements	Section addressed in BDAR
Woodland on Bassalts and Sediments in the New England Tableland Bioregion, • White Box, Yellow Box, Blakely's Red Gum Woodland in the New England Tablelands.	
The EIS must assess the impacts of wind turbine strikes on protected animals in accordance with Section 9.2.1.8 of the Biodiversity Assessment Method.	Section 7.3.3
Biodiversity impacts related to the proposed [development/ project] are to be assessed in accordance with Section 7.9 of the BC Act and the Biodiversity Assessment Method and documented in a Biodiversity Development Assessment Report (BDAR). The BDAR must include Information in the form detailed in the BC Act (s6.12), Biodiversity Conservation Regulation 2017 (s6.8) and Biodiversity Assessment Method, unless Biodiversity and Conservation Division and Planning and Assessment Group determine that the proposed development is not likely to have any significant impacts on biodiversity values.	Addressed throughout.
The BDAR must document the application of the avoid, minimise and offset framework including assessing all direct, indirect and prescribed impacts in accordance with the Biodiversity Assessment Method.	Section 6 Section 7
The BDAR must include details of the measures proposed to address the offset obligation as follows: • The total number and classes of biodiversity credits required to be retired for the development/project, • The number and classes of like-for-like biodiversity credits proposed to be retired, • The number and classes of biodiversity credits proposed to be retired in accordance with the variation rules, • Any Project to fund a biodiversity conservation action, • Any Project to conduct ecological rehabilitation (if a mining project), • Any Project to make a payment to the Biodiversity Conservation Fund.	Section 10
The BDAR must be submitted with all spatial data associated with the survey and assessment as per Appendix 11 of the BAM.	Provided separately.
The BDAR must be prepared by a person accredited in accordance with the Accreditation Scheme for the Application of the Biodiversity Assessment Method Order 2017 under s6.10 of the BC Act.	Document verification page (after cover page)
For threatened species known to inhabit the Oxley Wild Rivers National Park and the surrounding areas, the EIS must demonstrate how the project can: • Avoid habitat isolation / degradation caused by noise generated from the wind farm to Yellow-bellied Glider, Greater Glider, Spotted-tailed Quoll, Koala and Large Forest Owls. • Avoid vegetation clearing and the loss of connectivity to	Section 7.2 Section 7.3.1 Section 7.5.1 Section 7.5.3

Assessment requirements	Section addressed in BDAR
mature arboreal habitat between remnant vegetation and the national park.	

Department of Climate Change, Energy, Environment and Water requirements

On 31 August 2020, a delegate of the Federal Minister for the Department of Agriculture, Water and the Environment (DAWE; note, now the Department of Climate Change, Energy, Environment and Water) determined that the project was a controlled action under Section 75 of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Supplementary SEARs are summarised below and are also addressed within this BDAR.

Table 1-5 Controlled action biodiversity assessment requirements.

Assessment requirements	Section addressed in BDAR
The title of the action, background to the action and current status.	Section 1
The precise location and description of all works to be undertaken (including associated offsite works and infrastructure), structures to be built or elements of the action that may have impacts on Matters of National Environmental Significance (MNES).	Section 1.2
8. How the action relates to other actions that have been or are being taken in the region affected by the action.	Section 6.1
9. How the works are to be undertaken and design parameters for those aspects of the structures or elements of the action that may have relevant impacts on MNES.	Section 1.1
10. The EIS must include an assessment of the relevant impacts of the action on the matters protected by the controlling provisions, including: i) a description and detailed assessment of the nature and extent of the likely direct, indirect and consequential impacts, including short term and long-term relevant impacts, ii) a statement whether any relevant impacts are likely to be unknown, unpredictable or irreversible, iii) analysis of the significance of the relevant impacts, and iv) any technical data and other information used or needed to make a detailed assessment of the relevant impacts.	Section 7
11. For each of the relevant matters protected that are likely to be significantly impacted by the action, the EIS must provide information on proposed avoidance and mitigation measures to manage the relevant impacts of the action including: i) a description, and an assessment of the expected or predicted effectiveness of the mitigation	Section 8

Assessment requirements	Section addressed in BDAR
measures, ii) any statutory policy basis for the mitigation measures, iii) the cost of the mitigation measures, iv) an outline of an environmental management plan that sets out the framework for continuing management, mitigation and monitoring programs for the relevant impacts of the action, including any provisions for independent environmental auditing, v) the name of the agency responsible for endorsing or approving each mitigation measure or monitoring program.	
12. Where a significant residual adverse impact to a relevant protected matter is considered likely, the EIS must provide information on the proposed offset strategy, including discussion of the conservation benefit associated with the proposed offset strategy.	Section 10
13. For each of the relevant matters likely to be impacted by the action the EIS must provide reference to, and consideration of, relevant Commonwealth guidelines and policy statements including any: i) conservation advice or recovery plan for the species or community ii) relevant threat abatement plan for a process that threatens the species or community iii) wildlife conservation plan for the species iv) any strategic assessment.	Section 7.5 Appendix L
14. The EIS must identify each EPBC Act listed threatened species and community and migratory species likely to be impacted by the action. For any species and communities that are likely to be impacted, the proponent must provide a description of the nature, quantum and consequences of the impacts. For species and communities potentially located in the project boundary or in the vicinity that are not likely to be impacted, provide evidence why they are not likely to be impacted.	Appendix J Appendix L
15. Further analysis of the impacts of the 2019-2020 bushfires on EPBC Act-listed threatened species and communities should be undertaken during the assessment. Further assessment will determine whether the remaining habitat within the proposed action area is of substantially greater importance to the survival of the listed threatened species following the fires and/or whether the population of the species in the area is considered an important population.	Section 7.5
16. For each of the EPBC Act listed threatened species and communities and migratory species likely to be impacted by the action the EIS must provide a separate: i) description of the habitat (including identification and mapping of suitable breeding habitat, suitable foraging habitat, important populations and habitat critical for survival), with consideration of, and	Section 7.5 Appendix J Appendix L

Assessment requirements	Section addressed in BDAR
reference to, any relevant Commonwealth guidelines and policy statements including listing advice, conservation advice and recovery plans, ii) details of the scope, timing and methodology for studies or surveys used and how they are consistent with (or justification for divergence from) published Australian Government guidelines and policy statements, iii) description of the relevant impacts of the action having regard to the full national extent of the species or community's range, and iv) description of the specific proposed avoidance and mitigation measures to deal with relevant impacts of the action, v) identification of significant residual adverse impacts likely to occur after the proposed activities to avoid and mitigate all impacts are taken into account, vi) description of any offsets proposed to address residual adverse significant impacts and how these offsets will be established, vii) details of how the current published NSW Biodiversity Assessment Methodology (BAM) has been applied in accordance with the objects of the EPBC Act to offset significant residual adverse impacts, and viii) details of the offset package to compensate for significant residual impacts including details of the credit profiles required to offset the action in accordance with the NSW Biodiversity Assessment. Methodology and/or mapping and descriptions of the extent and condition of the relevant habitat and/or threatened communities occurring on proposed offset sites;	
17. Any significant residual impacts not addressed by the BAM may need to be addressed in accordance with the Environment Protection and Biodiversity Conservation Act 1999 Environmental Offset Policy.	Section 7.5
18. The EIS must assess the project's potential impacts on the listed values of the World Heritage Property, particularly regarding potential impacts on the diversity or composition of plant and animal species. The assessment must consider whether the project may fragment, isolate or substantially damage habitat important for the conservation or biological diversity in the World Heritage Property. The EIS must also assess the project's potential impacts on the listed values of the National Heritage Place.	Sections 7.5.3
19. The broad taxonomic groups that establish the biodiversity value of the World Heritage Property are listed within three supporting documents. These are the Statement of Outstanding Universal Value, Management Plan and the Nomination Document. Under the World Heritage criterion (x): i) All listed threatened species listed under the NSW	Section 7.5.1

Assessment requirements	Section addressed in BDAR
Biodiversity Conservation Act 2016 (BC Act) and the EPBC Act that occur in the World Heritage property are automatically Matters of National Environmental Significance. ii) Taxonomic groups that are listed in the aforementioned documents but are not separately listed as threatened species under either Commonwealth or State legislation, are attributes of the World Heritage Value of the property, and therefore become Matters of National Environmental Significance in the context of the World Heritage property.	
20. For the World and National Heritage listed Gondwana rainforests of Australia, the proponent should also consider: i) Identification and assessment of impacts to downstream environments under a range of climate scenarios. ii) Assessment on the movement of species, that establish the biodiversity value of the World Heritage Property, from the adjacent World Heritage Property to the proposed action area. iii) A description of the recent 2019/2020 bushfire event and its impacts on the World Heritage Property. Further consideration should be given to remaining vegetation patches and their importance for the preservation of the property.	Section 7.5.3

The following Table 1-6 addresses wind farm assessment requirements under the Biodiversity Assessment Method (BAM 2020).

Table 1-6 Wind farm assessment requirements under the Biodiversity Assessment Method (BAM 2020).

Biodiversity Assessment Method Order 2020 requirement	Relevant section	Description
Section 6.1.5 Wind farm developments		
1. For a wind farm development, the assessor must identify a list of protected animals that may use the development site as a flyway or migration route, including: a. resident threatened aerial species b. resident raptor species c. nomadic and migratory species that are likely to fly over the proposed development site.	Addressed in Table 1 of Bird and Bat Risk Assessment Summarised in Section 7.3 of BDAR	This has been outlined in the Risk Assessment (Appendix D). Table 2 of the Risk Assessment outlines all listed migratory and threatened species and species of concern (including raptors) that have the potential to fly over the study area. Section 7.3 also addresses this topic.
2. For the species identified above, the assessor must perform a targeted survey: a. using appropriate methods as per	Addressed in BUS	Bird utilisation surveys have been undertaken at the study area throughout the year to gather data on species flying across

Biodiversity Assessment Method Order 2020 requirement	Relevant section	Description
Section 5.3 b. using methods that measure movement of a species (e.g. ultrasonic bat detectors on monitoring masts or other structures of suitable height) c. at times of the year appropriate for identifying the species d. as part of an ongoing monitoring program post development approval, and/or e. in accordance with any guide published by the Department for this purpose.	Summarised in Section 7.3 of BDAR	the study area. Similarly bat surveys have been undertaken using ultrasonic bat detectors to determine which species are present. Flight paths of raptors have been recorded. NGH has conducted targeted surveys for Glossy Black-Cockatoo and threatened owls. The white-throated Needletail was identified through the risk assessment as a threatened species of concern of collision with turbines and targeted surveys were initiated. Results of the survey are included in Appendix Q.
3. The technique, effort and timing of targeted surveys for each species must be documented and justified in the BAR.	Provided in section 4.2.5	Information provided in relation to targeted surveys is in section 4.2.5
4. Based on the outcomes of the targeted surveys, the assessor must: a. predict and map the habitual flight paths for nomadic and migratory species likely to fly over the proposed development site on the Site Map and Location Map. b. map the likely habitat for resident threatened aerial and raptor species on the Site Map.	Flight data for raptors is provided in Section 3 of BUS report	We have flight data for raptors and this has been incorporated into the BUS report and can be used in the BDAR if required. It is difficult to capture any meaningful data and flight paths for other nomadic and migratory species due to the low levels of activity across the site. White-throated Needletail have not been recorded in surveys thus far.
Section 8.3.5 Wind turbine strike 1. Assessment of the impacts of wind turbine strikes on protected animals identified in Subsection 6.1.5 must:		
a. predict the: i. impact on species living in, or likely to fly over, the proposed development site, including bat or bird strike and barotrauma.	Direct and indirect impacts on threatened bird and bat species assessed in the Bird and Bat Risk Assessment (Table 6)	The Bird and Bat Risk Assessment process for impacts to bird and bat species includes a description of hazard (direct or indirect), an evaluation of the likelihood and consequence of the risk event, and allocation of a risk rating.
ii. rate and timing of impact per turbine per year for species likely to be affected.	A general summary of collision risk is included in Section 6.7 of Bird and Bat Risk Assessment	A CRM is required to predict rate and timing of impact per turbine per year. A post construction analysis on bird and bat mortality in western Victoria has been summarised and included in the risk assessment.
iii. consequences of impacts for the persistence of populations.	Impacts to populations assessed in the Bird and Bat Risk	Outlined in the Risk Assessment (Table 6).

Biodiversity Assessment Method Order 2020 requirement	Relevant section	Description
	Assessment (Table 6)	
iv. cumulative impacts of the proposed development alongside existing wind farms, on species mortality, movement patterns and use of adjacent habitat.	Section 6.7 of the Bird and Bat Risk Assessment provides information on average mortality rates for birds and bats	Average collision rates for birds and bats are described in the Bird and Bat Risk Assessment.
v. likelihood and nature of impacts on aerial species living in, or likely to fly over, the proposed development site, including barriers to migratory pathways, and breeding, feeding and resting resources.	Impacts to aerial species assessed in the Bird and Bat Risk Assessment (Section 5)	BUS, WTNT, BBRA and prescribed impacts.
vi. impact of avoidance behaviour for migratory species relative to migration distances, and the availability of suitable habitat for breeding, feeding and resting over the migration route.	Avoidance behaviour for White-throated Needletail addressed in the WTNT Survey Report	White-throated Needletail is the critical migratory species. Other migratory species that may occur in the study area are likely to migrate in the tree canopy and fly through forested areas.
b. justify predictions with reference to data, collision risk modelling (if available), relevant literature or other published sources including any publications by the Department.	Bird and Bat Risk Assessment is provided in Appendix E.	Nature Advisory Risk Assessment, provided in Appendix E
c. map the disturbance zone around wind turbines, and the significant landscape and habitat features within that zone, for species likely to be affected, e.g. hollow bearing trees and important habitat for migratory species.		Disturbance zone would be the Tower, RSA, hard stand, access tracks and overhead transmission line. Broad disturbance buffers of 120m from tower and 50m either side of access tracks and overhead transmission lines were used. There are habitat descriptions of each BUS point in the BUS report.

1. Introduction

This Biodiversity Development Assessment Report (BDAR) assesses the Winterbourne Wind Farm (the project) for potential impacts to biodiversity in accordance with the Biodiversity Assessment Method (BAM) 2020, pursuant to the NSW *Biodiversity Conservation Act 2016* (BC Act). The Winterbourne Wind Farm is considered State Significant Development (SSD) in NSW. This BDAR addresses project-specific Secretary's Environmental Assessment Requirements (SEARs) issued in September 2020 for the Project as well as Supplementary SEARs provided by the Federal Department of Agriculture, Water and the Environment (DAWE).

This BDAR is supported by a Land Category Assessment (Appendix A) and Desktop Haulage Route Upgrade Risk Assessment (Appendix B).

1.1 The proposal

WinterbourneWind Pty Ltd (WinterbourneWind) are proposing to develop the Winterbourne Wind Farm (hereon referred to as the Project) in the Northern Tablelands of New South Wales. The site is located within the proposed New England Renewable Energy Zone (REZ). The Project would be located to the north and east of the town of Walcha and is located within the Walcha and Uralla Local Government Areas (LGA).

The project site is approximately 24,100ha, the development site is 4424.58 hectares (ha) and the development footprint is 586.17.

The project would comprise of up to 119 wind turbine generators (WTG), with a combined maximum capacity of approximately 700 megawatts (MW).

The Project is proposed to include:

- Up to 119 Wind Turbine Generators (WTGs), each with:
  - a generating capacity of approximately 6.2 MW,
  - three blades mounted to a rotor hub (hub height of 149 m) on a nacelle above a tubular steel tower, with a blade tip height (blade length plus hub height) of up to 230m Above Ground Level (AGL),
  - a gearbox and generator assembly housed in the nacelle, and
  - adjacent hardstands for use as crane pads, assembly and laydown areas.
- Two 33/330 kV electrical substations, including control room, transformers, circuit breakers, switches and other ancillary equipment,
- An operations and maintenance facility,
- A battery energy storage system (BESS) of up to 100 MW/200 MWh capacity (two hours of storage),
- Aboveground and underground 33 kV electrical reticulation and fibre optic cabling connecting the WTGs to the onsite substations (generally following site access tracks),
- A 330 kV single or double circuit twin conductor overhead transmission line route of approximately 50km connecting the two substations to a new electrical switchyard (including circuit breakers, switches and other ancillary equipment), located approximately 7km south of Uralla and adjacent to TransGrid's 330 kV Tamworth to Armidale transmission line (Line 85),

- Internal access tracks (combined total length of approximately 113km) connecting the WTGs and associated Project infrastructure with the public road network, and
- Upgrades to roads and intersections required for the delivery of oversize and over mass WTG components, transformers and associated construction-phase materials and vehicular movements:
    - Minimum 5.5m carriageway width,
    - A minimum vertical clearance of 4m to any overhanging obstructions, including tree branches,
    - Property access must provide a suitable turning area,
    - Curves have a minimum inner radius of 6m and are minimal in number to allow for rapid access and egress,
    - The minimum distance between inner and outer curves is 6m,
    - The crossfall is not more than 10 degrees; maximum grades for sealed roads do not exceed 15 degrees and not more than 10 degrees for unsealed roads.
- Decommissioning of four meteorological monitoring masts and installation of up to two permanent meteorological monitoring masts for power testing. The permanent monitoring masts will be located close to a WTG location with a maximum height of approximately 149m AGL, equivalent to the hub height of the installed WTGs,
- The following temporary elements will be required during the construction phase of the Project:
    - Site buildings and facilities for construction contractors / equipment, including site offices, car parking and amenities for the construction workforce,
    - Mobile concrete batching plant/s to supply concrete for WTG footings and substation construction works,
    - Earthworks for access tracks, WTG platforms and foundations, potentially including controlled blasting in certain areas,
    - Potential rock crushing facilities for the generation of suitable aggregates for concrete batching and/or for access track and hardstand construction,
    - Hardstand laydown areas for the storage of construction materials, plant, and equipment,
    - Up to four temporary meteorological monitoring masts. The temporary monitoring masts will be located close to a WTG location with a maximum height of approximately 149m AG,
    - External water supply and storage for concrete batching and construction activities,
    - The transport, storage and handling of fuels, oils and other hazardous materials for construction and operation of wind farm infrastructure, and
    - Beneficial reuse of materials won from within the development footprint during cut and fill and WTG foundation excavation works for use in access track, hardstands and foundation material.

In addition to the wind farm infrastructure, the Project will involve upgrades to some local roads and private property to facilitate haulage of WTG components from the Port of Newcastle to the development site (Appendix B). Some of these works will require removal of vegetation. These areas along the haul route have also been subject to assessment as follows:

- Upgrades between the Port of Newcastle and the Walcha area are described and assessed via a Desktop Haulage Route Upgrade Risk Assessment, provided in Appendix B.
- Upgrades between Walcha and the site are addressed within the BDAR (with the addition of limited additional areas between Tamworth and Walcha, where more extensive impacts are predicted).

1.1.1 Definitions

The BAM is legislated under the BC Act and as such, terminology is prescribed and sometimes differs from the terms used in the Environmental Impact Assessment. The following terms are used in this document:

- Development footprint – The area of land that is directly impacted by the project where vegetation is to be removed, as described in Section 1.1. It captures all temporary and permanent impact areas required for the project, from construction through to operation.
- Development site – synonymous with subject land, defined by a 100m buffer to the development footprint, and is the area in which Stage 1 of the BAM has been applied to assess the biodiversity values of the land where direct and indirect impacts may occur. As the development site is used in other specialist reports for this Project, the BDAR adopts this term only to reduce confusion, and it should be taken to mean ‘subject land’ as defined by the BAM. The development footprint is sited within the development site, together with areas of land that are subject to potential direct and indirect impacts from the proposal.
- Assessment area – All land within a 500m buffer area of the development site, as appropriate for linear development under the BAM.

1.2 The development site

1.2.1 Development site location

The development site (Figure 1-1) is located in the Northern Tablelands of New South Wales to the north and east of the town of Walcha. The project boundary falls into both the Walcha and Uralla Local Government Areas (LGA). To the east of the site lies Oxley Wild Rivers National Park, Carrai National Park and Willi Willi National Park.

1.2.2 Development site description

The topography of the development site is generally undulating with steep vegetated hills. The development site is predominantly used for agriculture and the land is dominated by exotic grasslands created as part of grazing activities. There is a higher percentage of native canopy vegetation within steeper terrain. The Oxley Wild Rivers National Park is situated to the east of the development site.

1.3 Source of information used in the assessment

The following details sources of information were used in the preparation of this report. The full list of references is presented in Section 12.

- Australia’s IBRA bioregions and subregions (Department of Agriculture, Water and the Environment, 2020) http://environment.gov.au/land/nrs/science/ibra/australias-bioregions-maps

- Department of Environment and Climate Change NSW (Department of Environment and Climate Change, 2002). Descriptions for NSW (Mitchell) Landscapes, Version 3
- NSW Biodiversity Assessment Method (BAM) calculator (Department of Planning, Industry and Environment, n.d.) (www.environment.nsw.gov.au/bbccapp/ui/mynews.aspx)
- NSW OEH's BioNet threatened biodiversity database (Office of Environment and Heritage, 2021)
- Accessed online via login at www.bionet.nsw.gov.au
- BioNet Vegetation Classification Database (Department of Planning, Industry and Environment, 2021)
- Accessed online via login at: www.environment.nsw.gov.au/NSWVCA20PRapp/default.aspx
- OEH VIS Mapping (Department of Planning, Industry and Environment, 2019)
- Accessed online at http://www.environment.nsw.gov.au/research/VISmap.htm
- NSW Department of Planning Infrastructure and Environment BAM (Department of Planning, Industry and Environment, 2020).
- NSW Government SEED Mapping (SEED, 2021)
- https://geo.seed.nsw.gov.au/Public_Viewer/index.html?viewer=Public_Viewer&locale=en-AU
- NSW Biodiversity Values Map (Department of Planning, Industry and Environment, 2021)
- www.lmbc.nsw.gov.au/Maps/index.html?viewer=BVMap
- Aerial imagery of historical land use (Sourced from Google Earth and NSW Spatial Services Delivery)

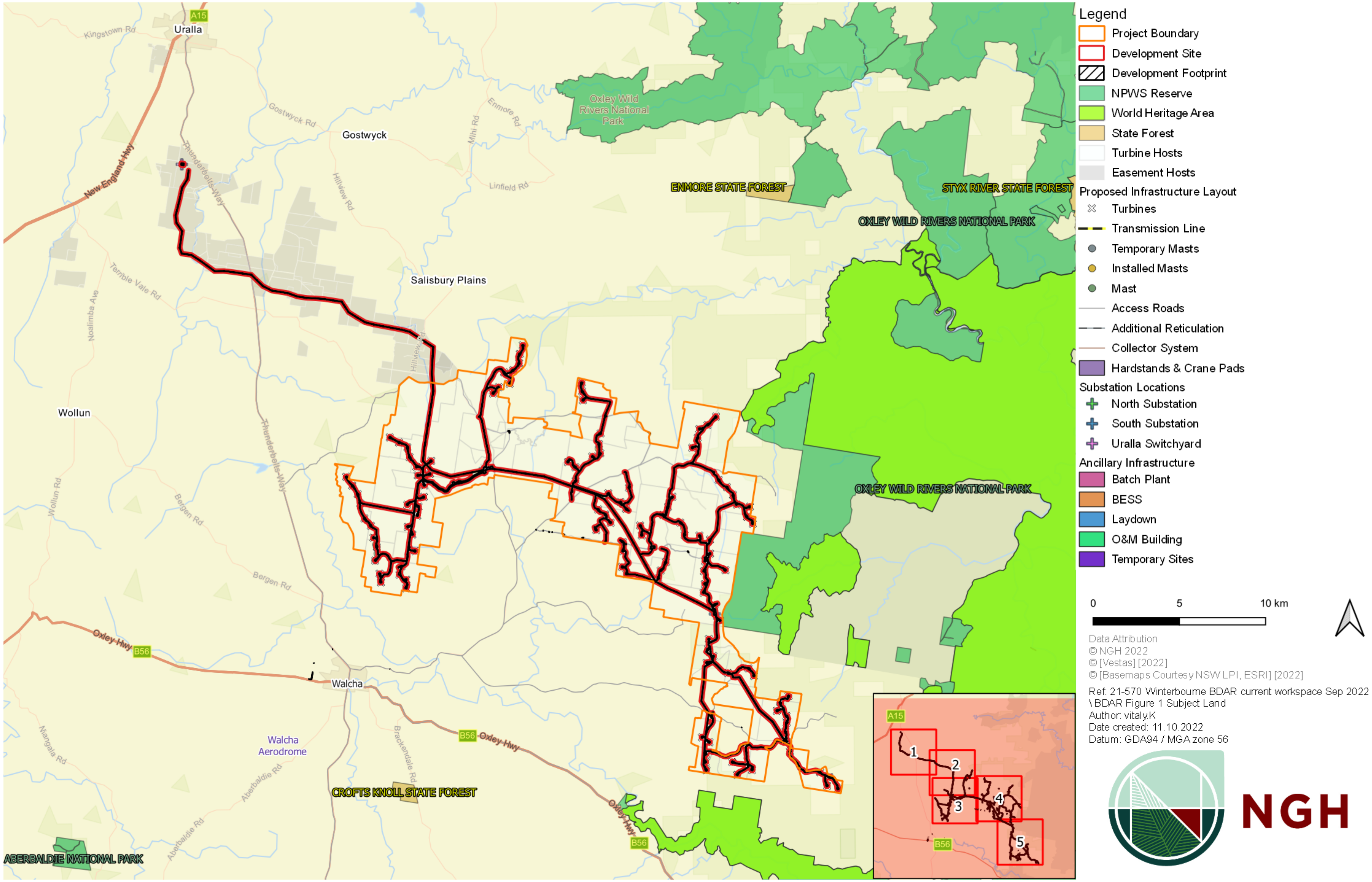


Figure 1-1 Development site, development footprint and assessment area (detailed mapping is provided in Appendix N.1)

2. Landscape context

A landscape-scale assessment was conducted with particular focus on the development site along with a 500m buffer (the assessment area). The site is located within land zoned as RU1 (Primary Production). Land located immediately adjacent to the site is zoned RU1 (Primary Production). Walcha (R1 (General Residential)) and Oxley Wild Rivers National Park (C1 (National Parks and Nature Reserves)) are located to the west and east of the site, respectively.

2.1 IBRA bioregions and subregion

The assessment area falls within the New England Tablelands Interim Biogeographic Regionalism for Australia (IBRA) Bioregion (shown on Figure 2-2) and the following three (3) IBRA Subregions (Table 2-1):

- Armidale Plateau,
- Walcha Plateau, and
- Yarrowyck – Kentucky Downs.

These IBRA sub-regions are shown on Figure 2-3. The Walcha Plateau was used in preparation of the BAM-C case, however the other two IBRA sub-regions were used to generate additional species and these were added to the BAM-C case.

Table 2-1 IBRA region and sub-regions

IBRA Region	IBRA Sub-region	Extent (ha)	% Development site
New England Tablelands	Armidale Plateau	2208.9ha	13 %
New England Tablelands	Walcha Plateau	14557.7ha	85 %
New England Tablelands	Yarrowyck – Kentucky Downs	338.6ha	2 %

The New England Tablelands IBRA Bioregion is situated between the North Coast and Nandewar Bioregions in northeast NSW, extending into Queensland (Department of Agriculture, Water and the Environment, 2020)). It is dominated by a cool temperate climate characterised by warm summers, with uniform rainfall generally occurring in summer. The topography consists of stepped plateau hills and plains with elevations between 600-1,500m on Permian sedimentary rocks, intrusive granites and extensive Tertiary basalts. Rainfall, temperature and soils change with topography and bedrock, and the vegetation is very diverse with a high degree of endemism.

The Armidale Plateau IBRA Sub-region is characterised by undulating to hilly plateaus at 1,100 m. This sub-region vegetation is characterised by open Ribbon Gum forest and woodland with Snow Gum and Black Sally on basalt. On sedimentary rocks the vegetation is dominated by Yellow Box, Blakely’s Red Gum, Rough-barked Apple and Apple Box. Silvertop Stringybark, New England Stringybark on dry aspects, Blakely’s Red Gum, Yellow Box and Apple Box on moist, well-drained slopes, and New England Peppermint with Ribbon Gum on flats.

The Walcha Plateau IBRA Sub-region general topography is characterised by undulating and small rugged areas often related to geology. Snow Gum and Black Sally exist within cold wet ridges. Ribbon Gum, Mountain Gum, Silvertop Stringybark, New England Blackbutt, Narrow-leaved Peppermint, exist within moist high areas. New England Stringybark, Ribbon Gum, and cool temperate rainforest elements exist within moist sheltered gullies.

The Yarrowyck – Kentucky Downs IBRA Subregion consist of undulating to hilly landforms, with areas of rock outcrop and granite tors. The vegetation consists of Woodland of Blakely's Red Gum, New England Peppermint, Yellow Box, Rough-barked Apple, New England Stringybark. Tumbledown Gum and Black Cypress Pine occur on rocky hills and River Oak is typically present along main streams.

2.2 NSW landscape regions

The assessment area is located within the following Mitchell Landscapes:

- **Moonbi – Walcha Granites:** Characterised by a complex of steep ranges, plateau and rounded peaks with large tors and rock domes on Permian granite, granodiorite and porphyry.
- **Niangala Plateau and Slopes:** Characterised by high rolling plateau on steeply dipping Devonian slate, phyllite, tuff, sandstone, conglomerate, chert and jasper, faulted Permian conglomerate, sandstone and mudstone, Carboniferous sandstone, slate and schist with small areas of Permian granite.
- **Tia Tops:** Characterised by small plateau with conical peaks and stepped slopes on Tertiary basalt immediately above the Great Escarpment
- **Uralla Basalts and Sands:** Characterised by undulating stepped high plateau on Tertiary basalt with underlying fluvial sand and gravel resting on an exhumed landscape of Permian granites.

The dominant Mitchell Landscape is Niangala Plateau and Slopes, and this was used in the BAM-C for the purpose of this assessment.

2.3 Native vegetation

Within the Assessment area (500m buffer around development footprint), around 76% of the assessment area can be considered native vegetation while 24% is highly modified by agricultural land use (refer to Section 2.1.2). The native dominated areas are either:

- Wooded remnants and derived grasslands that remain within large agricultural land holdings, predominantly on ridgetops with within riparian corridors, particularly to the southeast.
- Nature reserves managed for conservation. The Oxley Wild Rivers National Park is located to the east and south of the project and includes an area which has been identified as Gondwana Rainforest of Australia and is listed as a World Heritage Area as well as a Wilderness area. Biodiversity corridors, State Forest, National Parks and World Heritage Area are shown on Figure 2-6.

In terms of native woodlands and forests in the area, remnants of New England Peppermint Woodland on Basalts and Sediments in the New England Tableland Bioregion and Box Gum Woodland in New England Tablelands dominate. See Figure 2-7 for a native vegetation map within the assessment area.

2.3.1 Percent native vegetation cover

The assessment area covers 17,174ha, of which 12,988ha is considered to contain native vegetation (Figure 2-7). This equates to 76% of the assessment area containing native vegetation, which falls into the greater than 70% category. A total of 76% native cover was entered into the

BAM-C for the purposes of this assessment. Native vegetation was calculated by applying a 500m buffer around the development site and then mapping native vegetation using both aerial imagery and ground truthing. This included both woody and non-woody native vegetation. Areas within the assessment area not mapped as native vegetation are generally used for cropping and grazing.

2.4 Cleared areas

Agricultural areas have been extensively cleared and are typically characterised by non-native grasslands, although a variety of native woodland and forest communities exist as tree corridors, as well as small to larger remnants, within these modified zones. Cleared areas are generally used for grazing rather than cropping, and while there are a number of constructed dams, there is very little irrigation infrastructure.

2.5 Rivers, streams and estuaries

2.5.1 Surface water

The project is located within the Northern Tablelands Local Land Services area and Macleay River Catchment. Elevation at the assessment area ranges from 1,050m to 1,350 metres above sea level, comprised of hills and ridgelines rising out of the Walcha Plateau. The development site is located approximately 13km west of the Macleay River. Ohio Creek runs southwest of the development site and a number of small local creeks traverse the site including Grose Creek, Draytons Creek, and Winterbourne Creek. Rivers and streams (classified by Strahler order and including riparian buffer areas) are also shown on Figure 2-6 and summarised in Table 2-2. For much of the year these creeks may have no running water. Small farm dams occur on site.

There are 14 named tributaries classified as Strahler third order or above within the development site that are classified as Key Fish Habitat (KFH). There are first order and second order unnamed tributaries located across the development site, however these are generally ephemeral gullies and are characteristic of the ridgeline topography. First and second order streams that only flow for a short period after rain are generally excluded, as are farm dams constructed on such systems. Wholly artificial waterbodies such as irrigation channels, urban drains and ponds, salt and evaporation ponds are also excluded except where they are known to support populations of threatened fish or invertebrates.

Table 2-2 Summary of Strahler streams within development site

Strahler Stream order	Subject land (development site) count
1	274
2	110
3	53
4	19
5	2
6	5

Named tributaries within the development site include:

- Boundary Creek
- Brookmount Creek
- Cook Station Creek
- Dog Trap Creek
- Draytons Creek
- Graveyard Creek
- Grose Creek
- Jacks Creek
- Lambing Flat Creek
- Mihi Creek
- Salisbury Waters
- Snake Creek
- Stockyard Creek
- Winterbourne Creek.

Assessment of aquatic potential impacts to aquatic habitats are discussed in Section 5.1.4. Potential mitigation measures to reduce the risk of impacts to waterways are presented in Section 8. The development site does not contain mapped wetlands.

2.5.2 Groundwater

The development site is within the North Coast Fractured and Porous Rock Groundwater Sources Groundwater Management Area and situated above Carboniferous/Devonian Sandon beds, Lochaber Greywacke, Oxley Metamorphics and Wybeena Metamorhics.

- Sandon beds – Low-grade, regionally metamorphosed, multiply deformed lithic wacke, paraconglomerate, siltstone, mudstone, minor chert, jasper, spillite.
- Lochaber Greywacke – Lithic wacke, slate, minor chert and jasper, rare metabasalt.
- Oxley Metamorphics – Siliceous schists and phyllite with interbedded chert, jasper and metabasalt.
- Wybeena Metamorhics – Siliceous schists and phyllite with interbedded metabasalt, chert and jasper (Geoscience Australia, 2021).

The North Coast Fractured and Porous Rock Groundwater Sources Groundwater Management Area provides water to the Macleay River as baseflow during periods of above average rainfall and is an important source of groundwater for agricultural activities.

It is noted that there are currently no high-priority groundwater dependent ecosystems as listed on Schedule 6 of the Water Sharing Plan for the Macleay River Unregulated and Alluvial Water Sources.

2.5.3 Flooding

Flood liable land mapping is currently available in the Walcha Local Environment Plan, however it only pertains to the Walcha town centre, which is approximately 5.5km southwest of the development site at the closest point. Existing flood behaviour in Walcha due to the Apsley River flood events were defined in the Walcha Flood Study (WBM, 2005). The flooding within Walcha is caused by two mechanisms:

- Flooding along the Apsley River, generated by intense rainfall upstream, and/or
- Localised flooding due to failure of the stormwater drainage system (especially in the Blairs Gully catchment area behind the western levee).

2.6 Wetlands

An EPBC Act Protected Matters search completed on 25 November 2021 identified four wetlands of international importance (Ramsar) and one wetland of national importance. The following wetlands identified include:

- Wetlands of international importance:
    - Banrock station wetland complex (1,000 to 1,100km proximity),
    - Gwydir wetlands: Gingham and lower Gwydir (big leather) watercourses (200 to 300km upstream),
    - Riverland (100 to 1,100km proximity), and
    - The Coorong, and Lakes Alexandrina and Albert Wetlands (1,200 to 1,300km proximity).
- Nationally important wetlands:
    - New England Wetlands.

None of these features occur within the development site.

2.7 Connectivity features

Much of the development site has been cleared or thinned of native vegetation due to agricultural practices, however, significant tracts of relatively uninterrupted bushland occur along the eastern boundary from Oxley Wild Rivers National Park extending into New England National Park and Werrikimbe National Park. This bushland is a prominent connectivity feature in the landscape. From the east, this connectivity feature extends into the development site as areas of intact bush land to remnant trees with a cleared understory.

There are no significant core habitat areas to the west of the site that indicate that the project site bisects any regional corridor for wildlife moving into and out of the national parks. Sub-regional and local corridors do exist for wildlife moving from the project site into and out of the national parks, and on a smaller scale, between habitat patches on the site. Waterways also provide connectivity in this landscape; refer Section 2.5. Figure 2-6 shows riparian corridors and indicative terrestrial biodiversity corridors within and adjacent to the project site and in context with the National Park, World Heritage Area and State Forest.

2.8 Areas of geological significance

No karsts, caves, significant crevices or cliffs occur within the development site. Figure 2-1 shows that rock outcrops are present but are firmly embedded. No rock outcrops are located within the development footprint though there are outcrops within the broader development site. No rock outcrops are proposed to be directly impacted.

Figure 2-1 Example of rock outcrops within the development site

2.9 Areas of outstanding biodiversity value

Areas of outstanding biodiversity value are special areas with irreplaceable biodiversity values that are important to the whole of New South Wales, Australia or globally. The Register of Declared Areas of Outstanding Biodiversity Value identifies the following declared by the Minister as Areas of Outstanding Biodiversity Value in New South Wales:

- Gould's Petrel – critical habitat declaration
- Little penguin population in Sydney's North Harbour – critical habitat declaration
- Mitchell's Rainforest Snail in Stotts Island Nature Reserve – critical habitat declaration
- Wollemi Pine – critical habitat declaration

None of these areas occur within the development site or are relevant to the Project.

2.9.1 Biodiversity values map

The NSW Biodiversity Values Map identifies land with high biodiversity that is particularly sensitive to impacts from development and clearing. Impacts within the gazetted map layer are a trigger for undertaking a BDAR and require strong justification.

The mapped areas within the development site correspond mostly to riparian corridors, as discussed in Section 2.5. Impacts in these areas would be minimised and restricted to rationalised waterway crossings designed and constructed in accordance with best practice guidelines (as set out in Section 8).

Section 6 describes how biodiversity values have been avoided or impacts minimised.

2.10 Site context components

2.10.1 Method applied

The project conforms to the definition of a linear-based development under the BAM 2020 and the linear-based development assessment methodology has been used in this BAM assessment.

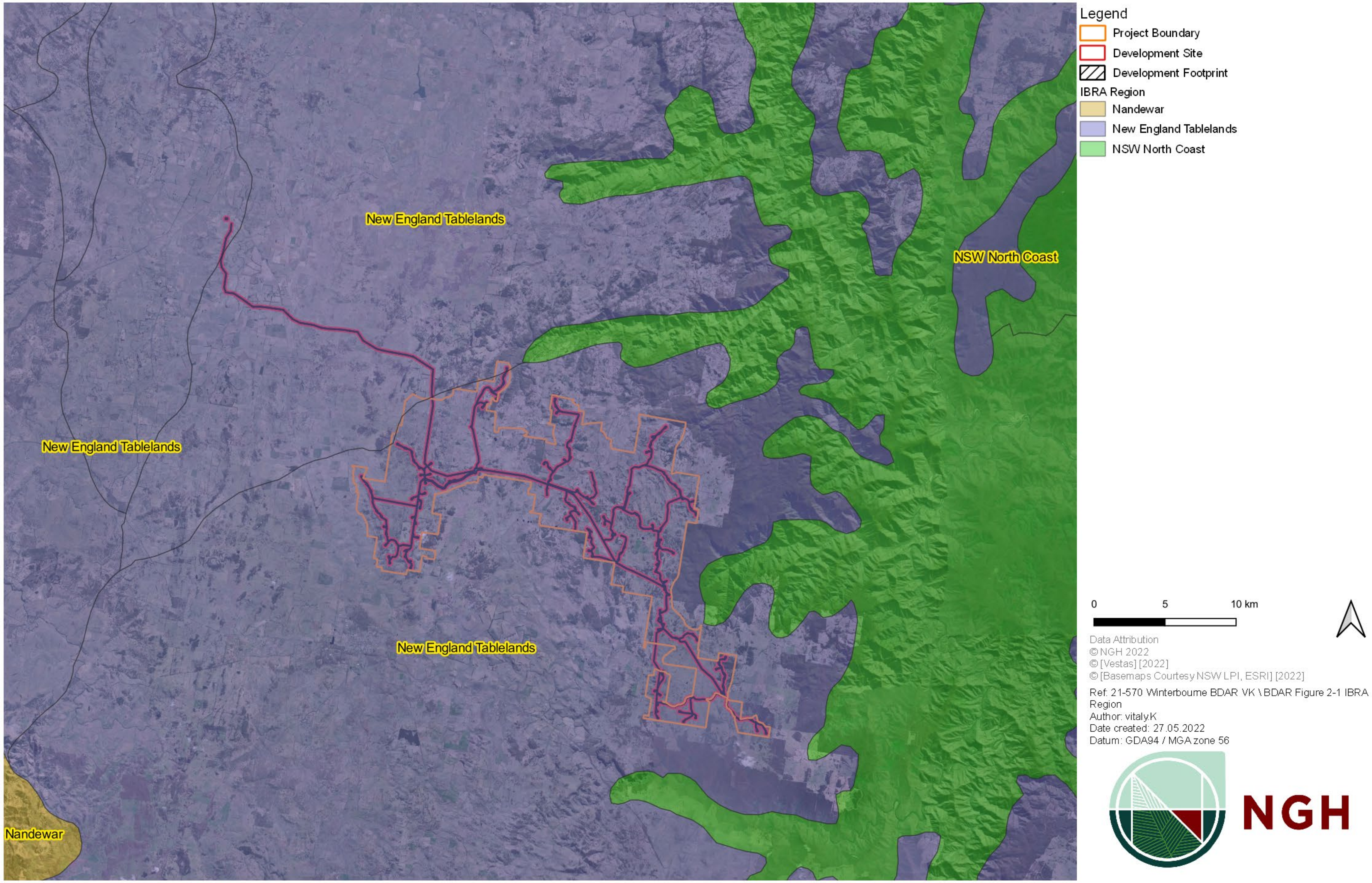


Figure 2-2 IBRA Regions

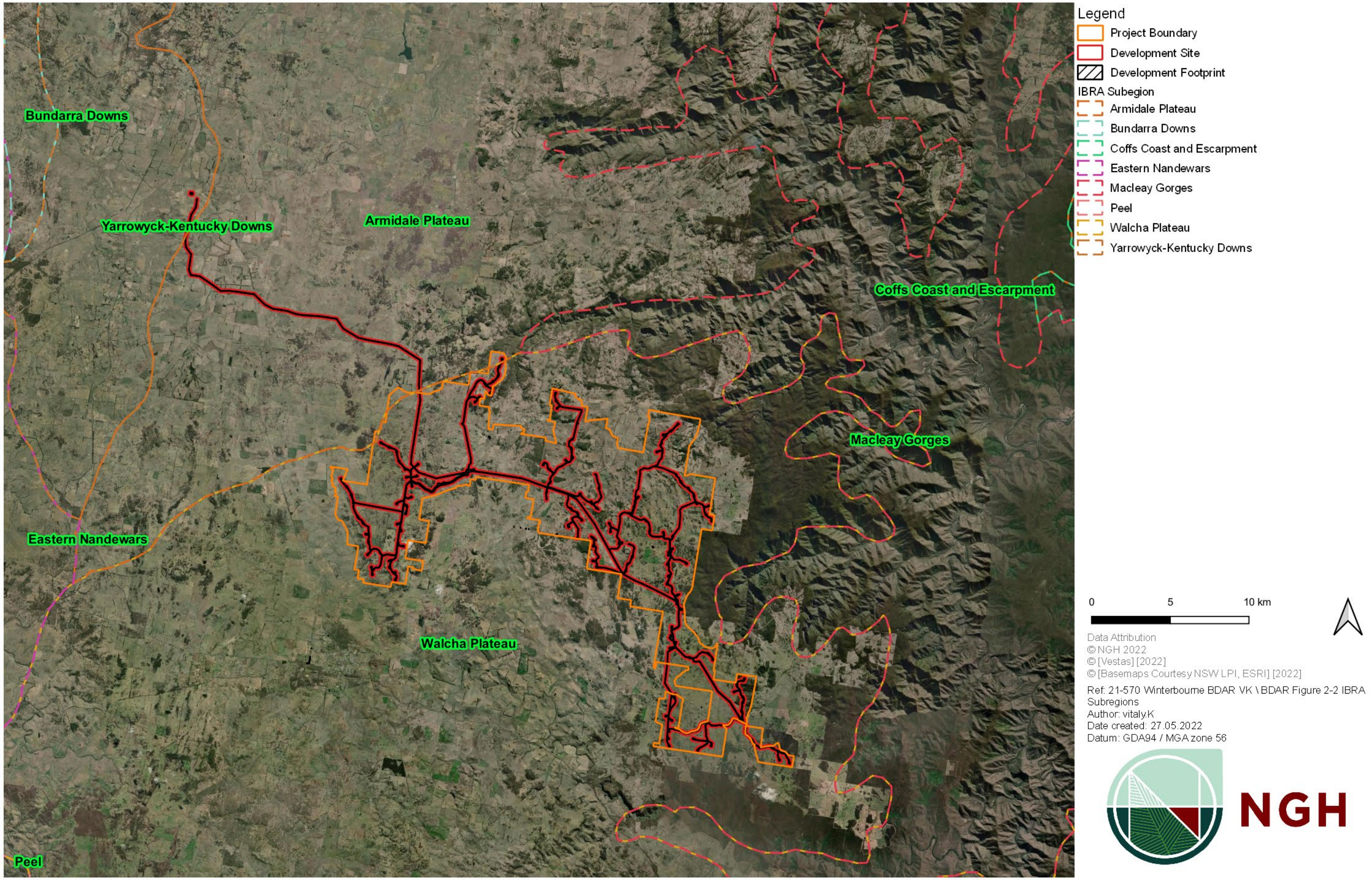


Figure 2-3 IBRA Sub-regions

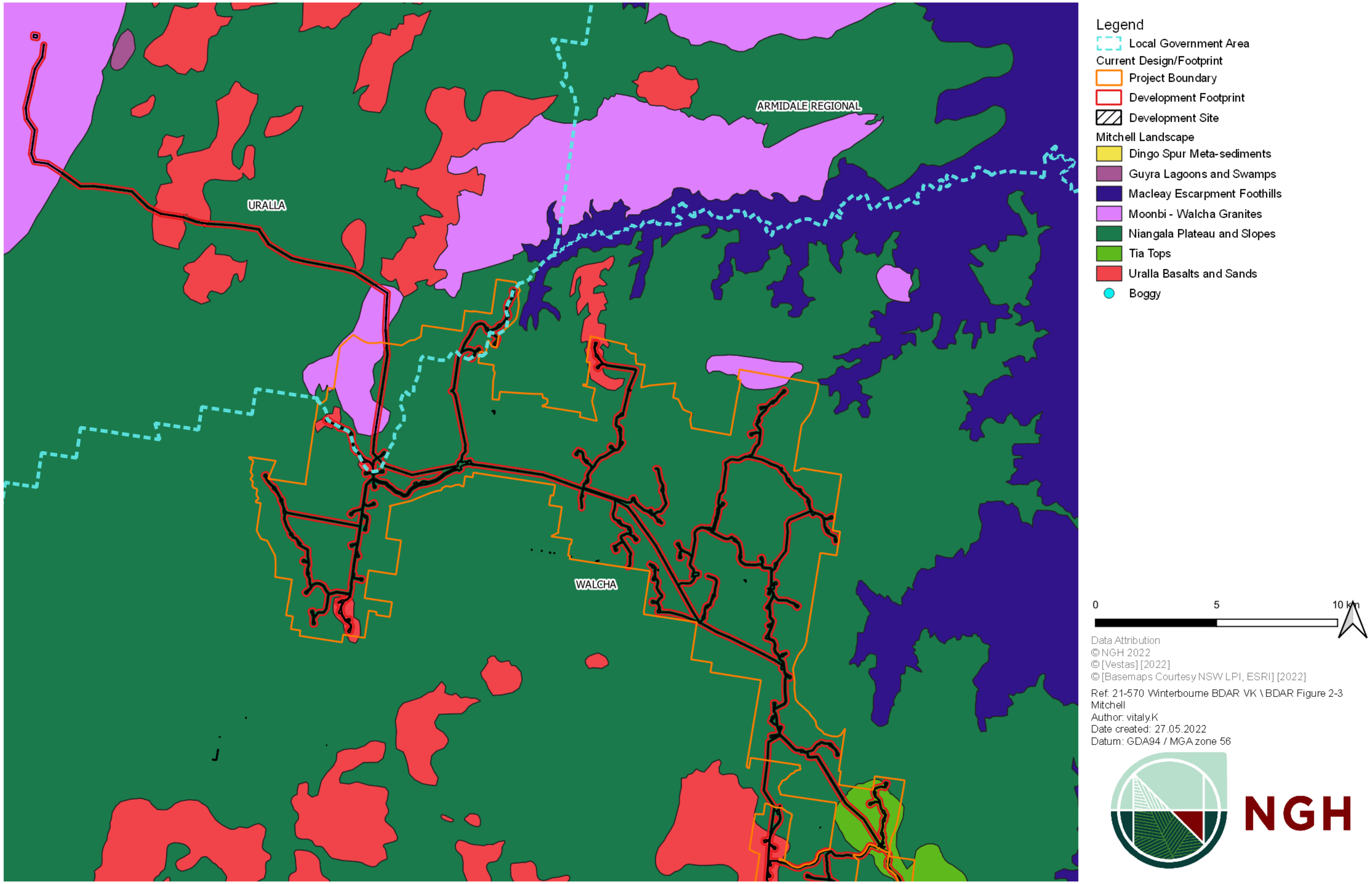


Figure 2-4 Mitchell Landscapes

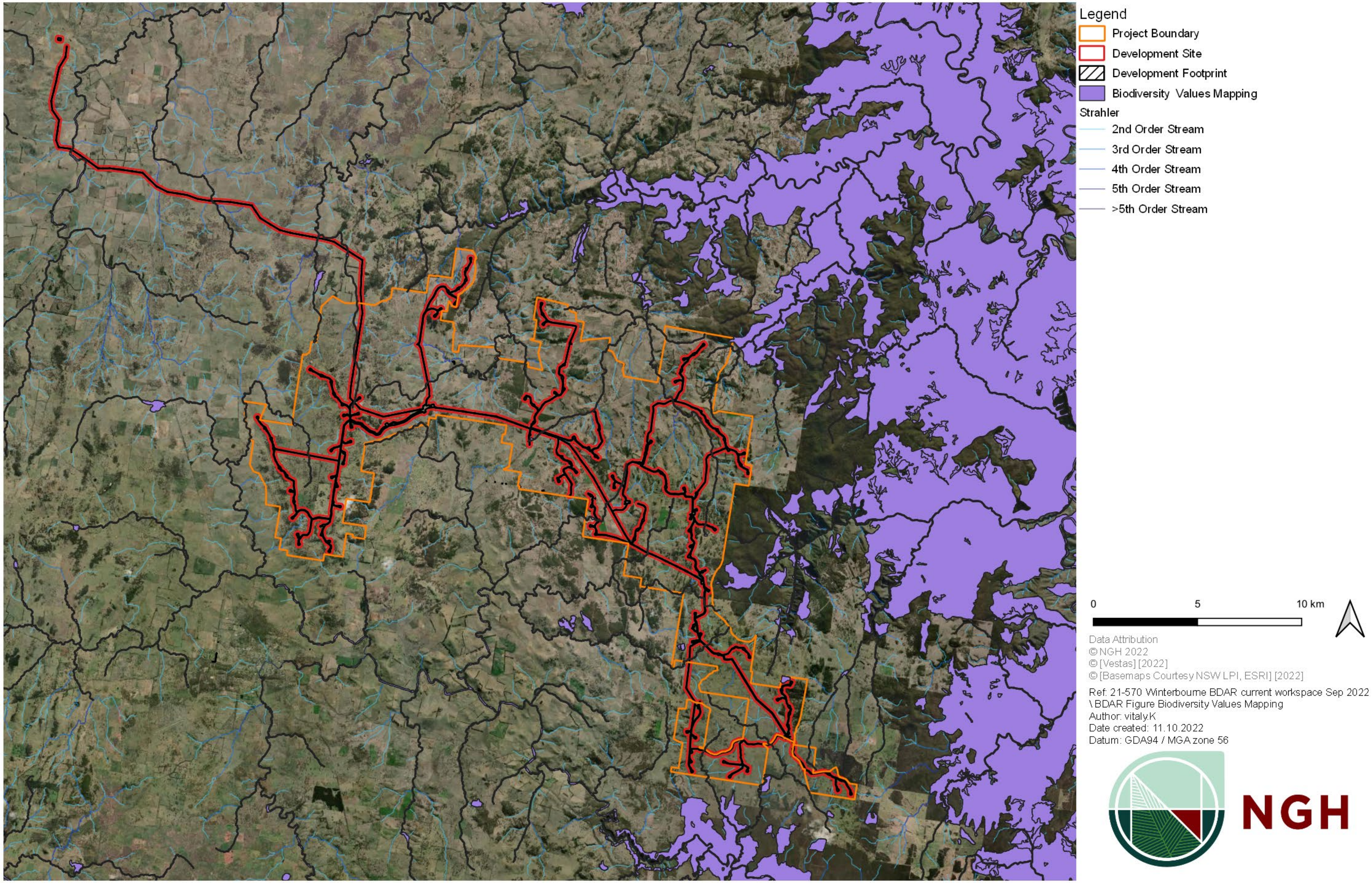


Figure 2-5 Biodiversity Values Mapping and waterways (Strahler)

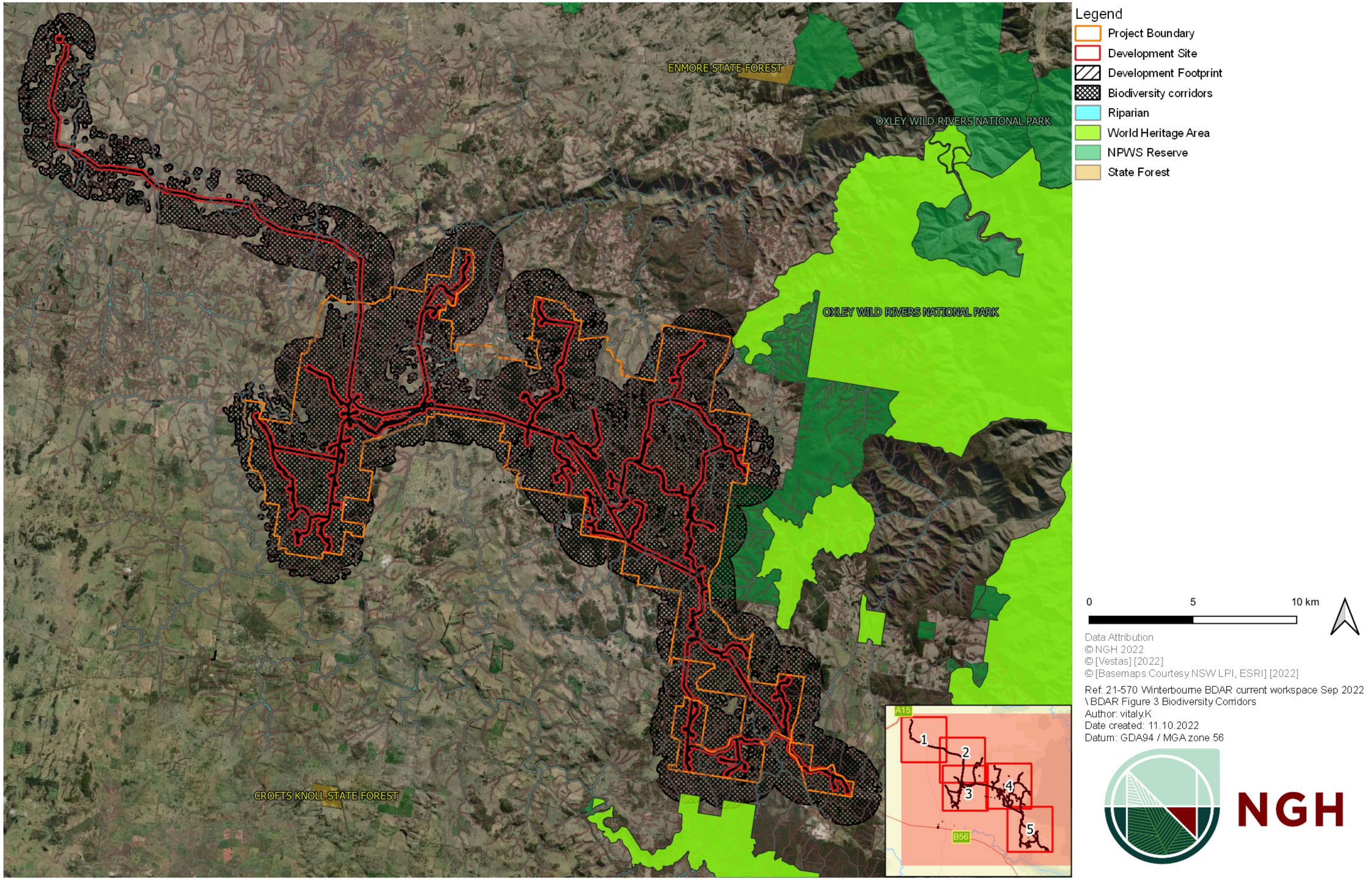


Figure 2-6 Biodiversity corridors, riparian areas, National Parks, State Forest and World Heritage Area (detailed mapping is provided in Appendix N.2)

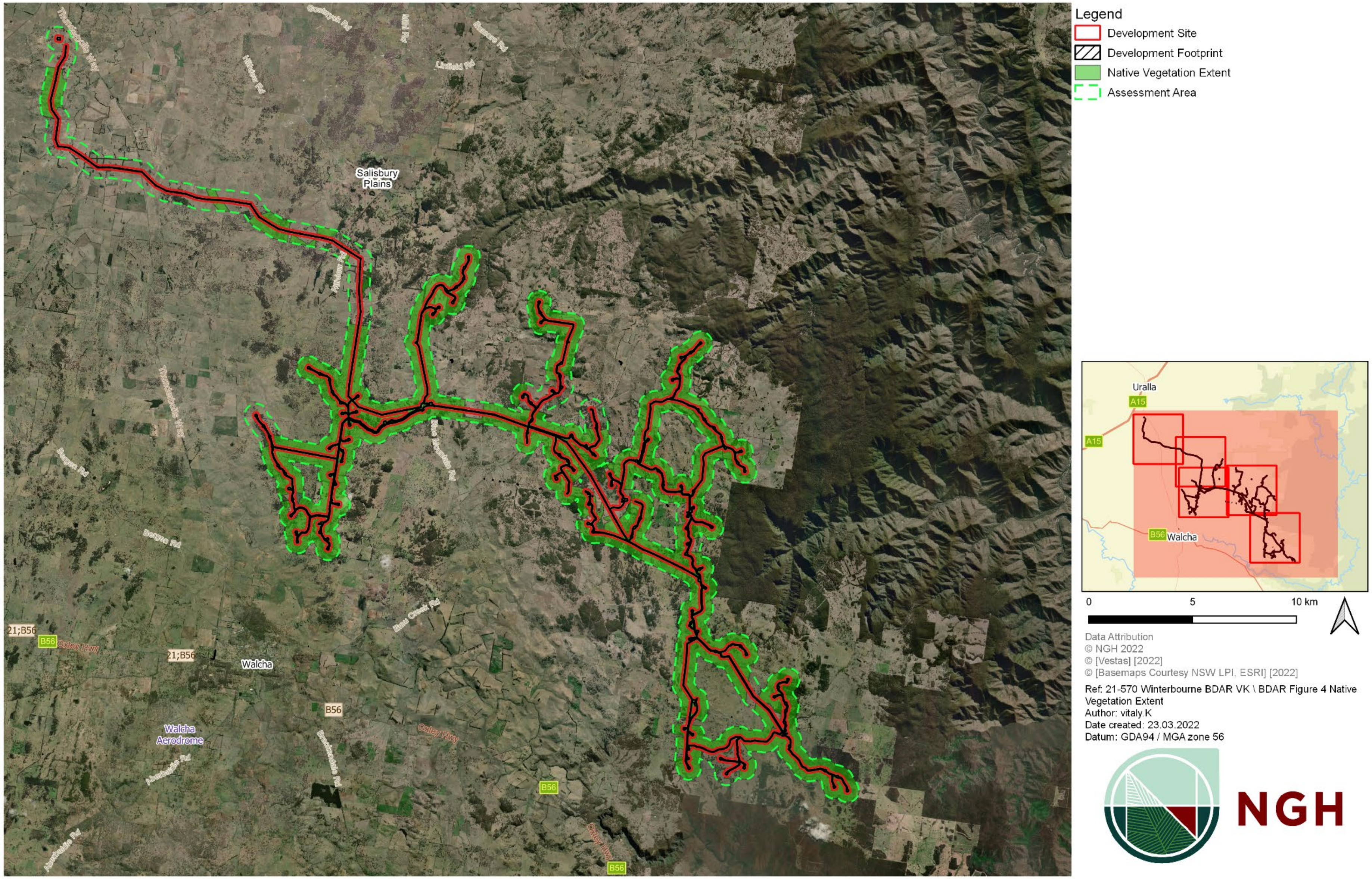


Figure 2-7 Native vegetation extent within the assessment area (detailed mapping is provided in Appendix N.3)

3. Native vegetation

3.1 Native vegetation extent

The development site is characterised by past clearing and ongoing agricultural and farming practices. Significant clearing has affected about 27% of the development footprint, with the remaining remnant, or less disturbed, treed areas occurring predominantly at higher elevations where topography and landform are prohibitive to anthropogenic land use.

The native vegetation within the development site is broadly comprised of the following vegetation classes:

- 1,365.7ha of New England Dry Sclerophyll Forests in treed and derived native grassland conditions
- 1,385.3ha of New England Grassy Woodlands in treed and derived native grassland conditions
- 152.7ha of Northern Tableland Wet Sclerophyll Forest in treed and derived native grassland conditions
- 17.5ha of Montane Bogs and Ferns
- 133.5ha of Tableland Clay Grassy Woodland in treed and derived native grassland conditions
- 1207.8ha of Category 1 land – not native, dominated by exotic pasture grasses and weeds.

3.1.1 Areas not containing native vegetation

Until the entire Native Vegetation Regulatory (NVR) map is finalised and released, assessors may establish the categorisation of land for the consent authority to consider by approximating the method used to make the NVR map under the provisions of the BC Act and the *Local Land Services Amendment Act 2016* (LLS Act). That is, for developments occurring on rural land (not including RU5 land), accredited assessors can establish whether land would meet the definition of Category 1 (exempt land). Under the BC Act (S6.8(3)), the BAM is to exclude the assessment of the impacts of any clearing of native vegetation and loss of habitat on Category 1 Land (within the meaning of Part 5A of the LLS Act), other than any impacts prescribed by the regulations under Section 6 of the BAM.

As Category 1 Land regulatory maps are not yet publicly available, an assessment was undertaken to determine whether the cleared areas within the development site meet the definition of Category 1 land (Appendix A).

In order to determine and justify land identified as Category 1 Land, the following information was analysed using a precautionary approach;

- NSW Land Use mapping (OEH 2017)
- Woody Vegetation layer (OEH 2015)
- Sensitive Regulated Land and Vulnerable Regulated Land Mapping
- Historic aerial imagery.

Using the above resources and rigorous ground-truthing, 1218.9ha was considered to be classed as Category 1 Land (Appendix A). These areas are considered exempt from further assessment in the BAM with exception to prescribed impacts as stated in Section 6 of the BC Act. The mapping has been provided in advance of this BDAR to BCD (updated mapping provided February 2022).

3.2 Plant community types

3.2.1 Methods to assess PCTs

Survey strategies started broadly, verifying PCTs, zone boundaries and higher biodiversity value areas. The survey intensity then increased as the development footprint became more certain. Survey intensity in these areas reflected both habitat value (more focus on areas of higher value that could not be avoided) and accessibility, to achieve sufficient representative data in accordance with the BAM.

PCT assignment utilised existing vegetation mapping, which was then ground-truthed, using rapid surveys and then collecting representative BAM plots. Investigations commenced in 2019 (ERM, 2020) and have been ongoing through 2020, 2021 and 2022.

A search was undertaken of the BioNet Vegetation Classification (Veg-C) database and NSW SEED Data Sharing Portal to access existing vegetation mapping information within the development site. Relevant mapping of the development site included that of the Northern Rivers Catchment Management Authority (DPIE, VIS, 2010)). This identified 13 PCTs that may occur within, and surrounding, the development site. These are summarised in Table 3-1.

Table 3-1 PCTs suggested to occur within the development site (DPIE 2010)

Mapped PCTs	Present within development site
1194: Snow Gum - Mountain Gum - Mountain Ribbon Gum open forest on ranges of the NSW North Coast Bioregion and eastern New England Tableland Bioregion	Confirmed present
997: New England stringybarks - Peppermint open forest of the New England Tableland Bioregion	Confirmed present
970: Narrow-leaved Peppermint - Wattle-leaved Peppermint shrubby open forest of the New England Tableland Bioregion	Confirmed present
954: Mountain Ribbon Gum - Messmate open forest of escarpment ranges of the NSW North Coast Bioregion and New England Tableland Bioregion	Not present
766: Carex sedgeland of the slopes and tablelands	Confirmed present
571: Ribbon Gum - Rough-barked Apple - Yellow Box grassy woodland of the New England Tableland Bioregion and NSW North Coast Bioregion	Not present
568: Broad-leaved Stringybark shrub/grass open forest of the New England Tableland Bioregion	Confirmed present

Mapped PCTs	Present within development site
567: Broad-leaved Stringybark - Yellow Box shrub/grass open forest of the New England Tableland Bioregion	Confirmed present
565: Silvertop Stringybark - Mountain Gum grassy open forest of the New England Tableland Bioregion	Confirmed present
554: Ribbon Gum - Mountain Gum - Snow Gum grassy open forest or woodland of the New England Tableland Bioregion	Not present
534: New England Peppermint grassy woodland on sedimentary or basaltic substrates of the New England Tableland Bioregion	Confirmed present
526: Mountain Ribbon Gum - Messmate - Broad-leaved Stringybark open forest on granitic soils of the New England Tableland Bioregion	Confirmed present
510: Blakely's Red Gum - Yellow Box grassy woodland of the New England Tableland Bioregion	Confirmed present

3.2.2 Floristic surveys

The development site was broadly surveyed whereby the native vegetation present was stratified into vegetation zones by PCT and broad condition state. The entire development site was surveyed with the aim of confirming the PCTs present, along with their extent and condition by way of rapid data collection techniques. Random meander searches were conducted to gain an overview of the plant species present and determine variation within vegetation types. Potential PCTs were identified using the BioNet VIS based on the native species present, landform, physiography and location in the IBRA subregion. The PCTs were then stratified into areas of similar condition class to determine vegetation zones for each PCT.

Vegetation Integrity (VI) plot data were collected across September-December 2020, March-April 2021 and December 2021. The required number of VI plots of 20m by 50m was established in each vegetation zone with the exception of zone 10 (one plot short). Data were collected on the composition, structure and function of the vegetation (Appendix C) in accordance with the BAM (2020). Once collected, the BAM plot data was reviewed to ensure it aligned with the vegetation zone that it has been assigned previously mapped during the stratification process. Personnel used to collect floristic field data including BAM plots are listed in Appendix H.

3.2.3 PCTs identified on the development site

Following floristic surveys, 10 native PCTs were identified within the development site:

- 1194: Snow Gum - Mountain Gum - Mountain Ribbon Gum open forest on ranges of the NSW North Coast Bioregion and eastern New England Tableland Bioregion (TEC)

- 997: New England stringybarks - peppermint open forest of the New England Tableland Bioregion
- 970: Narrow-leaved Peppermint - Wattle-leaved Peppermint shrubby open forest of the New England Tableland Bioregion
- 766: Carex sedgeland of the slopes and tablelands
- 568: Broad-leaved Stringybark shrub/grass open forest of the New England Tableland Bioregion
- 567: Broad-leaved Stringybark - Yellow Box shrub/grass open forest of the New England Tableland Bioregion (partially TEC)
- 565: Silvertop Stringybark - Mountain Gum grassy open forest of the New England Tableland Bioregion
- 534: New England Peppermint grassy woodland on sedimentary or basaltic substrates of the New England Tableland Bioregion (TEC)
- 526: Mountain Ribbon Gum - Messmate - Broad-leaved Stringybark open forest on granitic soils of the New England Tableland Bioregion
- 510: Blakely's Red Gum - Yellow Box grassy woodland of the New England Tableland Bioregion. (TEC)

Descriptions of the 10 PCTs identified within the development site (as shown in Table 3-1) are provided in Table 3-2 to Table 3-12. PCT locations within the development site are presented in Figure 3-2.

Table 3-2 Description of PCT 1194 within the development site

Snow Gum - Mountain Gum - Mountain Ribbon Gum open forest on ranges of the NSW North Coast Bioregion and eastern New England Tableland Bioregion		
Vegetation formation	Wet Sclerophyll Forests (Grassy sub-formation)	
Vegetation class	Northern Tableland Wet Sclerophyll Forests	
Vegetation type	PCT ID	1194
	Common Community Name	Snow Gum - Mountain Gum - Mountain Ribbon Gum open forest on ranges of the NSW North Coast Bioregion and eastern New England Tableland Bioregion
Approximate extent within the development site	152.7ha 90.90ha derived native grassland (grassland) 61.79ha woodland (Woodland)	
Species relied upon for PCT identification	Species name	Relative abundance
	White Sally *Eucalyptus pauciflora*	10
	Mountain Ribbon Gum *Eucalyptus nobilis*	10
	Mountain Gum *Eucalyptus dalrympleana*	5
	Black Sally *Eucalyptus stellulata*	10
	Messmate *Eucalyptus obliqua*	10
	Narrow-leaved Peppermint *Eucalyptus radiata*	1
	Silver Wattle *Acacia dealbata*	1
	Bracken *Pteridium esculentum*	0.2
Justification of evidence used to identify the PCT	The PCT contains White Sally, Mountain Gum and Ribbon Mountain Gum consistently in the canopy. These species are often joined by Black Sally and Messmate which may be locally dominant. Entry of the canopy species found within this PCT into the Veg-C along with the Walcha Plateau subregion revealed PCT 1194 as the only PCT containing the diversity of canopy species recorded, therefore, PCT 1194 is considered the most likely PCT.	
TEC Status	Ribbon Gum—Mountain Gum—Snow Gum Grassy Forest/Woodland of the New England Tableland Bioregion (BC Listed). All vegetation zones are considered to meet the criteria for BC Act listed TEC as per the DECC guideline for Identification of the TEC (DECC 2007). This is due to the presence of the canopy species *Eucalyptus pauciflora, Eucalyptus dalrympleana, Eucalyptus stellulata* across the vegetation zones. All areas are considered TEC under BC Act.	

Snow Gum - Mountain Gum - Mountain Ribbon Gum open forest on ranges of the NSW North Coast Bioregion and eastern New England Tableland Bioregion	
Estimate of percent cleared within NSW	80%
PCT 1194 derived native grassland Plot 1	
PCT 1194 woodland Plot 11	

Table 3-3 Description of PCT 997 within the development site

New England stringybarks - peppermint open forest of the New England Tableland Bioregion		
Vegetation formation	Dry Sclerophyll Forests (Shrub/grass sub-formation)	
Vegetation class	New England Dry Sclerophyll Forests	
Vegetation type	PCT ID	997
	Common Community Name	New England stringybarks - peppermint open forest of the New England Tableland Bioregion
Approximate extent within the development site	144.1ha 73.44ha derived native grassland (grassland) 70.68ha woodland (Woodland)	
Species relied upon for PCT identification	Species name	Relative abundance
	Narrow-leaved Peppermint *Eucalyptus radiata*	20
	Broad-leaved Stringybark *Eucalyptus caliginosa*	30
	Eucalyptus williamsiana	1
	Bracken *Pteridium esculentum*	0.1
	Snowgrass *Poa sieberiana*	0.3
Justification of evidence used to identify the PCT	This PCT contains Broad-leaved Stringybark and Narrow-leaved Peppermint as dominants with *Eucalyptus williamsiana* occurring consistently but at low abundance. PCT 997 is the only PCT within the Walcha Plateau subregion containing these three species, therefore, PCT 997 is considered to be the most likely PCT.	
TEC Status	No associated TEC	
Estimate of percent cleared within NSW	55%	

New England stringybarks - peppermint open forest of the New England Tableland Bioregion	
PCT 997 derived native grassland Plot 101	
PCT 997 woodland Plot 100	

Table 3-4 Description of PCT 970 within the development site

<table>
<tr><th colspan="3">Narrow-leaved Peppermint - Wattle-leaved Peppermint shrubby open forest of the New England Tableland Bioregion</th></tr>
<tr><td>Vegetation formation</td><td colspan="2">Dry Sclerophyll Forests (Shrub/grass sub-formation)</td></tr>
<tr><td>Vegetation class</td><td colspan="2">New England Dry Sclerophyll Forests</td></tr>
<tr><td rowspan="2">Vegetation type</td><td>PCT ID</td><td>970</td></tr>
<tr><td>Common Community Name</td><td>Narrow-leaved Peppermint - Wattle-leaved Peppermint shrubby open forest of the New England Tableland Bioregion</td></tr>
<tr><td>Approximate extent within the development site</td><td colspan="2">568.9ha
264.17ha derived native grassland (grassland)
304.87ha woodland (Woodland)</td></tr>
<tr><td rowspan="7">Species relied upon for PCT identification</td><td>Species name</td><td>Relative abundance</td></tr>
<tr><td>Narrow-leaved Peppermint Eucalyptus radiata subsp. sejuncta</td><td>20</td></tr>
<tr><td>Eucalyptus pauciflora</td><td></td></tr>
<tr><td>Bracken Pteridium esculentum</td><td>2</td></tr>
<tr><td>Snowgrass Poa sieberiana</td><td>5</td></tr>
<tr><td>Wattle-leaved Peppermint Eucalyptus acaciiformis</td><td>40</td></tr>
<tr><td>Eucalyptus dalrympleana subsp. heptantha</td><td>40</td></tr>
<tr><td>Justification of evidence used to identify the PCT</td><td colspan="2">The Eucalypt species listed above occur together frequently throughout this PCT. Entry of these three species, along with the Walcha Plateau IBRA subregion into the Veg-C identifies two PCTs that contain these three species, PCT 970 and PCT 533. However, PCT 533 typically contains Eucalyptus nova-anglica and Eucalyptus pauciflora, two species that were not recorded within this PCT. Therefore, PCT 970 was chosen as the most likely PCT.</td></tr>
<tr><td>TEC Status</td><td colspan="2">Associated with New England Peppermint (Eucalyptus nova-anglica) Woodland on Basalts and Sediments in the New England Tableland Bioregion (BC and EPBC Listed), however, New England Peppermint is not present in any plot, therefore, PCT 970 is not considered to align with the TEC in this instance.</td></tr>
<tr><td>Estimate of percent cleared within NSW</td><td colspan="2">56%</td></tr>
</table>

Narrow-leaved Peppermint - Wattle-leaved Peppermint shrubby open forest of the New England Tableland Bioregion	
PCT 970 derived native grassland Plot 34	
PCT 970 woodland Plot 8	

Table 3-5 Description of PCT 766 within the development site

<table>
<tr><th colspan="3">Carex sedgeland of the slopes and tablelands</th></tr>
<tr><td>Vegetation formation</td><td colspan="2">Freshwater Wetlands</td></tr>
<tr><td>Vegetation class</td><td colspan="2">Montane Bogs and Fens</td></tr>
<tr><td rowspan="2">Vegetation type</td><td>PCT ID</td><td>766</td></tr>
<tr><td>Common Community Name</td><td>Carex sedgeland of the slopes and tablelands</td></tr>
<tr><td>Approximate extent within the development site</td><td colspan="2">28.58ha riparian</td></tr>
<tr><td rowspan="3">Species relied upon for PCT identification</td><td>Species name</td><td>Relative abundance</td></tr>
<tr><td>Tall Sedge Carex appressa</td><td>50</td></tr>
<tr><td>Carex gaudichaudiana</td><td>5</td></tr>
<tr><td>Justification of evidence used to identify the PCT</td><td colspan="2">This PCT occurs on various drainage lines with poor drainage throughout the development site. Often times this PCT has a high exotic component, however, the consistent presence of Tall Sedge is the defining native feature. While PCT 582 shares similar attributes, PCT 582 is noted as containing canopy species, a feature which is lacking form the sedge fens within the development site. Therefore, PCT 766 is considered the most likely PCT.</td></tr>
<tr><td>TEC Status</td><td colspan="2">Carex Sedgeland of the New England Tableland, Nandewar, Brigalow Belt South and NSW North Coast Bioregions (BC Listed)
Upland Wetlands of the Drainage Divide of the New England Tableland Bioregion (BC Listed)</td></tr>
<tr><td>Estimate of percent cleared within NSW</td><td colspan="2">75%</td></tr>
<tr><td>PCT 766 riparian condition Plot</td><td colspan="2">
</td></tr>
</table>

Table 3-6 Description of PCT 568 within the development site

<table>
<tr><th colspan="3">Broad-leaved Stringybark shrub/grass open forest of the New England Tableland Bioregion</th></tr>
<tr><td>Vegetation formation</td><td colspan="2">Dry Sclerophyll Forests (Shrub/grass sub-formation</td></tr>
<tr><td>Vegetation class</td><td colspan="2">New England Dry Sclerophyll Forests</td></tr>
<tr><td rowspan="2">Vegetation type</td><td>PCT ID</td><td>568</td></tr>
<tr><td>Common Community Name</td><td>Broad-leaved Stringybark shrub/grass open forest of the New England Tableland Bioregion</td></tr>
<tr><td>Approximate extent within the development site</td><td colspan="2">167.52ha
83.29ha derived native grassland (grassland)
84.22ha woodland</td></tr>
<tr><td rowspan="5">Species relied upon for PCT identification</td><td>Species name</td><td>Relative abundance</td></tr>
<tr><td>Broad-leaved Stringybark Eucalyptus caliginosa</td><td>30</td></tr>
<tr><td>Eucalyptus dalrympleana subsp. heptantha</td><td>10</td></tr>
<tr><td>Moonbi Apple Box Eucalyptus malacoxylon</td><td>5</td></tr>
<tr><td>Wallaby Weed Olearia viscidula</td><td>10</td></tr>
<tr><td>Justification of evidence used to identify the PCT</td><td colspan="2">This PCT is dominated by Broad-leaved Stringybark with Eucalyptus dalrympleana subsp. heptantha and Moonbi Apple Box as common associated. Wallaby Weed is also a consistent presence in the midstory. While these species also occur in tandem in PCT Youman's Stringybark - Mountain Gum open forest of the western New England Tableland Bioregion, the dominance of Broad-leaved Stringybark and the lack of Youman’s Stringybark suggests that PCT 568 is the most likely PCT.</td></tr>
<tr><td>TEC Status</td><td colspan="2">No associated TECs</td></tr>
<tr><td>Estimate of percent cleared within NSW</td><td colspan="2">59%</td></tr>
</table>

<table>
<tr><th colspan="2">Broad-leaved Stringybark shrub/grass open forest of the New England Tableland Bioregion</th></tr>
<tr><td>PCT 568 derived grassland Plot 68</td><td></td></tr>
</table>

Broad-leaved Stringybark shrub/grass open forest of the New England Tableland Bioregion	
PCT 568 woodland Plot 69	

Table 3-7 Description of PCT 567 within the development site

Broad-leaved Stringybark - Yellow Box shrub/grass open forest of the New England Tableland Bioregion		
Vegetation formation	Grassy Woodlands	
Vegetation class	New England Grassy Woodlands	
Vegetation type	PCT ID	567
	Common Community Name	Broad-leaved Stringybark - Yellow Box shrub/grass open forest of the New England Tableland Bioregion
Approximate extent within the development site	1234.3ha 697.99 grassland 536.31 woodland	
Species relied upon for PCT identification	Species name	Relative abundance
	Broad-leaved Stringybark *Eucalyptus caliginosa*	30
	Yellow Box *Eucalyptus melliodora*	10
	Peach Heath *Lissanthe strigosa*	1
	Swamp Dock *Rumex brownii*	0.1
	Common Everlasting *Chrysocephalum apiculatum*	0.1
	Twining Glycine *Glycine clandestina*	0.1
Justification of evidence used to identify the PCT	This PCT is dominated by Broad-leaved Stringybark with Yellow Box as a common associate. Peach Heath is also sparsely consistent in the midstory. While three PCTs within the Walcha Plateau subregion contain these species, the dominance of Broad-leaved Stringybark suggests PCT 567 is the most likely.	
TEC Status	White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highlands, NSW South Western Slopes, South East Corner and Riverina Bioregions (BC Listed, EPBC Listed). Areas of this PCT that were dominated by *Eucalyptus caliginosa* (or other stringybark species) with no *Eucalyptus blakelyi or Eucalyptus melliodora* present, were determined to not meet the criteria for TEC status under EPBC. The TEC (BC Act and EPBC Act) has been mapped in Figure 3-1. Plots WWF051, WWF082, WWF091, WWF095 and WWF122 meet the criteria for EPBC listed White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Grassland under EPBC. Development footprint hectare areas: PCT 567 Grassland TEC BC Act – 97.12 ha	

Broad-leaved Stringybark - Yellow Box shrub/grass open forest of the New England Tableland Bioregion	
	PCT 567 Woodland TEC BC Act – 31.76 ha PCT 567 Grassland TEC EPBC Act – 38.37 PCT 567 Woodland TEC EPBC Act – 0.22 ha
Estimate of percent cleared within NSW	62%
PCT 567 derived native grassland Plot 82	
PCT 567 woodland Plot 92	

Table 3-8 Description of PCT 565 within the development site

<table>
<tr><th colspan="3">Silvertop Stringybark - Mountain Gum grassy open forest of the New England Tableland Bioregion</th></tr>
<tr><td>Vegetation formation</td><td colspan="2">Dry Sclerophyll Forests (Shrub/grass sub-formation)</td></tr>
<tr><td>Vegetation class</td><td colspan="2">New England Dry Sclerophyll Forests</td></tr>
<tr><td rowspan="2">Vegetation type</td><td>PCT ID</td><td>565</td></tr>
<tr><td>Common Community Name</td><td>Silvertop Stringybark - Mountain Gum grassy open forest of the New England Tableland Bioregion</td></tr>
<tr><td>Approximate extent within the development site</td><td colspan="2">168.03ha
75.60ha derived native grassland (grassland)
92.43ha woodland</td></tr>
<tr><td rowspan="7">Species relied upon for PCT identification</td><td>Species name</td><td>Relative abundance</td></tr>
<tr><td>Silvertop Stringybark Eucalyptus laevopinea</td><td>25</td></tr>
<tr><td>Apple Box Eucalyptus bridgesiana</td><td>20</td></tr>
<tr><td>Yellow Box Eucalyptus melliodora</td><td>10</td></tr>
<tr><td>Wallaby Weed Olearia viscidula</td><td>1</td></tr>
<tr><td>Silver Wattle Acacia dealbata</td><td>1</td></tr>
<tr><td>Peach Heath Lissanthe strigosa</td><td>1</td></tr>
<tr><td>Justification of evidence used to identify the PCT</td><td colspan="2">This PCT is dominated by Silvertop Stringybark in the canopy. While the associated species occur throughout other New England Dry Sclerophyll Forests, the dominance of Silvertop Stringybark suggests PCT 565 is the most likely.</td></tr>
<tr><td>TEC Status</td><td colspan="2">No associated TEC</td></tr>
<tr><td>Estimate of percent cleared within NSW</td><td colspan="2">44%</td></tr>
</table>

Silvertop Stringybark - Mountain Gum grassy open forest of the New England Tableland Bioregion	
PCT 565 derived native grassland Plot 106	
PCT 565 woodland Plot 107	

Table 3-9 Description of PCT 534 within the development site

<table>
<tr><th colspan="3">New England Peppermint grassy woodland on sedimentary or basaltic substrates of the New England Tableland Bioregion</th></tr>
<tr><td>Vegetation formation</td><td colspan="2">Grassy Woodlands</td></tr>
<tr><td>Vegetation class</td><td colspan="2">Tableland Clay Grassy Woodlands</td></tr>
<tr><td rowspan="2">Vegetation type</td><td>PCT ID</td><td>534</td></tr>
<tr><td>Common Community Name</td><td></td></tr>
<tr><td>Approximate extent within the development site</td><td colspan="2">133.46ha
37.40ha derived native grassland (grassland)
96.05ha woodland</td></tr>
<tr><td rowspan="6">Species relied upon for PCT identification</td><td>Species name</td><td>Relative abundance</td></tr>
<tr><td>New England Peppermint Eucalyptus nova-anglica</td><td>40</td></tr>
<tr><td>Snow Grass Poa sieberiana</td><td>1</td></tr>
<tr><td>Common Woodruff Asperula conferta</td><td>1</td></tr>
<tr><td>Common Everlasting Chrysocephalum apiculatum</td><td>1</td></tr>
<tr><td>Peach Heath Lissanthe strigosa</td><td>1</td></tr>
<tr><td>Justification of evidence used to identify the PCT</td><td colspan="2">This PCT is dominated by New England Peppermint which often is the only species present in the canopy. Within the Walch Plateau subregion, PCT 533 also shares this dominance of New England Peppermint, however, other species such as Snow Gum Eucalyptus pauciflora are usually present and possibly codominant. As this was not observed, PCT 534 was considered to be the most likely.</td></tr>
<tr><td>TEC Status</td><td colspan="2">New England Peppermint (Eucalyptus nova-anglica) Woodland on Basalts and Sediments in the New England Tableland Bioregion (BC Act Listed). New England Peppermint (Eucalyptus nova-anglica) Grassy Woodlands (EPBC Act listed). All vegetation zones were considered to meet the BC Act listed TEC criteria as per DECCW (DECCW 2010). However only Plot WWF081 met the EPBC Act TEC criteria as per condition thresholds listed in the scientific determination (DSEWPC 2005).
Development footprint hectare areas:
PCT 534 Grassland TEC BC Act – 3.32 ha
PCT 534 Woodland TEC BC Act – 11.10 ha
PCT 534 Woodland TEC EPBC Act – 1.42 ha</td></tr>
<tr><td>Estimate of percent cleared within NSW</td><td colspan="2">90%</td></tr>
</table>

New England Peppermint grassy woodland on sedimentary or basaltic substrates of the New England Tableland Bioregion	
PCT 534 derived native grassland Plot 115	
PCT 534 woodland	

Table 3-10 Description of PCT 526 within the development site

<table>
<tr><th colspan="3">Mountain Ribbon Gum - Messmate - Broad-leaved Stringybark open forest on granitic soils of the New England Tableland Bioregion</th></tr>
<tr><td>Vegetation formation</td><td colspan="2">Dry Sclerophyll Forests (Shrub/grass sub-formation)</td></tr>
<tr><td>Vegetation class</td><td colspan="2">New England Dry Sclerophyll Forests</td></tr>
<tr><td rowspan="2">Vegetation type</td><td>PCT ID</td><td>526</td></tr>
<tr><td>Common Community Name</td><td>Mountain Ribbon Gum - Messmate - Broad-leaved Stringybark open forest on granitic soils of the New England Tableland Bioregion</td></tr>
<tr><td>Approximate extent within the development site</td><td colspan="2">466.60ha
188.53ha derived native grassland (grassland)
278.07ha woodland</td></tr>
<tr><td rowspan="8">Species relied upon for PCT identification</td><td>Species name</td><td>Relative abundance</td></tr>
<tr><td>Forest Ribbon Gum Eucalyptus nobilis</td><td>20</td></tr>
<tr><td>Eucalyptus radiata subsp. sejuncta</td><td>10</td></tr>
<tr><td>Messmate Eucalyptus obliqua</td><td>10</td></tr>
<tr><td>Broad-leave Stringybark Eucalyptus caliginosa</td><td></td></tr>
<tr><td>Snowgrass Poa sieberiana</td><td>5</td></tr>
<tr><td>Bracken Pteridium esculentum</td><td>1</td></tr>
<tr><td>Spiny-headed Mat-rush Lomandra longifolia</td><td>1</td></tr>
<tr><td>Justification of evidence used to identify the PCT</td><td colspan="2">The canopy species listed above occur as associates throughout this PCT. Entry of these species for the Walcha Plateau into the Veg-C returns PCT 526 and PCT 738 as the strongest candidates. However, Broad-leaved Stringybark is typically dominant in PCT 738, which was not observed. Rather, the species occurred infrequently and Forest Ribbon Gum was dominant, hence, PCT 526 was chosen as the most likely PCT.</td></tr>
<tr><td>TEC Status</td><td colspan="2">No associated TEC</td></tr>
<tr><td>Estimate of percent cleared within NSW</td><td colspan="2">56%</td></tr>
</table>

<table>
<tr><th colspan="2">Mountain Ribbon Gum - Messmate - Broad-leaved Stringybark open forest on granitic soils of the New England Tableland Bioregion</th></tr>
<tr><td>PCT 526 derived native grassland Plot 2</td><td></td></tr>
<tr><td>PCT 526 woodland Plot 4</td><td></td></tr>
</table>

Table 3-11 Description of PCT 510 within the development site

<table>
<tr><th colspan="3">Blakely's Red Gum - Yellow Box grassy woodland of the New England Tableland Bioregion</th></tr>
<tr><td>Vegetation formation</td><td colspan="2">Grassy Woodlands</td></tr>
<tr><td>Vegetation class</td><td colspan="2">New England Grassy Woodlands</td></tr>
<tr><td rowspan="2">Vegetation type</td><td>PCT ID</td><td>510</td></tr>
<tr><td>Common Community Name</td><td>Blakely's Red Gum - Yellow Box grassy woodland of the New England Tableland Bioregion</td></tr>
<tr><td>Approximate extent within the development site</td><td colspan="2">151.43ha
72.98ha of derived native grassland
79.45ha of woodland</td></tr>
<tr><td rowspan="7">Species relied upon for PCT identification</td><td>Species name</td><td>Relative abundance</td></tr>
<tr><td>Blakely’s Red Gum Eucalyptus blakelyi</td><td>10</td></tr>
<tr><td>Yellow Box Eucalyptus melliodora</td><td>20</td></tr>
<tr><td>Apple Box Eucalyptus bridgesiana</td><td>2</td></tr>
<tr><td>Snowgrass Poa sieberiana</td><td>5</td></tr>
<tr><td>Weeping Grass Microlaena stipoides</td><td>10</td></tr>
<tr><td>Native Violet Viola betonicifolia</td><td>1</td></tr>
<tr><td>Justification of evidence used to identify the PCT</td><td colspan="2">This PCT is dominated by Blakely’s Red Gum and Yellow Box. Although a high number (15) of PCTs within Walcha Plateau subregion contain these two species, the constant dominance of these species and the consistent presence of the other species listed above suggests PCT 510 is the most likely.</td></tr>
<tr><td>TEC Status</td><td colspan="2">White Box - Yellow Box - Blakely’s Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highlands, NSW South Western Slopes, South East Corner and Riverina Bioregions (BC Listed, EPBC Listed). All vegetation zones were considered to meet the BC Act listed TEC criteria. However only Plots WWF090, WWF108, WWF110 met the EPBC Act TEC criteria as per condition thresholds.
The TEC (BC Act and EPBC Act) has been mapped in Figure 3-1.
Development footprint hectare areas:
PCT 510 Grassland TEC BC Act – 8.96 ha
PCT 510 Woodland TEC BC Act – 11.14 ha
PCT 510 Woodland TEC EPBC Act – 7.51 ha</td></tr>
<tr><td>Estimate of percent</td><td colspan="2">79%</td></tr>
</table>

Blakely's Red Gum - Yellow Box grassy woodland of the New England Tableland Bioregion	
cleared within NSW	
PCT 510 derived native grassland Plot 75	
PCT 510 woodland Plot 99	

3.2.4 Limitations

Several limitations are relevant to the assessment. Conservative strategies have been developed where required to address these.

Seasonal variability

To carry out a BAM assessment for a project as large as the Winterbourne Wind Farm, that is both responsive to the data collected and to changes in the development footprint for reasons other than avoidance of biodiversity impacts, the survey effort must span several years. This provides an excellent context to the assessment but also reflects seasonal variability. In the case of this assessment the seasonal variability was large particularly in relation to rainfall variation.

On the whole, the annual rainfall recorded at the Woolbrook Road weather station (BOM site 055136) was above average for 2020. Winter rainfall preceding t September-November 2021 survey period was below average. The development site may have still been experiencing the effects of drought in Spring 2020. However, on review of the BAM plots and relevant cover and abundance of native and exotic species these plots are considered suitable for the purposes of this assessment.

December 2020 had more than double the average rainfall and rainfall was generally above average through to November 2021. The final round of VI plot data was collected in December 2021. Based on the rainfall data, VI plot data collected from December 2020 onward is considered to not be affected by drought. The drought is not likely to have significantly impacted upon the credit generation across the development site.

Survey timing

It is recommended that VI plot data be collected during Autumn and Spring to maximise the cover and abundance of native flora. This was generally achieved through the survey program, though a small portion of VI plot data was collected during December 2020 and December 2021. Given the high rainfall of December 2020 and the high rainfall of 2021 generally (particularly November preceding survey), these conditions were still considered suitable.

Representative plots per zone

The BAM requires a minimum number of plots to represent each zone, based on its area. As the zone areas change size during the assessment, this can be challenging to achieve. However, of the 21 vegetation zones within the development footprint only one zone was deficient in plots. Zone 10 PCT 567 derived native grassland TEC condition has two plots instead of three plots completed. To account for this benchmark data for the additional plot has been used to supplement the missing plot data.

This is likely to have resulted in a higher VIS being recorded for the zones affected than if the minimum number of VI plots had been collected. Further surveys are planned in consultation with BCD, concurrent with the EIS exhibition. They will be documented prior to the Development's determination.

Location of VI plots

Of the 140 plots conducted, the majority are within the development site (subject land). A small number of plots were not within the development footprint but are representative of PCT type and condition within the development footprint and thus are considered suitable for this assessment.

Transport route

Generally, the development footprint assessed remains broad so that, in the detailed design phase of the Project, the assessment is robust to minor design changes which may be required. While the transport route between Walcha and the development site has been assessed for impacts to native vegetation in this BDAR, the areas of impact defined are still considered conceptual.

In total, 22 locations were assessed. Fifteen of these locations include polygonal areas of assumed impacts. The remaining seven were provided as point locations only. In consultation with ERM, NGH assumed a 0.1ha area of impact at each of these sites.

The assessment of these sites was conducted via a desktop analysis, with some ground truthing. This included:

- Six of the 15 polygons are located nearby the development site such that vegetation mapping of the development site was able to be extrapolated.
- Six of the 15 polygons were assessed via field survey.
- Three of the 15 polygons are located near or within the township of Walcha, and these areas are located along the roadside and likely to be exotic dominated. However, as a worst-case scenario, arguably the highest conservation value PCT (PCT 510) has been assumed present.
- All 7-point locations were assessed via field survey.

The development footprint, and this BDAR assessment, includes impacts at all 22 of these sites. Information on the haulage route is provided in Appendix B.

Scattered tree mapping

Scattered trees, in accordance with the definitions of the BAM, occur throughout the development site. Scattered trees have a percent foliage cover that is less than 25% of the benchmark for tree cover for the most likely plant community type and are on Category 2 (regulated land) and surrounded by Category 1 (exempt land) on the Native Vegetation Regulatory Map under the LLS Act.

Given Category 1 Land has been assessed as covering 1208ha of the development site, survey of each scattered tree to collect the attributes required by Appendix B of the BAM presented a practical limitation. To address this, each scattered tree within the development footprint was mapped via aerial imagery and assigned a PCT via extrapolation of ground-truthed mapping of the surrounding development site. As scattered trees are considered to constitute habitat for some candidate species (e.g. Koala), the scattered tree module of the BAM-C cannot be used, therefore, the areas of scattered trees have been added to the appropriate woodland vegetation zone. Each scattered tree was nominated an area of 0.01ha, resulting in the following areas being added to the BAM-C to account for scattered trees:

- Zone 2 PCT 510 Woodland, one tree for 0.01ha
- Zone 4 PCT 526 Woodland, 11 trees for 0.11ha
- Zone 6 PCT 534 Woodland, one tree for 0.01ha
- Zone 8 PCT 565 Woodland, 37 trees for 0.37ha
- Zone 11 PCT 567 Woodland, 41 trees for 0.41ha
- Zone 14 PCT 568 Woodland, three trees for 0.03ha
- Zone 17 PCT 970 Woodland, 19 tree for 0.19ha
- Zone 19 PCT 997 Woodland, nine trees for 0.09ha.

This approach is considered conservative as the BAM-C scattered tree calculator does not allow for additional hectare areas (above and beyond the ecosystem credit areas) to be considered as Koala habitat. This approach allows scattered trees to be used to generate species credits for Koala habitat.

3.3 Vegetation integrity assessment

3.3.1 Vegetation zones and survey effort

The PCTs identified within the development site were stratified into zones according to the condition described in Table 3-12. A total of 21 zones were identified within 10 PCTs. Note that PCT 567 has different zones for portions of the PCT that represent the associated TEC and those that do not represent the associated TEC. Vegetation zones were classified as poor, low, moderate and high depending on the VI score with poor less than 15, low 15-30, moderate 31-60 and high greater than 60.

Table 3-12 Vegetation zones within the development site

Zone ID	PCT_Zone	Condition (based on VI score)[1]	Zone area development site (ha)	Zone area development footprint (ha)	Survey effort completed (VI plots)	Survey effort required (VI plots)	Patch size (ha)
1	510_grassland low	Cleared areas of PCT 510 where little canopy remains resulting in a derived native grassland in low condition	72.98	8.96	4	3	>100
2	510_Woodland moderate	Treed areas of PCT 510 in moderate condition	79.45	11.15	10	3	>100
3	526_grassland poor	Cleared areas of PCT 526 where little canopy remains resulting in a derived native grassland in poor condition	188.53	28.56	6	4	>100
4	526_Woodland	Treed areas of PCT 526 in high	278.07	40.88	10	4	>100

[1] Poor = VI score<15, low = VI score 15-30, moderate = VI score >30-60, high = VI score >60

	high	condition					
5	534_grassland low	Cleared areas of PCT 534 where little canopy remains resulting in a derived native grassland in low condition	37.40	3.32	5	2	>100
6	534_Woodland moderate	Treed areas of PCT 534 in moderate condition	96.05	11.10	4	3	>100
7	565_grassland moderate	Cleared areas of PCT 565 where little canopy remains resulting in a derived native grassland in moderate condition	75.60	6.19	13	5	>100
8	565_Woodland moderate	Treed areas of PCT 565 in moderate condition	92.43	13.84	9	3	>100
9	568_grassland low	Cleared areas of PCT 568 where little canopy remains resulting in a derived native grassland in low condition	83.29	12.84	5	3	>100
10	568_Woodland high	Treed areas of PCT 568 in high condition	84.22	8.77	4	3	>100
11	766_Riparian low	Drainage lines with moisture loving species (*Carex*), occasional *Leptospermum* in low condition	28.58	1.60	5	1	>100
12	970_grassland	Cleared areas of PCT 510 where	264.17	34.84	7	4	>100

	poor	little canopy remains resulting in a derived native grassland in poor condition					
13	970_Woodland moderate	Treed areas of PCT 970 in moderate condition	304.87	37.80	10	4	>100
14	997_grassland poor	Cleared areas of PCT 997 where little canopy remains resulting in a derived native grassland in poor condition	73.44	6.03	3	2	>100
15	997_Woodland moderate	Treed areas of PCT 997 in moderate condition	70.68	10.18	5	3	>100
16	1194_grassland poor	Cleared areas of PCT 1194 where little canopy remains resulting in a derived native grassland in poor condition	90.90	17.95	5	3	>100
17	1194_Woodland moderate	Treed areas of PCT 1194 in moderate condition	61.79	5.65	9	3	>100
18	567_grassland_TEC moderate	Cleared areas of PCT 567 where little canopy remains resulting in a derived native grassland, considered TEC in moderate condition due to historic or adjacent Box Gum canopy	677.05	97.12	8	5	>100
19	567_Woodland_TEC moderate	Treed areas of PCT 567, considered TEC in moderate	252.10	31.76	7	4	>100

		condition, considered TEC due to presence of canopy Box trees					
20	567_grassland moderate	Cleared areas of PCT 567 where little canopy remains resulting in a derived native grassland in moderate condition (with historic or adjacent Stringybark canopy)	20.24	2.96	2	2	>100
21	567_Woodland high	Treed areas of PCT 567 in high condition dominated by Stringybark trees (*Eucalyptus caliginosa*)	284.24	35.45	13	5	>100
		TOTAL	3,216.66	425.67	140	55	

3.3.2 Vegetation integrity assessment results

The VI plot data collected was entered into the BAM-C by accredited assessor Brendon True (BAAS18155) and reviewed by Beth Noel (BAAS19015). The results of the vegetation integrity assessment are summarised in Table 3-13. Most derived grassland zones show poor (5-15) to low (16-30) VI scores, with occasional moderate (31-60) grasslands, reflective of the agricultural use of these areas. Most woodland sites have moderate (31-60) to high (>60) VI scores, reflecting more intact structure and composition.

The impact areas in Table 3-12 do not show clearly the degree to which the development footprint has been defined carefully to minimise impacts to higher value vegetation as many of the woodland zones are very open in structure and tree clearing in these zones will be low. To define additional zones to better reflect this effort would have complicated the assessment without significant benefit.

Table 3-13 Results of vegetation integrity assessment

Zone ID	PCT/Zone	Composition score	Structure score	Function score	Vegetation Integrity Score
1	510_grassland low	24.7	27.8	23.9	25.4
2	510_Woodland moderate	50.7	73.9	71.7	64.5
3	526_grassland poor	28.6	48.7	0.1	5.5
4	526_Woodland high	39	64.6	88.7	60.7
5	534_grassland low	42.3	36.6	7.4	22.5
6	534_Woodland moderate	55.7	45.4	50.3	50.3
7	565_grassland moderate	29.1	40	48.7	38.4
8	565_Woodland moderate	40.4	67.7	68.5	57.2
9	568_grassland low	43.9	32.9	2.2	14.7
10	568_Woodland high	63.9	47.5	82.9	63.1
11	766_Riparian low	55.9	7.8	-	20.8
12	970_grassland poor	24.9	22.1	1	8.2
13	970_Woodland moderate	15.3	73.9	63.2	41.5

14	997_grassland poor	14.1	41.1	2.7	11.6
15	997_Woodland moderate	23.2	41.1	75.6	41.6
16	1194_grassland poor	45.7	57.6	0.7	12.3
17	1194_Woodland moderate	68.6	45.3	63.5	58.2
18	567_grassland_TEC moderate	29.5	46.2	46	39.7
19	567_Woodland_TEC high	49.3	42.3	46.7	46
20	567_grassland low	8.8	5.2	29.9	11.1
21	567_Woodland high	61	66.6	87.1	70.7

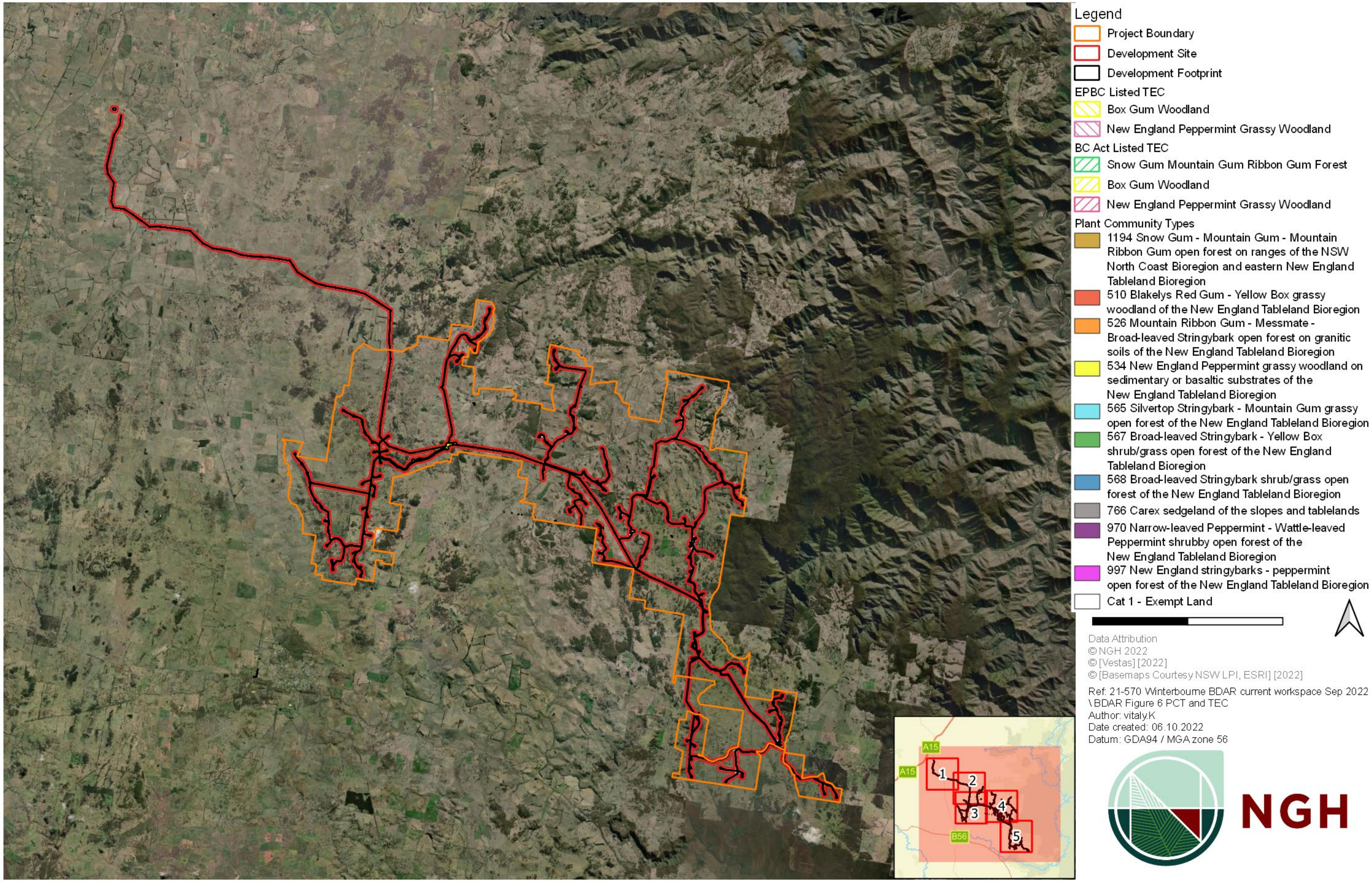


Figure 3-1 PCT and TEC mapping (detailed mapping is provided in Appendix N.4)

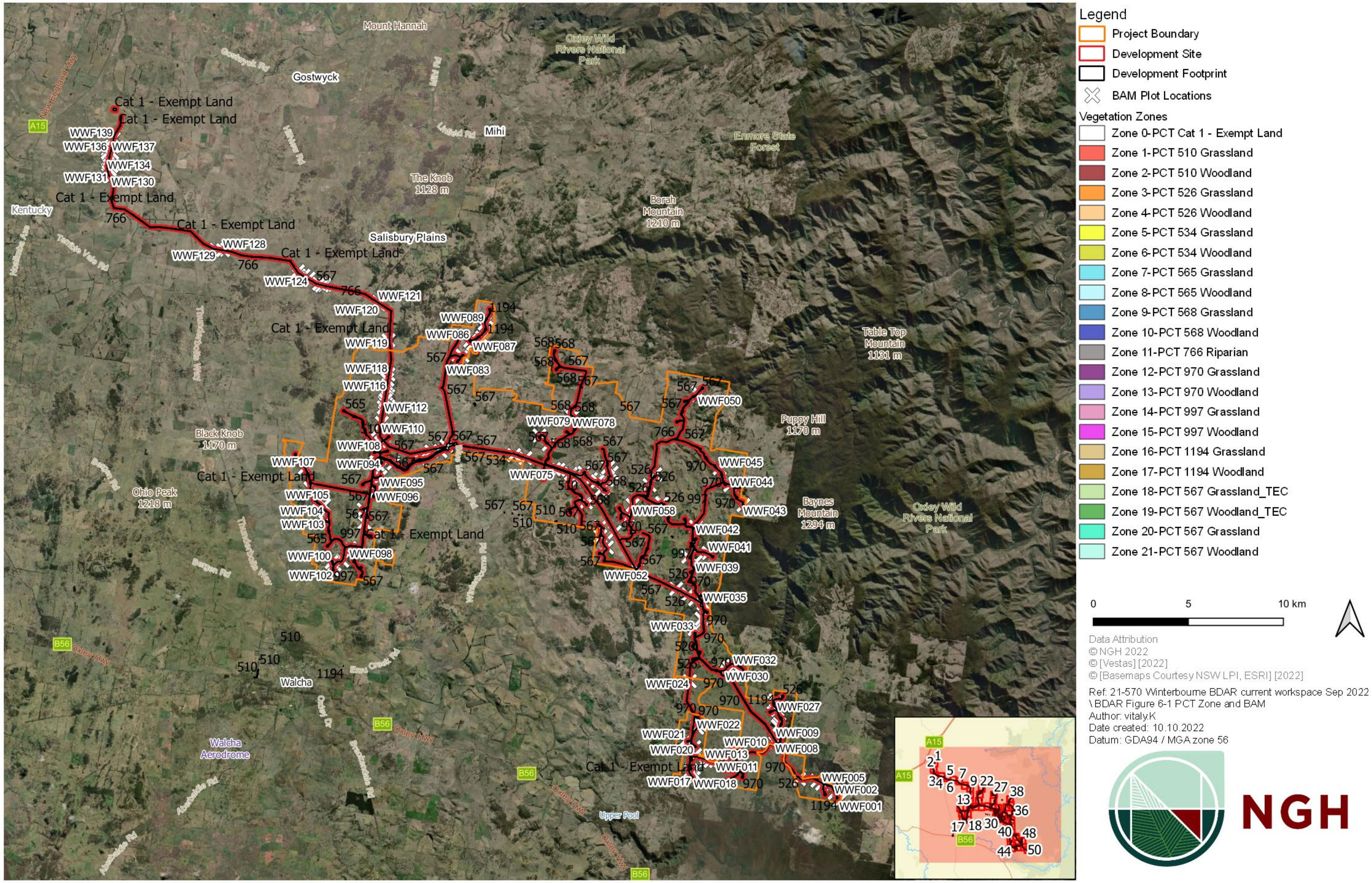


Figure 3-2 Vegetation Zones and BAM plot locations (detailed mapping is provided in Appendix N.5)

4. Threatened species

The development site is located in an agricultural landscape used for sheep and cattle production. The landscape is partially wooded and contains large and connected areas of woodland and forest in moderate to high condition. Outside of woodlands and forest there are large tracts of grassland that have been cleared of canopy and in most places midstory vegetation, leaving grasslands where intensive farming occurs. The grasslands vary in condition from moderate to low depending on the extent of native groundcover remaining. The variable elevation within the development site produces varied habitats from grassy woodlands to open forests and riparian areas, with several streams crossing the development site. The geology varies across the development site with basalts, granites, sedimentary and metamorphic rock and soil substrates occurring. This provides a highly varied landscape with much habitat suitable for flora and fauna, including habitat for threatened species. The development site has locations where woodland and forest connectivity enable fauna to move across the landscape. Tree cover varies in age and height, which provides habitat for species with varying requirements.

4.1 Ecosystem credit species

The following ecosystem credit species were returned by the BAM calculator as being associated with the PCTs identified on the development site. No ecosystem credit species were excluded from the assessment; all are assumed to occur and contribute to ecosystem credits. Additional species were added that were either detected on site or identified through desktop searches such as Ebird or Bionet.

Figure 4-1 Ecosystem credit species generated by the BAM-C and additional species relevant to the assessment

Kingdom	Class	Family	Scientific Name	Common Name	BC Act	EPBC Act	Sensitivity to Gain	IBRA Sub-region		
								Armidale Plateau	Walcha Plateau	Yarrowyck-Kentucky
Animalia	Aves	Acanthizidae	*Chthonicola sagittata*	Speckled Warbler	V	-	High Sensitivity to Potential Gain	Y	Y	Y
Animalia	Aves	Accipitridae	*Circus assimilis*	Spotted Harrier	V	-	Moderate Sensitivity to Potential Gain	Y	Y	
Animalia	Aves	Accipitridae	*Haliaeetus leucogaster*	White-bellied Sea-Eagle	V	-	N/A	Y	Y	Y
Animalia	Aves	Accipitridae	*Hieraaetus morphnoides*	Little Eagle	V	-	N/A	Y	Y	Y
[2]Animalia	Aves	Apodiformes	*Hirundapus caudacutus*	White-throated Needletail		V	High sensitivity to Potential Gain			
Animalia	Aves	Accipitridae	*Lophoictinia isura*	Square-tailed Kite	V	-	N/A	Y	Y	Y
Animalia	Aves	Apodidae	*Hirundapus caudacutus*	White-throated Needletail	-	-		Y	Y	Y
Animalia	Aves	Artamidae	*Artamus cyanopterus cyanopterus*	Dusky Woodswallow	V	-	Moderate Sensitivity to Potential Gain	Y	Y	y
Animalia	Aves	Cacatuidae	*Calyptorhynchus lathami*	Glossy Black-Cockatoo	V	-	N/A	Y	Y	Y

[2] Added to the BAM-C due to presence as Ebird sightings.

Kingdom	Class	Family	Scientific Name	Common Name	BC Act	EPBC Act	Sensitivity to Gain	IBRA Sub-region		
								Armidale Plateau	Walcha Plateau	Yarrowyck-Kentucky
Animalia	Aves	Ciconiidae	*Ephippiorhynchus asiaticus*	Black-necked Stork	E	-	Moderate Sensitivity to Potential Gain	Y	Y	
Animalia	Aves	Climacteridae	*Climacteris picumnus victoriae*	Brown Treecreeper (eastern subspecies)	V	-	High Sensitivity to Potential Gain	Y	Y	y
Animalia	Aves	Estrildidae	*Stagonopleura guttata*	Diamond Firetail	V	-	Moderate Sensitivity to Potential Gain	Y	Y	y
Animalia	Aves	Meliphagidae	*Anthochaera phrygia*	Regent Honeyeater	CE	CE	N/A	Y	Y	
Animalia	Aves	Meliphagidae	*Grantiella picta*	Painted Honeyeater	V	V	Moderate Sensitivity to Potential Gain	Y	Y	Y
Animalia	Aves	Meliphagidae	*Melithreptus gularis gularis*	Black-chinned Honeyeater (eastern subspecies)	V	-	Moderate Sensitivity to Potential Gain	Y		
Animalia	Aves	Neosittidae	*Daphoenositta chrysoptera*	Varied Sittella	V	-	Moderate Sensitivity to Potential Gain	Y	Y	Y
Animalia	Aves	Pachycephalidae	*Pachycephala olivacea*	Olive Whistler	V	-	Moderate Sensitivity to Potential Gain	Y	Y	
Animalia	Aves	Petroicidae	*Melanodryas cucullata cucullata*	Hooded Robin (south-eastern form)	V	-	Moderate Sensitivity to Potential Gain	Y	Y	Y
Animalia	Aves	Petroicidae	*Petroica boodang*	Scarlet Robin	V	-	Moderate Sensitivity to Potential Gain	Y	Y	Y
Animalia	Aves	Petroicidae	*Petroica phoenicea*	Flame Robin	V	-	Moderate Sensitivity to Potential Gain	Y	Y	y
Animalia	Aves	Psittacidae	*Glossopsitta pusilla*	Little Lorikeet	V	-	High Sensitivity to Potential Gain	Y	Y	Y

Kingdom	Class	Family	Scientific Name	Common Name	BC Act	EPBC Act	Sensitivity to Gain	IBRA Sub-region		
								Armidale Plateau	Walcha Plateau	Yarrowyck-Kentucky
Animalia	Aves	Psittacidae	*Lathamus discolor*	Swift Parrot	E	CE	N/A	Y	Y	Y
Animalia	Aves	Psittacidae	*Neophema pulchella*	Turquoise Parrot	V	-	High Sensitivity to Potential Gain	Y		Y
Animalia	Aves	Strigidae	*Ninox connivens*	Barking Owl	V	-	N/A	Y	Y	y
Animalia	Aves	Strigidae	*Ninox strenua*	Powerful Owl	V	-	N/A	Y	Y	Y
Animalia	Aves	Tytonidae	*Tyto novaehollandiae*	Masked Owl	V	-	N/A	Y	Y	Y
Animalia	Aves	Tytonidae	*Tyto tenebricosa*	Sooty Owl	V	-	N/A	Y	Y	
Animalia	Mammalia	Dasyuridae	*Dasyurus maculatus*	Spotted-tailed Quoll	V	E		Y	Y	
Animalia	Mammalia	Emballonuridae	*Saccolaimus flaviventris*	Yellow-bellied Sheathtail-bat	V	-	High Sensitivity to Potential Gain	Y	Y	Y
Animalia	Mammalia	Miniopteridae	*Miniopterus orianae oceanensis*	Large Bent-winged Bat	V	-	N/A	Y	Y	Y
Animalia	Mammalia	Muridae	*Pseudomys novaehollandiae*	New Holland Mouse	-	V	High Sensitivity to Potential Gain	Y	Y	
Animalia	Mammalia	Muridae	*Pseudomys oralis*	Hastings River Mouse	E	E	High Sensitivity to Potential Gain		Y	
Animalia	Mammalia	Petauridae	*Petaurus australis*	Yellow-bellied Glider	V	-	High Sensitivity to Potential Gain	Y	Y	Y
Animalia	Mammalia	Phascolarctidae	*Phascolarctos cinereus*	Koala	V	V[3]	N/A	Y	Y	Y

[3] Koala status was Vulnerable at the time of the controlled action decision on the EPBC referral. Despite up-listing to Endangered in February 2022, this species will be assessed against the Vulnerable criteria.

Kingdom	Class	Family	Scientific Name	Common Name	BC Act	EPBC Act	Sensitivity to Gain	IBRA Sub-region		
								Armidale Plateau	Walcha Plateau	Yarrowyck-Kentucky
Animalia	Mammalia	Pteropodidae	*Pteropus poliocephalus*	Grey-headed Flying-fox	V	V	N/A	Y	Y	Y
Animalia	Mammalia	Vespertilionidae	*Chalinolobus nigrogriseus*	Hoary Wattled Bat	V	-	High Sensitivity to Potential Gain	Y		
Animalia	Mammalia	Vespertilionidae	*Falsistrellus tasmaniensis*	Eastern False Pipistrelle	V	-	High Sensitivity to Potential Gain	Y	Y	
Animalia	Mammalia	Vespertilionidae	*Scoteanax rueppellii*	Greater Broad-nosed Bat	V	-	High Sensitivity to Potential Gain	Y	Y	Y

4.1.1 Ecosystem credit exclusions

No ecosystem credit species were excluded from the assessment; all are assumed to occur and contribute to ecosystem credits.

4.2 Species credit species

The following species credit species were returned by the calculator, on the basis of the zones and plot data entered. Under the BAM, these generate additional species credits unless:

1. They are excluded because habitat constraints required by the species are not present, or
2. Geographical constraints exclude their presence, or
3. Habitat quality is sufficiently degraded such that they could not occur, or
4. Survey effort has demonstrated they are not present.

The assessment against these criteria is included in the table below. In summary:

- Two species have been excluded because habitat constraints required by the species are not present (Table 4-1). These are discussed further in Section 4.2.1.
- Four species have been excluded due to geographical constraints not being met (Table 4-1)
- No species have been determined to be absent, on the basis of degraded habitat quality.
- Forty-eight species were included for further assessment under the BAM. Further information on survey method, effort and results is provided in section 4.2.4 and 4.2.5
- Forty-one species have been determined to be absent, on the basis of targeted surveys.
- Seven species are verified to be present through surveys:
    - Squirrel Glider *Petaurus norfolcensis*
    - Koala *Phascolarctos cinereus*
    - Greater Glider *Petauroides volans*
    - Glossy Black-Cockatoo *Calyptorhynchus lathami*
    - Barking Owl *Ninox connivens*
    - Narrow-leaved Black Peppermint *Eucalyptus nicholii*
    - Bluegrass *Dichanthium setosum.*

Table 4-1 summarises the analysis used to include or exclude species for further assessment under the BAM and the details of further assessment to establish species impacted by the proposal.

Table 4-1 Species Credit Species assessment against BAM criteria for exclusion or inclusion for further assessment.

Manually Added to BAM-C	Class	Scientific Name	Common Name	BC Act	EPBC Act	IBRA Region			Included or excluded for further assessment under the BAM
						Armidale Plateau	Walcha Plateau	Yarrowyck -Kentucky	
Fauna									
No	Amphibia	*Litoria booroolongensis*	Booroolong Frog	E	E		Y	Y	Included
Yes	Amphibia	*Litoria castanea*	Yellow-spotted Tree Frog	CE	E	Y			Included
No	Amphibia	*Litoria daviesae*	Davies' Tree Frog	V	-		Y		Included
No	Amphibia	*Litoria piperata*	Peppered Tree Frog	CE	V	Y			Included
Yes	Amphibia	*Litoria subglandulosa*	Glandular Frog	V	-	Y			Included
No	Amphibia	*Adelotus brevis*	Tusked Frog	EP	-	Y	Y	Y	Included
No	Amphibia	*Mixophyes balbus*	Stuttering Frog	E	V		Y		Excluded – Geographic constraint not met
No	Aves	*Haliaeetus leucogaster*	White-bellied Sea-Eagle	V	-	Y	Y	Y	Included
No	Aves	*Hieraaetus morphnoides*	Little Eagle	V	-	Y	Y	Y	Included
No	Aves	*Lophoictinia isura*	Square-tailed Kite	V	-	Y	Y	Y	Included
No	Aves	*Burhinus grallarius*	Bush Stone-curlew	E	-	Y	Y		Included
No	Aves	*Calyptorhynchus lathami*	Glossy Black-Cockatoo	V	-	Y	Y	Y	Included
No	Aves	*Anthochaera phrygia*	Regent Honeyeater	CE	CE	Y	Y	Y	Excluded due to geographical constraints – site does not fall within an important area
No	Aves	*Lathamus discolor*	Swift Parrot	E	CE	Y	Y	Y	Excluded due to geographical

Manually Added to BAM-C	Class	Scientific Name	Common Name	BC Act	EPBC Act	IBRA Region			Included or excluded for further assessment under the BAM
						Armidale Plateau	Walcha Plateau	Yarrowyck -Kentucky	
									constraints – site does not fall within an important area
No	Aves	*Ninox connivens*	Barking Owl	V	-	Y	Y	Y	Included
No	Aves	*Ninox strenua*	Powerful Owl	V	-	Y	Y	Y	Included
No	Aves	*Tyto novaehollandiae*	Masked Owl	V	-	Y	Y	Y	Included
No	Aves	*Tyto tenebricosa*	Sooty Owl	V	-	Y	Y		Included
No	Mammalia	*Cercartetus nanus*	Eastern Pygmy-possum	V	-	Y	Y		Included
No	Mammalia	*Phascogale tapoatafa*	Brush-tailed Phascogale	V	-		Y		Excluded – Geographic constraint not met
No	Mammalia	*Macropus parma*	Parma Wallaby	V	-		Y		Included
No	Mammalia	*Petrogale penicillata*	Brush-tailed Rock-wallaby	E	V	Y	Y		Included
No	Mammalia	*Miniopterus orianae oceanensis*	Large Bent-winged Bat	V	-	Y	Y	Y	Species Credit Excluded – No suitable breeding habitat located (caves)
No	Mammalia	*Petaurus norfolcensis*	Squirrel Glider	V	-	Y	Y	Y	Included
No	Mammalia	*Phascolarctos cinereus*	Koala	V	V	Y	Y	Y	Included
No	Mammalia	*Aepyprymnus rufescens*	Rufous Bettong	V	-		Y		Included
No	Mammalia	*Petauroides volans*	Greater Glider	-	V		Y		Included
No	Mammalia	*Pteropus poliocephalus*	Grey-headed Flying-fox	V	V	Y	Y	Y	Included
No	Mammalia	*Chalinolobus dwyeri*	Large-eared Pied Bat	V	V	Y	Y		Species Credit Excluded – No suitable breeding habitat located (caves)

Manually Added to BAM-C	Class	Scientific Name	Common Name	BC Act	EPBC Act	IBRA Region			Included or excluded for further assessment under the BAM
						Armidale Plateau	Walcha Plateau	Yarrowyck -Kentucky	
No	Mammalia	*Myotis macropus*	Southern Myotis	V	-	Y	Y		Included
No	Reptilia	*Hoplocephalus bitorquatus*	Pale-headed Snake	V	-	Y	Y		Included
Flora									
Yes	Flora	*Picris evae*	Hawkweed	V	V	Y			Included
No	Flora	*Callitris oblonga*	Pygmy Cypress Pine	V	V	Y	Y		Included
Yes	Flora	*Styphelia perileuca*	Montane Green Five-corners	V	V	Y			Included
No	Flora	*Bertya ingramii*	Narrow-leaved Bertya	E	E	Y	Y		Included
Yes	Flora	*Swainsona sericea*	Silky Swainson-pea	V	-	Y			Included
No	Flora	*Haloragis exalata subsp. Velutina*	Tall Velvet Sea-berry	V	V	Y	Y		Included
No	Flora	*Prostanthera cineolifera*	Singleton Mint Bush	V	V		Y		Included
No	Flora	*Eucalyptus magnificata*	Northern Blue Box	E	-	Y	Y		Included
No	Flora	*Eucalyptus nicholii*	Narrow-leaved Black Peppermint	V	V	Y	Y	Y	Included
No	Flora	*Chiloglottis anaticeps*	Bird Orchid	E	-		Y		Included
No	Flora	*Chiloglottis platyptera*	Barrington Tops Ant Orchid	V	-	Y	Y		Included
No	Flora	*Cryptostylis hunteriana*	Leafless Tongue Orchid	V	V		Y		Included
No	Flora	*Diuris pedunculata*	Small Snake Orchid	E	E	Y	Y		Included

Manually Added to BAM-C	Class	Scientific Name	Common Name	BC Act	EPBC Act	IBRA Region			Included or excluded for further assessment under the BAM
						Armidale Plateau	Walcha Plateau	Yarrowyck-Kentucky	
No	Flora	*Pterostylis elegans*	Elegant Greenhood	V	-		Y		Included
No	Flora	*Pterostylis riparia*	*NA*	V	V		Y		Included
No	Flora	*Euphrasia arguta*	*NA*	CE		Y			Included
No	Flora	*Euphrasia ciliolata*	Polblue Eyebright	V	-		Y		Included
No	Flora	*Dichanthium setosum*	Bluegrass	V	V	Y	Y		Included
Yes	Flora	*Grevillea beadleana*	Beadle's Grevillea	E	E	Y			Included
Yes	Flora	*Boronia granitica*	Granite Boronia	V	E	Y			Included
No	Flora	*Thesium australe*	Austral Toadflax	V	V	Y	Y	Y	Included
No	Flora	*Tasmannia glaucifolia*	Fragrant Pepperbush	V	V		Y		Included
No	Flora	*Tasmannia purpurascens*	Broad-leaved Pepperbush	V	-		Y		Included

4.2.1 Species credit exclusions based on habitat features

As per Section 5.2.3 of the Biodiversity Assessment Method (DPIE, 2020) a candidate species credit species that does not have suitable habitat as per BAM (2020) does not require further assessment. The following candidate species credit species have been determined to meet this clause as per below (Table 4-2)

Table 4-2 Excluded species

Candidate Species Credit Species	Exclusion Justification
Miniopterus orianae oceanensis **Large Bent-winged Bat**	No suitable caves, tunnels, mines or culverts that are considered potential breeding habitat were located on site.
Chalinolobus dwyeri **Large-eared Pied Bat**	No suitable caves, caves or cliffs that are considered potential breeding habitat were located on site.

4.2.2 List of species credit species targeted for further targeted survey

Table 4-3 lists all species that could not be ruled out through geographical or habitat constraints and therefore required targeted survey to determine if the species is present or if its habitat could potentially be impacted.

Table 4-3 List of species credit species for targeted survey

Class	Scientific Name	Common Name	BC Act	EPBC Act
Amphibia	*Litoria booroolongensis*	Booroolong Frog	E	E
Amphibia	*Litoria castanea*	Yellow-spotted Tree Frog	CE	E
Amphibia	*Litoria daviesae*	Davies' Tree Frog	V	-
Amphibia	*Litoria piperata*	Peppered Tree Frog	CE	V
Amphibia	*Litoria subglandulosa*	Glandular Frog	V	-
Amphibia	*Adelotus brevis*	Tusked Frog	EP	-

Class	Scientific Name	Common Name	BC Act	EPBC Act
Aves	*Haliaeetus leucogaster*	White-bellied Sea-Eagle	V	-
Aves	*Hieraaetus morphnoides*	Little Eagle	V	-
Aves	*Lophoictinia isura*	Square-tailed Kite	V	-
Aves	*Burhinus grallarius*	Bush Stone-curlew	E	-
Aves	*Calyptorhynchus lathami*	Glossy Black-Cockatoo	V	-
Aves	*Ninox connivens*	Barking Owl	V	-
Aves	*Ninox strenua*	Powerful Owl	V	-
Aves	*Tyto novaehollandiae*	Masked Owl	V	-
Aves	*Tyto tenebricosa*	Sooty Owl	V	-
Mammalia	*Cercartetus nanus*	Eastern Pygmy-possum	V	-
Mammalia	*Macropus parma*	Parma Wallaby	V	-
Mammalia	*Petrogale penicillata*	Brush-tailed Rock-wallaby	E	V
Mammalia	*Petaurus norfolcensis*	Squirrel Glider	V	-
Mammalia	*Phascolarctos cinereus*	Koala	V	V
Mammalia	*Aepyprymnus rufescens*	Rufous Bettong	V	-
Mammalia	*Petauroides volans*	Greater Glider	-	V

Class	Scientific Name	Common Name	BC Act	EPBC Act
Mammalia	*Pteropus poliocephalus*	Grey-headed Flying-fox	V	V
Mammalia	*Myotis macropus*	Southern Myotis	V	-
Reptilia	*Hoplocephalus bitorquatus*	Pale-headed Snake	V	-
Flora	*Picris evae*	Hawkweed	V	V
Flora	*Callitris oblonga*	Pygmy Cypress Pine	V	V
Flora	*Styphelia perileuca*	Montane Green Five-corners	V	V
Flora	*Bertya ingramii*	Narrow-leaved Bertya	E	E
Flora	*Swainsona sericea*	Silky Swainson-pea	V	-
Flora	*Haloragis exalata subsp. velutina*	Tall Velvet Sea-berry	V	V
Flora	*Prostanthera cineolifera*	Singleton Mint Bush	V	V
Flora	*Eucalyptus magnificata*	Northern Blue Box	E	-
Flora	*Eucalyptus nicholii*	Narrow-leaved Black Peppermint	V	V
Flora	*Chiloglottis anaticeps*	Bird Orchid	E	-
Flora	*Chiloglottis platyptera*	Barrington Tops Ant Orchid	V	-
Flora	*Cryptostylis hunteriana*	Leafless Tongue Orchid	V	V

Class	Scientific Name	Common Name	BC Act	EPBC Act
Flora	*Diuris pedunculata*	Small Snake Orchid	E	E
Flora	*Pterostylis elegans*	Elegant Greenhood	V	-
Flora	*Pterostylis riparia*	*NA*	V	V
Flora	*Euphrasia arguta*	*NA*	CE	
Flora	*Euphrasia ciliolata*	Polblue Eyebright	V	-
Flora	*Dichanthium setosum*	Bluegrass	V	V
Flora	*Grevillea beadleana*	Beadle's Grevillea	E	E
Flora	*Boronia granitica*	Granite Boronia	V	E
Flora	*Thesium australe*	Austral Toadflax	V	V
Flora	*Tasmannia glaucifolia*	Fragrant Pepperbush	V	V
Flora	*Tasmannia purpurascens*	Broad-leaved Pepperbush	V	-

4.2.3 Inclusions based on habitat features

As per the BAM Operational Manual – Stage 1, an assessor must consider species recorded on or near the development site even if they are not predicted by the BAM-C. The species listed in Table 4-4 were manually added. All were added because of their association with the adjoining Armidale Plateau IBRA sub-region.

Table 4-4 Added species

Species	Justification
Litoria castanea,	Species credit species that have not been

Species	Justification
Litoria piperata	nominated within the dominant IBRA sub-region but has been nominated within the adjoining Armidale Plateau IBRA subregion in which a part of the linear shaped development is located. EPBC species not generated by BAM-C that are thought to have habitat have also been added.
Litoria subglandulosa	
Boronia granitica	
Grevillea beadleana	
Picris evae	
Styphelia perileuca.	
Swainsona sericea	

4.2.4 Species credit species summary of survey effort and results

Targeted surveys for species credit species were undertaken in accordance with Section 6.5 of the BAM, including undertaking surveys during the nominated survey period specified for each candidate species and in accordance with survey guidelines unless otherwise stated. The survey effort, timing and locations for threatened flora and fauna are outlined in the following Sections and summarised in Table 4-6. In total, forty-one species have been determined to be absent, on the basis of the targeted survey program (refer to Table 4-6) showing the total number of hours for targeted flora and fauna surveys at Winterbourne.

Summary of survey effort

A total of 2,663.5 hours of survey effort was completed at the project site between 2020 and 2022.

Table 4-5 Total number of field hours spent assessing potential development impacts

Survey type	Hours
BAM plots	714.50
Frog & reptile	235.75
Glossy Black-cockatoo & Owl	114.00
Orchid	136.00
Roadside	32.00
Flora surveys-	286.25
Threatened eucalypt	157.50
Reptile	48.00
BUS	240.00
White-throated Needletail	120.00
Threatened flora- Veg Mapping	277.50
Fauna surveys	100.00
Threatened flora	106.50
HBT	95.50
Grand Total	**2,663.50**

Microbat detector nights totalled 518 over 8 different locations.

The following sections provide a summary of species surveyed for, survey effort, survey guidelines, survey results and if the surveys were deemed suitable. Additional information required to further validate the flora and fauna surveys is provided in a summary in section 4.2.4 and in greater detail in section 4.2.5.

Table 4-7 Summary of total field survey time by NGH 2020-22 (all survey types)

Year	Month											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2020								124	104	185	16	78
2021			240	26				114		630	32	993
2022	120											
Total (hr)	**120**		**240**	**26**				**238**	**104**	**815**	**48**	**1,071**

The following Table 4-6 summarises the survey method, survey effort, survey results and whether the surveys are considered suitable for detection of the species. Further information on survey methodologies is provided in section 4.2.5.

Table 4-6 Summary of targeted species credit species survey effort and results

Scientific Name	Common Name	Survey Window	Targeted Survey Dates	Survey Effort	Guidelines	Comments	Results
Litoria booroolongensis	Booroolong Frog	Oct -Dec	Dec 2021	Nocturnal aural-visual surveys were undertaken at twelve sites, with transects of 500m in breeding habitat. Call playback was employed along the transects at 100m intervals. Tadpole searches were also undertaken at each transect. Surveys were conducted by two people for two hours and repeated between one and four times at each of the twelve sites over different nights. A total of 72 person hours were undertaken. See Section 4.2.5 for further details.	NSW Survey Guide for Threatened Frogs 2020	Survey considered suitable for exclusion of this species	Not detected
Litoria castanea	Yellow-spotted Tree Frog	Nov-Dec	Dec 2021			No recorded calls available for this species but all calls heard were identified, thus considered suitable survey effort	Not detected
Litoria daviesae	Davies' Tree Frog	Sep-Jan	Dec 2021			Survey considered suitable for exclusion of this species	Not detected
Litoria subglandulosa	Glandular Frog	Oct-Dec	Dec 2021			Survey considered suitable for	Not detected

Scientific Name	Common Name	Survey Window	Targeted Survey Dates	Survey Effort	Guidelines	Comments	Results
						exclusion of this species	
Litoria piperata	Peppered Tree Frog	Aug-Mar	Dec 2021			Survey considered suitable for exclusion of this species	Not detected
Adelotus brevis	Tusked Frog	Oct-Jan	Dec 2021			Survey considered suitable for exclusion of this species	Not detected
Haliaeetus leucogaster	White-bellied Sea-Eagle	Jul-Dec	Feb 2020, Aug 2020, Oct 2020, Mar-Apr 2021, Jan 2022, Mar 2022	Bird utilisation and raptor surveys (BUS) were undertaken over 3 years and 3 seasons. The fixed-point bird count method was used; 15 min surveys were carried out. Eight impact points were surveyed 8 times each (2 reference points were also surveyed 8 times each). BUS surveys totalled 48 hours of survey effort for Oct 2020 (8 days), Mar-Apr 2021 (6 days) and Jan 2022 (5 days) and were conducted to detect diurnal bird activity within	Guidelines listed in the TBDC for species credits “Breeding” for this species	This species was not recorded during bird surveys on site and so breeding was excluded. Surveys are considered suitable for exclusion of these credits.	Not detected

Scientific Name	Common Name	Survey Window	Targeted Survey Dates	Survey Effort	Guidelines	Comments	Results
Hieraaetus morphnoides	Little Eagle	Aug-Oct	Feb 2020, Aug 2020, Oct 2020, Mar-Apr 2021, Jan 2022, Mar 2022	the subject land over a 2-year period. An additional BUS survey was conducted in Mar 2022 (3 days). Stick nest surveys were carried out in woodland areas during other field surveys. See Appendix C for details of BUS surveys.	Guidelines listed in the TBDC for species credits “Breeding” for this species	This species was not recorded during bird surveys on site and so breeding was excluded. Surveys are considered suitable for exclusion of these credits.	<u>Not detected for Breeding</u>
Lophoictinia isura	Square-tailed Kite	Sep-Jan	Feb 2020, Aug 2020, Oct 2020, Mar-Apr 2021, Jan 2022, Mar 2022		Guidelines listed in the TBDC for species credits “Breeding” for this species	This species was not recorded during bird surveys on site and so breeding was excluded. Surveys are considered suitable for exclusion of these credits.	Not detected for breeding
Burhinus grallarius	Bush Stone-curlew	All year	Mar, Apr, Sep, Oct, Nov, Dec	This species was surveyed concurrently with nocturnal birds. These were surveyed using spotlighting and call play back		Despite extensive surveys through the	Not detected

Scientific Name	Common Name	Survey Window	Targeted Survey Dates	Survey Effort	Guidelines	Comments	Results
				techniques. Spotlighting beams had a penetration of 20-40m. A total of 44 sites were surveyed for nocturnal birds over a total of 23 hours.		site, no signs of this species were found. This survey is considered suitable for exclusion of this species	
Calyptorhynchus lathami	Glossy Black-Cockatoo	Jan-Sep	Mar, Aug, Oct Aug 2021, Mar 2022	Targeted surveys for this species were undertaken in areas identified, through previous site inspection, as having suitable food trees and potential breeding habitat. During Aug 2021 14 sites were surveyed, including 2ha survey by 2 people at each site. A total of 79 survey hours were undertaken. BUS surveys totalled 48 hours of survey effort for Oct 2020 (8 days), Mar-Apr 2021 (6 days) and Jan 2022 (5 days) and were conducted to detect diurnal bird activity within the subject land over a 2-year period. An additional BUS survey was conducted in Mar 2022 (3 days). See section 4.2.5 for further details.	Guidelines as per the TBDC. Surveys look for signs of breeding on site as follows; (a) begging birds of any age or sex; or (b) lone adult males identified during the breeding season (April to August); or (c) an occupied nest.	Despite extensive surveys searching for this species and breeding habitat during the breeding period, no signs of breeding were found. This survey is considered suitable for exclusion of the species credit of this dual credit species	This species was detected on site and species credits were generated for areas within 200m of hollow bearing trees

Scientific Name	Common Name	Survey Window	Targeted Survey Dates	Survey Effort	Guidelines	Comments	Results
Ninox connivens	Barking Owl	May-Dec	Aug 2020 & 2021	These species were surveyed concurrently with other nocturnal birds. These were surveyed using spotlighting and call play back techniques. Spotlighting beams had a penetration of 20-40m. A total of 44 sites were surveyed for nocturnal birds over a total of 23 hours.	Working Draft Threatened Species Survey and Assessment Guidelines. DEC 2004	This species was incidentally recorded on site outside of breeding season.	This species was detected on site and species credits were generated for areas within 100m of hollow bearing trees
Ninox strenua	Powerful Owl	May-Aug	Aug 2020 & 2021		Working Draft Threatened Species Survey and Assessment Guidelines. DEC 2004	Due to the number of sites and replication of surveys, and as per table 5.6 of DECC 2004, detectability of the species is presumed to be >90%	Not detected
Tyto novaehollandiae	Masked Owl	May-Aug	Aug 2020 & 2021		Working Draft Threatened Species Survey and Assessment Guidelines. DEC 2004	Due to the number of sites and replication of surveys, and as per table 5.6 of DECC 2004, detectability	Not detected

Scientific Name	Common Name	Survey Window	Targeted Survey Dates	Survey Effort	Guidelines	Comments	Results
						of the species is presumed to be >90%	
Tyto tenebricosa	Sooty Owl	Apr-Aug	Aug 2020 & 2021		Working Draft Threatened Species Survey and Assessment Guidelines. DEC 2004	Due to the number of sites and replication of surveys, and as per table 5.6 of DECC 2004, detectability of the species is presumed to be >90%	Not detected
Cercartetus nanus	Eastern Pygmy-possum	Oct-Mar	Aug 2020 Mar 2021, Dec 2021	8 cameras were deployed for 7 nights (56 Trap nights) 36 baited hair-tube traps (36mm) for 7 nights, total of (252 trap nights) A total of 44 sites were surveyed using spotlighting for nocturnal birds over a total of 23 hours. See section 4.2.5for details		Survey considered suitable for exclusion of this species.	Not detected

Scientific Name	Common Name	Survey Window	Targeted Survey Dates	Survey Effort	Guidelines	Comments	Results
Macropus parma	Parma Wallaby	All year	Aug, Sep, Oct, Dec Oct 2021, Dec 2021	Diurnal targeted searches were undertaken Parma Wallaby within suitable habitat. Searches targeted direct sightings of individuals as well as evidence of occupation such as scats, tracks or fur. Camera traps deployed for Rufous Bettong would also have detected this species.	As per macropod surveys in: Survey guidelines for Australia's threatened mammals. SEWPAC 2011	Surveys are considered suitable for exclusion of this species.	Not detected
Petrogale penicillata	Brush-tailed Rock-wallaby	All year	Aug, Sep, Oct, Nov Oct 2021, Dec 2021	Diurnal targeted searches were undertaken for Brush-tailed Rock Wallaby within suitable habitat. Searches targeted direct sightings of individuals as well as evidence of occupation such as scats, tracks or fur. Camera traps deployed for Rufous Bettong would also have detected this species	Survey guidelines for Australia's threatened mammals. SEWPAC 2011	Surveys are considered suitable for exclusion of this species.	Not detected
Petaurus norfolcensis	Squirrel Glider	All year	Aug 2020, Aug 2021 Dec 2021	Opportunistic scat searches also took place during mammal surveys in Aug 2020. A total of 44 sites were surveyed using spotlighting for nocturnal birds and mammals over a total of 23 hours in Aug 2020.		This species was heard during nocturnal call playback surveys and was additionally detected on a	Detected

Scientific Name	Common Name	Survey Window	Targeted Survey Dates	Survey Effort	Guidelines	Comments	Results
				A total of 7 cameras were deployed across the study area in arboreal positions as described in section 4.2.5 in Dec 2021.		camera trap in 2020	
Aepyprymnus rufescens	Rufous Bettong	All year	Oct 2021, Dec 2021	6 hair tubes (large sizes 50 and 90mm) (42 trap nights). 7 camera traps deployed for 7 nights (42 trap nights). These were deployed in conjunction with hair tubes for maximum detection.	As per Northern Bettong in: Survey guidelines for Australia's threatened mammals. SEWPAC 2011	Camera trap and Hair-tube sampling surveys are recommen-ded for the ecologically similar northern bettong. As such these recommen-dations have been followed and the surveys are considered suitable for exclusion of this species	Not detected

Scientific Name	Common Name	Survey Window	Targeted Survey Dates	Survey Effort	Guidelines	Comments	Results
Petauroides volans	Greater Glider	All year	Feb 2020 Aug 2020 Aug 2021 Dec 2021	Opportunistic scat searches took place during mammal surveys in 2020. A total of 44 sites were surveyed using spotlighting for nocturnal birds and mammals over a total of 23 hours in Aug 2021. A total of 7 cameras were deployed across the study area in arboreal positions as described in section 4.2.5 in Dec 2021.		Greater Glider was detected in the south-east of the development site. At one location, only scats were found. At a second location, a cluster of individuals (13 total) were found in February 2020	Detected
Phascolarctos cinereus	Koala	All year	Feb 2020, Aug 2021 Dec 2021	Targeted koala scat surveys. Opportunistic scat searches took place during mammal surveys in 2020. A total of 44 sites were surveyed using spotlighting for nocturnal birds and mammals over a total of 23 hours in Aug 2021. A total of 7 cameras were deployed across the study area in arboreal	Methodology was based on the Spot Assessment Technique (SAT) of Phillips and Callaghan (2011)	Field surveys were preliminary in nature. Due to the positive detection of koala scats from three sites, no further field surveys were undertaken	Detected

Scientific Name	Common Name	Survey Window	Targeted Survey Dates	Survey Effort	Guidelines	Comments	Results
				positions as described in section 4.2.5 in Dec 2021.		as the species is assumed present with breeding habitat within the development site	
Pteropus poliocephalus	Grey-headed Flying-fox	Oct-Dec	Oct, Nov, Dec	Field staff made observations across the site for any potential camp sites during all field surveys at the site. Additionally, a desktop search was undertaken via the National Flying-fox monitoring viewer	TBDC	No camp sites were recorded on site and so breeding was excluded. Surveys are considered suitable for exclusion of these credits.	Not detected
Myotis macropus	Southern Myotis	Oct-Mar	Not surveyed	Targeted microbat surveys were undertaken using SongMeter Detector units set to remotely record ultrasonic echolocation calls overnight. Two rounds of surveys were undertaken during Spring 2020 (5 October to 20 November 2020) and Autumn 2021 (8 March to 22 April 2021).	‘Species credit’ threatened bats and their habitats. OEH 2018	Surveys were considered suitable for this species	Not detected

Scientific Name	Common Name	Survey Window	Targeted Survey Dates	Survey Effort	Guidelines	Comments	Results
				The total Anabat survey effort across the site was 518 detector nights.			
Hoplocephalus bitorquatus	Pale-headed Snake	Nov-Mar	Dec 2021	Twelve sites were surveyed for this species with the transect at each site replicated twice on different nights. Survey effort for each transect was one person-hour (standard spotlighting techniques were used with a focus placed on the tree trunks and other habitat likely to be used by the Pale-headed snake).	Survey guidelines for Australia's threatened reptiles: Guidelines for detecting reptiles listed as threatened under the EPBC Act. SEWPAC 2011	No specific guidelines for this species is listed. Surveys were undertaken in accordance with the generalised Nocturnal spotlight searches.	Not detected
Flora							
Picris evae	Hawkweed	Nov-Feb	Dec November 2020 & 2021; December 2021	Surveys were undertaken where the 100-square-metre gridlines intersect within suitable habitat for a target species. Surveys for multiple target species occurred. At each survey location point (grid intersect), a 40-metre diameter	Surveying Threatened Plants and Their Habitats (NSW guideline)	In accordance with survey guidelines	Not detected

Scientific Name	Common Name	Survey Window	Targeted Survey Dates	Survey Effort	Guidelines	Comments	Results
Callitris oblonga	Pygmy Cypress Pine	All year	Mar, Apr, Sep, Oct, Nov, Dec Mar 2021, Apr 2021, Sep 2020, Oct 2020 & 2021; Nov 2020 & 2021; Dec 2021	area (1,256 m^2 circular area) was systematically surveyed for the target species. A total of 518 survey points were undertaken within the development site as shown in Figure 4-2 with any threatened flora detected recorded as a point datum. Some of the 518 survey points were duplicates as they were visited several times due to the different seasonal survey requirements of the threatened flora species. These 518 survey points resulted in a total of 65 hectares of potential threatened flora habitat inspected across the development footprint and represent approximately 670 survey hours.	Surveying Threatened Plants and Their Habitats (NSW guideline)	In accordance with survey guidelines	Not detected
Styphelia perileuca	Montane Green Five-corners	All year	Mar 2021, Apr 2021, Sep 2020, Oct 2020 & 2021; Nov 2020 & 2021; Dec 2021		Surveying Threatened Plants and Their Habitats (NSW guideline)	In accordance with survey guidelines	Not detected
Bertya ingramii	Narrow-leaved Bertya	All year	Mar 2021, Apr 2021, Sep 2020, Oct 2020 & 2021; Nov 2020 & 2021; Dec 2021		Surveying Threatened Plants and Their Habitats (NSW guideline)	In accordance with survey guidelines	Not detected
Swainsona sericea	Silky Swainson-pea	Sep-Nov	Nov 2020 & 2021		Surveying Threatened Plants and Their	In accordance	Not detected

Scientific Name	Common Name	Survey Window	Targeted Survey Dates	Survey Effort	Guidelines	Comments	Results
					Habitats (NSW guideline)	with survey guidelines	
Haloragis exalata* subsp. *velutina	Tall Velvet Sea-berry	All year	Mar 2021, Apr 2021, Sep 2020, Oct 2020 & 2021; Nov 2020 & 2021; Dec 2021		Surveying Threatened Plants and Their Habitats (NSW guideline)	In accordance with survey guidelines	Not detected
Prostanthera cineolifera	Singleton Mint Bush	Sep-Oct	Sep 2020, Oct 2020 & 2021		Surveying Threatened Plants and Their Habitats (NSW guideline)	In accordance with survey guidelines	Not detected
Eucalyptus magnificata	Northern Blue Box	All year	Mar 2021, Apr 2021, Sep 2020, Oct 2020 & 2021, Nov 2020 & 2021, Dec 2021	Surveys were undertaken where the 100-square-metre gridlines intersect within suitable habitat for a target species. Surveys for multiple target species occurred. At each survey location point (grid intersect), a 40-metre diameter	Surveying Threatened Plants and Their Habitats (NSW guideline)	In accordance with survey guidelines	Not detected

Scientific Name	Common Name	Survey Window	Targeted Survey Dates	Survey Effort	Guidelines	Comments	Results
Eucalyptus nicholii	Narrow-leaved Black Peppermint	All year	Mar 2021, Apr 2021, Sep 2020, Oct 2020 & 2021, Nov 2020 & 2021 Dec 2021	area (1,256 m^2 circular area) was systematically surveyed for the target species. A total of 518 survey points were undertaken within the development site resulting in a total of 65 hectares of potential threatened flora habitat inspected across the development footprint which represented approximately 670 survey hours	Surveying Threatened Plants and Their Habitats (NSW guideline)	In accordance with survey guidelines	Detected
Chiloglottis anaticeps	Bird Orchid	Dec-Mar	Mar 2021, Dec 2021		Surveying Threatened Plants and Their Habitats (NSW guideline)	In accordance with survey guidelines	Not detected
Chiloglottis platyptera	Barrington Tops Ant Orchid	Oct	Oct Oct 2020 & 2021		Surveying Threatened Plants and Their Habitats (NSW guideline)	In accordance with survey guidelines	Not detected
Cryptostylis hunteriana	Leafless Tongue Orchid	Nov-Jan	Dec		Surveying Threatened Plants and Their Habitats (NSW guideline)	In accordance with survey guidelines	Not detected

Scientific Name	Common Name	Survey Window	Targeted Survey Dates	Survey Effort	Guidelines	Comments	Results
Diuris pedunculata	Small Snake Orchid	Sep-Oct	Sep 2020, Oct 2020 & 2021		Surveying Threatened Plants and Their Habitats (NSW guideline)	In accordance with survey guidelines	Not detected
Pterostylis elegans	Elegant Greenhood	Feb-Apr	Mar 2022			In accordance with survey guidelines	Not detected
Pterostylis riparia	*NA*	Nov-Dec	Nov 2020 & 2021; Dec 2021	Surveys were undertaken where the 100-square-metre gridlines intersect within suitable habitat for a target species. Surveys for multiple target species occurred. At each survey location point (grid intersect), a 40-metre diameter area (1,256 m^2 circular area) was systematically surveyed for the target species. A total of 518 survey points were undertaken within the development site resulting in a total of 65 hectares of potential threatened flora habitat inspected across the development footprint which represented approximately 670 survey hours	Surveying Threatened Plants and Their Habitats (NSW guideline)	In accordance with survey guidelines	Not detected
Euphrasia arguta	*NA*	Nov-Mar	Nov 2020 & 2021, Dec 2021, Mar 2021		Surveying Threatened Plants and Their Habitats	In accordance with survey guidelines	Not detected

Scientific Name	Common Name	Survey Window	Targeted Survey Dates	Survey Effort	Guidelines	Comments	Results
					(NSW guideline)		
Euphrasia ciliolata	Polblue Eyebright	Dec-May	Dec 2021, Mar 2021		Surveying Threatened Plants and Their Habitats (NSW guideline)	In accordance with survey guidelines	Not detected
Dichanthium setosum	Bluegrass	Nov-May	Nov 2020 & 2021, Dec 2021, Mar 2021		Surveying Threatened Plants and Their Habitats (NSW guideline)	In accordance with survey guidelines	Detected
Grevillea beadleana	Beadle's Grevillea	All year	Mar 2021, Apr 2021, Sep 2020, Oct 2020 & 2021, Nov 2020 & 2021, Dec 2021		Surveying Threatened Plants and Their Habitats (NSW guideline)	In accordance with survey guidelines	Not detected
Boronia granitica	Granite Boronia	All year	Mar 2021, Apr 2021, Sep 2020, Oct 2020 &		Surveying Threatened Plants and Their	In accordance	Not detected

Scientific Name	Common Name	Survey Window	Targeted Survey Dates	Survey Effort	Guidelines	Comments	Results
			2021, Nov 2020 & 2021, Dec 2021		Habitats (NSW guideline)	with survey guidelines	
Thesium australe	Austral Toadflax	Nov-Feb	Nov 2020 & 2021; Dec 2021		Surveying Threatened Plants and Their Habitats (NSW guideline)	In accordance with survey guidelines	Not detected
Tasmannia glaucifolia	Fragrant Pepperbush	All year	Mar 2021, Apr 2021, Sep 2020, Oct 2020 & 2021, Nov 2020 & 2021, Dec 2021		Surveying Threatened Plants and Their Habitats (NSW guideline)	In accordance with survey guidelines	Not detected
Tasmannia purpurascens	Broad-leaved Pepperbush	All year	Mar 2021, Apr 2021, Sep 2020, Oct 2020 & 2021, Nov 2020 & 2021, Dec 2021		Surveying Threatened Plants and Their Habitats (NSW guideline)	In accordance with survey guidelines	Not detected

Summary weather records for all targeted surveys

Table 4-7 details weather conditions during flora and fauna surveys at the project site. The survey effort and results may have been influenced by weather and thus sections detailing survey results will comment if weather was considered a factor that influenced whether surveys were effective in detecting the targeted species.

Table 4-7 Weather records during field surveys

Date	Temps		Rain	9 am					Survey
	Min	Max		Temp	RH	Cld	Dir	Spd	
	°C	°C	mm	°C	%	8th		km/h	
November 2019 Average	9	25	136mm total	-	-	-	-	-	BAM Plots, Opportunistic Bird Records
February 2020 Average	14	22	353mm total	-	-	-	-	-	Bird Surveys, Koala Scat Surveys
August 2020 Average	2	12	42mm total	-	-	-	-	-	Vegetation Assessment, Owl Surveys
September 2020 Average	6	16	48mm total	-	-	-	-	-	BAM Plots, Threatened Flora Surveys
October 2020 Average	8	21	144mm total	-	-	-	-	-	Bird Utilisation Surveys, Bat Surveys
November 2020 Average	10	25	34mm total	-	-	-	-	-	Threatened Flora Surveys
March 2021 Average	12	20	360mm total	-	-	-	-	-	BAM Plots, Threatened Flora Surveys, Camera Trap Surveys
April 2021	7	17	60mm total	-	-	-	-	-	Bird Surveys, Bat Surveys
27/08/2021	-1.6	11.0	0	6.5	79	4	NNW	4	Glossy Black-cockatoo Surveys; Owl Surveys
28/08/2021	-3.7	12.7	0	8.0	93	0	W	9	Glossy Black-cockatoo Surveys; Owl Surveys
29/08/2021	-4.0	19.5	0	8.0	93	0	E	4	Glossy Black-cockatoo Surveys; Owl Surveys
30/08/2021	-2.5	16.0	0	10.0	93	2	Calm		Glossy Black-cockatoo Surveys; Owl Surveys

Date	Temps		Rain	9 am					Survey
	Min	Max		Temp	RH	Cld	Dir	Spd	
	°C	°C	mm	°C	%	8th		km/h	
31/08/2021	-1.0	19.7	0	9.0	75	0		Calm	Glossy Black-cockatoo Surveys; Owl Surveys
01/09/2021	0.2	23.0	0	13.0	73	0		Calm	Glossy Black-cockatoo Surveys; Owl Surveys
10/10/2021	7.4	25.0	0	20.0	87	2	NW	7	Threatened Flora Surveys, Diurnal Mammals
11/10/2021	7.5	16.0	29.2	13.5	84	8		Calm	Threatened Flora Surveys, Diurnal Mammals
12/10/2021	8.5	16.0	12.0	9.5	93	8	ESE	7	Threatened Flora Surveys, Diurnal Mammals
13/10/2021	9.0	19.7	4.0	16.0	23	3	SE	4	Threatened Flora Surveys, Diurnal Mammals
14/10/2021	13.8	22.5	1.0	17.5	85	2	NW	7	Threatened Flora Surveys, Diurnal Mammals
15/10/2021	11.5	16.6	7.4	13.2	56	7	NW	13	Threatened Flora Surveys, Diurnal Mammals
16/10/2021	5.0	14.3	3.8	10.2	88	5	W	11	Threatened Flora Surveys, Diurnal Mammals
18/10/2021	2.8	20.7	0	13.2	92	5	NNW	4	Threatened Flora Surveys, Diurnal Mammals
19/10/2021	2.2	22.0	0	14.0	68	2		Calm	Threatened Flora Surveys, Diurnal Mammals
20/10/2021	4.3	19.5	0.6	13.0	78	2		Calm	Threatened Flora Surveys, Diurnal Mammals
21/10/2021	7.0	21.0	0	14.5	80	2	NE	6	Threatened Flora Surveys, Diurnal Mammals
22/10/2021	11.8	24.0	0	16.0	78	4	NW	4	Threatened Flora Surveys, Diurnal Mammals
24/10/2021	16.0	21.0	0.4	17.0	85	3	NW	7	Threatened Flora Surveys
25/10/2021	6.0	19.6	0	11.0	71	0		Calm	Threatened Flora Surveys
26/10/2021	1.0	20.3	0	14.5	84	0	SE	4	Threatened Flora Surveys
27/10/2021	6.5	24.2	0	16.2	78	2	N	4	Threatened Flora Surveys
28/10/2021	5.5	27.0	0	19.5	77	2	NW	11	Threatened Flora Surveys
29/10/2021	11.8	22.5	11.8	17.0	94	8	NW	6	Threatened Flora Surveys
15/11/2021	5.2	18.0	0	11.5	88	3	SW	11	Threatened Flora Surveys
16/11/2021	1.2	18.0	0	12.2	86	0	SW	4	Threatened Flora Surveys

Date	Temps		Rain	9 am					Survey
	Min	Max		Temp	RH	Cld	Dir	Spd	
	°C	°C	mm	°C	%	8^{th}	km/h		
6/12/2021	10.5	21.6	0	15.7	24	4	SE	7	Frog Surveys; Mammal Surveys
7/12/2021	14.3	23.5	9.2	16.5	90	8	Calm		Reptile Surveys; Frog Surveys; Mammal Surveys
8/12/2021	11.0	25.2	49.4	15.0	90	7	Calm		Reptile Surveys; Frog Surveys; Threatened Flora Surveys; Mammal Surveys
9/12/2021	11.3	23.0	23.2	18.5	68	2	N	7	Reptile Surveys; Frog Surveys; Threatened Flora Surveys; Mammal Surveys
10/12/2021	5.8	19.0	17.0	12.0	51	0	SW	6	Reptile Surveys; Frog Surveys; Threatened Flora Surveys; Mammal Surveys
11/12/2021	6.2	22.0	0	14.0	68	0	Calm		Reptile Surveys; Frog Surveys; Threatened Flora Surveys; Mammal Surveys
12/12/2021	10.0	23.0	0	17.0	68	5	Calm		Reptile Surveys; Frog Surveys; Threatened Flora Surveys; Mammal Surveys
13/12/2021	9.5	24.0	0	16.0	83	0	Calm		Reptile Surveys; Frog Surveys; Threatened Flora Surveys; Mammal Surveys
14/12/2021	10.5	25.5	0	18.0	68	2	Calm		Reptile Surveys; Frog Surveys; Threatened Flora Surveys; Mammal Surveys
15/12/2021	6.7	29.0	0	18.5	44	0	Calm		Threatened Flora Surveys; Mammal Surveys
16/12/2021	12.4	24.5	0	20.0	57	4	Calm		Threatened Flora Surveys; Mammal Surveys
17/12/2021	14.5	28.0	0	20.5	70	0	SE	4	Threatened Flora Surveys; Mammal Surveys

4.2.5 Detailed information on targeted surveys for species credit species

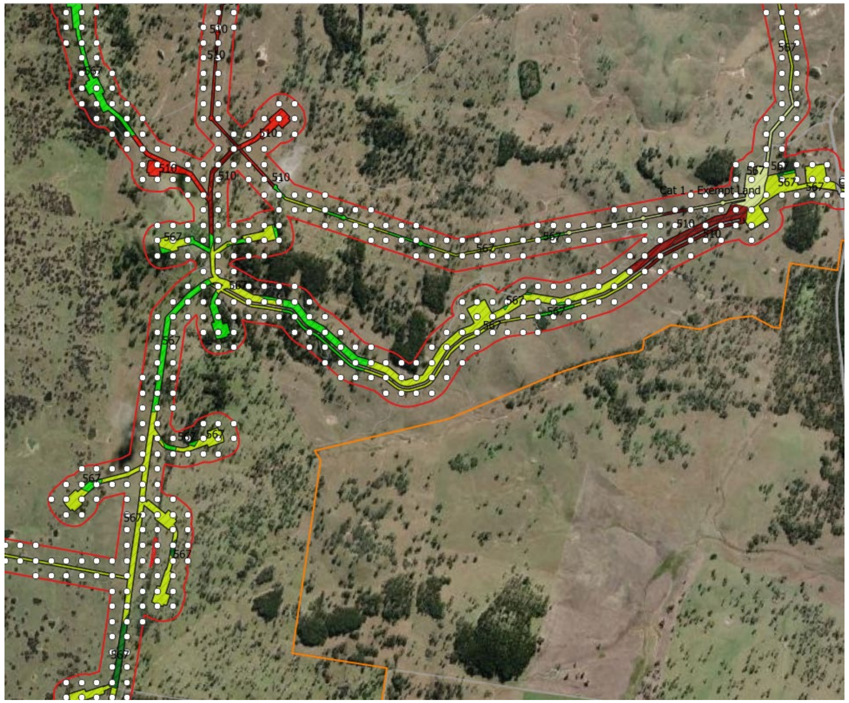
Threatened flora

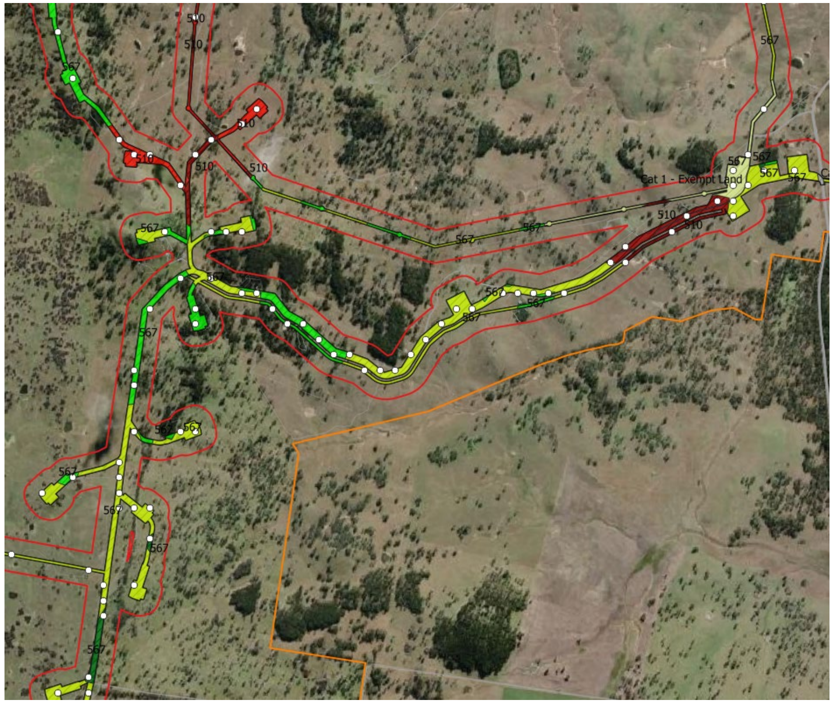
Flora species
Species Targeted
Picris evae Hawkweed, *Callitris oblonga* Pygmy Cypress Pine, *Styphelia perileuca* Montane Green Five-corners, *Bertya ingramii* Narrow-leaved Bertya, *Swainsona sericea* Silky Swainson-pea, *Haloragis exalata subsp. Velutina* Tall Velvet Sea-berry, *Prostanthera cineolifera* Singleton Mint Bush, *Eucalyptus magnificata* Northern Blue Box, *Eucalyptus nicholii* Narrow-leaved Black Peppermint, *Chiloglottis anaticeps* Bird Orchid, *Chiloglottis platyptera* Barrington Tops Ant Orchid, *Cryptostylis hunteriana* Leafless Tongue Orchid, Diuris pedunculata Small Snake Orchid, *Pterostylis elegans* Elegant Greenhood, *Pterostylis riparia*, *Euphrasia arguta*, *Euphrasia ciliolate* Polblue Eyebright, *Dichanthium setosum* Bluegrass, *Grevillea beadleana* Beadle's Grevillea, *Boronia granitica* Granite Boronia, *Thesium australe* Austral Toadflax, *Tasmannia glaucifolia* Fragrant Pepperbush, *Tasmannia purpurascens* Broad-leaved Pepperbush,
Guidelines used
NSW Government DPIE Surveying threatened plants and their habitats (DPIE, Surveying threatened plants and their habitats, 2020) was used to establish the most effective survey methodology across the development site. In order to maximise the likelihood of detection of targeted plants and apply survey techniques that aim to cover a large proportion of suitable habitat in a large site, a two phase grid based survey approach was adopted.
Survey planning
The targeted flora surveys were applied to land within the development footprint. A grid spaced at 100 square metres (m^2) nested within a one-square-kilometre grid from a topographic map image was overlayed onto the development site using a geographic information system (GIS). Surveys were proposed where the 100-square-metre gridlines intersected with suitable habitat for the targeted flora species. Suitable habitat was considered to include all native vegetation zones. Any areas of exotic vegetation or areas categorised as Category 1 land (as shown in the land category assessment in Appendix A) were not surveyed for threatened flora. A total of 3030 grid points were within the development site, 382 grid points intersected the development footprint excluding Category 1 land (see inset below showing survey planning). The grid points that were situated within the development footprint were then adjusted to target turbine locations and ensure coverage across the vegetation zones. At the time of the flora surveys additional assessment of exotic land was being undertaken.

Surveyors selected only areas of native vegetation in which to conduct the flora surveys and thus a reduced number of flora surveys were conducted from the 382 grid points identified within the development footprint.

A matrix of the threatened flora species credit species was prepared from the BAM Candidate Species Report. This detailed the survey window for each species and was used to establish the optimum time of year for detecting the most threatened flora. This was determined to be November with 15 of the 23 species able to be surveyed within November. Six species including Bird Orchid (Dec), Barrington Tops Orchid (Oct), Small Snake Orchid (Oct), *Ephrasia ciliota* (Dec) and Singleton Mint Bush (Oct) were surveyed for in other months (shown in brackets) and one species Elegant Greenhood was was surveyed in March 2022.

The majority of surveys were carried out in November 2021, with additional flora surveys carried out in October and December 2021 and March 2022.





Flora grid across the development site inset showing part of the DF(3030 points) Flora grids intersecting the development footprint native vegetation inset showing comparison of the same part of the DF (382 points)
Survey personnel
Ecologists experienced in the identification of threatened species and trained in the survey methodology conducted the threatened flora searches. Survey personnel are detailed in Appendix H.
Survey method
The 328 grid points were targeted for threatened flora surveys. At each survey location point, a 40-metre diameter area (1,256 m^2 circular area) was systematically surveyed for the target species by conducting parallel field traverses across the area with transects four metres apart (open vegetation) for all threatened flora species with the exception of eucalyptus species. All trees within the 40-metre diameter area were inspected and identified to determine if they were the target species. Surveys for threatened eucalypts were only conducted in woodland vegetation zones. Any threatened flora detected were recorded using a tablet or GPS generating an easting and a northing. A photo of the threatened species and other descriptive notes were also recorded with each sighting.
Survey Effort
A total of 518 survey points were undertaken within the development site as shown in Figure 4-2 with any threatened flora detected recorded as a point datum. Some of the 518 survey points were duplicates as they were visited several times due to the different seasonal survey requirements of the threatened flora species. Areas of orchid habitat were inspected October and December in addition to the area also being inspected in November during all other flora species targeted surveys. These 518 survey points resulted in a total of 65 hectares of potential threatened flora habitat inspected across the development footprint and represent approximately 670 survey hours.
Survey results
The results of the surveys are presented in Figure 4-4 including the location of all threatened flora detected during surveys across the development site. The following threatened flora were detected: • Narrow-leaved Black Peppermint was recorded within the development site and the development footprint. A total of 85 trees were identified within the development site. A total of 19 trees were within the development footprint. • Eight Bluegrass individuals were recorded within a non-associated PCT (PCT 970) in the east of the development site. As the neighbouring PCTs were not generally associated with Bluegrass, there is no justification to include them in the polygon as the area was searched for other individuals and they were not detected.

No other threatened flora species were detected within the development site.
Comment on survey effectiveness
This survey is considered suitable for all threatened flora species credit species listed above. A total of 328 flora survey points were required within the development footprint. A total of 258 flora survey points were conducted within the development footprint and a total of 518 flora survey points were conducted within the development site. This survey effort is considered sufficient due to the extensive survey hours applied across the development site and the fact that the flora survey points conducted just outside the development footprint, but within the development site, are representative of the surrounding vegetation. Survey points were conducted outside the development footprint due to changes in the development footprint over 2020 to 2021. Some survey locations were visited more than once due to varied survey windows.
Species polygons
The following methodology for generating species credit species for threatened flora was employed: • Narrow-leaved Black Peppermint: 19 trees were entered into the BAM-C in their respective vegetation zones. • Bluegrass: the entire area of PCT 970 within this part of the development footprint was considered suitable habitat for this species. A species polygon included PCT 970 where seed dispersal through wind and animal movement was thought likely to extend from the area the Bluegrass was detected. This resulted in an area of 13.2ha being entered into the BAM-C. Species polygons are presented in Figure 4-5 and in greater detail in Appendix N.9
Limitations
Weather conditions over 2020 and 2021 varied greatly, and therefore it is possible that some of the threatened flora, although expected to flower within certain windows, may not have flowered and thus may have gone undetected. The guidelines required completion of 382 threatened flora survey points within the development footprint. A total of 518 flora survey points were conducted within the broader development site, of which 248 survey points were conducted inside the development footprint and 270 flora survey points were collected outside the development footprint. The survey points conducted outside the development footprint were situated within habitat which was indicative of the adjacent development footprint. This survey is considered suitable for this assessment.

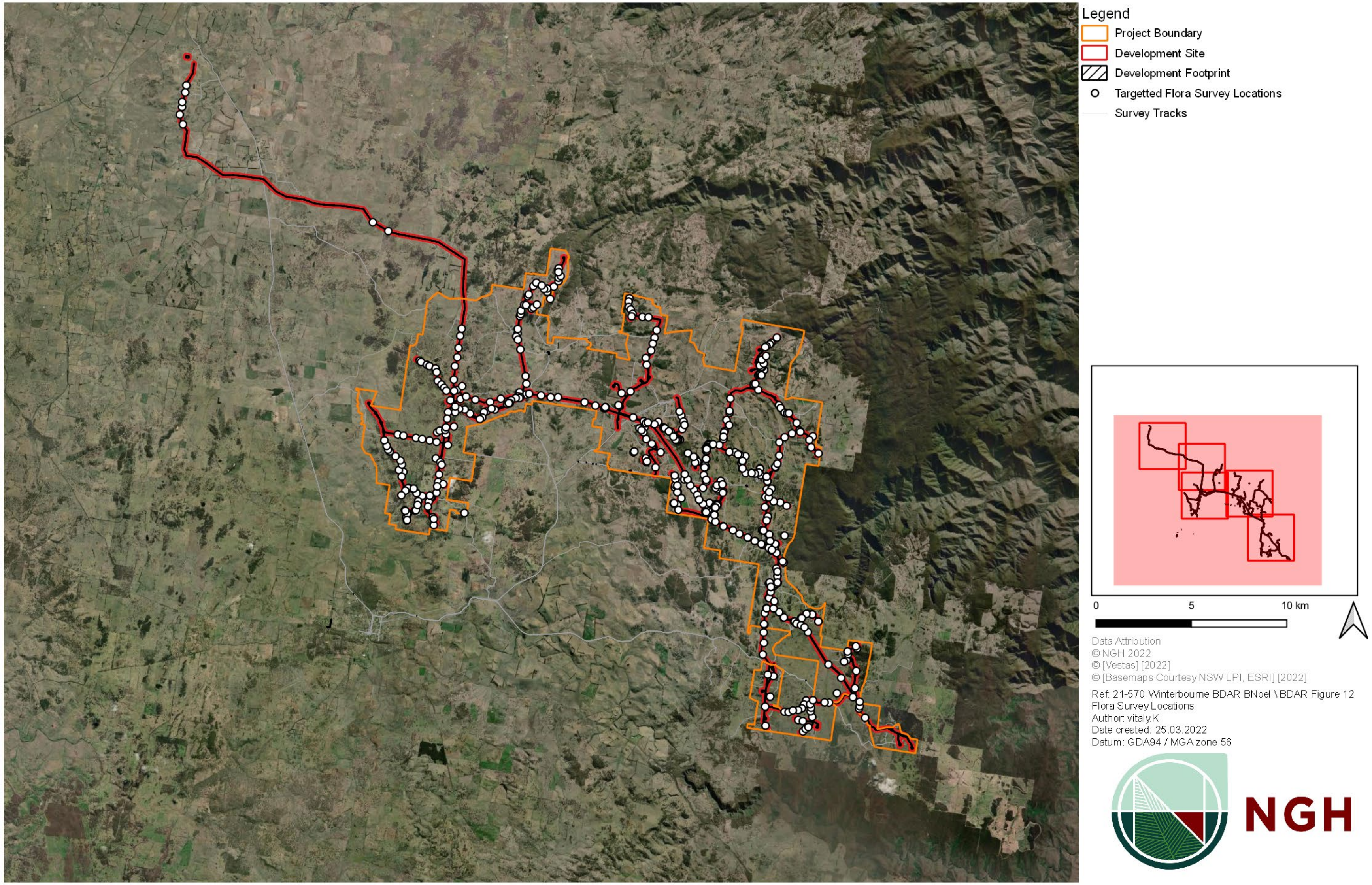


Figure 4-2 Targeted flora survey locations (further detailed mapping is provided in Appendix N.6)

Threatened fauna - Amphibian

Amphibian species	
Species Targeted	
Litoria booroolongensis Booroolong Frog, _Litoria castanea_ Yellow-spotted Tree Frog, _Litoria piperata_ Peppered Tree Frog, _Litoria daviesae_ Davies' Tree Frog, _Litoria subglandulosa_ Glandular Frog, _Adelotus brevis_ Tusked Frog	
Guidelines used	
The NSW Guide for the survey of threatened frogs and their habitats for the Biodiversity Assessment Method (DPIE, NSW Guide for Threatened Frogs, 2020) was used to establish the survey methodology across the development site. The survey objective was to determine, with a high level of confidence, the species present within the development site and, if present, to map the extent of habitat as a species polygon.	
Survey planning	
The following sites were selected for survey based on the most suitable breeding and non-breeding habitat within the development site for the species targeted for survey as listed above.	
Site	Description
1	Stream, some standing water, slow flow, mostly clay substrate with some rocks, large pools with small riffles, no trees or shrubs but heavily vegetated banks, Juncus sp, Carex, Paspalum, Carex and mix of exotics. Water quality turbid but good, yabbies, back swimmers, dragon fly nymphs, some stock damage in places
2	No access
3	Stream, dam 250m upstream, some flowing water, substrate consists of rock, clay, vegetation. Banks 5m either side have some scattered canopy eucalypts, native vegetation on banks includes _Eleocharis_, patches of native dominant with up to 50% of exotic cover. Some filamentous algae, mostly clear ponds, invertebrate activity, possible short finned eel, gastropods, eastern long necked turtle, by the last survey stock had damaged the channel and water quality was compromised
4	Ephemeral channel 20-30m wide, shallow puddles, water drained very quickly, substate clay/sandy loam, mini pools, slow moving stream. Gully erosion on banks of creek. Mix of weed and native paddock/grassland with some scattered native trees, higher weed cover in ground stratum. Stock access, steep eroded banks, yabbies, turbid water flowing, vegetation cover low.

5	Flowing stream in floodplain, braided channel upstream. High flow, channel 1-3m wide, day four still flowing strong. Quite deep, hard to see substrate. Paddock either side, native juncus, weedy cropping species in sediment but higher native composition in rock banks. Water quality good, looks like very limited stock access, Dragonfly and Mayfly nymphs, shrimp, yabbies, rock outcrop and instream vegetation increases upstream
6	Ephemeral channel and dam. High flow from rain. Substrate pebbles and sandy loam sections of mud/weeds in floodplain area. Dam, rocky banks downstream, paddock either side a mix of native and exotics. Good water quality, limited stock access, long necked turtle, swamp hens.
7	Small stream with pools and terraces. Some high flow sections with pools. Substrate sandy loam, some rock in channel, vegetated in some sections. Banks mostly exotic with little to no canopy. Water quality poor/moderate, some sections eroded, turbid post high flow, rubbish throughout.
8	Stream in pasture, floodplain in some areas. High to medium flow. Mainly vegetated. Dam. Pasture weeds on banks. Stock damage.
9	Stream, ephemeral and permanent / semi-permanent pools, substrate mainly silt, some stone areas, majority of stream within paddock and riparian vegetation limited to sparse sedges
10	Ephemeral stream and wetland. Silty substrate. Wetland further upstream. No fish passage barriers. Variable width of vegetation, paddock along upper area, sedges and rushes present at wetland area.
11	Stream. Moderate flow, perennial stream. Silty substrate. Two small oxbows, some deeper pools. Culvert under road. Mostly through paddock, some sedges and rushes throughout.
12	Large stream/river. High and permanent flow. Rock and silt substrate. Multiple areas of floodplain along riverbank. Fence minor obstruction to fish passage. Areas of riparian woodland 30 plus metres wide.
13	Stream with occasional swamps fed by springs. Moderate flow, signs of flooding. Vegetated substrate, some rock on banks and instream. Pools, swamps, some rock, riffles. Good native coverage 2-5m either side, some exotics and cropping grass but diverse native sections, sedges and reeds with spaced native canopy up to 20m wide in sections. Very good water quality, low frog diversity, possibly due to high flow and narrow stream. Native aquatic submergent vegetation, tolerant frog species only, calling.
Survey personnel	

Ecologists experienced in the identification of threatened frogs and trained in the survey methodology conducted the threatened amphibian surveys. Survey personnel are detailed in Appendix H.
Survey method
Aural-visual surveys are a combination of listening for the calls of frogs and searching for individuals along a transect. One survey night covers a minimum 120-minute period of listening for calling frogs and conducting a visual search along a 500 metre transect in breeding habitat along, around or through a suitable waterbody. Where there is insufficient habitat to accommodate a 500 metre transect a pro-rata effort is to be applied with all available habitat being searched. An aural-visual survey commences with an aural survey where the surveyor/s listens for calls (in silence and darkness), for a minimum of five minutes whilst remaining still. The aural survey process is repeated every 50 metres of the transect (i.e.11 points on a full 500 metre transect). The visual survey detects frogs via 'eyeshine'. Suitable habitat is scanned along the transect, around and between aural survey points, using a headlamp with a minimum of 200 lumens brightness. Focus should be on the habitats in which individuals would be expected to be active. Walking slowly and quietly whilst undertaking the visual search will assist in noticing moving frogs (e.g. those fleeing disturbance). A minimum of five minutes should be taken to cover each 50 metres of transect with a visual search, regardless of the number of surveyors involved. An aural-visual survey on a 500 metre transect requires a minimum time commitment of 11 blocks of five minutes listening and 10 blocks of five minutes of visual searching, totalling 105 minutes on the transect. Aural-visual surveys included a call-playback component where a loudspeaker was used to broadcast the advertisement calls of target threatened frogs to elicit either an advertisement or territorial response call. Call playbacks are completed at the same location as the aural survey and should be undertaken after the aural survey for each point. The call is broadcast continuously through the speaker for a period of no less than two minutes and responses are typically heard within the first minute. The playback period is followed by a two-minute listening period to detect any late responses or responses masked by the sound of the broadcast call. Volume of the call playback should be audible over a distance of at least 20 metres. Any frogs heard responding that were not calling initially were recorded and any frogs that calls were not immediately identifiable were also recorded. One tadpole search was completed when an identified breeding waterbody has been surveyed. The tadpole search is undertaken by sweeping a fine meshed net (minimum 30 centimetres diameter head – see Anstis 2013) through the water for 10 minutes per 50 square metres of waterbody surface area. Sweep netting is completed by sweeping a net backwards and forwards through the water. Sampling should cover all parts of the water column up to a minimum of two metres from the bank. Sweeping must include areas of vegetation (as far as is practical) and cover areas of the waterbody suitable for the target species. Sweeps should be made at about one metre per second. Tadpoles are held in clear plastic containers or plastic bags, photographed and then returned to where they were netted from.

Survey Effort		
Site	Survey effort	Comment
1	3 nights, 2 hours per night, Total 6 hours	Survey personnel change over, one night missed due to insufficient personnel and safety requirements for two people
2	No access	
3	3 nights, 2 hours per night, Total 6 hours	Survey personnel change over, one night missed due to insufficient personnel and safety requirements for two people
4	2 nights, 2 hours per night, Total 4 hours	This site was a low priority due to lower habitat values and thus was only surveyed twice before other sites were prioritised as being more likely to have frog presence and better quality habitat
5	4 nights, 2 hours per night, Total 8 hours	In accordance with the guidelines
6	4 nights, 2 hours per night, Total 8 hours	In accordance with the guidelines
7	1 night, 2 hours per night, Total 2 hours	This site was a low priority due to lower habitat values and thus was only surveyed once before other sites were prioritised as being more likely to have frog presence and better quality habitat
8	2 nights, 2 hours per night, Total 4 hours	This site was a low priority due to lower habitat values and thus was only surveyed twice before other sites were prioritised as being more likely to have frog presence and better quality habitat
9	4 nights, 2 hours per night, Total 8 hours	In accordance with the guidelines
10	4 nights, 2 hours per night, Total 8 hours	In accordance with the guidelines
11	3 nights, 2 hours per night, Total 6 hours	Survey personnel change over, one night missed due to insufficient personnel and safety requirements for two people
12	4 nights, 2 hours per night, Total 8 hours	In accordance with the guidelines

13	3 nights, 2 hours per night, Total 6 hours	Survey personnel change over, one night missed due to insufficient personnel and safety requirements for two people
TOTAL	**74 survey hours**	
Survey results		
All surveys were conducted from 6 to 14 December 2021 (nine nights) with weather ranging from 0 mm of rain to 49.4mm (see Table 4-7 for further information regarding weather conditions) across thirteen sites totalling 74 survey hours. No threatened frogs or tadpoles were detected. The survey locations are shown on Figure 4-3. The following common frog species were detected during surveys: • *Crinia parinsignifera* • *Crinia signifera* • *Limnodynastes fletcheri* • *Limnodynastes dumerelii* • *Limnodynastes tasmaniensis* • *Litoria dentata* • *Litoria fallax* • *Litoria latopalmata* • *Litoria peronii* • *Litoria verreauxii* • *Uperoleia fusca* It should be noted that survey guidelines indicate that surveys should be conducted 2-3 hours after sunset, however some surveys were conducted late into the night to take advantage of personnel being onsite after dark. It was noted that calls started to reduce after about 10pm. Surveys were conducted over nine nights.		
Photographs		

	
Site 1	**Site 8**

	
Site 8 dam	**Site 5 Millbank**
Comment on survey effectiveness	
This survey is considered suitable for the frog species targeted. Although some sites were not given four survey nights, they were sites with lower habitat quality where less frog call activity was observed. It should be noted that survey guidelines indicate that surveys should be conducted 2-3 hours after sunset, however some surveys were conducted late into the night to take advantage of personnel being onsite after dark and create survey efficiencies. It was noted that calls started to reduce after about 10pm however the sites were visited in different order each survey night accounting for variation in call activity with time of evening. Surveys were not carried out 14 days apart, surveys were conducted over nine nights but significant variation in weather conditions was achieved. Two species, Peppered Frog and Yellow Spotted Tree Frog did not have calls available to conduct call playback, however since all calls were identified either in the field or recorded for later identification and there are no unidentified calls this survey is considered suitable for ruling these species out.	
Species polygons	
Not applicable	
Limitations	

Survey sites were observed for between two and four nights, however it was lower quality habitat sites that had reduced survey effort based on initial assessment and frog call activity on the first two nights. Although one night was too cold for frog calling (9/12/21), frogs were still observed on this night. Two species, Peppered Frog and Yellow Spotted Tree Frog did not have calls available to conduct call playback, however since all calls were identified either in the field or recorded for later identification and there are no unidentified calls this survey is considered suitable for ruling these species out. Overall this survey is considered suitable for detecting threatened frogs.

Threatened fauna - Raptor

Raptor species
Species targeted
Haliaeetus leucogaster White-bellied Sea-Eagle, *Hieraaetus morphnoides* Little Eagle, *Lophoictinia isura* Square-tailed Kite
Guidelines used
Survey guidelines for Australis threatened birds: Guidelines for detecting birds listed as threatened under the EPBC Act (DEWHA, 2010)
Survey planning
The three species listed above are all dual credit species, and the aim is to detect breeding habitat and detect impacts to these and other raptor species in relation to turbine collision risks. Surveys focused on Bird Utilisation Surveys (BUS) to determine turbine collision risk and potential species presence and stick nest surveys were conducted to establish breeding activity. The table below shows the BUS observation sites with a description of the associated habitat. Ten fixed survey points were established: eight impact points and two reference points. Impact points were located near proposed turbine sites and reference points were located at least 500 metres away from proposed turbine sites in areas of similar habitat. In autumn 2021, BUS 1 was replaced by a new BUS 9 point and in summer 2022, BUS 1 and BUS 9 were abandoned and replaced by BUS 12 and BUS 13. The changes in some of the BUS points was necessitated by changes in the basic layout of the turbines and weather-related access constraints. The survey points were distributed as evenly as possible (subject to access constraints) across the wind farm to sample the various habitat types and maximise coverage in areas where wind turbines are proposed, survey points are shown in Figure 4-3. Impact points were positioned on elevated ground, allowing a clear view in all directions. The table below provides a description of the habitats associated with each impact and reference point.

Survey Sites

Survey Point	Habitat Description
BUS1	Located on the top of the ridge, scattered stringybark with grass understory.
BUS2	Sheep pasture with a few paddock trees, and one riparian strip close by.
BUS3	Scrappy stringybark timbered ridge adjacent to pasture.
BUS4	Stringybark grassland ridge.
BUS5	Sheep pasture with few, small scattered trees, approximately 500m away from woodland patch.
BUS6	Dirt road on side of sloped wooded paddock, with some shrub ground cover.
BUS7	Mid-slope pasture surrounded by open woodland with mature New England Peppermint (*Eucalyptus nova-anglica*) and Blakely's Red Gum - adjacent to large ridge.
BUS8	Pasture surrounded by open woodland with mature New England Peppermint and small tree ferns.
BUS9	Top of ridge in cleared grassland paddock.
BUS12	Cleared mixed native and exotic pasture on a saddle between two hills, scattered paddock eucalypts and some bracken and little or no shrub cover with few fallen branches.
BU13	Ridge line, with cleared pasture, mostly exotic grass and forest block close by to the south-east and degraded understorey.
Ref1	Stringybark grassland gully with stream.
Ref2	Open paddock near roadside with scattered mature New England Peppermint and stringy bark.

Survey personnel
Ecologists experienced in the identification of threatened species and trained in the survey methodology conducted the BUS and stick nest surveys. Nature Advisory conducted BUS surveys with one survey also conducted by ERM staff. Survey personnel are detailed in Appendix H.
Survey methods
BUS survey method
Bird Utilisation Surveys (BUS) involved diurnal surveys which were undertaken throughout the day from between 6:30am to 5:30pm depending on time of year across October 2020, April 2021 and January 2022. The fixed-point bird count method was used by Nature Advisory and involved an observer stationed at a survey point for 15 minutes. The adequacy of using 15 minutes as an interval to record the presence of birds during bird utilisation surveys was investigated in an earlier study at another wind farm site (Brett Lane & Associates Pty Ltd, unpublished data). This showed that 82 to 100 percent (average 88 percent) of species actually seen in one hour of surveying were seen in the initial 15 minutes of observation. Based on this result, the period of 15 minutes used in the formal bird utilisation surveys was considered adequate to generate representative data on the bird species in the area during the survey. During this period of observation, all bird species and numbers of individual birds observed within 200 metres were recorded. The species, the number of birds and the height of the bird when first observed were documented. For species of concern (threatened species, waterbirds and raptors), the minimum and maximum heights were recorded. This schedule ensured that all points were visited equally during four different times of day to allow for time-of-day differences in bird movements and activity. The periods were: • Before 10.00am; • 10.00am to 12.30pm; • 12.30 pm to 2.30 pm; and • After 2.30 pm. Every survey point (impact and reference) was visited eight times over the survey period.
Stick nest survey method

These searches were conducted opportunistically in woodland areas whilst conducting other targeted surveys, including threatened Eucalypt surveys, hollow bearing tree surveys, driving between survey sites and the other ~2600 hours of surveys conducted from 2020-2022. When detected, stick nests were observed for current use, their location recorded (easting and northing) and their size recorded.
Survey Effort
BUS survey effort
Eight impact points were surveyed eight times each (two reference points were also surveyed eight times each). A total of sixteen survey hours at impact points were undertaken totalling 48 survey hours for the three surveys. The BUS observations were undertaken during eight days in October 2020, six days in March-April 2021 and 5 days in January 2022 (see Appendix C for further information). The timing included suitable periods for surveying birds. The spring survey gathering data on species richness during the breeding season and when spring/ summer migrants visit the wind farm area. The autumn survey covered a period when bird populations are usually at their maximum abundance following summer recruitment.
Stick nest survey effort
These searches were conducted opportunistically in woodland areas whilst conducting other targeted surveys, including threatened Eucalypt surveys, hollow bearing tree surveys, driving between survey sites. When detected stick nests were observed for use, their location recorded (easting and northing) and their size. A total of ~2600 plus hours have been spent on the Winterbourne Wind Farm site.
Survey Results
BUS survey results
In total, 98 observations were recorded from seven raptor species at the site during the BUS surveys. The following raptors were observed during BUS surveys: • Brown Falcon • Brown Goshawk • Nankeen Kestrel • Wedge-tailed Eagle • Black-shouldered Kite • Peregrine Falcon

• Whistling Kite Wedge-tailed Eagle was the most abundant raptor species at site during the three seasons of BUS. Numbers observed were high during autumn (64 observations), lower in spring (41) and lowest in summer (28). Of the total number of eagles seen (133), 62.4% were observed flying at RSA heights. They made up 74.3% of all raptors. In addition, during BUS surveys, a Little Eagle was incidentally observed flying over the wind farm site. Little Eagle was the only threatened raptor observed and the level of activity was not considered enough to indicate breeding habitat presence within the development site.
Stick nest survey results
Approximately 13 stick nests were observed across the development site as shown on Figure 4-4. Only one was around 60cm (suitable for a medium to large raptor). The other nests were all 20-30cm in size and likely suitable fore Magpies, Ravens and similar sized birds. The Little Eagle and Square-tailed Kite could potentially use a nest that is 60cm, however that stick nest was outside of the development site and around 200m from any turbine and showed no signs of current use. None of the development site was considered to be breeding habitat for threatened raptors.

Photographs	
	
Small stick nest (30 cm)	Small stick nest (~30cm)
Comment on survey effectiveness	
The BUS surveys are considered suitable for detecting the presence of threatened raptors utilising the site as foraging or soaring habitat. BUS observations indicate that none of the three threatened raptors were utilising the development site over three seasonal windows giving some confidence that no threatened raptors are currently breeding within the development site. This is the reason that no species polygons are proposed.	
Species polygon	

Not applicable.
Limitations
Stick nest surveys were not conducted at the right time of year to determine breeding at all the detected stick nests. No stick nest suitable for any of the threatened raptors was identified as breeding habitat, however further targeted surveys could be conducted to gain certainty. BUS observations indicate that none of the three threatened raptors were utilising the development site over three seasonal windows giving confidence that no threatened raptors are currently breeding within the development site.

Threatened fauna – Diurnal birds

Diurnal bird species		
Species targeted		
Calyptorhynchus lathami Glossy Black-Cockatoo		
Guidelines used		
Survey guidelines for Australis threatened birds: Guidelines for detecting birds listed as threatened under the EPBC Act (DEWHA, 2010)		
Survey planning		
The Glossy Black-cockatoo is a dual credit species, and therefore the aim is both to identify impacts to this species and detect potential breeding habitat for the species. This species was initially detected during Bird Utilisation Surveys (BUS) and this prompted dedicated surveys for the species in locations where foraging habitat existed and the species had been observed. A total of 15 sites were initially selected, though only 14 sites were surveyed due to access constraints following wet weather. The surveyed sites are listed below with survey dates.		
Glossy Black-cockatoo survey site surveys		
Date	**2Ha Survey Site Locations**	**2Ha Survey Site GPS Coordinates**
Tuesday 24 August 2021	Glendower (Site 1)	E 386613.410 N 6575786.39
Tuesday 24 August 2021	Mountain View 2 (Site 4)	E 375674.945

		N 6589905.48
Tuesday 24 August 2021	Retreat Part C (Site 8.1)	E 394115.365 N 6565185.32
Wednesday 25 August 2021	Moona Vale (Site 8.2)	E 390996.266 N 6570297.11
Wednesday 25 August 2021	The Retreat Part B (Site 8)	E 388375.049 N 6565839.86
Wednesday 25 August 2021	Millbank (Site 11)	E 378755.643 N 6582865.75
Wednesday 25 August 2021	Bywell (Site 5)	E 381975.649 N 6580801.74
Thursday 26 August 2021	Cairnie (Site 6.2)	E 368331.628 N 6577698.23
Thursday 26 August 2021	Thorley (Site 6.1)	E 369539.423 N 6580081.55
Thursday 26 August 2021	Wyamba (Site 6)	E 370625.014 N 6582729.49
Thursday 26 August 2021	Bywell (Site 3)	E 383739.306 N 6577466.77
Thursday 26 August 2021	Millbank (Site 7)	E 386515.170 N 6586245.85
Friday 27 August 2021	Myamba/Eagle Ridge (Site 2)	E 387059.494 N 6583662.83

Friday 27 August 2021	Auburnvale (Site 10)	E 379347.580 N 6588152.23
Survey personnel		
Ecologists experienced in the identification of threatened species and trained in the survey methodology conducted the Glossy Black-cockatoo surveys. Survey personnel are detailed in Appendix H.		
Survey method		
BUS survey method		
Bird Utilisation Surveys (BUS) involved diurnal surveys which were undertaken throughout the day from between 6:30am to 5:30pm depending on time of year across October 2020, April 2021 and January 2022. ERM conducted one additional BUS survey in March 2022. The fixed-point bird count method was used by Nature Advisory and involved an observer stationed at a survey point for 15 minutes. The adequacy of using 15 minutes as an interval to record the presence of birds during bird utilisation surveys was investigated in an earlier study at another wind farm site (Brett Lane & Associates Pty Ltd, unpublished data). This showed that 82 to 100 percent (average 88 percent) of species actually seen in one hour of surveying were seen in the initial 15 minutes of observation. Based on this result, the period of 15 minutes used in the formal bird utilisation surveys was considered adequate to generate representative data on the bird species in the area during the survey. During this period of observation, all bird species and numbers of individual birds observed within 200 metres were recorded. The species, the number of birds and the height of the bird when first observed were documented. For species of concern (threatened species, waterbirds and raptors), the minimum and maximum heights were recorded. This schedule ensured that all points were visited equally during four different times of day to allow for time-of-day differences in bird movements and activity. The periods were: • Before 10.00am; • 10.00am to 12.30pm; • 12.30 pm to 2.30 pm; and • After 2.30 pm. Every survey point (impact and reference) was visited eight times over the survey period.		
Glossy Black-cockatoos survey method		

A total of 14 sites were chosen within suitable GBC habitat in the project boundary. These sites visited are listed above and shown on Figure 4-3.
Survey effort
BUS surveys
Eight impact points were surveyed eight times each (two reference points were also surveyed eight times each). A total of sixteen survey hours at impact points were undertaken totalling 48 survey hours for the three surveys. The BUS observations were undertaken during eight days in October 2020, six days in March-April 2021 and 5 days in January 2022 (see Appendix C for further information). The timing included suitable periods for surveying birds. The spring survey gathered data on species richness during the breeding season and when spring / summer migrants visit the wind farm area. The autumn survey covered a period when bird populations are usually at their maximum abundance following summer recruitment. The ERM March 2022 survey was conducted over three days at 11 impact points and 2 reference sites (BUS1-BUS9, BUS12013 and REF1-2).
Glossy Black-cockatoo survey effort
During the week of the 23-27 August 2021, a total of 79.5 hours were spent surveying for the presence of the Glossy Black-cockatoo on properties that are proposed to host wind turbines and infrastructure. These survey sites were selected based on previous recordings of GBC foraging evidence and potential habitat that fell within the Winterbourne Wind Farm project impact areas. A two (2) hectare survey was conducted on foot by two ecologists at each of the four survey locations. Ecologists searched for: • Signs of Glossy Black-cockatoo (visual sightings, calls, sounds or signs of foraging etc.). • Glossy Black-cockatoo foraging habitat (presence of Allocasuarina sp. and Casuarina sp.). • Glossy Black-cockatoo breeding habitat (hollow bearing trees - living or dead trees with hollows greater than 15 cm diameter and greater than 8m above ground). Opportunistic bird surveys were also undertaken by field staff across 2020 and 2021 field surveys (over 2,600 hours in total).
Survey Results
Glossy Black-cockatoo survey results

Glossy Black-cockatoo was observed opportunistically but not detected during targeted stag watches or habitat searches. The species was not observed breeding although feeding habitat was present and evidence of Glossy Black-cockatoo using these areas was detected. Glossy Black-cockatoo were observed during BUS (March 2021), targeted surveys (October 2021) and incidentally (February 2020) outside of the breeding period. Evidence of foraging was found at another eight locations. This utilisation is considered to represent potential signs of breeding. Glossy Black-cockatoo is a dual credit species, and as such the focus is on identifying breeding habitat for this species. Throughout the week of targeted Glossy Black-cockatoo surveys, no Glossy Black-cockatoo were visually or audibly observed. There was only one hollow-bearing tree (HBT) large enough to be potential breeding habitat for Glossy Black-cockatoo within the impact area of the project and that was in the southwest corner of Thorley. It did not fall within the development footprint area or turbine location but in the outer edge of the development site. This was recorded as a GPS point.
Diurnal bird survey results
The following additional threatened diurnal birds were observed on site during BUS surveys and other opportunistic sightings: • Speckled Warbler (ecosystem credit), already included in BAM-C • Varied Sitella (ecosystem credit), already included in BAM-C • Dusky Woodswallow (ecosystem credit), already included in BAM-C • Scarlett Robin (ecosystem credit), already included in BAM-C • Diamond Firetail (ecosystem credit), already included in BAM-C Little Eagle (species credit species addressed above in Raptors). Not considered to have breeding habitat onsite.
Photographs

	
Glossy Black-cockatoo surveys	Signs of Glossy Black-cockatoo feeding on Allocasuarina littoralis at Wyamba (Site 6)
Comments on survey effectiveness	
The survey could not rule out the presence of Glossy Black-Cockatoo breeding habitat due to the observed presence of the species incidentally throughout field work, and the fact that suitable foraging habitat is also present indicating the potential for breeding habitat to occur in the vicinity. Precautionarily the species has been assumed present for breeding.	
Species polygons	
To create species polygons for Glossy Black-cockatoo, all hollow bearing trees identified within the project boundary were buffered by 200m (as per the TBDC), and the resulting area was then clipped to woodland vegetation zones within the development footprint and the hectare	

areas were entered into the BAM-C in order to generate credits for this species. As suitable data indicating hollow sizes was not available all HBTs were buffered which is a precautionary approach.
Limitations
Weather during field surveys is detailed above in Table 4-7 Weather records during field surveys Severe flooding occurred throughout the Walcha region during the August 2021 surveys. There were 15 Glossy Black-cockatoo survey sites selected to be surveyed. Of these, 14 were surveyed. Due to weather-related delays, there was one scheduled site that was not able to be accessed and surveyed, Yalgoo (survey site 9). The survey could not rule out the presence of Glossy Black-Cockatoo breeding habitat due to the observed presence of the species incidentally throughout field work, and the fact that suitable foraging habitat is also present indicating the potential for breeding habitat to occur in the vicinity. In addition, as suitable data indicating hollow sizes was not available all HBTs were buffered which is a precautionary approach.

Threatened fauna – Nocturnal birds

Nocturnal bird species
Species targeted
Burhinus grallarius Bush Stone-curlew, *Ninox connivens* Barking Owl, *Ninox strenua* Powerful Owl, *Tyto novaehollandiae* Masked Owl, *Tyto tenebricosa* Sooty Owl
Guidelines used
Survey guidelines for Australia’s threatened birds: Guidelines for detecting birds listed as threatened under the EPBC Act (DEWHA, 2010) Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities (DEC, 2004)
Survey planning
The forest owls listed above are dual credit species, and therefore the aim is to detect breeding habitat and detect impacts to the habitat. Bush Stone-curlew is a species credit species for foraging and breeding and relevant habitat was targeted during nocturnal surveys. Surveys included Bird Utilisation Surveys (BUS), targeted nocturnal surveys (in areas of HBTs for forest owls and areas of fallen timber for Bush Stone-curlew) and hollow bearing tree (HBT) surveys to establish breeding habitat/activity (for forest owls).
Survey personnel

Ecologists experienced in the identification of threatened species and trained in the survey methodology conducted the threatened nocturnal bird surveys. Survey personnel are detailed in Appendix H.
Survey method
Nocturnal bird surveys were conducted using spotlighting and call playback techniques. Nocturnal spotlighting conducted using high wattage for purpose spotlights aiming to detect movement and eye shine by targeting logs habitat (Bush Stone-curlew) and tree habitat (forest owls). Spotlighting beams had a penetration of 20-40m depending on location. Call playback surveys were undertaken following the broadcast (call playback) methodology outlined in 'Survey guidelines for Australia's threatened birds' (DEWHA, 2010) and the TBDC. Twenty minutes of call playback was undertaken at each cluster of habitat trees. Trees were spotlighted before and after the call playback, listening for calling responses (for at least 30 seconds) and watching the surrounding landscape was undertaken throughout the survey. Calls from Pizzey and Knight (Birds of Australia Digital Edition 1.5, 2017) were broadcast using an MP3 player and amplified through a megaphone.
Survey effort
Nocturnal bird surveys were conducted following dusk over a period of four nights in August 2020 as well as over eight nights in August 2021. In August 2021 from 23, 25-28 August and 1 to 2 September 2021 a total of 44 sites were surveyed for nocturnal forest owls with call playback and spotlighting conducted. Spotlighting also targeted Bush Stone-curlew during this same survey period. Surveys were conducted from approximately 6pm to between 8:30pm and 10:30pm. Total survey effort was 23 hours of nocturnal surveys including spotlighting and call playback during 2021.
Survey results
No threatened nocturnal birds were detected during targeted surveys. However, a single Barking Owl perched in a tree, was observed opportunistically within the project boundary outside the breeding season in February 2020. Barking Owl is a dual credit species, and as such the focus is on identifying breeding habitat for this species within the development footprint. No breeding habitat was detected.
Comment on survey effectiveness
The August 2021 survey was predominantly carried out from the roadside with no detection of any forest owl activity during the survey period. This result may be due to edge effects and could have resulted in a false negative result where no forest owls were detected. However, over the 2600 plus hours that have been spent onsite both during the day and at night it is likely that further detection of forest owls would have occurred if they were present, at least for foraging and roosting. Due to the number of sites and replication of surveys, and as per table 5.6 of DECC 2004, detectability of the species is presumed to be >90% confidence.

Species polygons
To create species polygons, all hollow bearing trees identified within the project boundary were buffered by 100m (as per the TDBC), the resulting area was then clipped to woodland vegetation zones within the development footprint and the hectare areas were entered into the BAM-C to generate credits for this species. As suitable data indicating hollow sizes was not available all HBTs were buffered as a precautionary approach.
Limitations
Severe flooding occurred throughout the Walcha region during the August 2021 surveys. Due to the rain events, much of the development footprint was inaccessible due to track degradation and increased chance of bogging. As such, nocturnal bird surveys were limited to predominantly roadside surveys outside of the target species preferred habitat. The survey could not rule out the presence of Barking Owl breeding habitat due to the observed presence of the species detected during field work (outside of the breeding period) and the fact that suitable foraging habitat is also present. As suitable data indicating hollow sizes was not available all HBTs were buffered to create species polygons.

Threatened fauna – Bats

Bat species
Species targeted
Pteropus poliocephalus Grey-headed Flying-fox, *Myotis macropus* Southern Myotis, *Miniopterus orianae oceanensis* Large Bent-winged Bat, *Miniopterus australis* Little Bent-winged Bat, *Vespadelus troughtoni* Eastern Cave Bat.
Guidelines used
Species credit threatened bats and their habitats; NSW guide for the Biodiversity Assessment Method (OEH, 2018).
Survey planning
It was noted that Large Bent-winged Bat, Little Bent-winged Bat and Eastern Cave Bat do not have breeding habitat available within the development site. However, deploying echolocation detection equipment would target all microbat species that could be present in the locality and thus all species credit species were listed as targeted species. Sites selected as being representative of the development site and targeting suitable habitat for microbat species were selected by Nature Advisory and are detailed below.

Survey sites			
Site	**Duration of spring 2020 survey (nights)**	**Duration of autumn 2021 survey (nights)**	**Habitat description**
1	23	30	Gully bottom of steep wooded hill, with dense understorey, near farm dam
2	55	41	Grazed hilltop with scattered trees
3	21	44	Pasture with scattered remnant vegetation
4	4	44	Woodland with some dieback on hilltop
5	55	13	Open pasture near farm dam, surrounded by remnant woodland
6	55	44	Open pasture near farm dam on mid slope
7	54	0	Woodland with dense understorey bordering escarpment & creekline
8	20	15	Woodland surrounded by agriculture near farm dam
TOTAL	287	231	
Survey personnel			
Ecologists experienced in the identification of threatened species and trained in the survey methodology deployed the echolocation recording equipment and personnel experienced in bat call analysis conducted the analysis of the recorded calls. Survey personnel are detailed in Appendix H.			
Survey method			
Microbat surveys were undertaken to collect information on bat species, including any listed threatened species, using the site and the relative call frequency (activity levels) of these species. The surveys were undertaken using automated SongMeter® detectors (SM4BAT; Wildlife Acoustics) distributed across all habitat types on the proposed wind farm site located near proposed wind turbine sites.			

The bat detectors were secured to trees or fence posts approximately 1.5 to 2.0 metres above ground. The detectors were programmed to commence operation approximately 30 minutes before dusk and to cease approximately 30 minutes after dawn. Each SongMeter unit used a 64GB SD card that recorded bat echolocation calls, along with the date and time of each call. Calls from the units were downloaded and sent to Greg Ford (Balance! Environmental, Toowoomba, Queensland) for identification. The recoded call files were viewed in Kaleidoscope Pro analysis software (Wildlife Acoustics, USA), which provides a sonogram display of frequency versus time. Call identification was based on a key developed by comparing the characteristics of bat calls with reference calls from known species recorded across Australia. Identification is largely based on changes to frequency patterns over time, especially as the characteristic frequency changes. Only those recordings that contained at least three definite and discrete pulses were classified as bat calls. For most species, a call sequence of several seconds in duration is required before identification can be made confidently.
Survey effort
Targeted microbat surveys were undertaken using SongMeter Detector units set to remotely record ultrasonic echolocation calls overnight. Two rounds of surveys were undertaken during Spring 2020 (5 October to 20 November 2020) and Autumn 2021 (8 March to 22 April 2021). Refer Appendix C for the Bat Survey report prepared by Nature Advisory. The total survey effort across the site, which included eight sites, was between four and 54 detector nights for each site, which totalled 518 detector nights. Locations of the SongMeters are shown in Figure 4-4.
Survey Results
The following threatened bats were recorded via ultrasonic detection: • Eastern False Pipistrelle (ecosystem credit species, included in BAM-C) • Greater Broad-nosed Bat (ecosystem credit species, included in BAM-C) • Eastern Cave Bat (species credit species, TDBC says breeding habitat only) • Little Bent-winged Bat (species credit species for breeding habitat) • Large Bent-winged Bat (species credit species for breeding habitat) • Yellow-bellied Sheathtail Bat (ecosystem credit species, included in BAM-C) Southern Myotis was not detected. Eastern Cave Bat, Little Bent-winged Bat and Large Bent-winged Bat will not generate species credits due to a lack of rocky areas containing caves, overhangs, escarpments, outcrops, crevices or boulder piles within 2km, or within two kilometres of old mines, tunnels, old buildings or sheds.

Comment on survey effectiveness
This survey effort is considered suitable across the development site. The sites are well spread and representative microbat habitat found throughout the development footprint was targeted. Suitable habitat for each species was also targeted. The guidelines state that four detection units should be used for four nights per 2.5km of riparian length (Southern Myotis) or per 50ha or less of breeding habitat (other species). A total of 518 detector night were achieved, with 287 and 231 detector nights for 2020 spring and 2021 autumn, respectively. The development footprint consists of 426ha of native vegetation which indicates that 16 detector nights are required for every 50ha which totals 136 detector nights. The survey effort significantly exceeded this level with 287 and 231 detector nights, totalling 518 detector nights.
Species polygons
No species polygons were prepared as no breeding habitat was detected for any of the species within the development footprint (or development site) or they were already accounted for as ecosystem credit species.
Limitations
During call analysis four combined species calls were detected that may be attributed to two of the listed threatened species, including the following. These calls could not be specifically identified as being any species but cannot be ruled out as being the following: • Eastern False Pipistrelle/Lesser Long-eared Bat • Eastern False Pipistrelle/Western Broad-nosed Bat • Eastern False Pipistrelle/Little Broad-nosed Bat • Large Bent-winged Bat/Forest bats. In addition, it is also noted that in the autumn 2021 survey, half of the unresolved calls were recorded at site 6, which is located beside two isolated paddock trees, about 80m downstream of a small farm dam. Most (17,082) of these unresolved calls were probably from *Vespadelus vulturnus* and/or *V. regulus* but were labelled either *V. vulturnus*/*C. morio* or Vespadelus sp./*M. orianae*. The calls were largely of a type associated with bats flying in “cluttered” airspace (e.g., in dense vegetation, near a roost or over water) and many files contained calls from multiple individuals. This suggests that the trees next to the detector perhaps contained a maternity roost or that some sort of communal behaviour (e.g., swarming) was occurring at the site.

Threatened fauna – Terrestrial mammals

Terrestrial mammal species
Species targeted
Macropus parma Parma Wallaby, *Petrogale penicillata* Brush-tailed Rock-wallaby, *Aepyprymnus rufescens* Rufous Bettong,
Guidelines used
Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities (DEC, 2004). Survey guidelines for Australia's threatened mammals: Guidelines for detecting mammals listed as threatened under the EPBC Act (DSEWPC, Survey guidelines for Australia's threatened mammals, 2011)
Survey planning
When surveying for mammals multiple methods are proposed because one method may be biased for one group of mammals over another (DEC, 2004). The following plan for surveying threatened ground dwelling mammals includes infrared cameras and hair tubes used in conjunction with each other to ensure detection of the targeted species. In addition, the spotlighting conducted for nocturnal birds should also bolster the confidence in these surveys as they did not detect any mammals. Hair tubes were made by NGH staff in line with designs described in (DSEWPC, Survey guidelines for Australia's threatened mammals, 2011). Consultation with BCS on survey method and effort was undertaken, see Appendix N.
Survey personnel
Ecologists experienced in the identification of threatened species and trained in the survey methodology conducted the microbat surveys and post field call analysis. Survey personnel are detailed in Appendix H.
Survey method
Diurnal targeted searches were undertaken for Brush-tailed Rock Wallaby and Parma Wallaby within suitable habitat (rocky escarpments and moist eucalypt forest with thick, shrubby understorey, nearby grassy areas, rainforest margins or drier eucalypt forest). Searches targeted direct sightings of individuals as well as evidence of occupation such as scats, tracks or fur. Camera trap surveys were used across the site to target all terrestrial mammal species in 2019 and again in December 2021. Cameras were set on trees within areas suitable for the target species. In 2021 a target specific bait (honey, oats, peanut butter and truffle oil mixture) was suspended in the middle of the camera frame within a bait canister approximately 2m from the camera (as per DSEWPC Survey guidelines for

Australia's threatened mammals, 2011). These baits were also sprayed with honey water to aid attraction. Two cameras were deployed at seven locations with two cameras facing in opposite directions targeting Rufous Bettong. The guidelines state that 10 cameras per hectare should be deployed. This was not considered practical on a site with that has 205ha of woodland habitat, since this would have required 2050 cameras. Instead, cameras, spotlighting and hair tubes were used together. In 2019 the camera traps were baited with sardines and chicken necks. Camera traps in 2019 were deployed in accordance with (al, 2015) Hair tubes were deployed to supplement the use of camera traps and increase the detection rate of Rufous Bettong. Hair tubes were based on simplistic PVC pipe designs (Scotts, 1988) (Suckling, 1978). Hair tubes consisted of a PVC pipe with one open end and the other capped with a bait canister (honey, oats, peanut butter and truffle oil mixture used for bait) attached to the inner side. A strip of double-sided tape approximately 15 cm long along the inside of the open end of the tube is placed at the top and collects hair of any mammal entering the hair tube to investigate the bait. Three sizes (diameter of tube) of hair tube were deployed: 90 mm (targeting Rufous Bettongs), 45 mm and 32 mm (targeting Eastern Pygmy Possum). The majority of the hair tubes were deployed within the development site or adjacent to the development site in better habitat to increase the probability of detecting the targeted species. This approach is based on the assumption that if animals are not detected in the higher quality vegetation that they will not be present within the lower condition development footprint. Hair attached was sent to specialist Georgeana Story (see Appendix H) for analysis. Nocturnal spotlighting was conducted using high wattage spotlights for nocturnal birds, and these surveys aimed to detect movement and eye shine by targeting log habitat for Bush Stone-curlew and tree habitat for forest owls. These efforts would also detect threatened arboreal and terrestrial mammals.
Survey effort
A total of 105 hair tubes were deployed across four sites for a total effort of 735 trap nights in December 2021. Hair tubes were deployed on 6 and 7 December 2021 and retrieved on 13 and 14 December 2021, with each hair tube deployed for seven nights. A total of twelve cameras were deployed across the site, two at each of the six locations. Some of the cameras were placed in conjunction with the hair tubes. All hair tube locations and camera traps are shown on Figure 4-3. Cameras were also deployed on 6 and 7 December and retrieved on 13 and 14 December. The camera deployment time totalled 168 survey hours as they were on 24 hours per day. On 23 August, 25-28 August and 1-2 September 2021, a total of 44 sites were surveyed for nocturnal forest owls with call spotlighting conducted. Spotlighting also targeted Bush Stone-curlew during this same survey period. Surveys were conducted from approximately 6pm to between 8:30pm and 10:30pm. Total survey effort was 23 hours of nocturnal surveys including spotlighting and call playback during 2021. These surveys were also relevant for detecting terrestrial mammals.
Survey results

No threatened terrestrial macropods were detected via hair tubes, diurnal searches or camera traps. However, one Spotted-tailed Quoll was detected in 2019 (refer Figure 4-4). Ten hair samples were retrieved from hair tubes and the results showed Rattus (rat) and Trichosurus (possum) species only. Only common species were detected through hair samples and camera traps. These included Eastern Grey Kangaroo (see photo below), Rattus species (see photo below), Sheep, Magpie, feral Cat, Common Brush-tailed Possum, Fox, Rabbit, Currawong, Red-necked Wallaby, and Echidna.

<table>
<tr><th colspan="2">Photographs</th></tr>
<tr><td></td><td></td></tr>
<tr><td>Rufous Bettong Camera trap set up</td><td>Rufous Bettong Hair tubes Point 2</td></tr>
</table>

	
Parma Wallaby and Brush-tailed Rock Wallaby diurnal survey points	Parma Wallaby and Brush-tailed Rock Wallaby diurnal survey points

Camera trap 10 – Rattus sp.

Camera trap 13 – Eastern Grey Kangaroo

Comment on survey effectiveness

The survey coverage across the development site, although not extensive in terms of number of sites surveyed using cameras and hair tubes, did target good quality habitat which should maximise detection of the threatened terrestrial mammals. In addition, surveys for nocturnal birds using spotlighting added to the survey effort for mammals.

Species polygons

No species polygons were generated. Spotted-tailed Quoll is an ecosystem credit species and already included in the BAM-C. No evidence or detection of other threatened terrestrial mammals occurred.

Limitations

The hair tubes only produced 10 samples from 105 tubes indicating they may not have been deployed long enough or that the high rainfall that occurred on 8-10 December 2021 affected the activity and hence the detection rate. The guidelines (DSEWPC, Survey guidelines for Australia's threatened mammals, 2011) state that 10 cameras per hectare should be deployed. This was not considered practical on a site that has 205ha of woodland habitat, this would require 2050 cameras, hence the use of cameras, spotlighting and hair tubes together. Consultation with BCS resulted in a reduced survey effort that was not achieved as it required 21 days of camera trapping Appendix O.

Threatened fauna – Arboreal mammals

Arboreal mammal species
Species targeted
Cercartetus nanus Eastern Pygmy-possum, *Petaurus norfolcensis* Squirrel Glider, *Petauroides volans* Greater Glider, *Phascolarctos cinereus* Koala
Guidelines used
Survey guidelines for Australia's threatened mammals (DSEWPC, Survey guidelines for Australia's threatened mammals, 2011)
Survey planning
When surveying for mammals multiple methods are proposed because one method may be biased for one group of mammals over another (DEC, 2004). The following plan for surveying threatened ground dwelling mammals includes infrared cameras and hair tubes used in conjunction with each other to ensure detection of the targeted species. In addition, the spotlighting conducted for nocturnal birds should also bolster the confidence in these surveys as they did not detect any mammals. Hair tubes were made by NGH staff in line with designs described in (DSEWPC, Survey guidelines for Australia's threatened mammals, 2011).
Survey personnel
Ecologists experienced in the identification of threatened species and trained in the survey methodology conducted the threatened arboreal mammal surveys. Survey personnel are detailed in Appendix H.
Survey method

Camera trap surveys were used across the site to target all terrestrial mammal species in December 2021. Cameras were set on trees within areas suitable for the target species. A target specific bait (honey, oats, peanut butter and truffle oil mixture) was suspended in the middle of the camera frame within a bait canister approximately 2m from the camera (as per DSEWPC Survey guidelines for Australia's threatened mammals, 2011). These baits were also sprayed with honey water to aid attraction. Two cameras were deployed at seven locations with two cameras facing in opposite directions targeting Rufous Bettong. The guidelines state that 10 cameras per hectare should be deployed. This was not considered practical on a site with that has 205ha of woodland habitat, since this would have required 2050 cameras. Instead, cameras, spotlighting and hair tubes were used together. In 2019 the camera traps were baited with sardines and chicken necks. Camera traps in 2019 were deployed in accordance with (al, 2015) Hair tubes were deployed to supplement the use of camera traps and increase the detection rate. Hair tubes were based on simplistic PVC pipe designs (Scotts, 1988) (Suckling, 1978). Hair tubes consisted of a PVC pipe with one open end and the other capped with a bait canister (honey, oats, peanut butter and truffle oil mixture used for bait) attached to the inner side. A strip of double-sided tape approximately 15 cm long along the inside of the open end of the tube is placed at the top and collects hair of any mammal entering the hair tube to investigate the bait. Three sizes (diameter of tube) of hair tube were deployed: 90 mm (targeting Rufous Bettongs), 45 mm and 32 mm (targeting Eastern Pygmy Possum). The majority of the hair tubes were deployed within the development site or adjacent to the development site in better habitat to increase the probability of detecting the targeted species. This approach is based on the assumption that if animals are not detected in the higher quality vegetation that they will not be present within the lower condition development footprint. Hair attached was sent to specialist Georgeana Story (see Appendix H) for analysis. Nocturnal spotlighting was conducted using high wattage spotlights for nocturnal birds, and these surveys aimed to detect movement and eye shine by targeting log habitat for Bush Stone-curlew and tree habitat for forest owls. These efforts would also detect threatened arboreal and terrestrial mammals.
Survey effort
Camera trap surveys were used across the site to target Eastern Pygmy-possum and Squirrel Gliders in December 2021 in conjunction with hair tubes. Cameras were set on trees within areas suitable for the target species at appropriate heights. Eight cameras were deployed at an appropriate height for Eastern Pygmy possum. A total of 105 hair tubes were deployed across four sites for a total effort of 735 trap nights in December 2021. Hair tubes were deployed on 6 and 7 December 2021 and retrieved on 13 and 14 December 2021, with each hair tube deployed for seven nights. A total of eight arboreal cameras were deployed across the site. Some of the cameras were placed in conjunction with the hair tubes. All hair tube locations and camera traps are shown on Figure 4-3. Cameras were also deployed on 6 and 7 December and retrieved on 13 and 14 December. The camera deployment time totalled 168 survey hours as they were on 24 hours per day. Of the 14 cameras, eight targeted Eastern Pygmy Possum totalling 56 camera trap nights. Of the 105 hair tubes, 36 were sized, baited and situated for Eastern Pygmy Possum detection. This totalled 252 hair trap nights for this species. Opportunistic scat

searches were undertaken on site targeting large hollow bearing trees and Koala food trees to detect Koala scats and Koala. Scats around suitable feed trees were collected and sent to for analysis to specialists Dr David Dique and Barbara Triggs. On 23 August, 25-28 August and 1-2 September 2021, a total of 44 sites were surveyed for nocturnal forest owls with call spotlighting conducted. Spotlighting also targeted Bush Stone-curlew during this same survey period. Surveys were conducted from approximately 6pm to between 8:30pm and 10:30pm. Total survey effort was 23 hours of nocturnal surveys including spotlighting and call playback during 2021. These surveys were also relevant for detecting arboreal mammals.
Survey results
Squirrel Glider was detected aurally (heard warning call) and observed on a camera trap. See Figure 4-4 showing threatened fauna sightings. Greater Glider was detected in the south-east of the development site. At one location, only scats were found. At a second location, a cluster of individuals (13 total) were found in February 2020 within a reasonable isolated patch of bushland connected to the development site. See Figure 4-4 showing threatened fauna sightings. Koala scat was found in three locations and this species is assumed present with breeding habitat within the development site. See Figure 4-4 showing threatened fauna sightings.

Photographs

Camera set up for arboreal mammals

Comment on survey effectiveness
All but the Eastern Pygmy Possum was detected using the survey methodology and thus it was considered suitable for the Koala, Greater Glider and Squirrel Glider. The habitat within the development footprint does not contain significant resources for Eastern Pygmy with fragmented habitat composed of insufficient nectar producing shrub and tree cover.
Species polygons
The Koala Habitat Information Base Technical Guide (DPIE 2019) was used to inform the species polygon for Koala. As all woodland zones contain Koala use trees listed for the Northern Tablelands region, all woodland zones have been included in the species polygon for Koala. This includes all the scattered trees that were entered into the BAM-C. In preparing the species polygon for Greater Glider, consideration was given to the level of connectivity present where the individuals were found as well as the known dispersal abilities of the species. Initially, all parts of all woodland zones were considered for inclusion into the species polygon. Isolated pockets of wooded vegetation, that the species could not reasonably be expected to access, were then removed, to produce the final species polygon. The species polygon for this species incudes areas of all woodland/forest vegetation zones that the species could reasonably be expected to access and all scattered trees have been included as habitat for Koala.
Limitations
The TBDC specifies a survey requirement for these species however these requirements were not considered achievable on such a large project. However as the camera traps have been deployed in varied environments using target bait in potentially suitable habitat this survey effort is considered suitable for this assessment.

Threatened fauna – Reptiles

Reptile species
Species targeted
Hoplocephalus bitorquatus Pale-headed Snake and *Uvidicolus sphyrurus* Border Thick-tailed Gecko
Guidelines used

Survey Guidelines for Australia's Threatened Reptiles: Guidelines for detecting reptiles listed as threatened under the Environment Protection and Biodiversity Conservation Act 1999 (DSEWPC, Survey guidelines for Australia's threatened reptiles, 2011), Threatened Species Database (TBDC) and Threatened Biodiversity Survey and Assessment Guidelines for Developments and Activities (DEC, 2004)
Survey planning
There are no guidelines specifically for Pale-headed Snake however the TBDC says survey should be undertaken 1-2 days after rainfall and on humid nights. In addition, (DEC, 2004) recommend thirty-minute searches on two separate nights per stratification unit. Transects should run with contour lines so habitat is sampled in homogeneity. The species is arboreal and seems to favour habitats closer to riparian areas. It is import that all survey areas have potential habitat trees for the species. Twelve sites were proposed across the development site. These were chosen based on potentially suitable habitat as identified in earlier field work. There are Commonwealth guidelines for Border Thick-tailed Gecko that state survey should be undertaken on warm humid nights with good insect activity, or search by day under rocks, bark, logs, or in logs. It is unlikely to attempt to cross cleared land with grass ground cover as it requires litter dominated shrubby open forest or woodland. During the day individuals shelter under boulders, rock slabs and fallen timber, deep in leaf litter, in rotten logs, or under bark at base of standing trees. It occurs at sites ranging from 500m to 1100m elevation. It favours forest and woodland areas with boulders, rock slabs, fallen timber and deep leaf litter. Occupied sites often have a dense tree canopy that helps create a sparse understorey.
Survey personnel
Ecologists experienced in the identification of threatened species and trained in the survey methodology conducted the threatened reptile surveys. Survey personnel are detailed in Appendix H.
Survey method
Targeted surveys for this species consisting of timed nocturnal transect searches. Twelve sites were surveyed for this species with the transect at each site replicated twice on different nights. Survey effort for each transect was one person-hour (standard spotlighting techniques were used with a focus placed on the tree trunks and other habitat likely to be used by the Pale-headed snake). The species is arboreal and seems to favour habitats closer to riparian areas and so these sites were targeted. Diurnal surveys were undertaken for Border Thick-tailed Gecko at Rufous Bettong Point 5 and Point 13 as show on Figure 4-3. These involved turning over partially embedded or surface rock to detect reptiles sheltering during the day.
Survey effort

Pale-headed Snake and Border Thick-tailed Gecko surveys were conducted from 13 to 16 December across the twelve sites which were visited twice during this period. Humidity ranged between 44 and 83%. This species is more often detected on humid nights, and rainfall had occurred between 8 to 12 December resulting in suitable conditions. Although temperatures overnight were low the evening temperatures were considered suitable for reptile detection. Diurnal surveys were undertaken for Border Thick-tailed Gecko at Rufous Bettong Point 5 and Point 13 as show on Figure 4-3. A total of 30 minutes was conducted at each site turning over rocks and fallen timber in suitable woodland locations.
Survey results
No Pale-headed Snake or signs of occupation (shed skin, roadkill etc) were detected. No Border Thick-tailed Gecko were detected. A range of common woodland species were detected including Common Brushtail Possum, Common Ringtail Possum, Eastern Grey Kangaroo, Tawny Frogmouth, Red-necked Wallaby, Swamp Wallaby, Sugar Glider, Wild Dog, Bearded Dragon, Boobook Owl, Short-beaked Echidna, European Brown Hare, European Rabbit, Australian Wood Duck, Pacific Black Duck, Domestic Cat, Fox.
Comment on survey effectiveness
The weather conditions were suitable and survey effort was targeted to suitable habitat with diurnal and nocturnal searches conducted at the right time of year. This survey is considered suitable for the purposes of this assessment.
Species polygons
Not applicable.
Limitations
Weather during field surveys is detailed in Table 4-7. This data is based on records from Woolbrook (Woolbrook Road) station (ID 055136). The daytime temperatures were between 22 and 28 degrees which is not the ideal warmth, however nocturnal surveys were considered suitable.

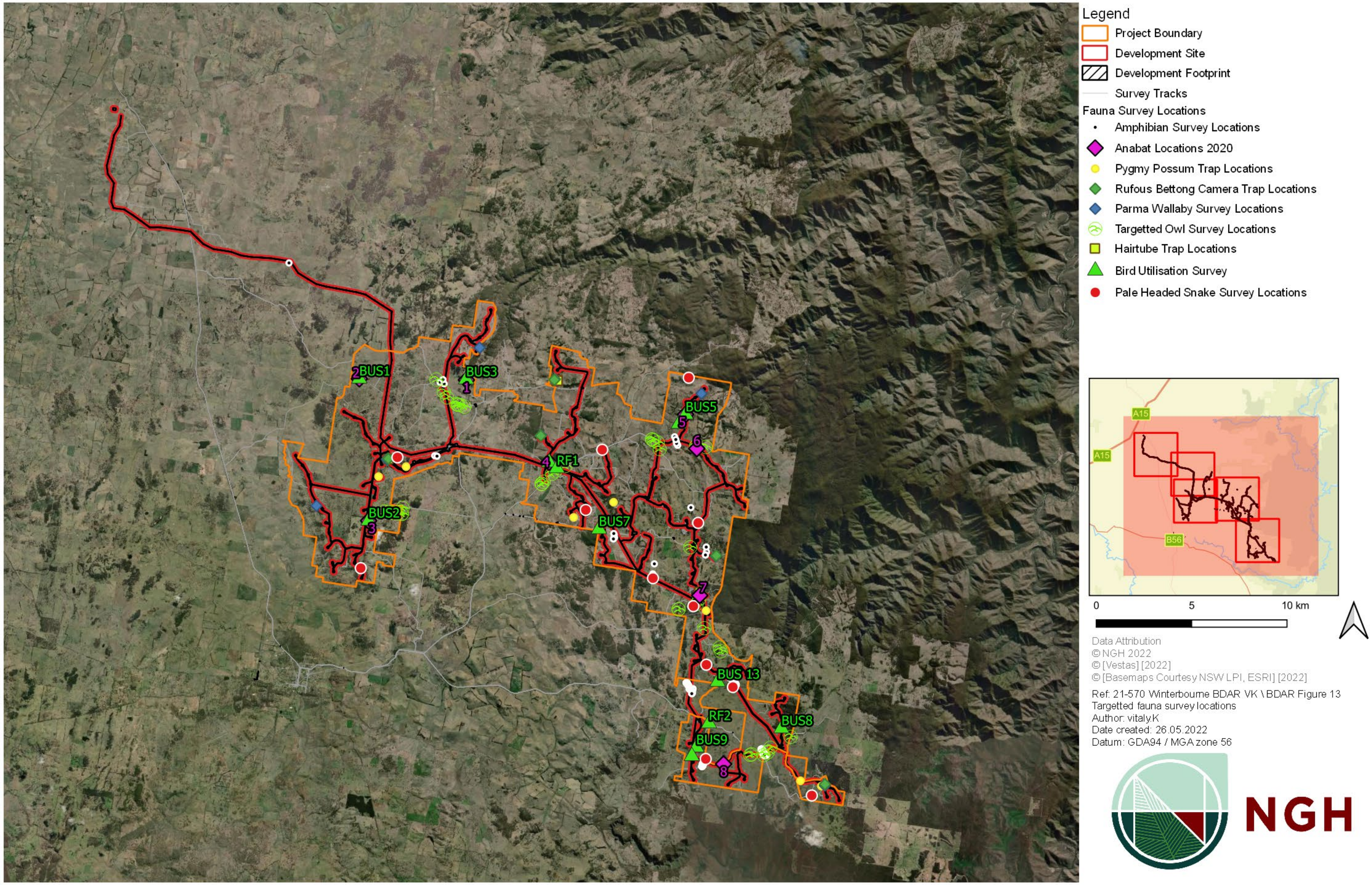


Figure 4-3 Fauna survey locations (detailed mapping is provided in Appendix N.7)

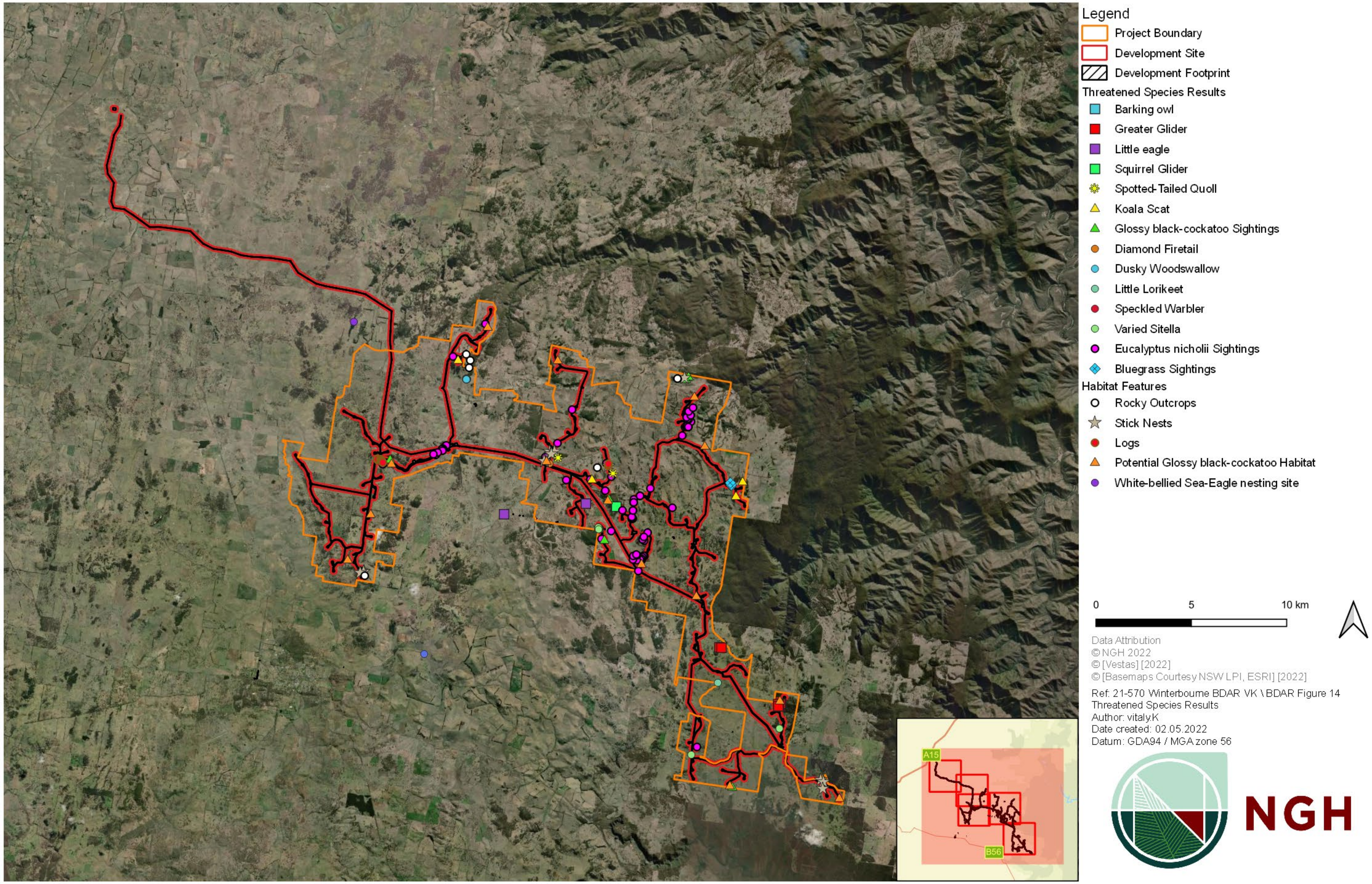


Figure 4-4 Threatened flora and fauna results (detailed mapping presented in Appendix N.8)

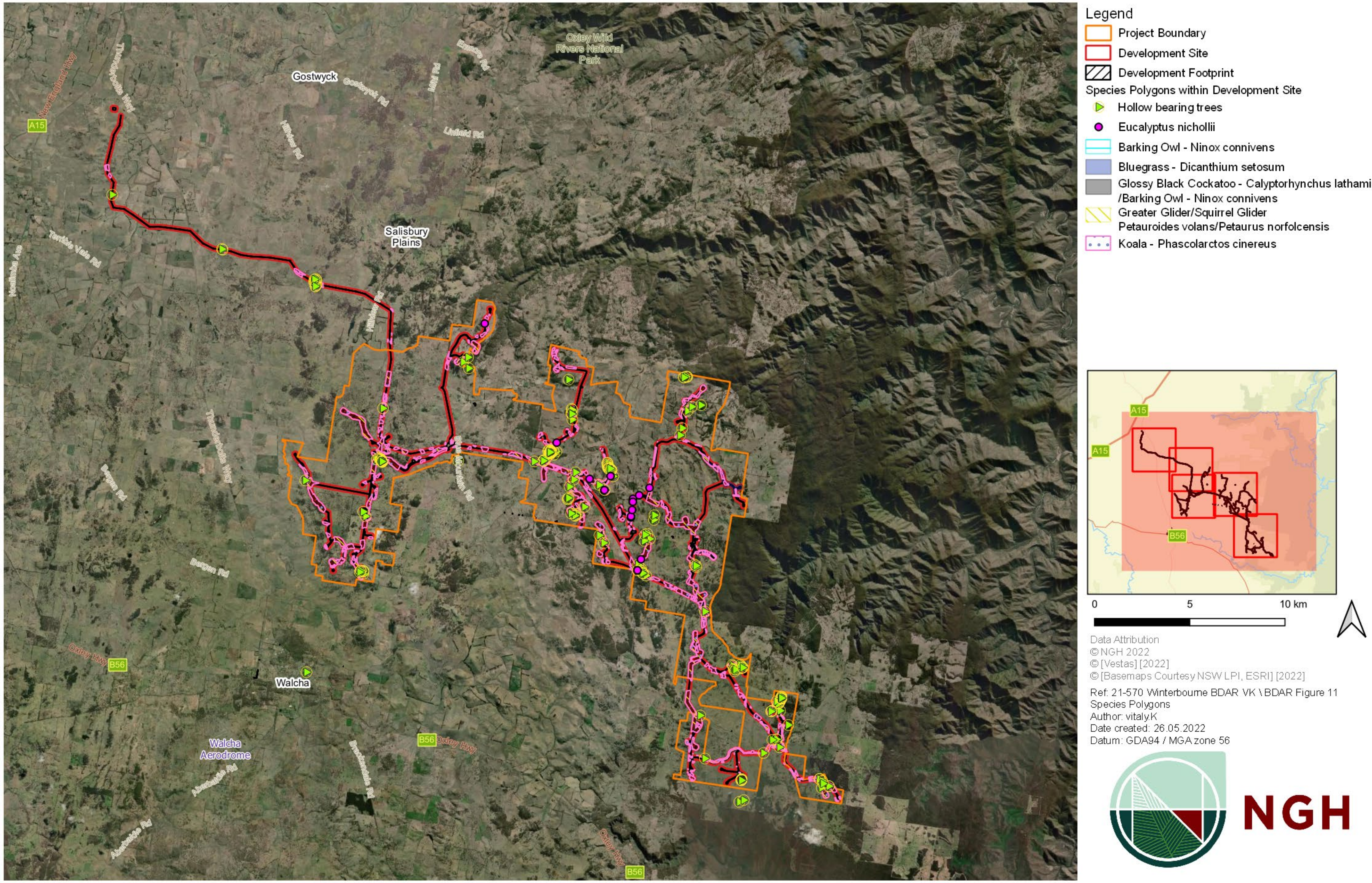


Figure 4-5 Threatened species polygons (detailed mapping is presented in Appendix N.9)

5. Prescribed biodiversity impacts

5.1.1 Occurrences of karst, caves, crevices and cliffs, rocks and other geological features

Isolated areas of rock outcrop were observed within the development site, mostly consisting of largely embedded rock and sporadic loose rock. The groundcover in these locations, as with the majority of the development site, has been subject to heavy grazing.

As shown in Figure 2-1 the rocky outcrops are not considered potential habitat for species credit candidates such as Brush-tailed Rock Wallaby or cave-dwelling microbats. This type of outcrop could provide refuge for threatened reptiles such as Pale-headed Snake where there are loose rocks and crevices, however targeted surveys suggest that this species is not present on the site.

Detailed design changes and mitigation measures aim to avoid the disruption and removal of rock outcrops (refer section 7.3). However, where it cannot be avoided, the removal of rock outcrop is not considered to impact the persistence of any threatened species or communities as none are considered to depend on it.

5.1.2 Occurrences of human-made structures and non-native vegetation

Non-native vegetation within the development site consists of cleared paddocks with improved pasture species. This vegetation does not provide key foraging or breeding habitat for any candidate species. This vegetation is of little value for habitat connectivity as most of the non-native vegetation consists of exotic pasture lands lacking a mid-storey and canopy. No threatened species are considered to rely on the non-native vegetation within the development site.

5.1.3 Occurrences of habitat connectivity

Much of the development site has been cleared or thinned of native vegetation due to agricultural practices, however, significant tracts of intact bushland occur along the eastern boundary from Oxley Wild Rivers National Park extending into New England National Park and Werrikimbe National Park. As described in Section 2.7, this bushland is the prominent regional connectivity feature in the landscape. From the east, connectivity extends into the development site as patches of intact bushland linked by remnant trees with a cleared understorey. Additionally, riparian corridors provide movement for fauna, particularly through the more open agricultural areas.

Section 7.3.1 describes likely impacts of the project on habitat connectivity.

5.1.4 Water bodies, water quality and hydrological processes

As set out in Section 2.5, surface water resources occur onsite and have potential to be impacted by the Project. Considering direct impacts to waterbodies, the potential for adverse impacts to water quality and hydrological processes is considered very low. Best practice design and construction measures (including instream works procedures and restoration of areas disturbed within riparian corridors) will be utilised where works within waterways are required. Such works would be restricted to access tracks and cable crossings, as turbines will be sited higher in the landscape and other infrastructure will be sited in accordance with hydrological modelling. The specific purpose of the modelling is to ensure that infrastructure:

- Would be located in areas that would not be at an unacceptable risk of flooding

- Would not cause changes to local hydrology or exacerbate erosion.

In the flood study prepared for the Project, Footprint (NSW) Pty Ltd (2020) confirmed the risks are very low. There are estimated to be 52 new watercourse crossings with the majority of those on first order streams (32) and second order streams (15) and only five on third order streams.

The Project would have negligible impact on groundwater quality given the low pollution potential. The proposed WTGs are located on higher elevation and ridgelines, and therefore interception and impacts from the Project to shallow groundwater is considered unlikely.

Flood impacts can relate to the potential of a development to increase the risk of flood occurrence or severity, or the potential to create hazards in the event of a flood affecting the site. Parts of the site may be at risk of temporary minor flooding during high rainfall events and high flows through north and northeast portions of site. The Project has the potential to create the following hazards in the event of a localised flood:

- Pollution risks from leakage of stored pollutants (hydrocarbons, pesticides, solvents).
- Physical damage from the mobilisation of components in flood waters.

No components are considered susceptible to becoming mobile and entering waterways during construction. The proposed development will be located along ridgelines rather than gullies and therefore typically will be well outside of flood prone areas. This is further demonstrated by riparian corridor mapping (Figure 2-6) which show the location of the proposed infrastructure in relation to existing watercourses, including the ordering of streams in accordance with the Strahler system and the buffering of streams in accordance with the riparian corridor widths contained in the Guidelines for Riparian Corridors on Waterfront Land (DPI Water, 2012). All potential pollutants stored on-site during construction would be stored in accordance with HAZMAT requirements and bunded. Maintaining grass cover across the site as far as practicable during construction, particularly within the existing waterways, would help maintain soil stability during floods, and would improve soil permeability over time.

The waterways also provide aquatic and riparian habitat for a range of species. Due to historical agricultural land use, the riparian vegetation for many of these creeks consist mainly of exotic vegetation with little canopy cover and no mid-storey. No potential maternal roost sites were found on site. No Flying fox camps were recorded on site or previously recorded via the Flying-fox Camp viewer. Even so, Southern Myotis has been assumed present on the basis of the farm dams providing potential habitat. A 200m buffer was applied around waterbodies within the relevant PCTs to define its species polygon.

Although some increased water runoff could occur there is a very low risk of impact arising from the project. In the flood study prepared for the project, Footprint (NSW) Pty Ltd (2020) confirmed the risks are very low. However, natural flood events do occur in the region, and these have the potential to be exacerbated by climate change. It is recommended that maintaining grass cover across the site, as far as practicable during construction and operation, particularly within the existing waterways, would help maintain soil stability during floods.

5.1.5 Wind farm developments

The operation of wind turbines presents a risk to a range of birds and bats. The main risk is mortality through collision with moving turbine blades (blade-strike), although alienation (behavioural avoidance of suitable habitat near infrastructure) is also an important issue to consider. A summary of the general impact risks to birds and bats from collisions and habitat avoidance is provided below, followed by a summary of the bird and bat species considered likely to be at risk from the project.

Birds and bats flying within or close to the rotor swept area (RSA) are at risk of collision impacts. This is the area of air space defined by the rotation of the turbine blade. As well as direct collision with infrastructure, the rotating blades produce a wake with turbulence, eddies and blade-tip vortices; the wake is principally behind the turbine (Sandersee 2009). The extent of the wake is influenced by factors including blade design and landscape location. The wake extends behind the turbines at least three blade-diameters (Holland 2008), attenuating with distance. The lateral extent of the wake appears to be less than a blade length (Maalouf et al. 2009), but this is not well studied. In summary, the wind turbine primarily presents a collision risk to birds and bats that fly within RSA height. An additional risk occurs for species that are affected by the wake. Therefore, the ground clearance of the RSA relative to the flying height of bird species is a key consideration.

Within a wind farm design layout there is potential for some turbines to contribute a higher collision risk to bird and bat species (Thelander 2004; Kunz, et al. 2007 ; Marques, et al. 2014). BUS survey points were chosen to be representative of the habitat types present at a wind farm site and are therefore not conducted at every potential turbine location. Additionally, wind farm design typically changes during the BUS pre-approval period, in response to emerging ecological risks identified during surveys. In the experience of NGH and Nature Advisory (unpublished data across multiple Australian wind farms), mortality records during operation rarely correlate with those turbines hypothesised to be at greater risk prior to construction.

Whilst it is challenging to accurately classify all turbines with a risk level on the basis of pre-construction survey data, higher risk turbines are typically located in areas where bird and bat collisions are considered more likely to occur, due to proximity to:

- Steep topography: gully heads, ridge lines, deep valleys and escarpments. These areas can concentrate migrating birds along relatively narrow pathways. They also provide updraughts utilised by swifts, swallows, martins, gulls and raptors. However, turbines are rarely located in areas with complex topography or in lower elevations due to the potential yield loss through turbulence and low elevation.
- Wetlands: marsh, pond, lake, stream, and/or river. Higher concentrations of birds and bats would be encountered near water sources. Water bodies may also provide staging areas for migrating waterbirds. However, turbines are rarely located in lower elevation wetland areas and this is not considered a concern for Winterbourne Wind Farm.
- Dense vegetation areas: woodland, forest, tree lines, tree clusters supporting habitat resources such as hollow-bearing trees. Narrow flight corridors usually occur through gaps between habitat patches. Preliminary design of the wind farm has avoided densely vegetated areas and provides a buffer to large areas of intact remnant vegetation (Section 6 and Figure 6-2).

Alienation impacts

Operational wind turbines may cause changes in bird and bat behaviour (Marques, et al., 2014). Where such behaviour includes avoiding nesting or foraging resources or diverging around the broad area where turbines are located, this is termed an 'alienation' or 'barrier' effect. The turbines in these instances act to 'sterilise' otherwise suitable areas of habitat or movement pathways. Alienation may affect local sedentary birds in their daily traverses for foraging, roosting and breeding sites or may cause migratory birds to shift migratory flyways. Birds and bats may be forced to change their flight behaviour to avoid collisions with turbines, subsequently impacting on their breeding and foraging success (Drewitt & Langston 2006). Barrier effects have been demonstrated at offshore wind farms in Europe, however there is little evidence at onshore wind farms (Environment Protection and Heritage Council 2010; Hull & Muir 2013; Hull, Starke, Peruzzo, & Sims 2013).

Whilst habitat avoidance may be a potential impact arising from the operation of the wind farm, the particular habitat types found within the project site are abundant and widely distributed in the locality, within and surrounding the site, and as such, the level of risk of alienation impacts to bird and bat species arising from the wind farm operation is considered to be low.

Barotrauma impacts

Barotrauma is used to describe injuries caused when an animal encounters a sudden and extreme change in atmospheric pressure. The rapid change in air pressure causes air-containing structures (such as the lungs) to rupture, leading to injuries or death (Baerwald et al. 2008). Bat deaths at wind farms have been partly attributed to barotrauma due to the air pressure changes that occur around rotating turbine blades (Baerwald et al. 2008). However, recent research has brought this theory into doubt. Rollins et al. (2012) found that bat deaths at wind farms were more likely to be attributed to collisions rather than barotrauma. Houck (2012) found that the pressure changes at rotating wind turbines was minimal and below that which is known to cause barotrauma in other small mammals. Further, the study found that there were few scenarios of movement near rotating blades in which the pressure changes would cause injury. The studies concluded that the majority of deaths of bats at wind farms are likely to be through collisions with turbines rather than from barotrauma.

Typical at-risk species

Generally speaking, birds at risk of collision are those that frequent the RSA (Hull et al. 2013). Not all species of bird are at equal risk of collision with turbines. Generally, the identified groups at higher risk are (Kingsley and Whittam 2003; Kunz, et al. 2007; Marques, et al. 2014):

- Raptors: Soaring birds use landform features such as elevation, ridges and slopes to cruise and take ascendance. Further, they are generally higher order species, meaning they are less abundant and therefore more susceptible to population level impacts.
- Passerines: Passerines have been among the most frequently reported fatalities at wind farms in Europe, America and Australia. Breeding birds in the vicinity of wind farms may be at greater collision risk if displaying aerial courtship. Migrating and nomadic passerines typically fly at altitudes of 150m or higher.
- Waterbirds: waterbird (i.e., grebes, cormorants, ducks, waders, cranes, rails, crakes, gulls, shorebirds) fatalities have been reported worldwide at wind farms close to staging, breeding and wintering areas.

In addition, wind farm sites may be frequented by scavenger species (e.g., crows, raptors), attracted by crops, livestock or carrion, resulting in an increased risk of collisions with turbines.

However, publicly available carcass monitoring data from Australian wind farms, which is restricted mainly to several facilities in Tasmania, have found no single foraging or taxonomic guild to predominate amongst mortalities. Species colliding with wind farms include carnivores, scavengers, nectivores and ground- and aerial-feeders (Woehler 2018). In Victoria, the species most often discovered in mortality surveys are, in descending order, Australian Magpie, Brown Falcon and Nankeen Kestrel (Smales pers. comm. May 2016).

Australian carcass monitoring results reviewed by Hull (2013) suggest that approximately 20% of the bird species present at the wind farm are involved in collisions; common species were found to be at most risk of colliding with turbines rather than rare or threatened species, based on their higher abundance. However, De Lucas et al. (2008) found no clear relationship between species abundance and species mortality (overseas study).

Bats, and more specifically microbats, are the second largest group of vertebrates to be impacted by collision impacts at wind farms worldwide (Cryan and Brown 2007, Kunz et al. 2007). In terms of blade- strike, Australian species that appear to be most at risk are those that forage well above canopy height (i.e., in open airspace) and move through their environment at high speeds, such as the White-striped Freetail Bat (Austronomus australis). These species are more likely to travel at the RSA. Collisions result either where the individual fails to detect the moving blades or is unable to manoeuvre around them.

Another group of microbats that appears to be at high risk from wind farms, based on international studies, are those that migrate (Baerwald et al. 2008). Migrating bats are thought to travel high in the air column on 'auto pilot'. That is they appear to rely less on echolocation when migrating, instead navigating using alternative spatial senses or orographic features such as mountain ranges (Baerwald et al. 2008, Popa-Lisseanu and Voight 2009). Consequently, migrating bats may fail to detect wind turbines.

Based on the above, two groups of Australian bats can be identified as higher risk from blade-strike impacts:

- Non-migrating, high-flying microbats
- Migrating, high-flying microbats, particularly those of conservation concern.

Further information on impacts to birds and bats specific to Winterbourne Wind Farm is provided in Section 7.3.2. This includes the results of surveys and collision risk assessment at the Project Site.

5.1.6 Vehicle strike

The development site is predominantly agricultural. Farm machinery is a common feature of current operations. The wind farm would formalise and extend the internal access track network to facilitate the delivery of wind turbines and other components and allow for plant maintenance. The noise and vibration associated with constructing the track network (approximately 113km of internal tracks) and the peak construction phase when overmass and oversize vehicles deliver infrastructure to hardstand areas and laydown areas would deter most fauna from the immediate area.

Operational traffic will be low volume, standard light vehicles, to carry out monitoring, maintenance and land management actions. These activities are unlikely to present significant biodiversity risks. Site management to enforce and reduce site speed limits and the introduction of fauna fencing are standard measures that have been recommended to further minimise impacts of vehicle strikes during construction and operation. This is not considered a high risk for the project.

6. Avoid and minimise impacts

The proposed avoid and minimise measures are in accordance with the development mitigation hierarchy, which aims for a result of 'no net loss' of biodiversity through implementing, in the following order, avoidance, mitigation, rehabilitation/restoration and offsetting (Figure 6-1). Mitigation measures and offsets for the Project are described in Sections 8 and 10, respectively.

The goal of 'no net loss' is to enable appropriate development without associated biodiversity losses (Gardner, et al., 2013).

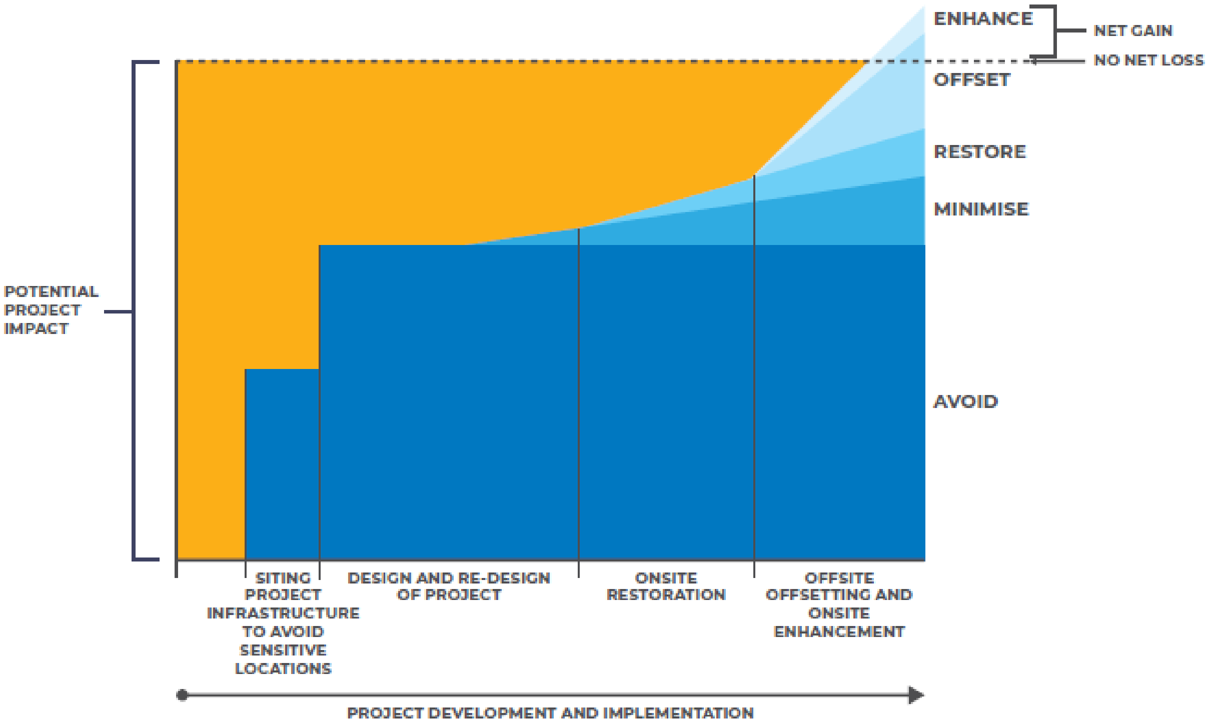


Figure 6-1 The mitigation hierarchy (from Bennun, et al., 2021)

6.1 Site selection – consideration of alternatives

The project boundary has been carefully chosen to balance the assessed social, environmental and economic aspects of the Project and enable an outcome which benefits the community, the region, and NSW as a whole.

A number of key factors were assessed to determine site suitability, identifying the Project Site as the most desirable option:

- Consistently high wind speeds
- Connection to the national electricity grid in close proximity to the wind farm site
- Minimal land clearing required to support wind farm infrastructure
- Suitable road access available to the wind farm site
- Large land parcels consisting of low levels of residential development
- Willingness for landholders to support wind farm infrastructure
- Minimisation of impact on local amenity.

The Project is located within the New England Renewable Energy Zone, declared as such by the NSW government in December 2021, with the intention of providing up to eight gigawatts of new network capacity (DPIE, 2022).

Chapter 2 of the Environmental Impact Statement provides a consideration of alternative designs and a discussion of design changes taken since 2019 to avoid and minimize impact to biodiversity.

6.2 Design and land use constraints

Most wind farms in Australia are situated along highly visible ridgelines or coastal cliffs to take advantage of the strong wind resources offered along the high terrain and costal cliffs respectively (CSIRO 2012).

The Project sits on elevated ridgelines with good exposure to prevailing wind directions. The Proponent has been monitoring the wind resource using on-site meteorological monitoring masts since 2019 along with assessment of long-term Bureau of Meteorology data. The wind turbine layout has been designed to capture high and consistent wind speeds. Generally, the wind turbines are proposed to be located on hilltops and ridgelines where the wind speed tends to be higher and the winds blow more steadily, while minimising potential noise, visual and biodiversity impacts.

The Project Site is predominantly zoned for agricultural purposes (RU1 – Primary Production), which reflects the primary use of the land for agricultural grazing. There is also no previous history of other land uses that could be considered to be potentially contaminating and therefore it is considered that the Project Site has a low contamination risk.

The Project Site is suitable as it hosts existing roads (Winterbourne Road, Bark Hut Road, Hazeldene Road, and Blue Mountain Road) which can be used as access roads, with some upgrades to meet the needs of the Project, which are also beneficial to the existing community and surrounding land uses.

6.3 Avoid and minimise actions throughout the planning, assessment through to detailed design of the Project

6.3.1 Proposal planning phase

The current Development Footprint has been designed through numerous iterations which have taken into account ecological as well as engineering and technical constraints. Ecological considerations have been factored into design decisions from the early stages of the project, through to detailed assessment and consideration of agency feedback.

The key stages where biodiversity findings have contributed to Development Footprint design include:

- Preliminary constraints stage
- Detailed ecological surveys
- Agency consultation.

These stages are discussed further below.

6.3.2 Preliminary constraints analysis

ERM (2019-2020) conducted a preliminary analysis of biodiversity constraints in November 2019 to inform the initial design of the site layout. These constraints considered vegetation characteristics of high ecological value, including:

- Forming components of a TEC
- Providing threatened fauna or flora habitat
- Providing connectivity in the local landscape.

Initial vegetation mapping and an ecological constraints assessment were used to assign a constraints rating to each individual turbine and access road element. Design features were assigned a constraints rating, with high (i.e., TEC, presence of *E. nicholli*), moderate (i.e., extensive native vegetation clearing required) or low (i.e., some native vegetation clearing required). A recommendation was made for each element to either omit, relocate elsewhere, or move within the same general area.

6.3.3 Detailed ecological surveys

Assessment of vegetation, targeted threatened species surveys and bird and bat surveys have been carried out between 2020 and 2022.

The Project ecologists have contributed to the evolution of the Development Footprint through information sharing and workshops to discuss survey findings and opportunities to avoid and minimise impacts.

In July 2020, each turbine and wind farm element was again assigned a (high level) constraints level, with individual recommendations made. Recommendations involved avoiding threatened species habitat, raptor nests, areas with known threatened species, and areas where large patches of native vegetation would otherwise be impacted.

In February 2021, a risk workshop was held with the Project team to identify priority areas to avoid. This included detailed consideration of the biodiversity constraints mapping overlaid on the preliminary infrastructure layout. Each area of the project was reviewed with the client. Key issues discussed and resolved included:

- Box Gum Woodland – this SAII candidate was given focussed attention due to its prevalence onsite. Condition was reflected in the constraints mapping so that higher condition areas could be avoided as much as possible. Further detailed design consideration was flagged and specific consideration of tracks and turbine locations in three areas to move infrastructure out of high and into moderate constraint areas was discussed.
- New England Peppermint vegetation community – the key issue identified for this community was a single transmission line. The proposed transmission line route was constrained by landowner requirements, however relocation of the line to the west and minimising tree clearing were considered.
- Snow Gum Ribbon Gum vegetation community – recommended for avoidance.
- *E. nicholii* records were mapped with a buffer area and recommended for avoidance.

In June 2021 a design workshop was held. The location of each wind turbine and Project component was assessed by a multi-disciplinary team including ecologists, landscape architect, engineers and planners. This enabled the Proponent to select the best possible location for each wind turbine where environmental impacts were avoided and/or mitigated without negatively impacting feasibility from engineering and planning perspectives. The outcome of this workshop resulted in further avoidance and minimisation of impacts to ecological values, with the outcomes of this process described in section 6.4.

6.3.4 Agency consultation – Biodiversity Conservation Division

Targeted consultation was conducted with BCD as well as NP&WS to discuss the Development Footprint and identify further opportunities to avoid and minimise, particularly regarding SAII and protected areas.

In May 2021 the Project team held a workshop with BCD to give specific consideration to SAII. The meeting presented the background to the project and its impacts, preliminary survey results and facilitated discussion around acceptable impacts on SAII candidates to ensure the overall impacts would be approvable.

6.4 Avoid and minimise outcomes

6.4.1 Design approach

Access tracks and cabling have been designed to traverse the shortest feasible distance and consider topographic constraints in order to minimise the overall impact area for these services and provide the most cost effective and constructable routes. In order to minimise impacts on key areas of vegetation and habitat, specific design refinements have been made by the project including:

a) Maximising use of existing tracks
b) Avoidance of values that may result in SAII where possible
c) Preferentially locating turbines in cleared areas
d) Prioritising underground cables (as opposed to overhead powerlines), co-located with existing or new tracks where possible to reduce clearing requirements
e) Reducing the width of tracks to the minimum, considering landform and other engineering constraints
f) Rationalising the number of turbines and layout of the wind farm to balance a viable Project.
g) Choosing a haulage route to the Project Site that is considered very unlikely to cause impacts to threatened species or native vegetation such that species or ecosystem credits would be generated (Appendix B).

6.4.2 Avoid and minimise outcomes

Table 6-1 and Table 6-2 describes how the development design evolved through each stage and the associated improved biodiversity result. There have been multiple design iterations between 2019 and 2022, with the two compared in the tables below representative of key points in design evolution. These two layouts also have corresponding vegetation data and are therefore able to be compared.

A key change is a reduction in the number of proposed turbine locations, from 130 down to 119, as described in Table 6-2.

Key avoidance and minimisation outcomes as a result of design refinements can be summarised as:

- 42% reduction in native vegetation impacts, with an additional 316.7ha able to be retained
- Avoidance of 91.12ha of SAII, reducing impacts to SAII by 68%
- Avoidance of TEC (which includes areas that are SAII), reducing impacts on TEC by 91.12 ha
- Fifteen (15) out of 52 identified locations of *E. nicholii* were able to be fully avoided.

Specific examples of design changes as a result of the June 2021 workshop include:

- Turbine B007 was relocated to reduce impacts on native vegetation
- Turbines B020 and BO21 were relocated to minimise impacts on SAII
- Turbine B072 was relocated to avoid native vegetation
- Turbines B080 and A103 were removed to avoid impacts on ecological values
- Turbines B115 and B116 were moved to increase the distance away from the protected areas

Table 6-1 Project design iterations responding to ecological constraints

Design stage	Key Project elements	Design changes in response to ecological constraints	Enhanced biodiversity outcome
Scoping Report Addendum	V1.0 layout: • 130 turbines • 746ha native vegetation impacts • Project boundary 24,000 ha	n/a	n/a
Exhibited Project (EIS)	V2.0 layout: • 119 turbines • 426.05ha native vegetation impacts • Project boundary 22,285 ha • Development site 4424.58 ha • Development Footprint 586.17 ha	Compared to V1.0: • Removed 11 turbines • Reduced Project boundary by 2,115 ha	• Reduced impacts on native vegetation by 323.80 ha • Reduced impacts on SAII by 60.40 ha • Reduced impacts on TEC by 84.30 ha

Table 6-2 Avoidance of native vegetation through design iterations

Land category	PCT	Management zone	TEC	SAII Candidate	Area as at January 2020 (ha)	Area as at EIS (ha)	Change in area (ha)	Change in area (%)
Cat 1 – Exempt Land					729.13	160.12	569.01	78%
Category 1 change					**738.08**	**157.81**	**571.31**	
Cat 2 – Regulated Land	997	grassland			6.38	6.03	0.35	5%
Cat 2 – Regulated Land	997	Woodland			16.91	10.27	6.64	39%
Cat 2 – Regulated Land	970	grassland			69.25	34.84	34.41	50%

Land category	PCT	Management zone	TEC	SAII Candidate	Area as at January 2020 (ha)	Area as at EIS (ha)	Change in area (ha)	Change in area (%)
Cat 2 – Regulated Land	970	Woodland			50.5	37.99	12.51	25%
Cat 2 – Regulated Land	766	Riparian			0.82	1.6	-0.78	-95%
Cat 2 – Regulated Land	568	Woodland			14.74	8.8	5.94	40%
Cat 2 – Regulated Land	568	grassland			17.73	12.84	4.89	28%
Cat 2 – Regulated Land	567	grassland	Yes	Yes	33.78	5.55	28.23	84%
Cat 2 – Regulated Land	567	Woodland	Yes	Yes	9.89	2.64	7.25	73%
Cat 2 – Regulated Land	567	Woodland			129.79	67.2	62.59	48%
Cat 2 – Regulated Land	567	grassland			98.2	94.54	3.66	4%
Cat 2 – Regulated Land	565	Woodland			30.73	13.84	16.89	55%
Cat 2 – Regulated Land	565	grassland			16.08	6.19	9.89	62%
Cat 2 – Regulated Land	534	grassland	Yes	Yes	12.85	3.32	9.53	74%
Cat 2 – Regulated Land	534	Woodland	Yes	Yes	22.07	11.1	10.97	50%
Cat 2 – Regulated Land	526	Woodland			75.59	40.88	34.71	46%

Land category	PCT	Management zone	TEC	SAII Candidate	Area as at January 2020 (ha)	Area as at EIS (ha)	Change in area (ha)	Change in area (%)
Cat 2 – Regulated Land	526	grassland			38.58	28.56	10.02	26%
Cat 2 – Regulated Land	510	grassland	Yes	Yes	29.61	8.96	20.65	70%
Cat 2 – Regulated Land	510	Woodland	Yes	Yes	25.64	11.15	14.49	57%
Cat 2 – Regulated Land	1194	grassland	Yes		39.57	17.95	21.62	55%
Cat 2 – Regulated Land	1194	Woodland	Yes		7.91	5.65	2.26	29%
Category 2 (native vegetation) change					**746.6**	**429.9**	326.7	**42%**

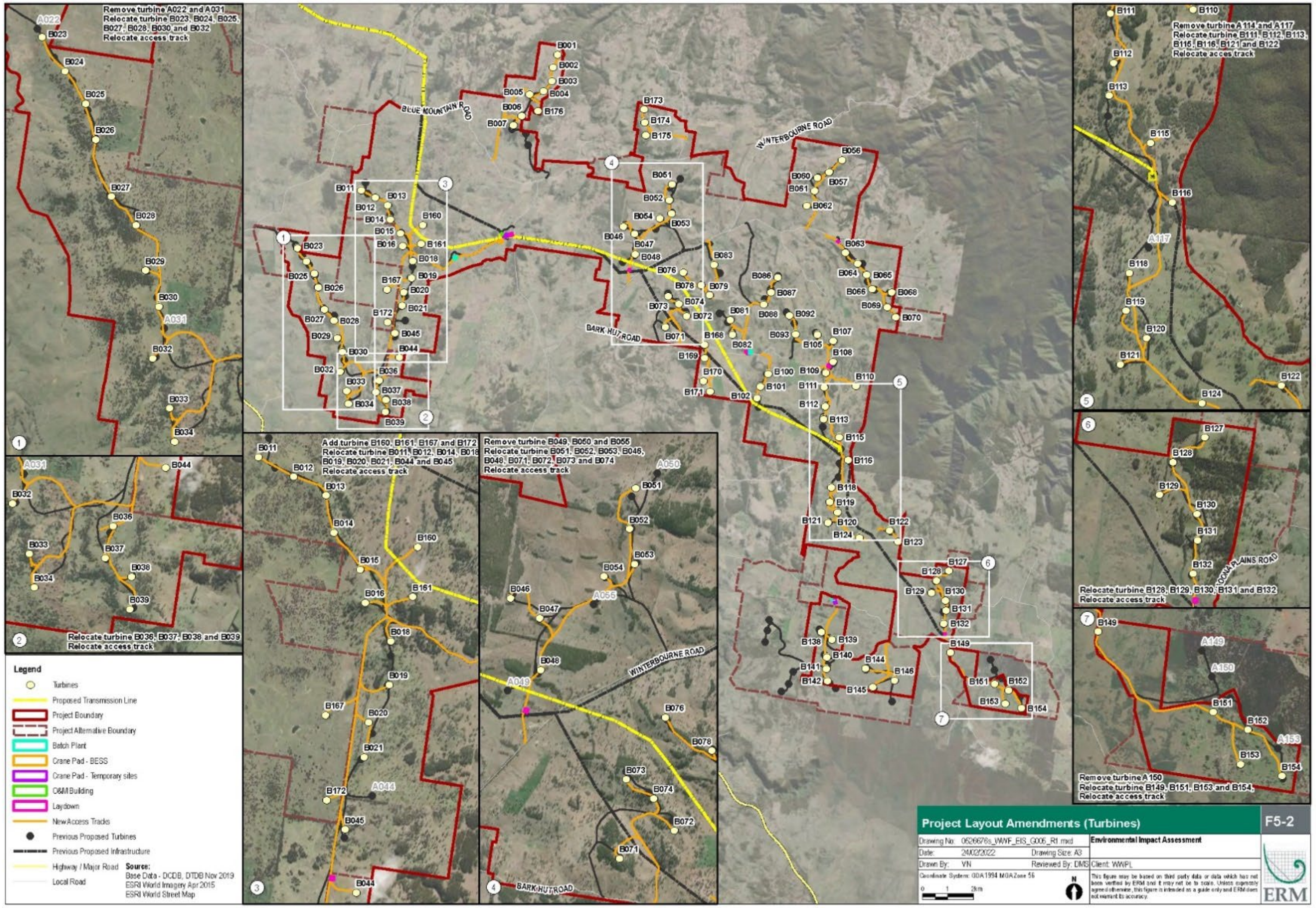


Figure 6-2 Reduction of impact through avoid and minimise measures through Project layout amendments

6.4.3 Avoiding and minimising prescribed impacts

The BC Regulation (clause 6.1) identifies actions that are prescribed as impacts to be assessed under the NSW Biodiversity Offset Scheme (BOS).

The following prescribed impacts are relevant to the proposal:

- Impacts of development on habitat connectivity
- Impacts of wind turbine operation.

Section 6.4.1 describes the avoid and minimise approach that has been applied to reduce general biodiversity impacts. Specific measures that have been included in the Project design to address prescribed impacts are detailed in Table 6-3.

Table 6-3 Approach taken to avoid and minimise prescribed impacts

Prescribed impact	Avoid and minimise approach
Habitat connectivity	• Acknowledging that connectivity is a key issue for gliding mammals, clearing widths (for tracks and transmission) have been kept under 40m (see Section 7.3.1) • In the unlikely instance that clearing widths exceed 50m within areas of Greater Glider habitat during the detailed design process, crossing infrastructure (i.e., glide poles, potential for rope bridges) will be installed
Wind turbine operation	• Likely minimum RSA for the Project of 70m is above typical flight height for the majority of bird and bat species at the Project site. 95.7% of species observed were under 40m height (Section 0). • Bat activity across cleared agricultural land drops off considerably at 120 metres from forested areas (Brett Lane and Associates Pty Ltd 2015). All turbines are located a minimum of 150m from a protected area.

7. Assessment of impacts

7.1 Direct impacts

Despite the significant work completed to date to avoid and minimise impacts on sensitive areas of the site, the construction and operational phases of the Project have the potential to impact biodiversity values within the Development Footprint that 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.

Direct impacts associated with the development are primarily related to:

- The proposed site clearing and excavation works during construction where vegetation is removed and directly impacts upon habitat and biodiversity values.
- The operational risks to birds and bats during operation. This includes the risks of turbine strike and barotrauma that could lead to bird and bat mortalities.

7.1.1 Changes in vegetation integrity scores due to clearing

The changes in vegetation integrity scores as a result of clearing are documented for each vegetation zone in Table 7-1.

Table 7-1 Current and future vegetation integrity scores for each vegetation zone within the development footprint

Zone ID	PCT/Zone	Area development footprint (ha)	Current vegetation Integrity Score	Future vegetation Integrity Score
1	510_grassland low	8.96	25.4	0
2	510_Woodland moderate	11.14	64.5	0
3	526_grassland poor	28.56	5.5	0
4	526_Woodland high	40.77	60.7	0
5	534_grassland low	3.32	22.5	0
6	534_Woodland moderate	11.10	50.3	0
7	565_grassland moderate	6.19	38.4	0
8	565_Woodland moderate	13.47	57.2	0
9	568_grassland poor	12.84	14.7	0
10	568_Woodland high	8.77	63.1	0
11	766_Riparian low	1.60	20.8	0
12	970_grassland poor	34.84	8.2	0

Zone ID	PCT/Zone	Area development footprint (ha)	Current vegetation Integrity Score	Future vegetation Integrity Score
13	970_Woodland moderate	37.80	41.5	0
14	997_grassland poor	6.03	11.6	0
15	997_Woodland moderate	10.18	41.6	0
16	1194_grassland poor	17.95	12.3	0
17	1194_Woodland moderate	5.65	58.2	0
18	567_grassland_TEC	97.12	39.7	0
19	567_Woodland_TEC	31.76	46	0
20	567_grassland_low	2.96	11.1	0
21	567_Woodland_high	35.03	70.7	0

7.1.2 Impacts to species credit species habitat or individuals

The loss of species credit species or habitat or individuals as a result of clearing is documented in Table 7-2.

Table 7-2 Summary of species credit species hectare areas impacted for all species with *Eucalyptus nicholli* represented as a count of individuals

Species Credit Species	Biodiversity risk weighting	Area of habitat (ha) or count of individuals lost within the development footprint																					Total
		Zone																					
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	
	PCT	**510**	**510**	**526**	**526**	**534**	**534**	**565**	**565**	**568**	**568**	**766**	**970**	**970**	**997**	**997**	**1194**	**1194**	**567 TEC**	**567 TEC**	**567**	**567**	
Calyptorhynchus lathami **Glossy Black-Cockatoo**	2		0.55		4.01		3.87				5.09			5.78		1.10		0.1		2.37		10.9	33.76
Dichanthium setosum Bluegrass	2												5.65	7.59									13.24
Eucalyptus nicholii Narrow-leaved Black Peppermint	2				5					1	2						1			2		2	13
Ninox connivens Barking Owl	2		0.25		2.33		1.25				2.78			3.15		0.01				1.28		6.66	17.70

Species Credit Species	Biodiversity risk weighting	Area of habitat (ha) or count of individuals lost within the development footprint																					Total
Petauroides volans Greater Glider	2		11.14		40.77		11.1		13.47		8.77			37.8		10.18		5.65		31.76		35.03	205.7
Petaurus norfolcensis Squirrel Glider	2		11.14		40.77		11.1		13.47		8.77			37.8		10.18		5.65		31.76		35.03	205.7
Phascolarctos cinereus Koala	2		11.15		40.88		11.11		13.84		8.80			37.99		10.27		5.65		31.76		35.45	206.9

7.1.3 Loss of hollow-bearing trees

Hollow-bearing tree mapping across the development site was not exhaustive. Of those that were mapped, according to GIS, 29 would be removed. An inventory of HBTs is provided in Appendix I.

7.1.4 Operational turbine impacts

The operation of wind turbines presents a risk to a range of birds and bats. The main risk is mortality through collision with moving turbine blades (blade-strike), although alienation (behavioural avoidance of suitable habitat near infrastructure) is also an important issue to consider. Section 7.3.3 describes the general impact risks to birds and bats from collisions and habitat avoidance is provided below, followed by a summary of the bird and bat species considered likely to be at risk from the Project.

7.2 Indirect impacts

Indirect impacts of the project include soil and water contamination, creation of barriers to fauna movement, or the generation of excessive dust, light or noise. Table 7-3 below details the type, frequency, intensity, duration and consequence of potential indirect impacts of the project.

Table 7-3 Potential indirect impacts to biodiversity during the construction and operational phases

Nature of impact	Extent	Frequency	Duration and timing	TEC, threatened species and habitats likely to be affected	Consequence for bioregional persistence
Indirect impacts (those listed below are included in the BAM)					
Inadvertent impacts on adjacent habitat or vegetation	Unknown	Rare	Construction Phase: short-term	• Box-gum Woodland CEEC • New England Peppermint Grassy Woodland CEEC • Spotted-tailed Quoll • New England Peppermint • Blue Grass • Koala • Greater Glider • Squirrel Glider • Eastern False Pipistrelle • Greater Broad-nosed Bat • Large Bent-winged Bat • Little Bent-wing Bat • Yellow-bellied Sheathtail Bat • Barking Owl • Glossy Black-cockatoo • Speckled Warbler • Varied Sitella • Dusky Woodswallow • Scarlett Robin • Diamond Firetail • Little Eagle	• Minor direct loss of native flora and fauna habitat • Low potential for injury and mortality during clearing for fauna habitat and habitat trees • Minor disturbance to stags, fallen timber, and bush rock • Increased edge effects
Reduced viability of adjacent habitat due to edge effects	Unknown	Constant	Operational Phase: long-term	• Box-gum Woodland CEEC • New England Peppermint Grassy Woodland CEEC	• Further degradation of TECs • Minor loss of native flora and fauna habitat

Nature of impact	Extent	Frequency	Duration and timing	TEC, threatened species and habitats likely to be affected	Consequence for bioregional persistence
				• Spotted-tailed Quoll • New England Peppermint • Blue Grass • Koala • Greater Glider • Squirrel Glider • Eastern False Pipistrelle • Greater Broad-nosed Bat • Large Bent-winged Bat • Little Bent-wing Bat • Yellow-bellied Sheathtail Bat • Barking Owl • Glossy Black-cockatoo • Speckled Warbler • Varied Sitella • Dusky Woodswallow • Scarlett Robin • Diamond Firetail • Little Eagle	
Reduced viability of adjacent habitat due to noise, dust or light spill	Unknown	Rare	Operational Phase: short-term	• Box-gum Woodland CEEC • New England Peppermint Grassy Woodland CEEC • Spotted-tailed Quoll • New England Peppermint • Blue Grass • Koala • Greater Glider	• May alter fauna activities and/or movements • Minor loss of foraging or breeding habitat • Inhibit the function of plant species, soils and dams

Nature of impact	Extent	Frequency	Duration and timing	TEC, threatened species and habitats likely to be affected	Consequence for bioregional persistence
				• Squirrel Glider • Eastern False Pipistrelle • Greater Broad-nosed Bat • Large Bent-winged Bat • Little Bent-wing Bat • Yellow-bellied Sheathtail Bat • Barking Owl • Glossy Black-cockatoo • Speckled Warbler • Varied Sitella • Dusky Woodswallow • Scarlett Robin • Diamond Firetail • Little Eagle	
Transport of weeds and pathogens from the site to adjacent vegetation	Unknown	Irregular	Construction and Operational Phase: long-term	• Box-gum Woodland CEEC • New England Peppermint Grassy Woodland CEEC • Spotted-tailed Quoll • New England Peppermint • Blue Grass • Koala • Greater Glider • Squirrel Glider • Eastern False Pipistrelle • Greater Broad-nosed Bat • Large Bent-winged Bat • Little Bent-wing Bat	• Degradation of TECs onsite through future weed invasion • Koala and Greater Glider mortality through spread of Chlamydia infection

Nature of impact	Extent	Frequency	Duration and timing	TEC, threatened species and habitats likely to be affected	Consequence for bioregional persistence
				• Yellow-bellied Sheathtail Bat • Barking Owl • Glossy Black-cockatoo • Speckled Warbler • Varied Sitella • Dusky Woodswallow • Scarlett Robin • Diamond Firetail • Little Eagle	
Increased risk of starvation, exposure and loss of shade or shelter	Unknown	Constant	Construction and Operational Phase: long-term	• Spotted-tailed Quoll • New England Peppermint • Blue Grass • Koala • Greater Glider • Squirrel Glider • Eastern False Pipistrelle • Greater Broad-nosed Bat • Large Bent-winged Bat • Little Bent-wing Bat • Yellow-bellied Sheathtail Bat • Barking Owl • Glossy Black-cockatoo • Speckled Warbler • Varied Sitella • Dusky Woodswallow • Scarlett Robin • Diamond Firetail	• Loss of foraging habitat • Loss of fauna corridors

Nature of impact	Extent	Frequency	Duration and timing	TEC, threatened species and habitats likely to be affected	Consequence for bioregional persistence
				• Little Eagle	
Loss of breeding habitat	HBTs within wooded zones that may be used for nesting/roosting	Constant	Construction Phase: long-term	• Spotted-tailed Quoll • Koala • Greater Glider • Squirrel Glider • Eastern False Pipistrelle • Greater Broad-nosed Bat • Large Bent-winged Bat • Little Bent-wing Bat • Yellow-bellied Sheathtail Bat • Barking Owl • Glossy Black-cockatoo • Speckled Warbler • Varied Sitella • Dusky Woodswallow • Scarlett Robin • Diamond Firetail	• Loss of potential breeding habitat for hollow dependent and fallen timber dependent fauna • Increased pressure and competition for remaining HBT resources from native and exotic hollow dependent fauna • Cumulative loss of HBTs in conjunction with rural clearing and other developments within the proposed renewable energy hub increasing competition and pressure for resources
Rubbish dumping	Unknown	Regular	Construction and Operational Phase: long-term	• Box-gum Woodland CEEC • New England Peppermint Grassy Woodland CEEC • Spotted-tailed Quoll • New England Peppermint • Blue Grass • Koala • Greater Glider • Squirrel Glider • Eastern False Pipistrelle	• Degradation of TECs onsite • Degradation of fauna habitat • Poisoning local fauna

Nature of impact	Extent	Frequency	Duration and timing	TEC, threatened species and habitats likely to be affected	Consequence for bioregional persistence
				• Greater Broad-nosed Bat • Large Bent-winged Bat • Little Bent-wing Bat • Yellow-bellied Sheathtail Bat • Barking Owl • Glossy Black-cockatoo • Speckled Warbler • Varied Sitella • Dusky Woodswallow • Scarlett Robin • Diamond Firetail • Little Eagle	
Earthworks and mobilisation of sediments	Unknown	Regular	Construction Phase: short-term	• Box-gum Woodland CEEC • New England Peppermint Grassy Woodland CEEC • New England Peppermint • Blue Grass	• Erosion and sedimentation and/or pollution of soils, dams and downstream habitats • Potential loss of groundcover resulting in unstable ground surfaces and sedimentation of adjacent waterways and dams
Increase risk of fire under high voltage transmission lines	Unknown	Regular	Operational Phase: long-term	• Box-gum Woodland CEEC • New England Peppermint Grassy Woodland CEEC • Spotted-tailed Quoll • New England Peppermint • Blue Grass • Koala • Greater Glider • Squirrel Glider • Eastern False Pipistrelle	• In the unlikely event of fire burning adjacent or underneath the high voltage transmission lines, there is a potential for electrical arcs that can endanger people, fauna and surrounds

Nature of impact	Extent	Frequency	Duration and timing	TEC, threatened species and habitats likely to be affected	Consequence for bioregional persistence
				• Greater Broad-nosed Bat • Large Bent-winged Bat • Little Bent-wing Bat • Yellow-bellied Sheathtail Bat • Barking Owl • Glossy Black-cockatoo • Speckled Warbler • Varied Sitella • Dusky Woodswallow • Scarlett Robin • Diamond Firetail • Little Eagle	
Increase predation by the European Red Fox and Wild Dogs	Development footprint	Regular	Operational Phase: long-term	• Koala • Greater Glider • Squirrel Glider • Eastern False Pipistrelle • Greater Broad-nosed Bat • Large Bent-winged Bat • Little Bent-wing Bat • Yellow-bellied Sheathtail Bat • Barking Owl • Glossy Black-cockatoo • Speckled Warbler • Varied Sitella • Dusky Woodswallow • Scarlett Robin • Diamond Firetail	• The removal of native vegetation may contribute to increased fox and wild dog predation pressure by facilitating fox and wild dog movement in the landscape

Nature of impact	Extent	Frequency	Duration and timing	TEC, threatened species and habitats likely to be affected	Consequence for bioregional persistence
Impacts to adjacent World Heritage Area wildlife (NSW NPWS 2005)	Unknown	Irregular	Operational Phase: long-term	• Koala • Greater Glider • Squirrel Glider • Spotted-tailed Quoll • Eastern False Pipistrelle • Greater Broad-nosed Bat • Large Bent-winged Bat • Little Bent-wing Bat • Yellow-bellied Sheathtail Bat • Glossy Black-cockatoo • Speckled Warbler • Varied Sitella • Diamond Firetail	• Disruption in connectivity for arboreal mammals Koala, Greater Glider, Squirrel Glider, although this is minimal due to the narrow development corridor • Moderate risk of turbine strike for Glossy Black-cockatoo. Unlikely to significantly reduce the population in the locality.

7.3 Prescribed impacts

The following two prescribed impacts are relevant to the Project:

- habitat connectivity
- impacts of wind turbines (changes in behaviour, barotrauma, flight path obstacles, vegetation corridor interruption).

Standard mitigation strategies have also been adopted to minimise the risk of impacts to waterways and hydrology and vehicles strikes.

7.3.1 Impacts of development on habitat connectivity

Removal of native vegetation and threatened species has the potential to result in fragmentation, with resultant effects on fauna species movement, reproduction and gene flow. Clearing can result in the inability of species to move between patches of suitable habitat and undertake important lifecycle processes, such as breeding and dispersal. This has the potential to increase the vulnerability of flora and fauna populations to stochastic events and extinction (Fischer and Lindenmayer 2007). Figure 2-6 shows biodiversity corridors within the development site. It is clear that corridors cross the development site and assessment area, however on viewing Figure 2-6 (more detail in Appendix M) the connectivity of those corridors is not complete in the majority of locations where they cross or are close to turbine areas. This shows that the vegetation is already fragmented. However habitat for species impacted by the project such as Quoll, Greater Glider, Squirrel Glider, Koala that may also use the World Heritage Area adjacent will still have habitat that allows them to traverse between the Project Area and the WHA.

The project has the potential to reduce connectivity through clearing, however this is unlikely to be a significant impact. Connectivity within and across the development site is currently provided for those species which do not require a consistent (or closed) canopy for traversal. The project has largely avoided dense tracts of native vegetation and the development footprint is typically limited to sparse woodland or scattered trees.

Existing movement opportunities for the majority of species on this project site will not be reduced by the linear and discrete nature of a wind farm development. Potential alienation or barrier impacts caused by operating wind turbines and limiting wildlife connectivity is raised in Section 7.3.3 and as follows.

Figure 7-1 provides an example of habitat connectivity for one of the species whose movement opportunity has the potential to be limited by linear clearing. This figure shows the area to the southeast of the project site where Greater Glider were confirmed, in an area of dense native vegetation which has functional connectivity to another habitat patch to the north of the footprint.

Greater Gliders have been recorded gliding up 100m. The Office of Environment and Heritage (2017) and the Wildlife Preservation Society of Queensland (2019) both note that this species can glide up to a horizontal distance of 100m. R. Kavanagh (pers. Comm., cited in Taylor, 2010) measured a maximum glide of 75m from a tree canopy 45m high. Squirrel Glider maximum glide distance is 70m, with typical glides closer to 30-35m (van der Ree et al. 2003; van der Ree et al. 2010). Van der Ree et al. (2010) suggest that average glide distances may be underestimated, as trees in continuous forest are spaced closer together, with gliders forced to undertake longer glides in habitat where trees are spaced further apart. A conservative approach to glide distance should however be taken, particularly given that there is a general paucity of information on glide performance for Greater Glider (B. Taylor, pers comm. November 2019; G.

Brearley, pers comm. May 2020). In direct response, the proponent has considered that an achievable average gliding distance for Greater Glider is 40m and committed to keeping the majority of clearing widths to below this distance, including below 30m where possible.

As shown in Figure 7-1, the project footprint (in red hatching) will bisect the vegetated connection between these two patches of good quality glider habitat with a minimum clearing width of 25m and a maximum of 39m. The maximum clearing remains well within the known glide distance for Greater Glider as well as Squirrel Glider, and therefore will not impede movement for either of these gliding mammals. Species records for Greater Glider are shown by yellow icons.

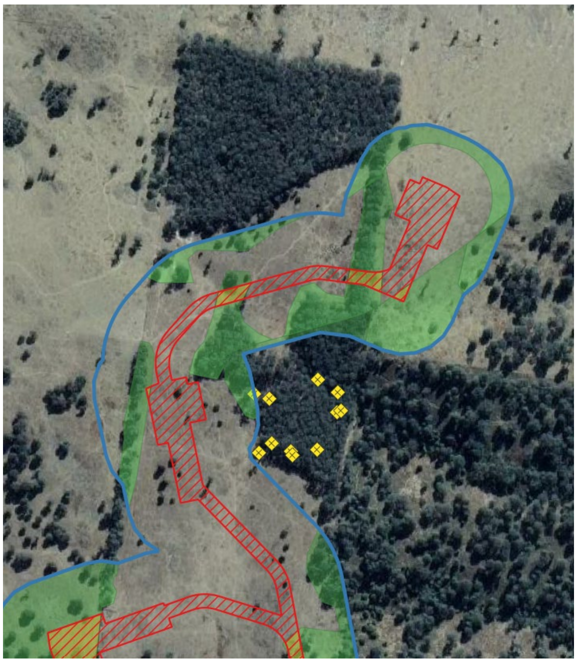


Figure 7-1 Example of habitat connectivity for Greater Glider

7.3.2 Impacts on species using the landscape

Operational wind turbines may cause changes in bird and bat behaviour. Where such behaviour includes avoiding nesting or foraging resources or diverging around the broad area where turbines are located, this is termed an ‘alienation’ or ‘barrier’ effect. The turbines, in these instances, act to ‘sterilise’ otherwise suitable areas of habitat or movement pathways. Alienation may affect local sedentary birds in their daily traverses for foraging, roosting and breeding sites or may cause migratory birds to shift migratory flyways. Birds and bats may be forced to change their flight behaviour to avoid collisions with turbines, subsequently impacting on their breeding and foraging success (Drewitt and Langston 2006). Alienation of hunting habitat for raptors such as Wedge-tailed Eagle may be of particular concern (Smales 2006) for local populations. The distance over which disturbance effects can extend from a wind farm varies considerably. A distance of 600m is often reported as the zone of disturbance around turbines, however this ranges from 80m (for a grassland songbird), to 800m (for waterfowl) and 4km (for seabirds) (Sharp 2010). Barrier effects have been demonstrated at offshore wind farms in Europe, however there is little evidence at onshore farms (EPHC 2010; Hull 2013a).

Siting and configuration of turbines is the primary factor influencing alienation impacts; inappropriate layout (such as lines of turbines between important habitat features) can create a barrier effect, resulting in habitat loss or fragmentation (Brett Lane and Associates 2009). Turbines are generally placed to maximise wind values and to minimise turbulence from topographic features and other turbines. In practice, this means there are usually large and variable spaces between turbines (Smales 2006). Rows of turbines throughout the Development Footprint could in effect act as multiple barriers to the movement of birds and bats, particularly if spaced too closely together.

The key data used to inform these risks are included in the Bird Utilisation Survey (BUS) Report 2020-2022 in Appendix C (Nature Advisory 2022a) and the Operational Risk Assessment in Appendix E (Nature Advisory 2022b). This work is based on extensive site survey, commencing in 2020.

7.3.3 Impacts of wind turbines

In order to assess the potential for the Project to impact bird and bat species, a number of targeted studies have been conducted. These are summarised herein, and provided in full within the appendices:

- Bird Utilisation & Raptor Survey (BUS) Report 2020-2022 (Nature Advisory 2022a; Appendix C)
- Bat Assessment Report 2020-2021 (Nature Advisory 2022b; Appendix C)
- Targeted White-throated Needletail Survey (Nature Advisory 2022c; Appendix Q)
- Bird and Bat Risk Assessment (Nature Advisory 2022d; Appendix D)
- Bird Utilisation Survey (Autumn 2022) (ERM, 2022; Appendix C)

The Bird and Bat assessment targeted species of concern, which are those that:

- are known, likely or have the potential to occur on the wind farm site, and
- that are also listed as threatened or migratory under the EPBC Act and/or BC Act, or
- are known to be particularly vulnerable to wind turbine impacts (turbines located in key movement pathways, flight behaviour, or other ecological traits).

7.3.4 BUS Surveys

Bird and bat utilisation survey (BUS) method, effort and limitations are covered in Section 4.2.5. BUS survey locations are shown on Figure 4-3.

Seasonal bat surveys (Songmeter deployment) were undertaken by Nature Advisory in Spring 2020 and Summer/Autumn 2021 to coincide with the most likely time to observe the threatened Large Bent-winged Bat moves about the landscape and covers larger distances than when it is confined to maternity caves and non-maternity caves. See Figure 4-3 for Songmeter locations.

Targeted surveys for White-throated Needletail were conducted in Summer 2021/22 in order to detect any seasonal use of the Development Site by this species, as well as identify any roosts or identifiable flight movement paths. See Appendix Q for details of this survey.

More than 90 species were recorded, with the highest diversity (but lowest abundance) in Summer, and the lowest in Autumn. A total of 4,656 individual birds were recorded during BUS. The five most commonly recorded species at impact sites during the BUS, comprising 42.5% of all observations, were Australian Magpie, Torresian Crow, Yellow-rumped Thornbill, Eastern Rosella and Superb Fairywren. Diversity was influenced mainly by surrounding habitat, and the number of species was usually higher at points surrounded by remnant woodland vegetation, with lower species richness occurring at grazed, open, agricultural land.

The majority of birds observed at impact sites (95.7%) were flying below the RSA height, with only 3.4% of observations within the RSA (40 to 150m). The Wedge-tailed Eagle was the most commonly observed species at RSA.

Eight raptor species were recorded, comprising 179 individual observations across all BUS periods, of which 57% were at RSA. An additional 98 incidental raptor observations were made by the BUS team outside of formal BUS.

Raptors are at risk of collision with operating turbines. Based on experience at other wind farms, carcasses of Wedge-tailed Eagles, Nankeen kestrels and Brown Falcons are found consistently under wind turbines (Nature Advisory data). No raptor nesting activities within the wind farm was confirmed in the surveys, however Wedge-tailed Eagles were observed performing courtship behaviour, as well as one individual carrying a stick, a behaviour associated with nest building.

Despite over 2,600 hours of ecological survey effort (section 4.2.5) including targeted searches, White-throated Needletail has not been confirmed within the Development Site. There are however database records within 10km of the site (see Nature Advisory 2022c). Given site habitat conditions and the lack of observations, the site is not considered to provide favourable habitat for foraging and few opportunities for roosting by needletails, however it may occasionally fly over the site.

Five threatened bat species were confirmed in the Assessment Area, all of which are listed as Vulnerable under the BC Act.

- Eastern False Pipistrelle
- Greater Broad-nosed Bat
- Large Bent-winged Bat
- Little Bent-winged Bat
- Yellow Bellied Sheathtail Bat.

Bat activity differed substantially between the two survey periods. Across both periods, Site 6 (Figure 4-3) had the highest number of calls. This location is in the northeast of the Project site in open pasture, on a ridge and near a farm dam, which is likely to be the key contributing factor to bat activity in this area.

Prior to surveys, it was considered possible that Large Bent-winged Bat may migrate between the coast and inland maternity cave(s) across the Project Site. The closest maternity cave is 60km east (Willi Willi Cave). Survey results suggest that it is unlikely that the Project Site is within a migratory route for this species, given low detection and no activity spikes during expected migration time periods.

Risk of impact during wind farm operation

The SEARs and BAM require an impact assessment to migratory species and resident raptors that may be subject to impacts associated with blade strike during the operational phase of the project. Nature Advisory (2022d) conducted a risk assessment to measure the overall risk of a potential impact event on the local population of any species of concern known or likely to occur (refer Appendix D).

The risk of waterbirds colliding with turbines is considered to be low, with only one observation of a waterbird (Australasian Darter) at RSA. Whilst the majority of birds at the Development Site were common farmland and woodland species, seven were identified during BUS or associated incidental surveys that are threatened (denoted in Table 7-4 with an asterisk).

Table 7-4 Collision risk for bird and bat species of concern (known or likely to occur)

Species of concern	Collision risk
Varied Sitella*	These species are strictly small bush birds that rarely venture outside cover and do not fly at RSA height. Therefore, they are not at risk of collision with operating turbines. **Low risk.**
Speckled Warbler*	
Diamond Firetail*	
Little Lorikeet*	
Dusky Woodswallow*	Recorded on six occasions at BUS point 3 during Summer BUS, considered likely to be a summer migrant to the region. Typically flies beneath the canopy (and therefore below RSA). **Low risk.**
Glossy Black-cockatoo*	Recorded from a single observation of a pair of birds during autumn BUS near the Oxley Wild Rivers National Park. Section 4.2.5 describes additional survey effort and results for this species, outside of the BUS survey period. Occurs in forests and woodlands with casuarinas, upon which they are dependent as a food source. The species was recorded during BUS, so are likely to occur in and between areas of high casuarina density around the Development Site. Their behaviour may place them at risk from turbine collisions and since the Black Summer fires of 2019-20, some have been displaced from their more traditional sites in NSW and Victoria. Given this species is long-lived and has a low recruitment rate, a casualty would have high consequences for the population. The species is therefore considered at **moderate risk** from the Project.
Little Eagle*	Little Eagle was an incidental observation (flying over the Development Site). The Little Eagle is a vulnerable raptor, found across the New England Tablelands, and is at risk of colliding with operating turbines, as they routinely fly at RSA heights. The species may be displaced by the presence of Wedge-tailed Eagle and is unlikely to have occurred at any of the BUS locations due to high Wedge-tailed Eagle densities. The bird was located on Moona Plains Road, approximately 14 kilometres from the nearest proposed turbine location. There are historic records of this species breeding at Eastlake, a property bordering the proposed wind farm site, as recently as 2017 (Larkin et al., 2020), however the nest was displaced by breeding White-bellied Sea-Eagle (*Haliaeetus leucogaster*). This raptor species has shown a 50% decline in numbers in NSW over three generations and is considered to have a low recruitment rate (Debus 2017). It may occur at the Project Site at low frequency and/or density, but should a collision occur this would have moderate consequences. The risk to the Little Eagle was therefore considered to be **low risk**.
White-throated Needletail	Not observed at the Development Site, despite targeted searches. Flocks may however pass over the Development Site during the warmer months of November to April. Collisions have been recorded at wind farms elsewhere in NSW and eastern Australia. The risk to this species from the Project is considered to be of **moderate risk** as the species is considered almost certain to collide with operating turbines

Species of concern	Collision risk
	resulting in a moderate loss of individuals at some stage in the wind farm operation.
Wedge-tailed Eagle	The number of Wedge-tailed Eagles were considered high compared with other wind farms with similar settings. The utilisation rate of eagles was estimated as 0.66 eagles per hectare per hour, higher than the range (0.01 – 0.44) calculated for other wind farms in south-eastern Australia (Nature Advisory data). There is a low incidence of disturbance of Wedge-tailed Eagles at most wind farms, successful breeding within 200 metres of operating turbines has been observed (Nature Advisory, unpublished data). Thus, risks to this species arise from likely collisions but not indirect disturbance. The risk to the Wedge-tailed Eagle is therefore considered to be **moderate risk**.
Raptors, general	No stick nests were observed within the Development Footprint. Commonly occurring raptor species recorded to collide with turbines include Nankeen Kestrel, Brown Falcon and Black-shouldered Kite (Nature Advisory, unpubl. data). The Brown Goshawk, Whistling Kite and Peregrine Falcon are also recorded at the Winterbourne WF site and may collide with turbines infrequently. Raptors appear not to be deterred by the presence of operating wind turbines and occur regularly at other wind farms in NSW (Nature Advisory, unpublished data). Overall, the risk from collision with turbines to these raptors is considered to be **low risk** as these species are widespread and common, making local population impacts unlikely as affected individuals would be readily replaced.
Large Bent-winged Bat	This species is known sometimes to fly above the canopy which puts it at risk of collision with turbines. However, few impacts to this species have been recorded. There was activity of Large Bent-winged Bat from the bat survey in Autumn 2021. Therefore, the Large Bent-winged Bat is indicated as having a precautionary likely risk of collision with turbines, with a low consequence rating resulting in an overall **low risk**.
Little Bent-winged Bat	This species can associate with Large Bent-winged Bat, so may be subject to the same pressures. It hibernates in winter in NSW and may fly above the canopy which puts it at risk of collision with turbines. Few impacts to this species have been recorded. There was activity of Little Bent-winged Bat from the bat survey in autumn 2021. Therefore, the species is assessed as having a potential risk of collision with turbines, with a low consequence rating resulting in an overall **low risk**.
White-striped Freetail Bat	Common and widespread across southern Australia and is not listed as threatened. It has been recorded flying at height at the site and has been regularly recorded colliding with turbines at other wind farms in south-eastern Australia. It is expected that there will be regular collisions with turbines and therefore is at **low risk**, with minor impacts on the local population.
Yellow-bellied Freetail Bat	Widespread across northern and eastern Australia but becomes rarer in the south of this range in NSW and Victoria (Churchill 2008). It was recorded at the Development Site during bat surveys in autumn 2021 and likely to fly at RSA height. It is expected that collisions of this species would occur, but given it is widespread and relatively common, consequences would be low. Therefore, its risk rating is considered **low risk**.

Species of concern	Collision risk
Grey-headed Flying-fox	Disperses widely in south-eastern Australia from numerous camps that are often now located in cities and country towns as well as natural habitats. The Project is not in an area of regular occurrence, but it cannot be discounted that groups of the species may pass through the area or set up temporary camps, so that consequences of collisions would be moderate and its overall risk rating is considered low risk.

In summary, these three species have been assessed as having moderate risk associated with collisions with turbine blades during the operation of the project to the following species:

- Glossy Black-cockatoo
- White-throated Needletail
- Wedge-tailed Eagle

Species polygons have been identified for Glossy Black-cockatoo (Figure 4-5). White-throated Needletail habitat is reasonably expected to occur across the majority of the Development Site, however there were no sightings of this species in or around the Development Footprint during BUS or additional targeted surveys. Figure 5 within the BUS report (Nature Advisory 2022a, Appendix C) shows raptor flight path mapping, including for Wedge-tailed Eagle.

Adaptive operational monitoring is required to address the uncertainty in the results obtained to date. While the BUS has extended over multiple years and seasons, many Australian species are known to respond to fluctuations in resources rather than follow predictable seasonal movement patterns. A range of mitigation strategies will be employed in response (see Section 8.3).

7.4 Adaptive management for biodiversity values that are uncertain

The key uncertainty in terms of the biodiversity impacts of the Project is in relation to bird and bat collision impacts. While project-specific data and analysis has been undertaken over multiple years and seasons, many Australian species are known to respond to fluctuations in resources rather than follow predictable seasonal movement patterns. For this reason, additional measures are included to specifically address this uncertainty in the form of an adaptive management framework.

The purpose of adaptive management framework is to ensure environmental outcomes are achieved. To this end, there are linkages between:

- Environmental outcomes;
- Implementation of mitigation and management measures;
- Monitoring, reporting and investigations; and
- Implementation of corrective actions to ensure environmental outcomes will be achieved.

The Project commits to collecting and analysing further data during operation, focussed on the higher risk species and higher risk areas of the site.

Higher risk species include:

- Glossy Black-cockatoo
- White-throated Needletail
- Wedge-tailed Eagle

Higher risk locations include:

- Adjacent ridge lines and areas of updrafts. No turbines have been identified as high risk specifically but areas within the development site include those adjacent to connected woodland habitat such as Oxley Rivers National Park.

The work would be implemented via an adaptive Bird and Bat Management Plan (BBMP) to be prepared to reflect the final infrastructure layout and implemented intensively for the first 3 years with potential to scale down in direct response to results, thereafter. The BBMP will include:

- A description of measures to be implemented on the project site for minimising bird and bat strike;
- Trigger levels for further investigation and mitigation measures to be implemented;
- An adaptive management plan to be implemented if the monitoring determines threatened or at-risk species are subject to adverse impacts; and
- A monitoring and reporting plan to assess the potential impacts and effectiveness of design and operational measures to mitigate bird and bat strike

A range of mitigation strategies can be employed in response, with the most certain being ‘sector shut down’, where turbines can be programmed to be operationally limited in the higher risk periods. Buffers and monitoring are addressed in the Project’s mitigation strategies.

7.5 Impacts to Matters of National Environmental Significance

On 31 August 2020, a delegate of the Federal Minister for the Department of Agriculture, Water and the Environment determined that the Winterbourne Wind Farm project was a controlled action under Section 75 of the EPBC Act. The EPBC Act controlling provisions for the proposed actions are:

i. World Heritage properties (Sections 12 and 15A);
ii. National Heritage places (Sections 15B and 15C);
iii. Listed threatened species and communities (Sections 18 and 18A); and
iv. Listed migratory species (Sections 20 and 20)

In addition, consideration for the impacts from 2019-2020 bushfires on MNES entities must be considered.

7.5.1 EPBC listed Threatened Ecological Communities and threatened/migratory species

A Protected Matters Search was undertaken (Appendix J), and 36 EPBC listed threatened or migratory species from this search were identified as having at least a moderate likelihood of occurring on site (see Table 7-5).

Based on the referral documentation (EPBC 2020/8734), the Commonwealth determined there was likely to be significant impacts on the following matters:

- New England Peppermint (*Eucalyptus nova-anglica*) Grassy Woodlands ecological community listed as critically endangered.
- Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll (SE mainland population) (*Dasyurus maculatus maculatus*) listed as endangered.

- Koala (combined populations of QLD, NSW and ACT) (Phascolarctos cinerus) listed as vulnerable[4].
- Narrow-leaved Black Peppermint (*Eucalyptus nicholli*) listed as vulnerable.
- Greater Glider (*Petauroides volans*) listed as vulnerable.[5]
- Beadle's Grevillea (*Grevillea beadleana*) listed as endangered.

In addition, the Commonwealth identified potential for some risk of significant impacts to the following matters:

- Brush-tailed Rock-wallaby (*Petrogale penicillata*) listed as vulnerable.
- Narrow-leaved Bertya (*Bertya ingramii*) listed as endangered

The following species were identified as requiring an assessment to determine the extent of potential impacts associated with transporting project components to the proposed site:

- Austral Toadflax (*Thesium australe*) listed as vulnerable.
- White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland listed as critically endangered.

Birds listed on the annexes to the China-Australia Migratory Bird Agreement (CAMBA), Japan-Australia Migratory Bird Agreement (JAMBA) and Republic of Korea-Australia Migratory Bird Agreement (ROKAMBA), are listed as migratory species under the EPBC Act. The following migratory species were identified by the DAWE as potentially impacted by a likely reduction of available habitat and the operation of wind turbines:

- White-throated Needletail (*Hirundapus caudacutus*), a migratory species listed under CAMBA, JAMBA and ROKAMBA.
- Fork-tailed Swift (*Apus pacificus*), a migratory species listed under CAMBA, JAMBA and ROKAMBA.

These entities are addressed within the BAM and BOS, as allowed under the Bilateral agreement with the Commonwealth. The survey program targeted these entities; the outcomes of the survey and assessment are summarised below in Table 7-5 and impacts are discussed further in the following Sections. Entities for which an Assessment of Significance (pursuant to the EPBC Act) has concluded a significant impact is likely for White-throated Needletail and Fork-tailed Swift. An EPBC referral will be required and credits generated will be included as part of the BAM assessment to generate credits under the Biodiversity Offset scheme.

[4] Koala has since been up-listed from Vulnerable to Endangered, however under the EPBC Act the project was declared a controlled action when Koala was vulnerable and therefore this assessment continues to assess Koala as vulnerable.

[5] Greater Glider has since been up-listed from Vulnerable to Endangered, however under the EPBC Act the project was declared a controlled action when Greater Glider was vulnerable and therefore this assessment continues to assess Greater Glider as vulnerable.

Table 7-5 EPBC Listed species, SEARs requirements and assessment outcomes

Low likelihood of occurrence indicates that the species has not been detected previously and there is limited or no habitat. Moderate likelihood of occurrence indicates habitat present and no reason to exclude. High likelihood of occurrence indicates habitat present and species records. All species with moderate to high likelihood of occurrence had Assessment of Significances (AOS') conducted. Species polygons for MNES entities likely to be impacted by the proposal are mapped in Figure 7-2. Those considered to have significant impact are highlighted below in blue with AOSs provided in **Appendix L**.

Scientific Name	Common Name	EPBC ACT	Presence of habitat	Likelihood of Occurrence	SEARs requirement	Impacts likely, species presence, AOS results
Litoria castanea	Yellow-spotted Tree Frog	E	Present	Moderate	NA	Absent – not detected during targeted surveys in December 2021 (See sect.4.2).
Litoria piperata	Peppered Tree Frog	V	Present	Moderate	NA	Absent – not detected during targeted surveys in December 2021 (See sect.4.2).
Anthochaera phrygia	Regent Honeyeater	CE	Marginal	Moderate	NA	Potential foraging habitat. AoS – Non-significant.
Apus pacificus	Fork-tailed Swift	M	Present	Moderate	Impact Likely	AoS – Significant. Risk stated as moderate by NA for collision risk,
Gallinago hardwickii	Latham's Snipe	M	Marginal	Moderate	NA	Potential foraging habitat. AoS – Non-significant.
Grantiella picta	Painted Honeyeater	V	Present	Moderate	NA	Potential foraging habitat. AoS – Non-significant.
Lathamus discolor	Swift Parrot	CE	Marginal	Moderate	NA	Potential foraging habitat. AoS – Non-significant.
Arthraxon hispidus	Hairy Jointgrass	V	Marginal	Moderate	NA	Absent – not detected during targeted surveys in March 2021; April 2021; November 2020 & 2021; December 2021 (See sect.4.2).
Bertya ingramii	Narrow-leaved Bertya	E	Marginal	Moderate	Potential Impact	Absent – not detected during targeted surveys in March 2021; April 2021; September 2020; October 2020 & 2021; November 2020 & 2021; December 2021

Scientific Name	Common Name	EPBC ACT	Presence of habitat	Likelihood of Occurrence	SEARs requirement	Impacts likely, species presence, AOS results
						(See sect.4.2).
Callistemon pungens		V	Marginal	Moderate	NA	Absent – not detected during targeted surveys in September 2020; October 2020 & 2021; November 2020 & 2021; December 2021 (See sect.4.2).
Dichanthium setosum	Bluegrass	V	Present	Recorded	NA	AoS – Significant. Species detected. Offsets have been generated under the BOS.
Diuris eborensis		E	Marginal	Moderate	NA	Absent – not detected during targeted surveys in November 2020 & 2021; December 2021 (See sect.4.2).
Diuris pedunculata	Small Snake Orchid	E	Present	High	NA	Absent – not detected during targeted surveys in September 2020; October 2020 & 2021 (See sect.4.2).
Eucalyptus mckieana	McKie's Stringybark	V	Present	Moderate	NA	Absent – not detected during targeted surveys in March 2021; April 2021; September 2020; October 2020 & 2021; November 2020 & 2021; December 2021 (See sect.4.2).
Eucalyptus nicholii	Narrow-leaved Black Peppermint	V	Present	Recorded	Impact Likely	AoS – Detected. Offsets have been generated under the BOS.
Euphrasia arguta		CE	Marginal	Moderate	NA	Absent – not detected during targeted surveys (See sect.4.2).
Grevillea beadleana	Beadle's Grevillea	E	Marginal	Moderate	NA	Absent – not detected during targeted surveys in November 2020 & 2021; December 2021; March 2021 (See sect.4.2).
Hirundapus caudacutus	White-throated Needletail	M	Present	Assumed Present	Impact Likely	AoS – Significant. Risk stated as moderate by NA for collision risk, not detected during surveys but multiple EBird records

Scientific Name	Common Name	EPBC ACT	Presence of habitat	Likelihood of Occurrence	SEARs requirement	Impacts likely, species presence, AOS results
Persicaria elatior	Tall Knotweed	V	Marginal	Moderate	NA	Absent – not detected during targeted surveys in March 2021; April 2021; & December 2021 (See sect.4.2).
Picris evae	Hawkweed	V	Present	High	NA	Absent – not detected during targeted surveys (See sect.4.2).
Thesium australe	Austral Toadflax	V	Present	High	Transport route	Absent – not detected during targeted surveys (See sect.4.2).
Dasyurus maculatus maculatus	Spotted-tailed Quoll	E	Present	Recorded	Impact Likely	AoS – Significant. Detected, is an ecosystem credit generating species, and credits have been generated under the BOS.
Petauroides volans	Greater Glider	V	Present	Recorded	Impact likely	AoS – Species detected. Species credits have been generated under the BOS.
Petrogale penicillata	Brush-tailed Rock-Wallaby		Present	Moderate	Potential Impact	Absent – not detected during targeted surveys (See sect.4.2).
Phascolarctos cinereus	Koala	V	Present	Recorded	Impact likely	AoS – Species detected. Species credits have been generated under the BOS.
Pseudomys oralis	Hastings River Mouse	E	Marginal	Moderate	NA	Absent – not detected during targeted surveys in December (See sect.4.2).
Pteropus poliocephalus	Grey-headed Flying-fox	V	Marginal	Moderate	NA	Absent – breeding habitat not detected during surveys, however foraging habitat is present. AOS nonsignificant.
Uvidicolus sphyrurus	Border Thick-tailed Gecko	V	Present	Moderate	NA	Absent – not detected during targeted surveys (See sect.4.2).
New England Peppermint (Eucalyptus nova-anglica) Grassy Woodlands		CE	Present	Known	Impact likely	AoS – Ecosystem credits have been generated under the BOS.
White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland		CE	Present	Known	Transport Route	AoS – Ecosystem credits have been generated under the BOS.

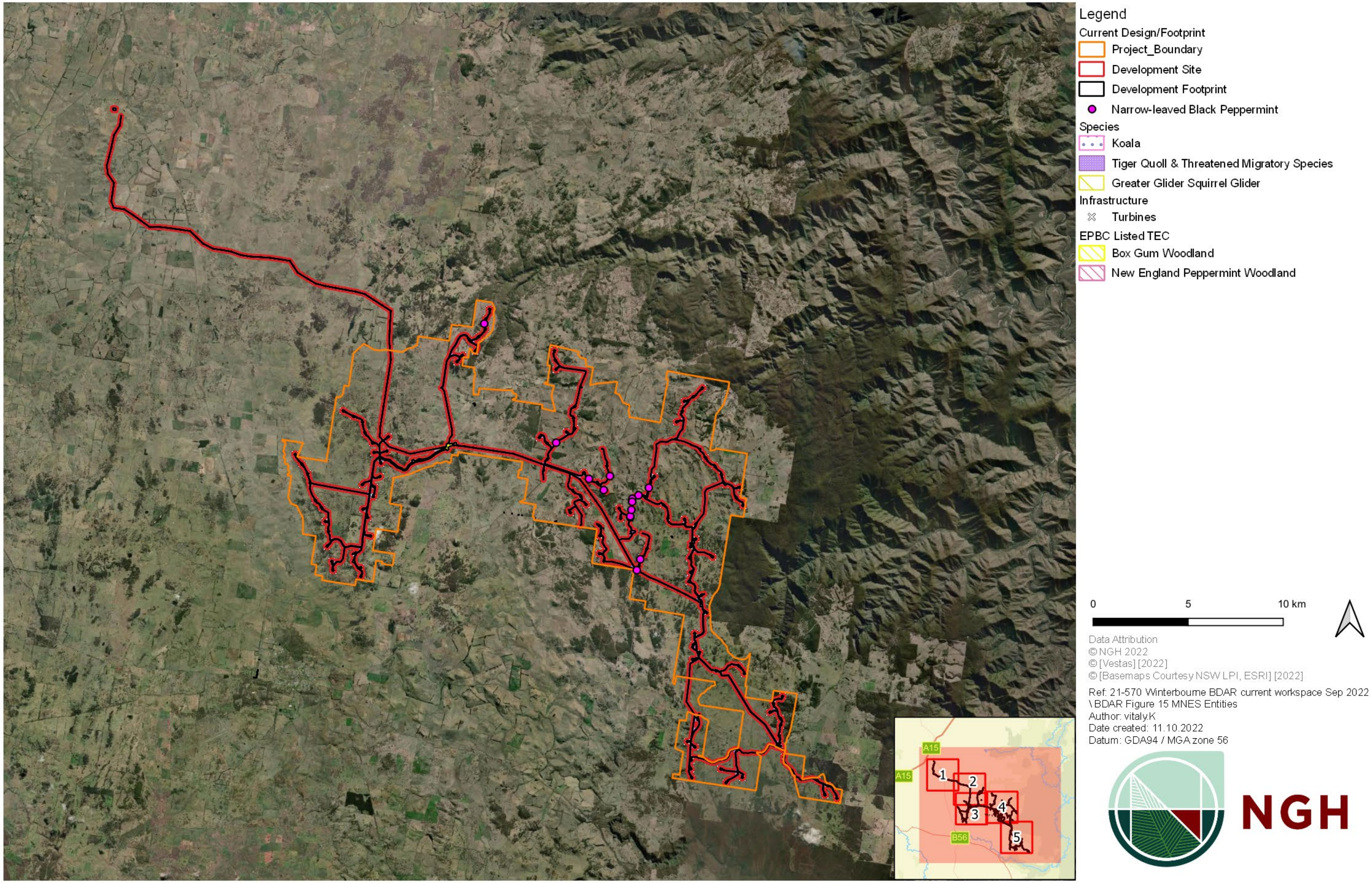


Figure 7-2 MNES entities species polygons (detailed mapping is provided in Appendix N.10)

7.5.2 Impacts to EPBC listed Threatened Ecological Communities and threatened/migratory species

As summarised above, targeted surveys (Section 4.2.5) confirmed the presence of the following EPBC Act Listed threatened ecological communities and species:

Threatened Ecological Communities:

- New England Peppermint (*Eucalyptus nova-anglica*) Grassy Woodlands
- White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland

Threatened/Migratory Species:

- Spotted-tailed Quoll
- Koala
- Greater Glider
- Narrow-leaved Black Peppermint
- White-throated Needletail
- Blue Grass

In addition, an Assessment of Significance (AOS) was prepared for each of the following species thought to have some habitat (foraging) within the development site although these species were not detected through survey and no breeding habitat for these species was detected through survey:

- Grey-headed Flying-fox – foraging habitat present onsite, no breeding habitat detected.
- Regent Honeyeater – foraging habitat present onsite, no mapped breeding habitat in this locality.
- Fork-tailed Swift – migratory foraging habitat present onsite.
- Latham's Snipe – migratory foraging habitat present onsite.
- Painted Honeyeater - foraging habitat present onsite
- Swift Parrot foraging habitat present onsite, no mapped breeding habitat in this locality.

Species credits under the BOS have been generated to offset the loss of habitat for the following:

- Koala
- Greater Glider
- Narrow-leaved Black Peppermint
- Blue Grass

Ecosystem credit species under the BOS are as follows (these have had AOSs prepared):

- Spotted-tailed Quoll
- Fork-tailed Swift
- White-throated Needletail
- Latham's Snipe
- Painted Honeyeater
- Swift Parrot

An AOS was completed for the threatened ecological communities and species listed above (see Table 7-5). Based on these characterisations of the significance of the project's impacts to these MNES, in all cases, the project is considered likely to result in a significant impact. The proposed Project will be assessed by NSW under an accredited assessment in accordance with Section 87 of the EPBC Act. Supplementary SEARs for this proposal have been addressed in this BDAR. Offset obligations in accordance with the BOS have been generated for the above species (see Section 10.3.2), as allowed under the Bilateral agreement, and can be retired in accordance with the NSW BOS.

7.5.3 World Heritage Areas

The project is situated to the west of Oxley Wild Rivers National Park, which forms part of the World Heritage-listed Gondwana Rainforest. Under the Natural World Heritage listing criteria, the Gondwana Rainforests are listed under three criteria (vii, ix and x; UNESCO, 2022):

> **(viii)** to be outstanding examples representing major stages of earth's history, including the record of life, significant on-going geological processes in the development of landforms, or significant geomorphic or physiographic features
>
> **(ix)** to be outstanding examples representing significant on-going ecological and biological processes in the evolution and development of terrestrial, fresh water, coastal and marine ecosystems and communities of plants and animals
>
> **(x)** to contain the most important and significant natural habitats for in-situ conservation of biological diversity, including those containing threatened species of outstanding universal value from the point of view of science or conservation

UNESCO (2022) detail the formal Statement of Outstanding Universal Value for the overall World Heritage property. The specific contribution of the Oxley Wild Rivers National Park component to the Outstanding Universal Value (World Heritage value) of the Gondwana Rainforest of Australia is outlined below. This contribution relates to geomorphology, ecological and biological processes, and biodiversity. The natural values of the area, many of which form part of its World Heritage value, are summarised below, along with… other values.

Key natural values:

- diverse plant communities including rainforests, eucalypt forests and woodlands, heath and swamps, some of which are rare and/or restricted;
- examples of dry, subtropical, warm temperate and cool temperate rainforest types, including an unparalleled sample of the transition of dry rainforest along gradients of moisture, exposure and soil depth;
- significant areas of old growth including well developed moist forests that contain some of the tallest trees in NSW;
- areas of tall moist tablelands forest, most of which has been cleared in surrounding lands;
- a large number of threatened fauna species and rare and threatened plant species, the centre of distribution of several restricted and threatened species and limits of distribution of several species;
- endemic invertebrate species in the Kunderang Brook Karst System (and probably in the rainforest areas).

- Significant landscape values:
  - spectacular gorges, cliff lines and deep, steep sided valleys illustrating on-going geomorphological processes associated with the Great Escarpment;
  - numerous high waterfalls;
  - panoramic views from locations along the escarpment edge;
  - attractive tall moist forests and rainforests and diverse vegetation types across the landscape. (NSW NPWS, 2005)

World heritage areas are an MNES. The Gondwana Rainforest of Australia is additionally listed as a World Heritage Place on the National Heritage list, which is also an MNES.

The closest proposed turbine location is approximately 1.2 km north of the to the World Heritage Area boundary area is approximately 1.2 kms north of the area in the southern part of Project Area.

Overview of Impacts relevant to World Heritage

In the World Heritage context there are broadly two categories of potential impact to consider which relate to geomorphology, ecological and biological processes, and biodiversity:

- actions arising from the Project Area but which have the potential to impact on World Heritage values and attributes inside the World Heritage Area (eg. Bushfires); and
- actions arising from the Project Area which have the potential to impact on World Heritage values and attributes which extend outside the World Heritage Area (e.g., wildlife Mammals or birds which are part of the World Heritage biodiversity and whose home range may extend into the Project Area, or which may disperse or traverse across the Project Area).
- which forage, sometimes inhabit/nest or traverse in the vicinity of the project area).

Such potential impacts are discussed in earlier chapters of this report, as well as in other studies.

The following table presents an overview of the potential impacts, information about where the impacts are considered in this report and other studies supporting the EIS, and a summary statement about impact in each case.

Table 7-6 Overview of impacts on World Heritage

Potential Impacts	Section of the BDAR and Other Studies where the Impacts are Considered	Summary Impact Comment
Actions arising from the Project Area but which have the potential to impact on World Heritage values and attributes inside the World Heritage Area		

Potential Impacts	Section of the BDAR and Other Studies where the Impacts are Considered	Summary Impact Comment
Bushfire spreading into the World Heritage Area	NGH (2022)	**Potential for a positive impact**. It is considered unlikely that a fire would spread from the wind farm to adjacent properties. The Project will establish new access tracks, significantly improving access for emergency services. Static water sources will also be provided and available for fire-fighting in the adjacent Oxley Wild Rivers National Park, potentially benefitting the World Heritage Area.
Chemical pollution flowing into the World Heritage Area	Section 5.1.4	**No impact.** All potential pollutants stored on-site during construction and operation would be stored in accordance with HAZMAT requirements (i.e., bunded).
Increased water runoff/ flooding/sediment flow into the World Heritage Area	Section 5.1.4	**Very low risk of impact arising from the project.** In the flood study prepared for the project, Footprint (NSW) Pty Ltd (2020) confirmed the risks are very low. However, natural flood events do occur in the region, and these have the potential to be exacerbated by climate change. Maintaining grass cover across the site as far as practicable during construction and operation, particularly within the existing waterways, would help maintain soil stability during floods.
Change to groundwater quality which might flow into the World Heritage Area	Section 5.1.4	**No impact.** The project would have negligible impact on groundwater quality given the low pollution potential. The proposed WTGs are located on higher elevation and ridgelines, and therefore interception and impacts from the project to shallow groundwater is considered unlikely.
Weed species and pathogens spreading into the World Heritage Area	Section 7.5.3 (below)	**No impact.** The adoption of hygiene protocols will prevent the spread of weeds and pathogens from the project site to the World Heritage Area.
Actions arising from the project area which have the potential to impact on World Heritage values and attributes which extend <u>outside</u> the World Heritage Area		

Potential Impacts	Section of the BDAR and Other Studies where the Impacts are Considered	Summary Impact Comment
Bird and bat mortality due to collision with wind turbines and barotrauma	Sections 5.1.5, 6.4.3, 7.3.3, 7.3.4	**Low risk of impact for the majority of bird and bat species.** The likely minimum height of the wind turbine blade sweep area for the project of 70m is above the typical flight height for the majority of bird and bat species at the project site. 95.7% of species observed were had a typical flight height under 40m. Bat activity across cleared agricultural land drops off considerably at 120m from forested areas. All turbines are located a minimum of 1.2km from the World Heritage Area, and a minimum of 150m from the National Park. However, **three species have been assessed as having a moderate risk of impact** associated with collisions with turbine blades during the operation of the project: • Glossy Black-cockatoo • White-throated Needletail • Wedge-tailed Eagle. Barotrauma is considered a **low risk** at worst. Studies have concluded that the majority of deaths of bats at wind farms are likely to be through collisions with turbines rather than from barotrauma.
Bird and bat avoidance of suitable habitat near wind turbines	Section 5.1.5	**Low risk of impact.** The particular habitat types found within the project site are abundant and widely distributed in the locality, within and surrounding the site.
Biodiversity mortality due to collision with vehicles	Section 5.1.6	**Low risk of impact.** Activities are unlikely to present significant biodiversity risks. Site management to enforce and reduce site speed limits and the introduction of fauna fencing are standard measures that have been recommended to further minimise impacts of vehicle strikes during construction and operation.

Potential Impacts	Section of the BDAR and Other Studies where the Impacts are Considered	Summary Impact Comment
Loss of habitat connectivity for gliding mammals	Sections 6.4.3, 7.31	**Low risk of impact.** Clearing widths for tracks and transmission have been kept under 40m. In the unlikely instance that clearing widths exceed 50m within areas of Greater Glider habitat as a result of the detailed design process, crossing infrastructure (i.e., glide poles, potential for rope bridges) will be installed.
Loss of relevant habitat connectivity for other wildlife	Section 7.3.1	**Low risk of impact.** Connectivity within and across the development site is currently provided for those species which do not require a consistent (or closed) canopy for traversal. The project has largely avoided dense tracts of native vegetation and the development footprint is typically limited to sparse woodland or scattered trees. Existing movement opportunities for the majority of species on this project site will not be reduced by the linear and discrete nature of a wind farm development.
Loss of hollow-bearing trees	Section 7.1.3, Section 8.2.2	**Low risk of impact**. Twenty-nine HBTs are known to be likely removed as a result of the Project. Of these, it is possible that some provide roosting, denning or breeding habitat for wildlife which are part of the World Heritage biodiversity.
Noise and vibration impacts on birds and mammals	Sections 5.1.6, 7.2	**Low risk of impact.** The noise and vibration associated with construction may cause short-term and geographically discrete changes to wildlife behaviour. During the operational phase, noise and vibration are anticipated to be relatively minimal and unlikely to impact on wildlife associated with the World Heritage Area.

As noted in Table 7-6, there are a range of potential impacts on the World Heritage Area that might arise from actions inside the project area. These include bushfire, chemical pollution, flooding and sediment flow, changes to groundwater and the spread of weeds and pathogens.

In most cases, it has been assessed that no impacts will arise because of measures taken on site to prevent impacts occurring within the World Heritage Area. For example, chemicals will be stored according to requirements for hazardous materials, including the use of bunding to contain any spills on the site.

In the case of flood impacts, the risk has been assessed as being very low, and site management will help maintain soil stability to prevent sediment flows. However, it is recognised that natural flooding has previously occurred in the region, and will no doubt arise in the future, especially under the influence of climate change.

Identification and assessment of impacts to downstream environments under a range of climate scenarios

Climate change has been identified as they key threat to World Heritage-listed Gondwana Rainforest (CSIRO, 2019). Even small climatic changes are predicted to change the distribution patterns of many endemic species and vegetation communities. Climate projections for the broader Gondwana Rainforests region include (from DAWE, 2020; CSIRO, 2019):

- increased average temperatures
- more hot days, with a substantial increase in the temperature reached, the frequency of hot days, and the duration
- a possible modest decrease in rainfall that is strongest in winter and modest increase in summer rainfall in the northern part of the region (low confidence)
- increased severity of extreme rainfall events
- higher surface solar radiation (i.e., decreased overall cloud cover)
- decreased relative humidity (although modest in winter)
- higher evapotranspiration
- more severe fire season, which is longer in duration
- exacerbated threatening processes such as invasive species and pathogens.

Climate change will continue to induce shifts in the distribution of flora and fauna species. Adams-Hosking et al. (2011) identify that current koala distributions, based on their climate envelope, will likely contract eastwards and southwards to many regions where koala populations are declining due to additional threats of high human population densities and ongoing pressures from habitat loss, dog attacks and vehicle collisions. This trend is likely to apply to other native species which reside in the Gondwana Rainforest WHA. Over time, the southern extent of the Gondwana Rainforest WHA (i.e., Oxley Wild Rivers National Park) will have increased importance as a refuge for species that are excluded from their current range by a changing climate.

Despite the acknowledged, immediate environmental impacts of the project (quantified in Section 7), broad environmental benefits will be delivered in both the short and long-term. The Project would assist in transitioning away from reliance on fossil fuels to renewable energy. Exploration, mining and combustion of fossil fuel resources produces greenhouse gases which contribute to reduced air quality, land degradation and pollution and warming of the atmosphere. Developing renewable resources for electricity generation will result in a reduction in these adverse environmental impacts arising from the use of fossil fuel.

The Project will have a net positive benefit with regard to climate change as it will:

- contribute to the achievement of NSW and Commonwealth renewable energy and emissions reduction targets
- help to meet local, national and international consumer demand for climate change action
- facilitate the consolidation of renewable energy infrastructure in the New England renewable energy zone

- reduce air pollution, water use and land degradation
- generate clean energy.

The proposed Project would generate around 2,200 GWh per year, saving approximately 1.8 million tCO^2e/yr, and contributing to a reduction in global greenhouse gas emissions. The reduction in emissions as a result of renewable energy development will contribute to slowing the warming of the planet resulting in important flow on effects benefiting the environment. Slowing climate change will help to reduce ocean acidification, sea level rise and improve air quality and biodiversity for the benefit of future generations.

Considering the above, the project is an important contribution to improving future climate scenarios and is considered a positive contribution to protecting the World Heritage Areas.

Assessment of the movement of species that establish the biodiversity value of the World Heritage Property, from the adjacent World Heritage Property to the proposed action area

Patches of woodland provide habitat connectivity between Oxley Wild Rivers National Park and the eastern boundary of the project. Whilst the project will result in the removal of vegetation, large areas of habitat will be retained within the project boundary. The project is unlikely to cause obstruction to ecological or biological processes that both the project site and the Oxley Wild Rivers National Park contribute to.

The stretches of woodland situated within the eastern boundary of the site provide potential fauna corridors between Oxley Wild Rivers National Park and areas of habitat within the project site for threatened fauna such as Koala, Spotted-tail Quoll and Greater Glider. Whilst the project is unlikely to cause direct mortality to these species, impacts to quality habitat and vegetation which provides connectivity could potentially result in impacts to the habitat values of Oxley Wild Rivers National Park containing threatened species. However, with stringent mitigation measures in place (refer to Section 8) corridors will be retained and opportunities for creating more linkages where practicable will be explored.

In perpetuity stewardship sites form the most feasible and preferred offset option for large scale wind farms under the NSW BOS. Involving host landowners and their neighbours spreads the benefits of the project and has several environmental benefits. Stewardship provides the most appropriate offset in terms of:

- Securing ‘like for like’ vegetation and habitat
- Locating the offset close to the impact
- Mitigating connectivity and fragmentation close to the clearing

In this case there is the added benefit that the offsets would be located close to important environmental areas (National park and World Heritage areas) and would thereby add to their habitat extent and protection. Stewardship requires an in-perpetuity fully funded management commitment that will ensure the stewardship areas are protected and improved over time.

There is potential for conflict with neighbours over the movement and spread of pest species, (DEHA, 2000) however stewardship would result in suitable pest control on properties secured under a Biodiversity Stewardship Agreement (BSA).

Bushfire Impacts (2019-2020)

In spring and summer of 2019-20, extensive areas of southern and eastern Australia were affected by bushfire at a scale considered unprecedented in European history. Across the Australian continent, more than 12.6 million hectares were burnt (DAWE, 2020).Australia-wide, 143 million mammals, 2.46 billion reptiles, 180 million birds and 51 million frogs Australia-wide are thought to have been killed or displaced due to the 2019/2020 bushfire (WWF, 2020).

Over 50% of the Gondwana Rainforests of Australia were affected (DPIE, 2020c), and 85% of Oxley Wild Rivers National Park (84,120ha of a total 98,906ha) was burnt at a high severity (DAWE, 2020). Previous drought conditions had defoliated trees within gully rainforests of Oxley Wild Rivers National Park, increasing susceptibility to fire.

The *Gondwana Rainforests State of Conservation Update - April 2020* report (DAWE, 2020) identifies that the loss of ground cover vegetation and shrubs leads to greater surface and subsurface run-off in post-fire rain events which may exacerbate the spread of soil-borne pathogens such as Phytophthora (*Phytophthora cinnamomi*) and myrtle rust (*Austropucinia psidii*).

The fires have resulted in large areas of reduced canopy cover, bare soil, and increased soil nutrients, creating favourable conditions for weed incursion. The increased biomass contributed by weeds can also impact the extent and intensity of future fires.

There were many casualties of common and threatened fauna species residing within the Oxley Wild Rivers National Park during the 2019/2020 bushfire event. Many of the resources to support local populations have diminished or are currently under strain. Considering this, it is likely the remnant vegetation within the development footprint offers refuge and foraging resources for individuals that may have been displaced due to the fire event.

The adoption of hygiene protocols will prevent the spread of weeds and pathogens from the development footprint into the Oxley Wild Rivers National Park and World Heritage Area.

In the case of the project, as noted above, bushfires arising from the project site which might then spread to the World Heritage Area have been considered within the Project Bushfire Assessment Report (NGH, 2022) which was developed with consultation from the NPWS with specific consideration of the Oxley Wild Rivers National Park and World Heritage Area. Commitments to mitigation measures during construction and operation are expected to keep bushfire risk to a minimum.

Summary discussion of potential impacts on World Heritage biodiversity values and attributes which extend outside the World Heritage Area

Given the proximity of the project site to the World Heritage Area, a number of wildlife species are known to move between the two areas. Some of these species are important for the biodiversity values of the World Heritage Area. In this way, it is possible that the project could impact such values, depending on actions and activities on the project site.

Potential impacts include bird and bat mortality or the avoidance of habitat, and loss of habitat connectivity. In most cases, there is a low risk of impact arising. For example, the majority of bird and bat species do not fly at the height of the wind turbine blades, and they are therefore not likely to collide with blades. In another example, the cleared width for tracks and transmission lines will be kept to a distance which still allow gliding mammals to move between habitat.

None the less, in the case of three bird species there is a moderate risk of collision and mortality because they do fly at the height of the wind turbine blades (section 7.3.3), however only one of these species, Glossy Black-cockatoo, is known to occupy the World Heritage Area. This will be appropriately managed during Project operation (section 8.3.1).

Assessment of the movement of species which contribute to the biodiversity value of the World Heritage Property, from the nearby World Heritage property to the proposed Project Area

Patches of woodland provide habitat connectivity between the Oxley Wild Rivers National Park and World Heritage Area, and the eastern boundary of the project. Whilst the project will result in the removal of vegetation, large areas of habitat will be retained within the Project Boundary. The Project is unlikely to cause significant impacts on ecological or biological processes that both the Project Area and the World Heritage Area contribute to.

The stretches of woodland situated within the eastern boundary of the site provide potential fauna corridors between the World Heritage Area and areas of habitat within the Project Boundary for mobile threatened fauna such as Koala, Spotted-tail Quoll and Greater Glider. Whilst the project is unlikely to cause direct mortality to these species, impacts to quality habitat and vegetation which provides connectivity could potentially result in impacts to the habitat values of the World Heritage area containing threatened species. However, with stringent mitigation measures in place (refer to Section 8), movement corridors will be retained and opportunities for enhancing existing or creating new linkages will be explored. In addition, due to the narrow development corridor, the connectivity of the landscape will not be significantly altered (Figure 7-1)

Credits will be generated to compensate for unavoidable impacts to biodiversity. It is intended that offsets would be sourced from within 100km of the development site, which would likely be located close to important environmental areas (National Park and World Heritage Areas) and would thereby add to the protected habitat extent of wildlife associated with World Heritage values.

Summary conclusion about impacts on World Heritage

With regard to potential impacts inside the World Heritage area, significant impacts are unlikely. There are a range of potential impacts (e.g., pollution, weed, pest species etc) which will be managed to ensure that they have minimal effect on World Heritage values. In the case of bushfire, there may be a net positive benefit to the World Heritage Area through improved access and facilities for fire-fighting.

Potential impacts outside the World Heritage area are also considered unlikely to be significant. There are a range of potential impacts (e.g., some habitat loss for species relevant to the World Heritage values, and the possibility of aerial species mortality during turbine operation). Mitigation and management (section 8) will address such impacts.

7.6 Assumptions and predictions

Uncertainty and assumptions relevant to this assessment are captured explicitly:

- Within the survey strategies set out in Section 4.2. Further targeted surveys are planned to continue concurrent with the public exhibition of the EIS to address some key uncertainties with regard to species presence and impact. If species presumed present cannot be ruled out by targeted surveys prior to the Development’s determination there may be a need for additional credit generation.
- Within the areas of assumed impact. The Development Footprint has been defined as the upper-most area of land that will be directly impacted. This is the area that has been used to calculate offset credits. It is anticipated that the final infrastructure layout will not require all of this area to be impacted. It has been generously delineated to allow flexibility in the detailed design stages of the project.

- Within the mitigation strategies set out in Section 8. Best practice design will incorporate conservative buffers and adaptive management approaches, and these are built into the project commitments.

8. Mitigating and managing impacts

A general summary of the key measures required to mitigate the impacts of the project are provided below as they relate to the design, construction and operation of the proposed wind farm.

A number of plans will be developed to guide biodiversity and environmental management through construction and operation. Each of these will include:

- clear roles and responsibilities
- monitoring and reporting
- adaptive management measures to be employed to address unanticipated adverse impacts.

8.1 Design stage

Detailed design will commence following development approval. The project layout will continue to be refined to further reduce potential impacts to biodiversity, in line with the development approach taken to date (e.g. Section 6.4).

Particular design focus will be placed on waterway crossings, which will be designed to minimise potential impacts to waterways. Specific guidelines for this design include:

- Why Do Fish Need to Cross the Road? Fish Passage Requirement for Waterways Crossings (Fairfull & Witheridge, 2003). A full list of Strahler streams within the development site is provided in section 2.5.1.
- Guidelines for laying pipes and cables in watercourses on waterfront land (Department of Primary Industries, 2012).
- Guidelines for watercourse crossings on waterfront land (Department of Primary Industries, 2012).
- Controlled activities on waterfront land – Guidelines for riparian corridors on waterfront land (Department of Primary Industries, 2012).

8.2 Construction stage

8.2.1 Construction environmental management plan

A **Construction Environmental Management Plan** (CEMP) will be developed for the Project and require endorsement from Department of Planning and Environment, as well as relevant agencies. This will include detailed sub-plans to address specific environmental issues:

- Soil and water management plan.
- Dust management plan or protocols
- Heritage management plan
- Bushfire management plan
- Fire safety study
- Noise management plan
- Landscape plan
- Traffic management plan

- Emergency response and safety plan
- Waste management plan.

An example table of contents for a CEMP is presented in Appendix M.1.

Measures required to manage biodiversity during construction will be detailed in a Biodiversity Management Plan, as set out below. Some measures to protect biodiversity will overlap other plans, such as restricted speed limits in the traffic plan to management risk of vehicle strike and erosion control measures.

8.2.2 Biodiversity management plan

A **Biodiversity Management Plan** (BMP) will be developed with input from BCD and DAWE prior to commencement of the action. An example table of contents is presented in Appendix M.2. Measures will include:

Fauna management:

- Staged removal of hollow-bearing trees and other habitat features such as fallen logs with attendance by an ecologist.
- Avoiding the removal of hollow-bearing trees during spring, where practicable, to avoid the main breeding period for hollow-dependant fauna.
- Unexpected threatened species finds procedure.
- Installation of nest boxes or hollow augmentation at a 2:1 ratio to mitigate removal of HBTs that are potential Greater Glider and Squirrel Glider den sites. This will require survey of suitable hollows (small to medium sized hollows, i.e., 10 to 20 cm, in live trees (Eyre, 2002) within the mapped Greater Glider and Squirrel Glider species polygon (Figure 4-5). Greater Glider have been confirmed using constructed nest boxes installed at 10m height (Wildlife Preservation Society of Queensland, 2019).
- Locations and specifics of wildlife crossing infrastructure that would be installed if detailed design results in clearing widths in excess of 40m within the mapped Greater Glider and Squirrel Glider species polygon (Figure 4-5) (noting that currently the clearing widths do not exceed 40m).

Vegetation management:

- Protection of native vegetation to be retained
- Best practice removal and disposal of vegetation

Restoration and rehabilitation:

- Details about rehabilitation of any areas identified during detailed design as opportunities to improve connectivity.
- Ensure areas disturbed during construction that are no longer required for operations (hardstand and road batters, cabling routes and temporary facilities) are stabilised and rehabilitated progressively during construction and preferably re-vegetated with appropriate species (native in native dominated areas) as soon as practical.
- Specific adherence to best practice design and construction measures for works in and near waterways (including design, instream works procedures and restoration of areas disturbed within riparian corridors).
- Landscape plantings and/or seeding within disturbed areas will comprise local

indigenous species with the primary objective of addressing erosion and sedimentation issues, but also to be consistent with the biodiversity values of the existing surrounding vegetation (e.g., species selections are to be consistent with the surrounding PCT composition, as well as meeting requirements for supplementation of feed tree species for threatened fauna, i.e., Koala).

- Detail appropriate planting and maintenance techniques for different areas of the site.
- Include monitoring to meet clear targets regarding ground cover establishment.

Weed and pest animal management:

- Identification and mapping of significant weeds occurring in construction areas prior to disturbance. This will support a clear determination of 'clean' and 'infested' construction zones to assist in weed management.
- The control of significant weeds recorded within the disturbance footprint; treat or remove weeds progressively prior to construction commencing in each area.
- All material to be disposed of in accordance with legislative requirements.
- Preventative measures for the spread or introduction of weeds from offsite areas or between sites (particularly into "clear" zones).
- Monitoring of control and preventative measures and ongoing adaptive management to suppress weeds.
- Laydown sites for excavated spoil, equipment and construction materials to be weed-free or treated for weeds prior to use.
- Pest animal monitoring and responsive management program, which may include shooting, trapping and baiting. Pest animal management will be sympathetic to land use (i.e., presence of working dogs on site) and will, where possible, be coordinated with pest management activities conducted by neighbouring land managers.

8.3 Operation stage

Many of the construction management plans and protocols will be carried over and adapted for the lesser risks and site activity during the operation of the project. These include:

- Dust management plan or protocols
- Bushfire management plan
- Fire safety study
- Noise management plan
- Traffic management plan
- Emergency response and safety plan
- Waste management plan.

It is common for the Biodiversity Management Plan to include operation as well as construction, to provide greater certainty and continuity as the project transitions to operations. For example:

- Continuation of weed and pest animal management.
- Continuation of rehabilitation monitoring and management from the construction stage to ensure that site rehabilitation and weed management objectives are met.

The key additional requirement of the operational plan is the bird and bat adaptive management plan (refer Section 8.3.1).

8.3.1 Bird and bat adaptive management plan

A **Bird and Bat Adaptive Management Plan** will be developed in consultation with BCD to address inherent uncertainty in relation to the impacts to specific bird and bat populations and to identify appropriate adaptive mitigation measures in the case that impacts are greater than predicted. This plan will be prepared to reflect the final infrastructure layout and implemented intensively for the first three years with potential to scale down in direct response to results, thereafter. An example table of contents is presented in Appendix M.3 .

The Plan will include details of:

- Higher risk species and turbine sites.
- A description of measures to be implemented on the project site for minimising bird and bat strike, such as removal of carcases from beneath turbines (reducing the attractiveness of the locations to birds of prey).
- A survey plan to monitor both utilisation and collisions in operation.
- Trigger levels / thresholds to instigate further investigation or specific mitigation measures in relation to monitoring results.
- A detailed set of mitigation actions specific to the site to cover the most likely events. A range of mitigation strategies can be employed with the most certain being ‘sector shut down’, where turbines can be programmed to be operationally limited in the higher risk periods.
- Reporting requirements
- Collision risk modelling (CRM) may be appropriate where sufficient data is available, with triggers to ensure that mitigation is appropriate to the modelled risk.

8.4 Decommissioning

Decommissioning will be predominantly in previously cleared areas or partially rehabilitated areas, ensuring no additional impacts to ecological values. A restoration plan to stabilise areas disturbed will be the central component.

8.5 Summary of mitigation measures

Mitigation measures proposed to manage impacts to biodiversity, including proposed techniques, timing, responsibility for implementing each measure, risk of failure, and an analysis of the consequences of any residual impacts are provided in Table 8-1. The effectiveness of these mitigation measures has been demonstrated through application at comparable wind farm developments (i.e., van der Ree 1999, Thompson and Thompson 2015).

8.5.1 Mitigating impacts on biodiversity

Table 8-1 Proposed measures to mitigate and manage impacts on biodiversity

Mitigation measure	Proposed techniques	Timing	Responsibility	Risk of failure	Risk and consequences of residual impacts
Avoidance of impacts					
Avoid impacts	○ Reduce the construction footprint and associated clearing requirements during detailed design ○ Preferentially avoid identified threatened species habitat (i.e., mapped species polygons) and HBT	Pre-construction	Developer	Low	None
Impacts to fauna and flora through vegetation clearing and habitat removal					
Timing works to avoid critical life cycle events such as breeding or nursing	○ Where practical, hollow-bearing trees would not be removed during breeding season, to mitigate impacts on hollow dependent fauna. ○ Pre-clearance surveys should be conducted prior to clearing to check hollows for fauna	Construction	Construction contractor	Moderate	Mortality of young fauna
Delineation of 'no-go areas'	○ Approved clearing limits to be clearly delineated with temporary fencing or similar prior to construction commencing ○ No stockpiling or storage within	Construction	Construction Contractor	Moderate	Low risk of inadvertent clearing of native vegetation and fauna habitat intended for conservation onsite

Mitigation measure	Proposed techniques	Timing	Responsibility	Risk of failure	Risk and consequences of residual impacts
	dripline of any mature trees. ○ No stockpiling or storage within riparian buffers				
Staff training and site briefing to communicate environmental features to be protected and measures to be implemented	○ Site induction ○ Toolbox talks	Regular	Contractor	Moderate	Impacts to vegetation or threatened species for staff training not being followed
Installation of wildlife crossing infrastructure in areas where the clearing widths are greater than 40m	○ If construction constraints require clearing widths greater than 40m, the project will commit to the installation of crossing infrastructure, such as glider poles and removeable rope bridges, to ensure that Greater Glider can safely move across the project footprint	Construction	Developer	Moderate	There is a moderate risk some gliders may not use the crossing structures, thereby limiting dispersal opportunity for gliding mammal species. However, previous studies (Goldingay & Taylor, 2009, Goldingay et al. 2011, and Goldingay & Taylor 2017) have confirmed use of poles and rope bridges by gliding mammals
Instigating clearing protocols including pre-clearance surveys, daily surveys and staged clearing, the presence of a trained ecological or licensed wildlife handler during clearing events	○ Development of a pre-clearing checklist and tree clearing procedure ○ Staged clearing, supervised by Ecologist or trained spotter catcher to allow for resident fauna to relocate or be relocated where required	Construction	Construction contractor	Moderate	High risk; consequences could include injury or death of fauna
Construction protocols to prevent fauna mortality in trenches	○ Trenches will be backfilled as soon as practicable to minimise chance of fauna becoming trapped ○ Trench sections left overnight would be inspected early in the morning by an ecologist or suitably qualified person. Any trapped fauna is to be removed ○ The use of ramps or ladders to facilitate trapped fauna escape is recommended (dependent on size of	Regularly	Construction contractor	Moderate	Moderate risk of fauna mortality

Mitigation measure	Proposed techniques	Timing	Responsibility	Risk of failure	Risk and consequences of residual impacts
	trench needed)				
Relocation of habitat features (fallen timber, hollow logs) from within the development footprint to retained areas within the development site	○ Tree-clearing procedure including relocation of habitat features to adjacent area for habitat enhancement ○ Opportunities for the salvage and re-use of important habitat features, including tree-hollows and bush rock, will be identified in the BMP ○ All fauna should also be relocated during clearing	Construction	Construction contractor	Low	Moderate risk and consequences could include loss of fauna resulting from inability to relocate to suitable habitat due to exposure or predation
Minimising impacts of wind turbine strikes on protected animals	○ Prepare a bird and bat adaptive management plan (i.e., Section 8.3.1)	Regular	Contractor	Moderate	Excessive strike mortality of threatened species
Indirect impacts on wildlife and vegetation					
Light shields or daily/seasonal timing of construction and operational activities to reduce impacts of light spill	○ Minimise night works where practicable ○ Direct lights away from vegetation, where practicable.	Construction/ operation	Construction contractor	Moderate	Avoiding night work and directing lighting away from habitat will reduce disturbance to fauna
Sediment controls to control the quality of water released from the development site into the receiving environment	○ Prepare an erosion and sediment control plan and implement recommended measures ○ Maintaining grass cover across the site as far as practicable during construction, particularly within the existing waterways ○ Implement spill management procedures. ○ Store any potential pollutants s in accordance with HAZMAT requirements	Construction	Construction contractor	Moderate	Indirect impacts may occur to waterways if erosion and sedimentation control plan not implemented

Mitigation measure	Proposed techniques	Timing	Responsibility	Risk of failure	Risk and consequences of residual impacts
Adaptive dust monitoring programs to protect air quality	○ Daily visual monitoring of dust generated by construction activities ○ Construction to cease if significant dust is observed being blown from development footprint until control measures are implemented ○ All project activities to be undertaken with the objective of preventing visible dust emissions from the development footprint	Construction	Construction contractor	Moderate	Dust and airborne pollutants can reduce water and soil quality, and reduce natural processes (i.e., impacting photosynthesis when coating leaves of native plants)

9. Serious and irreversible impacts

9.1 Potential serious and irreversible impact entities

This Section addresses Section 10.2 of the BAM and follows the Guidance to assist a decision-maker to determine a serious and irreversible impact (Department of Planning, Industry and Environment, 2019).

All threatened entities impacted by the proposal have been considered if they form or have potential to be Serious and Irreversible Impact (SAII) entities. Criteria for listing as an SAII entity are those species which:

- Are in a rapid rate of decline
- Have a very small population size
- Are severely degraded or disrupted
- Have a very limited geographic distribution
- Are unlikely to respond to measures to improve habitat.

Two threatened ecological communities listed as potential SAII entities in the Guidance to determine a serious and irreversible impact would be impacted by the project:

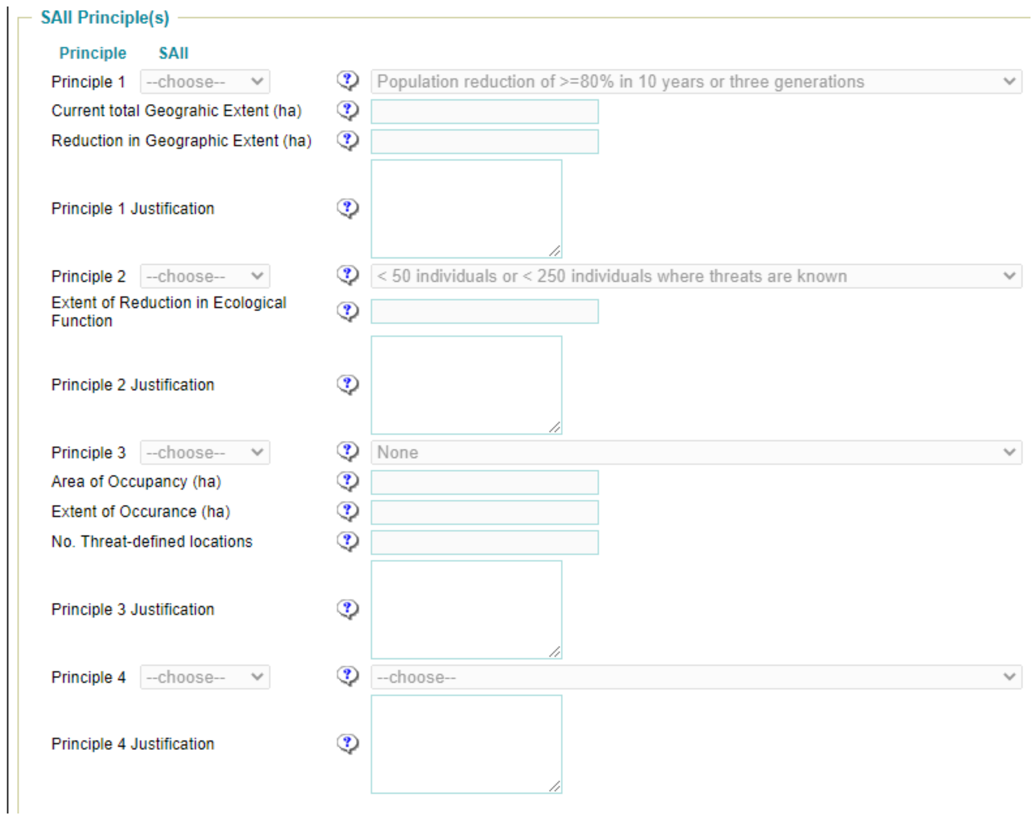
- New England Peppermint (*Eucalyptus nova-anglica*) Woodland on Basalts and Sediments in the New England Tableland Bioregion; and
- White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highlands, NSW South Western Slopes, South East Corner and Riverina Bioregions.

9.1.1 Threatened ecological communities

New England Peppermint (*Eucalyptus nova-anglica*) Woodland on Basalts and Sediments in the New England Tableland Bioregion

Additional impact assessment provisions for threatened ecological communities at risk of an SAII
Does the TBDC indicate that data is 'unknown' or 'deficient' for points 1(a-d) below?
At the time of writing, the TBDC does not indicate that the data is 'unknown' or 'deficient' for points 1(a-d) below, however, only the following information is provided by the TBDC:

Additional impact assessment provisions for threatened ecological communities at risk of an SAII



SAII Principle(s)

Principle			SAII
Principle 1	--choose--		Population reduction of >=80% in 10 years or three generations
Current total Geograhic Extent (ha)			
Reduction in Geographic Extent (ha)			
Principle 1 Justification			
Principle 2	--choose--		< 50 individuals or < 250 individuals where threats are known
Extent of Reduction in Ecological Function			
Principle 2 Justification			
Principle 3	--choose--		None
Area of Occupancy (ha)			
Extent of Occurance (ha)			
No. Threat-defined locations			
Principle 3 Justification			
Principle 4	--choose--		--choose--
Principle 4 Justification			

1. The assessor must consult the TBDC and/or other sources to report on the current status of the TEC, including:

a) Evidence of reduction in geographic distribution (Principle 1, clause 6.7(2)(a) BC Regulation) as the current total geographic extent of the TEC in NSW AND the estimated reduction in geographic extent of the TEC since 1750 (not including impacts of the proposal).

The TBDC indicates the TEC has had a reduction of greater than 80%. The NSW Scientific Committee (NSWSC) notes that this TEC has been extensively cleared for grazing and agricultural development. While the NSWSC doesn't give an estimate of the reduction of the TEC in NSW since 1750, an estimate is given for the Guyra map sheet where a supposed 11% of the original distribution remains. This TEC is also listed under the EPBC Act under the name New England Peppermint (*Eucalyptus nova-anglica*) Grassy Woodlands. The listing advice for the commensurate EPBC Act TEC indicates that the overall decline of the TEC in NSW is 82-86%. Furthermore, estimates of decline of the portion of the TEC on basalts and sediments (i.e. PCT 534 which was recorded within the development site) is considerably greater at 90-93% (X).

b) Extent of reduction in ecological function for the TEC using evidence that describes the degree of environmental degradation or disruption to biotic processes (Principle 2, clause 6.7(2)(b) BC Regulation) indicated by:

i) change in community structure

ii) change in species composition

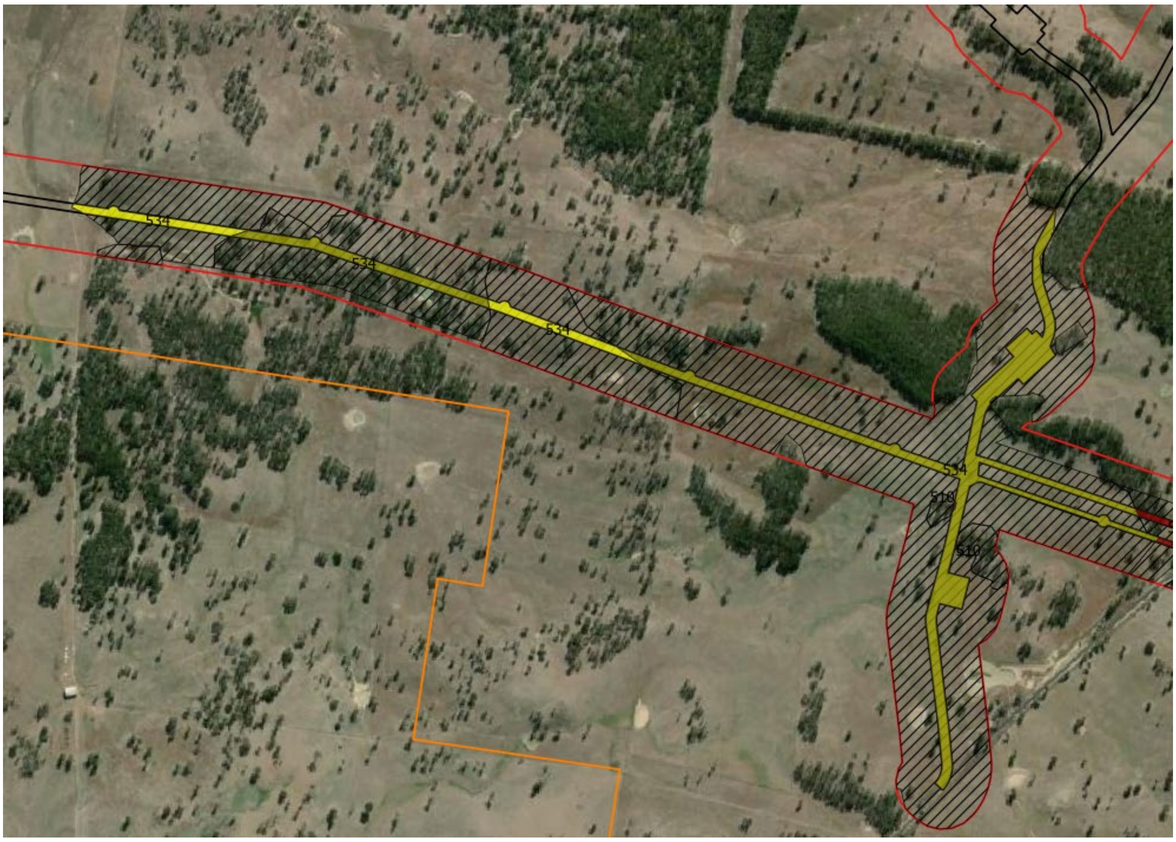
iii) disruption of ecological processes

iv) invasion and establishment of exotic species

Additional impact assessment provisions for threatened ecological communities at risk of an SAII
v) degradation of habitat, and vi) fragmentation of habitat.

The Project is going to impact upon 14.4ha of PCT 534 TEC within the development footprint. The removal and indirect impacts to this TEC will result in the following:

(i) The 14.4ha of TEC (3.32ha grassland and 11.1ha woodland) that will be removed may result in some minor edge effects in the remaining TEC. However, it can be seen from the following that the majority of TEC (hatched yellow areas) are already impacted by edge effects as the development footprint goes through already fragmented areas and therefore impacts to community structure, connectivity and edge effects will be minimal.



(ii) The 14.4ha of TEC (3.32ha grassland and 11.1ha woodland) that will be removed is unlikely to significantly alter the composition of the community structure. Areas to be removed are highly fragmented and the species remaining do not appear biased to particular flora species. The composition is not anticipated to change significantly due to the development footprint targeting areas already fragmented with no particular bias for unique TEC characteristics supporting threatened or rare species.

(iii) The 14.4ha of TEC that will be removed will have minimal impacts to ecological processes such as habitat provision for other threatened flora and fauna as this TEC is not in a condition that supports unique or rare species or ecological processes.

(iv) The 14.4ha of TEC that will be removed will have some minor impacts to habitat for threatened and protected fauna. This would include Greater Glider, Koala and Squirrel Glider. As much of their habitat is to be retained within the Project area and considering

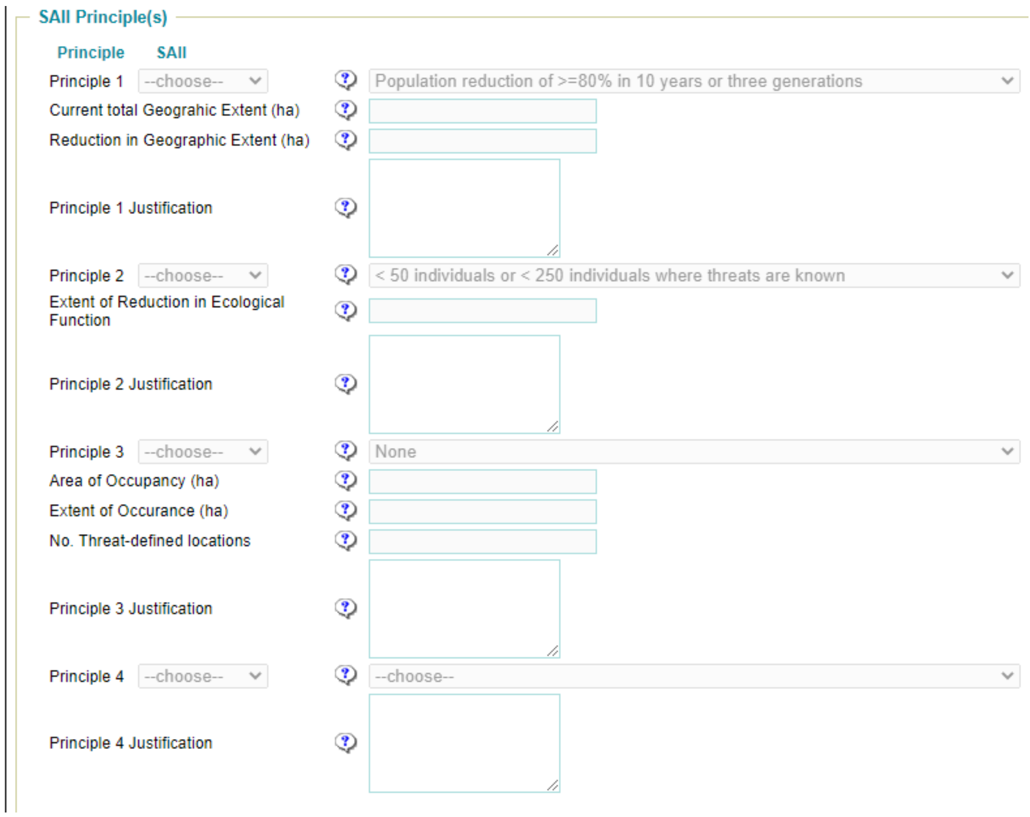
Additional impact assessment provisions for threatened ecological communities at risk of an SAII
the already fragmented nature of this landscape it is unlikely to be a significant impact on the quality of habitat for these species. (v) The 14.4ha of TEC that will be removed will have some minor impacts on habitat connectivity for threatened and protected fauna. This would include Greater Glider, Koala and Squirrel Glider. As much of their habitat is to be retained within the Project area and considering the already fragmented nature of this landscape it is unlikely to be a significant impact on the fragmentation of this already fragmented landscape. As can be seen from the figure above the development footprint is located in the most fragmented areas of habitat. It is unlikely to have significant impacts on seed dispersal.
c) Provide evidence of restricted geographic distribution (Principle 3, clause 6.7(2)I BC Regulation), based on the TEC's geographic range in NSW according to the: i) extent of occurrence ii) area of occupancy, and iii) number of threat-defined locations.
According to the Final Determination to list the TEC as Critically Endangered, the TEC has undergone a very large reduction in geographic distribution. However, the Final Determination does not put a number on the extent of occurrence. The listing advice for the EPBC Act TEC suggests the total current extent and are of occupancy is 14,000 hectares. The number of threat-defined locations is unknown, however, less than 3% of the TEC is said to be within conservation estate. For the remaining 97%, key threats include dieback of the overstorey eucalypts, intensified land-use and pasture development, ongoing vegetation clearance, impacts associated with fragmentation of remnants, and weed invasion.
d) Provide evidence that the TEC is unlikely to respond to management (Principle 4, clause 6.7(2)(d) BC Regulation).
The TEC is not listed as an SAII under Principle 4. The listing advice for the EPBC Act TEC notes that New England Peppermint is not listed as a threatened species and appears to be amenable to restoration. Decline in its abundance through dieback or other threats is potentially reversible, in the long-term, through the sufficiently widespread adoption of appropriate land management practices and other strategies to encourage regeneration.
2. In relation to the impacts from the proposal on the TEC at risk of an SAII, the assessor must include data and information on: a) The impact on the geographic extent of the TEC (Principles 1 and 3) by estimating the total area of the TEC to be impacted by the proposal i) I in hectares, and ii) as a percentage of the current geographic extent of the TEC in NSW
PCT 534, which occurs within the development site as a woodland and derived native grassland, represents this TEC. The total area of the TEC to be directly impacted by the proposal is about 14.2 ha, 11ha of which is woodland, 3.2ha is derived native grassland. The listing advice for the commensurate EPBC Act TEC in indicates this TEC may cover 14,000 ha, meaning the

Additional impact assessment provisions for threatened ecological communities at risk of an SAII
percentage to be removed by the proposal is 0.1%.
b) The extent that the proposed impacts are likely to contribute to further environmental degradation or the disruption of biotic processes (Principle 2) of the TEC by i) estimating the size of any remaining, but now isolated, areas of the TEC; including areas of the TEC within 500m of the Development footprint or equivalent area for other types of proposals
NGH estimates that there may be approximately 582.3ha of this TEC within 500m of the Development Footprint, based on connectivity of the known TEC area within the development site with other areas of wooded vegetation outside it and to the 500m buffer.
ii) describing the impacts on connectivity and fragmentation of the remaining areas of TEC measured by: • detailing the distance between isolated areas of the TEC, presented as the average distance if the remnant is retained AND the average distance if the remnant is removed as proposed • estimating maximum dispersal distance for native flora species characteristic of the TEC • providing other information relevant to describing the impact on connectivity and fragmentation, such as the area to perimeter ratio for remaining areas of the TEC as a result of the Development.
The proposal is linear in nature and this intrinsically minimises impacts on connectivity and fragmentation. Within the development site, five patches of the TEC occur. The average distance between these patches is 3,115m. Due to the linear nature of the proposal, the distances between these patches would not be increased. However, where the proposal intersects one of the five patches of the TEC, a small scale, localised disconnect would be generated. This introduced disconnect would be a maximum of 25m.
iii) describing the condition of the TEC according to the vegetation integrity score for the relevant vegetation zone(s) (Chapter 4.3), including the relevant composition, structure and function condition scores for each vegetation zone.
Vegetation zones 5 and 6 represent this TEC. Vegetation zone data is provided below. Zone 5 PCT 534 grassland: • VI score = 22.5 • Composition condition score = 42.3 • Structure condition score = 36.6 • Function condition score = 7.4 Zone 6 PCT 534 Woodland: • VI score = 50.3 • Composition condition score = 55.7

Additional impact assessment provisions for threatened ecological communities at risk of an SAII
• Structure condition score = 45.4 • Function condition score = 50.3 As both vegetation zones have a VI score greater than or equal to 15, clearing within said zones would generate an offset obligation. Given the TEC is critically endangered, the VI score of 50.3 for Zone 6 could be considered moderate condition (11.1ha).

White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highlands, NSW South Western Slopes, South East Corner and Riverina Bioregions

Additional impact assessment provisions for threatened ecological communities at risk of an SAII
Does the TBDC indicate that data is 'unknown' or 'deficient' for points 1(a-d) below?
At the time of writing, the TBDC does not indicate that the data is 'unknown' or 'deficient' for points 1(a-d) below, however, only the following information is provided by the TBDC:



SAII Principle(s)

Principle SAII

Principle 1 --choose-- Population reduction of >=80% in 10 years or three generations

Current total Geograhic Extent (ha)

Reduction in Geographic Extent (ha)

Principle 1 Justification

Principle 2 --choose-- < 50 individuals or < 250 individuals where threats are known

Extent of Reduction in Ecological Function

Principle 2 Justification

Principle 3 --choose-- None

Area of Occupancy (ha)

Extent of Occurance (ha)

No. Threat-defined locations

Principle 3 Justification

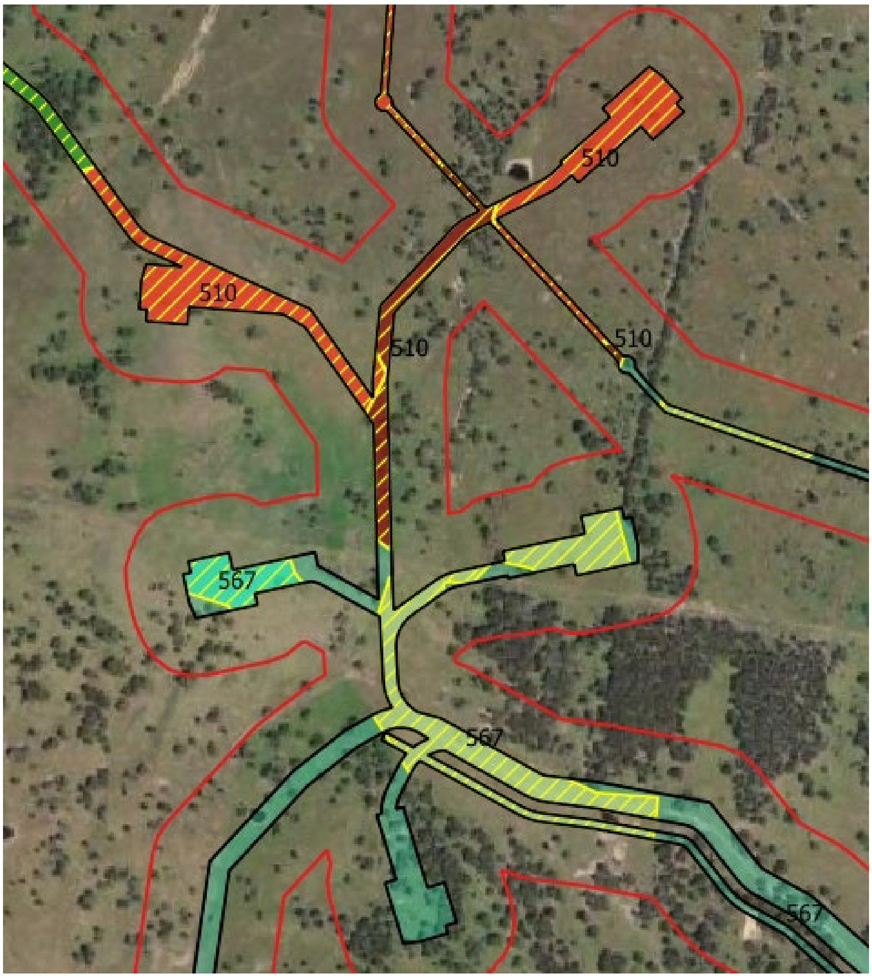
Principle 4 --choose-- --choose--

Principle 4 Justification

1. The assessor must consult the TBDC and/or other sources to report on the current status of the TEC, including: a) Evidence of reduction in geographic distribution (Principle 1, clause 6.7(2)(a) BC Regulation) as the current total geographic extent of the TEC in NSW AND the estimated

Additional impact assessment provisions for threatened ecological communities at risk of an SAII
reduction in geographic extent of the TEC since 1750 (not including impacts of the proposal).
White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland has undergone a very large reduction in geographic distribution. The TBDC states the TEC has had a reduction of greater than 80%. Thiele and Prober (2000) estimated that less than 0.1% of Grassy White Box Woodlands (a component of the Box – Gum Grassy Woodland and Derived Grassland ecological community) remains in a near-intact condition. Much of the original extent of the Box – Gum Grassy Woodland and Derived Grassland ecological community has been cleared for agriculture. Approximately three quarters of the distribution of the community occurs in NSW (TSSC 2006). During the period 2009 – 2016 an average of 395ha of Grassy Woodland (sensu Keith 2004) was lost annually across NSW to agriculture-related activities within the range of the community, and a further 155 ha/annum due to infrastructure developments (NSW DPIE 2019). NSW Threatened Species Scientific Committee (NTSSC) (2020) state there is some uncertainty surrounding the current extent of the community and its pre-1750 distribution. However, the plausible range estimated for the amount remaining includes values less than 10% for almost all of the components of the community described by Benson (2008).
b) Extent of reduction in ecological function for the TEC using evidence that describes the degree of environmental degradation or disruption to biotic processes (Principle 2, clause 6.7(2)(b) BC Regulation) indicated by: i) change in community structure ii) change in species composition iii) disruption of ecological processes iv) invasion and establishment of exotic species v) degradation of habitat, and vi) fragmentation of habitat.
The Project is going to impact upon 20.1ha of PCT 510 TEC and 128.88 ha of PCT 567 TEC within the development footprint. The removal and indirect impacts to this TEC will result in the following: (i) The 20.1ha of TEC (8.96ha grassland and 11.15ha woodland) and 128.88 ha of TEC (97.12 ha grassland and 31.76ha woodland) that will be removed may result in some edge effects in the remaining TEC. However, it can be seen from the following figure that the majority of TEC (hatched yellow areas) are already impacted by edge effects as the development footprint goes through already fragmented areas, therefore impacts to community structure, connectivity and edge effects will be minimal. The majority of the TEC areas are grassland or sparsely wooded areas and thus edge effects are already present.

Additional impact assessment provisions for threatened ecological communities at risk of an SAII



(ii) The 20.1ha of TEC (8.96ha grassland and 11.15ha woodland) and 128.88 ha of TEC (97.12 ha grassland and 31.76ha woodland) that will be removed is unlikely to significantly alter the composition of the community structure. Areas to be removed are highly fragmented and the species remaining do not appear biased to particular flora species. The composition is not anticipated to change significantly due to the development footprint targeting areas already fragmented with no particular bias for unique TEC characteristics supporting threatened or rare species. Even with the woodland in moderate to high condition it does not have a unique suite of species.

(iii) The 42.91 ha of TEC woodland that will be removed will have minimal impacts on ecological processes such as habitat provision for other threatened flora and fauna as this TEC is not in a condition that supports unique or rare species or ecological processes.

(iv) The 42.91ha of TEC woodland that will be removed will have some minor impacts on habitat for threatened and protected fauna. This would include Greater Glider, Koala and Squirrel Glider. As much of their habitat is to be retained within the Project area and considering the already fragmented nature of this landscape it is unlikely to be a significant impact on the quality of habitat for these species.

(v) The 42.91 of TEC woodland that will be removed will have some minor impacts on habitat connectivity for threatened and protected fauna. This would include Greater Glider, Koala and Squirrel Glider. As much of their habitat is to be retained within the Project area and considering the already fragmented nature of this landscape it is unlikely to be a

Additional impact assessment provisions for threatened ecological communities at risk of an SAII
significant impact to this already fragmented landscape. As can be seen from the figure above the development footprint is located in the most fragmented areas of habitat. It is unlikely to have significant impacts on seed dispersal.
c) Provide evidence of restricted geographic distribution (Principle 3, clause 6.7(2)I BC Regulation), based on the TEC's geographic range in NSW according to the: i) extent of occurrence ii) area of occupancy, and iii) number of threat-defined locations.
The NSWSC Final Determination states that the geographic distribution of White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland is not restricted. The best estimate of the extent of occurrence (EOO) is 702,800km2, based on a minimum convex polygon enclosing likely occurrences of the community, the method of assessment recommended by Bland et al. (2017). The best estimate of the area of occupancy (AOO) is 151,100km2 based on 10 x 10km grid cells (with a minimum of 1% occupied by the community), the scale recommended for assessing AOO by Bland et al. (2017). The average areas cleared annually over the period 2009-2018 and attributable to either agriculture or infrastructure in the bioregions in which the community occurs are (figures for NSW): Brigalow Belt South 2630 ha, Nandewar 659ha, New England Tableland 934ha, South Eastern Queensland 760ha, Sydney Basin 1320 ha, NSW North Coast 1273ha, Riverina 143ha South Eastern Highlands 440ha, South East Corner 151 ha, NSW South Western Slopes 746 ha. Clearing of vegetation in Queensland annually averaged for the same period was 2322ha in the New England Tableland Bioregion and 129,678ha in the Brigalow Belt Bioregion (QES 2018).
d) Provide evidence that the TEC is unlikely to respond to management (Principle 4, clause 6.7(2)(d) BC Regulation).
The TEC is not listed as an SAII under Principle 4, clause 6.7 (2)(d). The National Recovery Plan for this TEC states the following action will ensure the long-term viability of the TEC: • Development of conservation management plans for protected/high quality sites in all states and the ACT, including actions that relate to the maintenance or enhancement of habitat for component species. The above action suggests the TEC is responsive to management.
2. In relation to the impacts from the proposal on the TEC at risk of an SAII, the assessor must include data and information on: a) The impact on the geographic extent of the TEC (Principles 1 and 3) by estimating the total area of the TEC to be impacted by the proposal i) I in hectares, and ii) as a percentage of the current geographic extent of the TEC in NSW
PCT 510, which occurs within the development site as a woodland and derived native grassland, represents part of this TEC. Portions of PCT 567 that have co-dominance of Yellow Box and Blakely's Red Gum are considered this TEC. The total area of the TEC to be directly impacted by

Additional impact assessment provisions for threatened ecological communities at risk of an SAII
the proposal is 148.98ha (comprised of PCT 510 and parts of PCT 567).
b) The extent that the proposed impacts are likely to contribute to further environmental degradation or the disruption of biotic processes (Principle 2) of the TEC by i) estimating the size of any remaining, but now isolated, areas of the TEC; including areas of the TEC within 500m of the Development footprint or equivalent area for other types of proposals
NGH estimates that there may be approximately 545.73ha of this TEC within 500m of the Development Site, based on connectivity of the known TEC area within the development site with other areas of wooded vegetation outside it and to the 500m buffer.
ii) describing the impacts on connectivity and fragmentation of the remaining areas of TEC measured by: * detailing the distance between isolated areas of the TEC, presented as the average distance if the remnant is retained AND the average distance if the remnant is removed as proposed * estimating maximum dispersal distance for native flora species characteristic of the TEC * providing other information relevant to describing the impact on connectivity and fragmentation, such as the area to perimeter ratio for remaining areas of the TEC as a result of the Development.
The proposal is linear in nature and this intrinsically minimises impacts on connectivity and fragmentation. Within the development site, five patches of the TEC occur. The average distance between these patches is 2.45km. Due to the linear nature of the proposal, the distances between these patches would not be increased. However, where the proposal intersects one of the five patches of the TEC, a small scale, localised disconnect would be generated. This introduced disconnect would be a maximum of 25m.
iii) describing the condition of the TEC according to the vegetation integrity score for the relevant vegetation zone(s) (Chapter 4.3), including the relevant composition, structure and function condition scores for each vegetation zone.
Vegetation zones 1 and 2 represent this TEC. Vegetation zone data is provided below. Zone 1 PCT 510 grassland: • VI score = 25.4 • Composition condition score = 24.7 • Structure condition score = 27.8 • Function condition score = 23.9 Zone 2 PCT 510 Woodland: • VI score = 64.5 • Composition condition score = 50.7 • Structure condition score = 73.9

Additional impact assessment provisions for threatened ecological communities at risk of an SAII
• Function condition score = 71.7 Zone 18 PCT 567 grassland: • VI score = 39.7 • Composition condition score = 29.5 • Structure condition score = 46.2 • Function condition score = 46 Zone 19 PCT 510 Woodland: • VI score = 46 • Composition condition score = 49.3 • Structure condition score = 42.3 • Function condition score = 46.7 As both vegetation zones have a VI score greater than or equal to 15, clearing within said zones would generate an offset obligation. Given the TEC is critically endangered, the VI score of 64.5 for Zone 2 could be considered high, or good condition (11.15ha). Zone 18 and Zone 19 have VI scores that could be considered moderate (39.7-46) and Zone 1 has a low VI score of 25.4. All of these zones generate credits.

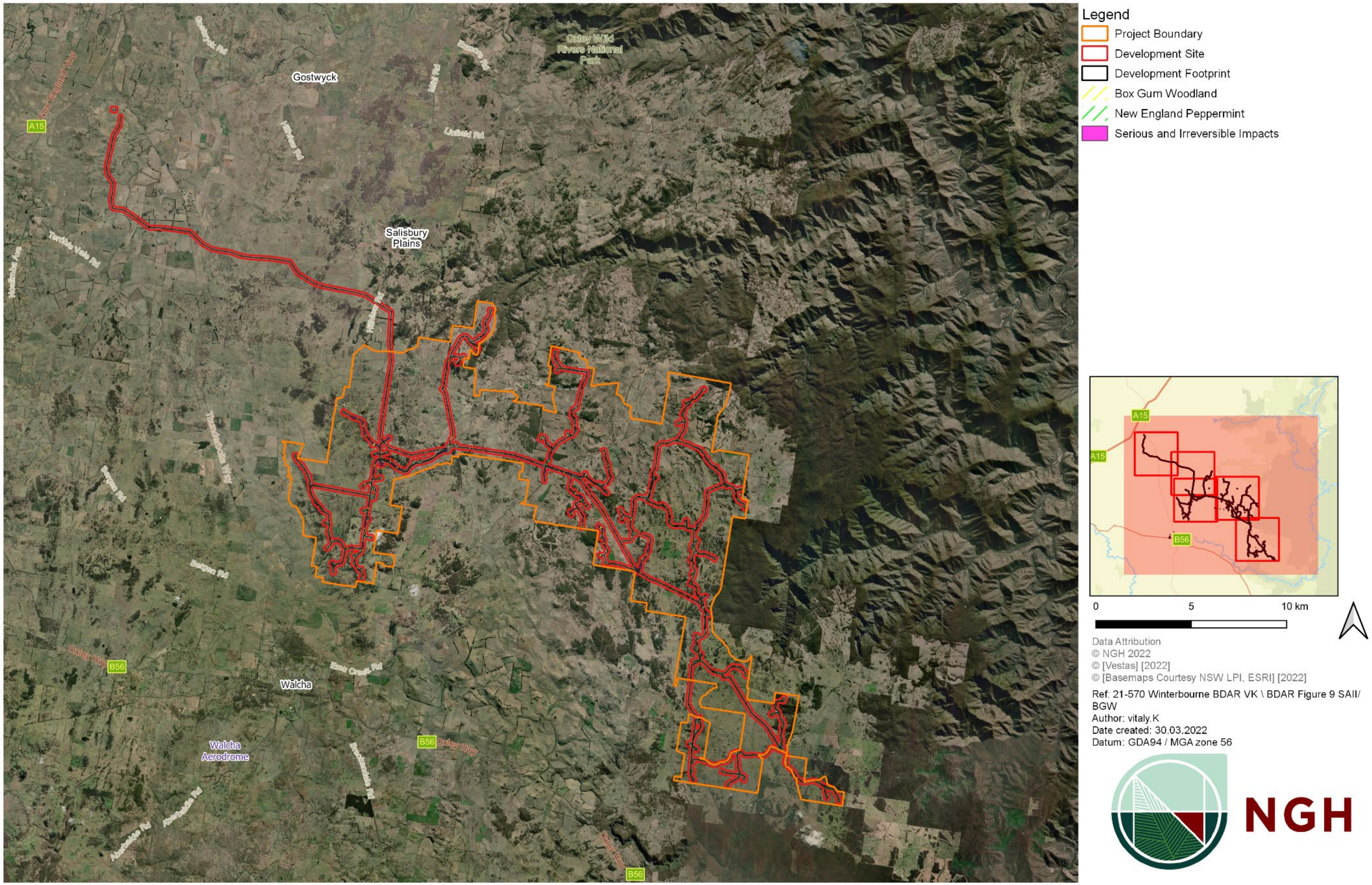


Figure 9-1 SAII impacts (detailed mapping is provided in Appendix N.11)

10. Offset requirement

10.1 Impacts requiring offset

10.1.1 Ecosystem credits

An offset is required for all impacts of development on PCTs that are associated with:

a) a vegetation zone that has a vegetation integrity score ≥15 where the PCT is representative of an endangered or critically endangered ecological community, or
b) a vegetation zone that has a vegetation integrity score of ≥17 where the PCT is associated with threatened species habitat (as represented by ecosystem credits), or is representative of a vulnerable ecological community, or
c) a vegetation zone that has a vegetation integrity score ≥20 where the PCT is not representative of a TEC or associated with threatened species habitat.

The PCTs and vegetation zones requiring offset and the ecosystem credits required are documented in Table 10-1 and mapped on Figure 10-1.

Table 10-1 PCTs and vegetation zones that require offsets

Zone ID	PCT ID	Zone area (ha)	Vegetation integrity score	Ecosystem credits required
1	510_grassland low	8.96	25.4	142
2	510_Woodland moderate	11.15	64.5	450
4	526_Woodland high	40.88	60.7	1085
5	534_grassland low	3.32	22.5	47
6	534_Woodland moderate	11.1	50.3	349
7	565_grassland moderate	6.19	38.4	89
8	565_Woodland moderate	13.84	57.2	297
10	568_Woodland high	8.8	64.4	248
10	766_Riparian low	1.6	20.8	17
13	970_Woodland moderate	37.99	41.5	690
15	997_Woodland moderate	10.27	41.6	187

Zone ID	PCT ID	Zone area (ha)	Vegetation integrity score	Ecosystem credits required
13	1194_Woodland moderate	5.65	58.2	164
18	567_grassland_TEC	97.1	39.7	2411
19	567_woodland_TEC	31.8	46	914
21	567_woodland high	35.5	70.7	1097

The full Biodiversity Credit Report generated by the BAM Calculator is provided in Appendix E.

10.1.2 Species credits

An offset is required for the threatened species impacted by the development that are species credit species or dual credit species. These species and the species credits required are documented in Table 10-2 and species polygons are shown on Figure 4-5. Note that areas that require offsets are comprised of areas that generate ecosystem credits, species credits or both.

Table 10-2 Species credit species that require offsets

Species Credit Species	Biodiversity risk weighting	Area of habitat (ha) or count of individuals lost	Species credits required
Glossy Black-Cockatoo	2	33.8	987
Bluegrass	2	13.2	180
Narrow-leaved Black Peppermint	2	13	26
Barking Owl	2	17.70	530
Greater Glider	2	206.5	5697
Squirrel Glider	2	206.5	5694
Koala	2	206.9	5709

10.2 Impacts not requiring offset

Impacts to PCTs that do not meet the thresholds identified in 10.1.1 do not require offsets. These PCTs and vegetation zones are identified in Table 10-3 and mapped on Figure 10-1

Table 10-3 PCTs and vegetation zones not requiring offset

Zone ID	PCT ID	Zone area (ha)	Vegetation integrity score	Ecosystem credits required
3	526_grassland poor	28.6	5.5	0
9	568_grassland poor	12.8	14.7	0

Zone ID	PCT ID	Zone area (ha)	Vegetation integrity score	Ecosystem credits required
12	970_grassland poor	34.8	8.2	0
14	997_grassland poor	6	11.6	0
16	1194_grassland poor	17.9	12.3	0
20	567_grassland poor	3	11.1	0

10.3 Areas not requiring assessment

Areas not requiring assessment are lands that have been deemed to be Category 1 Exempt Lands. These areas are shown as Cat 1 land within Figure 3-2.

10.3.1 Description of credit classes

See Appendix E for credit reports detailing the credit classes.

10.3.2 Offsets required under the EPBC Act

Assessments of significance for MNES Appendix O conclude that significant impacts are likely for:

- Threatened Ecological Communities:
  - New England Peppermint (Eucalyptus nova-anglica) Grassy Woodlands
  - White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland
- Threatened/Migratory Species (species credits):
  - Koala
  - Narrow-leaved Black Peppermint
  - Blue Grass
  - Greater Glider

Threatened/Migratory Species (ecosystem credits)

- Spotted-tailed Quoll
- White-throated Needletail
- Fork-tailed Swift

The proposed Project was determined to be a controlled action and will be assessed by NSW under an accredited assessment in accordance with Section 87 of the EPBC Act. Supplementary SEARs for this proposal have been addressed in this BDAR. The requirement to settle an EPBC offset obligations will be undertaken in accordance with the NSW offset rules where applicable to do so consistent with the endorsed bilateral agreement. An offset strategy addressing Federal requirements will be developed based on further investigations, prior to approval.

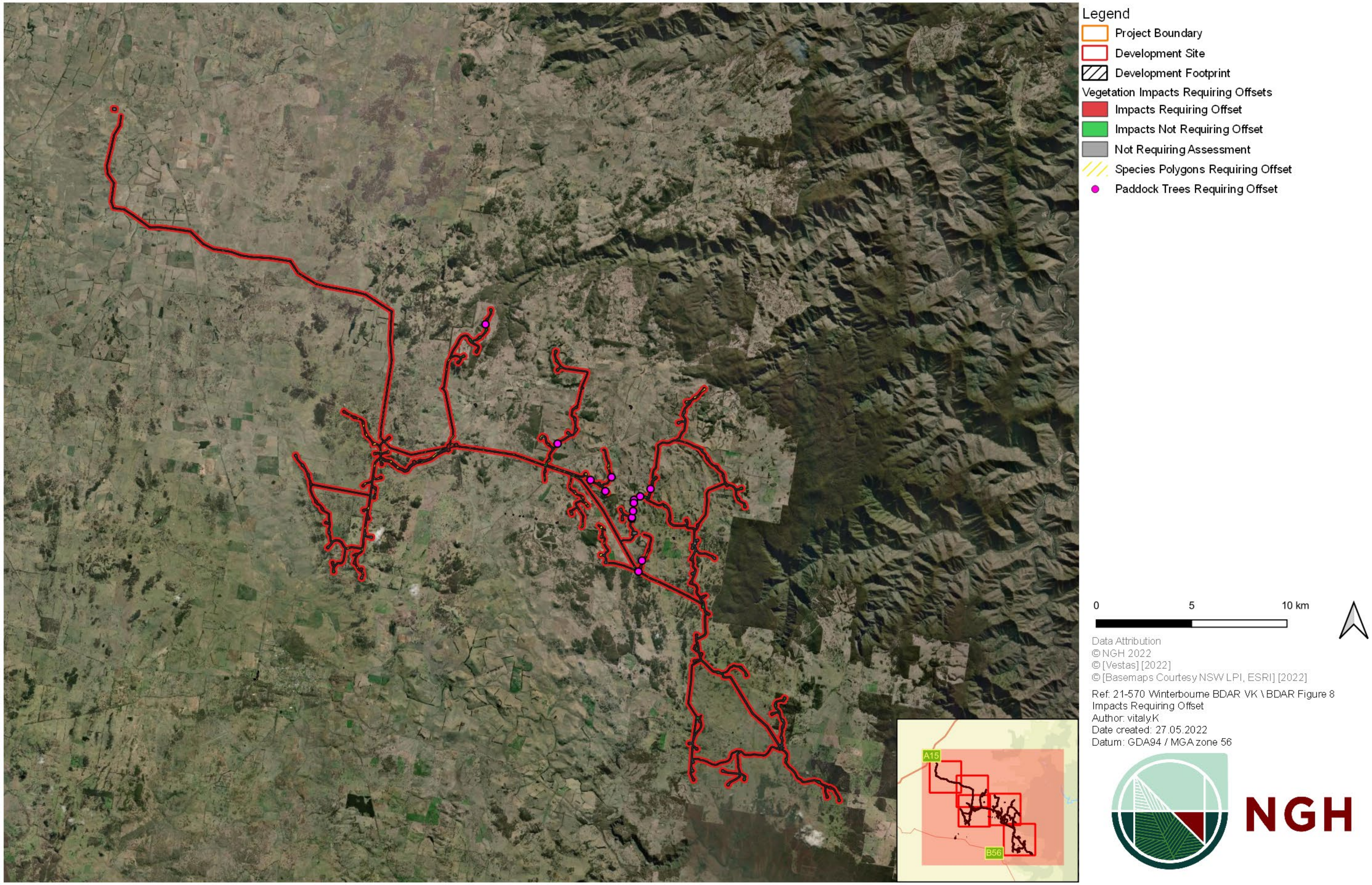


Figure 10-1 Areas requiring offsets and areas not requiring offsets (detailed mapping is provided in Appendix N.12)

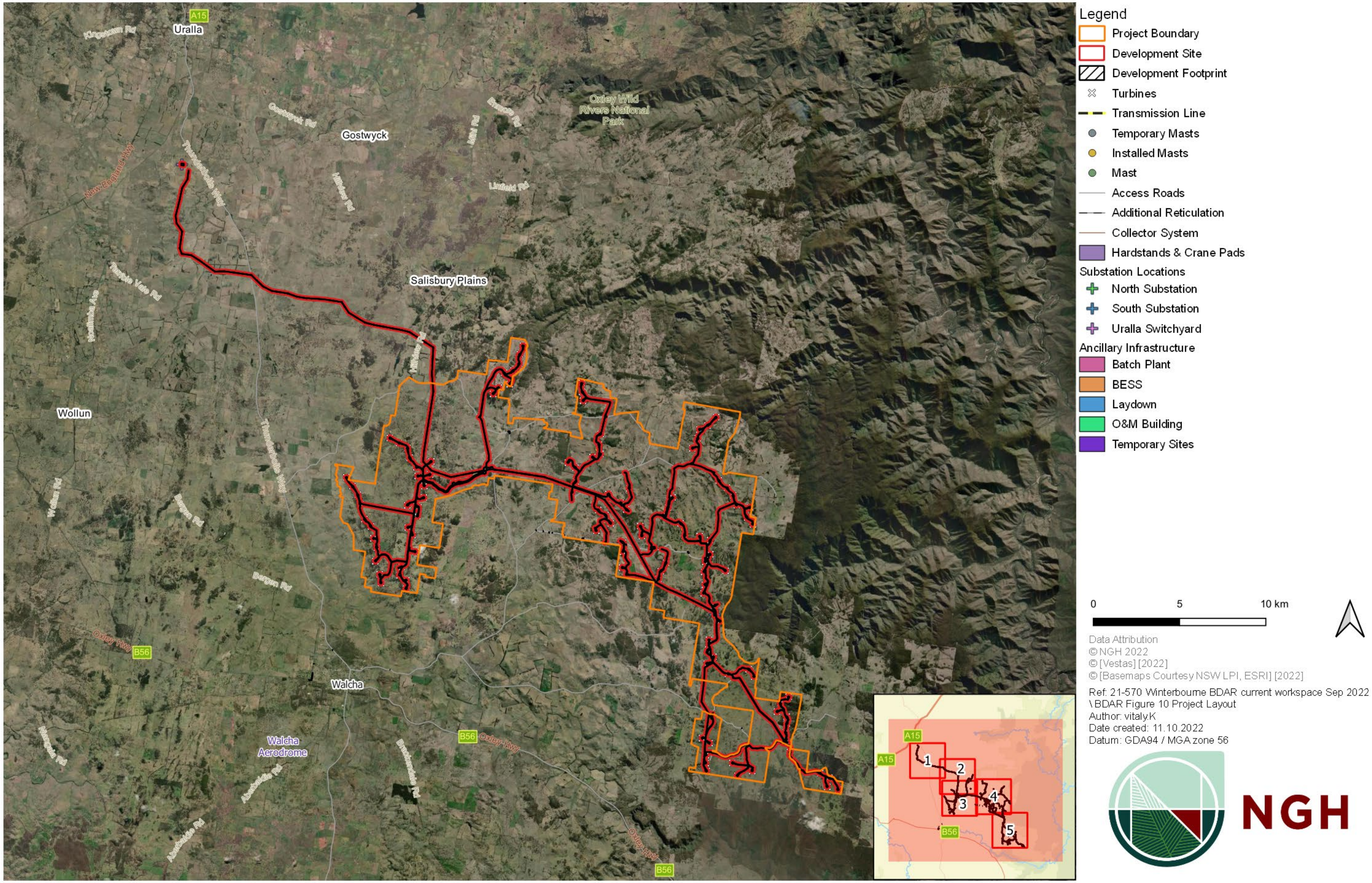


Figure 10-2 Project layout (detailed mapping is provided in Appendix N.13)

11. Conclusion

NGH has prepared this BDAR on behalf of WinterbourneWind Pty Ltd to assess the potential biodiversity impacts of the proposed Winterbourne Wind Farm. The purpose of this BDAR was to address the requirements of the BAM, and to address the biodiversity matters raised in the project-specific SEARs and Supplementary SEARs issued for this Project. In this BDAR:

- Biodiversity impacts have been assessed through comprehensive mapping and assessment completed in accordance with the BAM
- Biodiversity impacts have been assessed at a worst-case scenario, based on a broad development footprint which will allow micro-siting in response to detailed design planning
- Mitigation measures have been outlined to reduce impacts to biodiversity

While the civil earthworks program will be large and spread across a very large site, the actual percentage of the site that will be physically impacted is low; less than 5%. Through the measures outlined for design and construction, the risks and impacts are addressed through relatively standard mitigation measures with moderate confidence of success.

The key biodiversity impact for this project is the potential to have ongoing population impacts on birds or bats that are either excluded or injured by operational turbines. Extensive bird and bat utilisation data and risk assessment modelling has been undertaken to ensure that turbine placements minimise this risk and that actual impacts remain low as predicted. To address the inherent uncertainty however, a Bird and Bat Adaptive Management Plan to identify specific adaptive mitigation measures in the case that impacts are greater than predicted is the central recommendation of this report.

To account for loss of habitat, the credit obligation has been summarised as follows:

PCT	TEC	Area	Credits
510-Blakely's Red Gum - Yellow Box grassy woodland	Yes	20.1	592
526-Mountain Ribbon Gum - Messmate - Broad-leaved Stringybark open forest on granitic soils	No	69.4	1085
534-New England Peppermint grassy woodland on sedimentary or basaltic substrates	Yes	14.4	396
565-Silvertop Stringybark - Mountain Gum grassy open forest	No	20	386
567-Broad-leaved Stringybark - Yellow Box shrub/grass open forest (TEC)	Yes[6]	128.9	3325
567-Broad-leaved Stringybark - Yellow Box shrub/grass open forest (non TEC)	No	38.4	1097
568-Broad-leaved Stringybark shrub/grass open forest	No	21.6	248

[6] Partially a TEC due to areas Box Gum canopy species

PCT	TEC	Area	Credits
766-Carex sedgeland of the slopes and tablelands	No	1.6	17
970-Narrow-leaved Peppermint - Wattle-leaved Peppermint shrubby open forest	No	72.8	690
997-New England stringybarks - peppermint open forest	No	16.3	187
1194-Snow Gum - Mountain Gum - Mountain Ribbon Gum open forest on ranges	Yes	23.6	164

Species	Area / Count	Credits
Calyptorhynchus lathami / Glossy Black-Cockatoo	33.8	987
Dichanthium setosum / Bluegrass	13.2	180
Eucalyptus nicholii / Narrow-leaved Black Peppermint	13	26
Ninox connivens / Barking Owl	17.7	530
Petauroides volans / Greater Glider	206.5	5694
Petaurus norfolcensis / Squirrel Glider	206.5	5694
Phascolarctos cinereus / Koala	206.9	5709

Further targeted surveys are planned to continue concurrent with the public exhibition of the EIS. If species presumed present cannot be ruled out by targeted surveys prior to the Development's determination, then the retirement of the credits for all entities above will be carried out in accordance with the NSW BOS, and will be achieved by either:

a) Retiring credits under the BOS based on the like-for-like rules, or
b) Making payments into the Biodiversity Conservation Fund using the offset payments calculator, or
c) Funding a biodiversity action that benefits the threatened entities impacted by the development.

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12. References

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Appendix A Land category assessment

Appendix B Desktop haulage route risk assessment

Appendix C Bird utilisation survey reports

Appendix D Bat survey report

Appendix E Bird and bat collision risk assessment

Appendix F BAM-C credit reports

Appendix G Plot field data

Appendix H Assessment personnel

The assessment team have included the following key staff in the roles set out below:

Name	Title	Qualifications	Roles
Beth Noel	Technical Lead Ecology	• BAM Accredited Assessor (BAAS19015) • Master of Wildlife Management • B App. Sc. (Honours, Geology)	Accredited assessor Senior ecologist BDAR author – primary BAM calculations Impact area calculations
Matt Davis	ERM – Principal Ecologist	• Master of Environmental Management, Conservation Biology • Bachelor Science Ecology and Conservation Biology	Principal Ecologist BDAR review
Mitch Palmer	NGH Technical Lead Ecology	• BAM Accredited Assessor (BAAS17051) • MEIANZ BSc.	Senior field ecologist, directing survey and early avoidance advice, preliminary BAM calculations
Aleksei Atkin	NGH Technical Lead Ecology	• BAM Accredited Assessor (BAAS17093) • B Nat. Sci. M Wld. Mgmt.	Senior ecologist, directing survey, BAM calculations, technical oversight
Brendon True	NGH Senior Ecologist	• BAM Accredited Assessor (BAAS18155) • Master of Conservation Biology • Bachelor of Science (Ecology and Biodiversity)	Senior ecologist, BAM calculations BDAR co author
Giorginna Xu	NGH Ecologist	• BEnvSci	BDAR co author Ecologist and co author Nocturnal bird surveys August 2021 Threatened flora surveys Oct 2021
Jacqui Coughlan, EcoFocus Consulting	Principal Ecologist	• BSc, PhD, Grad Dip. Env. Law.	BDAR technical review and co-author (collision risks)
Vitaly Kolin	NGH Senior Spatial Analyst	• BSc (Earth Science) (Hons 1)	GIS mapping

Name	Title	Qualifications	Roles
Clancy Bowman	NGH Environmental Consultant Mapping coordinator	• Bachelor of Science (Resource & Environmental Management)	GIS coordinator and project manager
Brooke Marshall	NGH Principal – Renewable Energy Assessments	• Certified Environmental Practitioner (CEnvP) • B. Nat Res (First Class Honours)	Technical review
Beth Kramer	NGH Principal – ecologist, General Manager - Biodiversity	• B. Sci, • M Env Mgt	Technical review BDAR co author – wind farm impacts
Louiza Romane	NGH Regional Manager - Biodiversity	• BSc (Earth Science) (Hons 1)	Technical review
Gillian Young	NGH Senior Ecologist	• Accredited Assessor (BAAS17086)' • Bachelor of Natural Resources (Hons)	Senior Ecologist BAM plots Flora surveys Vegetation mapping
Rachel Buzio	NGH Ecologist	• Bachelor of Marine Science • Member of Australian Association of Bush Regenerators (AABR)	Frog surveys Dec 2021 Reptile surveys Dec 2021 Glossy Black surveys Aug 2021 Hair tubes, cameras Dec 2021
Teah Wills	NGH Ecologist	• Graduate Diploma Environmental Management • Bachelor Environmental Biology	Frog surveys Dec 2021 Reptile surveys Dec 2021 Glossy Black surveys Aug 2021 Hair tubes, cameras Dec 2021
Nick Weigner	NGH Ecologist	• Bachelor Science (Zoology & Ecology) (Hons)	Frog surveys Dec 2021 Reptile surveys Dec 2021 Hair tubes, cameras Dec 2021

Name	Title	Qualifications	Roles
Isaac Higgs	NGH Technical Assistant	• Field staff	Frog surveys Dec 2021 Reptile surveys Dec 2021 Hair tubes, cameras Dec 2021
Daniel Perkovic	NGH Senior Ecologist	• Accredited Assessor (BAAS21013) • Diploma Conservation Land management • Certificate III in Conservation Land Management • Bachelor Arts (LLB)	Initial field work BAM plots GIS mapping PCT mapping
Elijah Elias	NGH Senior Ecologist	• Accredited Assessor (BAAS21012) • Bachelor Biodiversity Conservation	BAM plots
Greg Ford	Director and Principal Consultant	• Specialist consultant – bat call analysis	Bat call analysis for Nature Advisory Bat Survey
Georgeanna Story	Consultant – specialist hair analysis	• Specialist consultant – hair analysis	Analysis of hair samples form hair tubes
Dr David Dique	Koala expert	• Specialist consultant – scat analysis	Analysis of scats for ERM
Barbara Triggs	Author of Tracks Scats and other traces	• Specialist consultant – scat analysis	Analysis of scats for ERM
Candice Larkin	Nature Advisory Ecologist	• Specialist ecological consultant	BUS survey October 2020
Dr Ahmad Barati	Nature Advisory Ecologist	• Specialist ecological consultant	BUS survey March and April 2021
Peter Lansley	Nature Advisory Ecologist	• Specialist ecological consultant	BUS survey January 2022

Name	Title	Qualifications	Roles
Ben Nottidge	Green Leafe Ecology Ecologist	• Specialist ecological consultant	Flora and Fauna surveys Oct 2021
Jacob White	NGH Technical Assistant	• Field staff	Flora and Fauna surveys Oct 2021
Wendy Hawes	JHT Ecologist	• Specialist ecological consultant	Pale Headed Snake + broad tailed Gecko surveys Dec 2021
John Hunter	JHT Ecologist	• Specialist ecological consultant	Threatened eucalypt, grey-headed flying fox, and Broad-tailed gecko surveys Dec 2021
Noah Bruce-Allen	NGH Technical Assistant	• Field staff	Threatened eucalypt, grey-headed flying fox, and Broad-tailed gecko surveys Dec 2021
Vanessa Hunter	JHT Ecologist	• Specialist ecological consultant	Threatened flora species surveys Dec 2021
James Mitchell Williams	Technical Assistant	• Specialist ecological consultant	Threatened flora species surveys Dec 2021
Cal Hunter	JHT Ecologist	• Specialist ecological consultant	Threatened flora species surveys Dec 2021
David Carr	Stringy Bark Ecology Ecologist	• Specialist ecological consultant – BAM accredited	BAM plots Dec 2021
Wendy Chapel	Stringy Bark Ecology Ecologist	• Specialist ecological consultant	BAM plots Dec 2021
Lorena Boyle	Environmental Resources Management	• Specialist ecological consultant	BUS survey March 2022

Appendix I Habitat tree inventory

The table below contains the hollow-bearing trees that would be removed as a result of the project.

wkt_geom	Date-Time	Type	Easting	Northing	Notes1	Comments	Small Holl	Medium Hol	Large Holl	Small Ho_1	Medium H_1	Large Ho_1	Hollow Hei	Fissuring	Decorticat
PointZM (361753.84595769515726715 6594009.24809723626822233 0 0)	2020-12-03T11:44:07.691	HBT	361753.85	6594009.25	Crimson Rosella nest		0	0	1	0	0	0			
PointZM (361791.30790236406028271 6593974.48685312364250422 0 0)	2020-12-03T11:45:50.505	HBT	361791.31	6593974.49	Galah nest		0	0	1	0	0	0			
PointZM (393624.43209158978424966 6565797.97416147124022245 1348.90087890625 0)	2021-03-10T09:11:15.313	HBT	393624.43	6565797.97			2	0	0	0	0	0			
PointZM (393625.97376699047163129 6565802.80702907778322697 1349.345458984375 0)	2021-03-10T09:15:04.119	HBT	393625.97	6565802.81			0	1	0	0	0	0			

wkt_geom	Date-Time	Type	Easting	Northing	Notes1	Comments	Small Holl	Medium Hol	Large Holl	Small Ho_1	Medium H_1	Large Ho_1	Hollow Hei	Fissuring	Decorticat
PointZM (393321.71541903237812221 6565939.16377073340117931 0 0)	2021-03-10T09:41:21.968	HBT	393321.72	6565939.16	Trunk hollows at 2-3m off ground		1	2	0	0	0	0			
PointZM (355989.43911406514234841 6596860.58452905155718327 0 0)	2021-03-10T10:14:59.419	HBT	355989.44	6596860.58			0	0	0	0	0	0			
PointZM (391132.12800165463704616 6570429.35037295427173376 1335.629638671875 0)	2021-03-10T14:12:58.352	HBT	391132.13	6570429.35			0	0	0	0	0	0		2	
PointZM (391130.87101504375459626 6570425.19070045091211796 1334.345458984375 0)	2021-03-10T14:14:04.007	HBT	391130.87	6570425.19			0	0	1	0	0	0			
PointZM (391122.76741454418515787 6570418.41912330314517021 1335.62548828125 0)	2021-03-10T14:14:45.448	HBT	391122.77	6570418.42			0	0	1	0	0	0			
PointZM (391119.20852334459777921	2021-03-10T14:15:46.652	HBT	391119.21	6570407.05			2	2	0	0	0	0			

wkt_geom	Date-Time	Type	Easting	Northing	Notes1	Comments	Small Holl	Medium Hol	Large Holl	Small Ho_1	Medium H_1	Large Ho_1	Hollow Hei	Fissuring	Decorticat
6570407.05185415968298912 1334.67333984375 0)															
PointZM (391110.11687775608152151 6570398.11305364407598972 1334.1922607421875 0)	2021-03-10T14:16:58.896	HBT	391110.12	6570398.11			0	0	2	0	0	0			
PointZM (391114.1869185296818614 6570382.71932490728795528 1330.9249267578125 0)	2021-03-10T14:21:05.298	HBT	391114.19	6570382.72			0	1	0	0	0	0			
PointZM (391119.83893544285092503 6570381.32517005689442158 1331.21728515625 0)	2021-03-10T14:22:37.437	Stag	391119.84	6570381.33			1	0	0	0	0	0			
PointZM (391130.67545115371467546 6570500.05067181028425694 0 0)	2021-03-11T10:24:42.205	HBT	391130.68	6570500.05			1	0	0	0	0	0			
PointZM (391131.05320242600282654 6570494.90592688042670488 0 0)	2021-03-11T10:26:12.649	HBT	391131.05	6570494.91			1	0	0	0	0	0			
PointZM (391135.54676868952810764	2021-03-11T10:27:10.128	HBT	391135.55	6570499.1			1	0	0	0	0	0			

wkt_geom	Date-Time	Type	Easting	Northing	Notes1	Comments	Small Holl	Medium Hol	Large Holl	Small Ho_1	Medium H_1	Large Ho_1	Hollow Hei	Fissuring	Decorticat
6570499.09992206003516912 0 0)															
PointZM (391126.7035558606730774 6570434.44322978425770998 0 0)	2021-03-11T10:28:24.350	HBT	391126.7	6570434.44			0	0	1	0	0	0			
PointZM (381850.0523285692324861 9 6581347.96460326667875051 0 0)	2021-03-29T15:39:33.788	Stag	381850.05	6581347.96			0	0	1	0	0	0			
PointZM (370210.14297932048793882 6585645.42688396386802197 0 0)	2021-04-01T11:05:24.103	HBT	370210.14	6585645.43			3	1	1	0	0	0			
PointZM (369296.78462108137318864 6579977.7953582052141428 1214.3585205078125 0)	2021-08-26T10:52:55.002	HBT	369296.78	6579977.8	Multiple HBTs and stags adjacent		4	2	0	0	0	0		4	
PointZM (390189.95434867800213397 6567542.01153152715414762 1213.6151123046875 0)	2021-10-11T15:46:54.654	HBT	390189.95	6567542.01			0	0	1	0	0	0			
PointZM (369885.7170162902912125	2021-10-18T17:07:48.364	HBT	943638.17	6574529.7			3	0	0	0	0	0		2	

wkt_geom	Date-Time	Type	Easting	Northing	Notes1	Comments	Small Holl	Medium Hol	Large Holl	Small Ho_1	Medium H_1	Large Ho_1	Hollow Hei	Fissuring	Decorticat
6582966.1963752806186676 0 0)															
PointZM (369988.88508616376202554 6583043.24400128517299891 0 0)	2021-10-18T17:20:27.170	HBT	943745.58	6574601.25			1	0	0	0	0	0		3	
PointZM (370030.3293398407404311 6583004.19165379740297794 0 0)	2021-10-18T17:24:17.625	Stag	943784.95	6574559.92	Excorticating bark		5	0	2	0	0	0		2	
PointZM (370090.53987947065616027 6582974.64405808039009571 0 0)	2021-10-18T17:29:53.078	Stag	943843.61	6574527.11	Excorticating bark		5	2	0	0	0	0			
PointZM (370096.0146610617521219 6582980.69241726957261562 0 0)	2021-10-18T17:31:25.103	Stag	943849.42	6574532.87	Excorticating bark		6	0	0	0	0	0			
PointZM (370085.52648757916176692 6582937.3303926158696413 1234.4073486328125 0)	2021-10-18T17:31:34.424	HBT	943836.58	6574490.04			2	0	0	0	0	0			
PointZM (370091.05623734812252223	2021-10-18T17:32:33.702	HBT	943843.5	6574515.37	Excorticating bark		5	0	0	0	0	0			

wkt_geom	Date-Time	Type	Easting	Northing	Notes1	Comments	Small Holl	Medium Hol	Large Holl	Small Ho_1	Medium H_1	Large Ho_1	Hollow Hei	Fissuring	Decorticat
6582962.939692303538322450 0)															
PointZM (370097.563528440776281066582945.516130247153341770 0)	2021-10-18T17:33:40.257	HBT	943849.07	6574497.58	Excorticating bark		2	0	0	0	0	0			
PointZM (370098.947069756686687476582920.964308642782270911238.7576904296875 0)	2021-10-18T17:34:10.325	HBT	943849.13	6574472.93			0	1	0	0	0	0			
PointZM (370094.022650712751783436582921.387676002457737921236.5152587890625 0)	2021-10-18T17:35:16.722	HBT	943844.23	6574473.62			1	0	0	0	0	0			
PointZM (370100.911623151390813296582929.738348895683884620 0)	2021-10-18T17:35:29.244	HBT	943851.57	6574481.61	Excorticating bark		0	0	0	0	0	0			
PointZM (370104.240059478848706936582905.817317863926291471235.3531494140625 0)	2021-10-18T17:36:05.313	HBT	943853.61	6574457.49			1	0	0	0	0	0			
PointZM (370111.51132483646506444	2021-10-18T17:37:04.761	Stag	943861.79	6574473.8	Excorticating bark		0	0	1	0	0	0			

wkt_geom	Date-Time	Type	Easting	Northing	Notes1	Comments	Small Holl	Medium Hol	Large Holl	Small Ho_1	Medium H_1	Large Ho_1	Hollow Hei	Fissuring	Decorticat
6582922.50555948354303837 0 0)															
PointZM (370122.12556216260418296 6582888.75286557245999575 1234.583251953125 0)	2021-10-18T17:38:31.298	HBT	943870.59	6574439.45			1	0	0	0	0	0			
PointZM (370122.13835030794143677 6582909.72815875895321369 0 0)	2021-10-18T17:39:14.595	HBT	943871.73	6574460.44	Excorticating bark		10	0	0	0	0	0			
PointZM (370131.88734511646907777 6582880.75937385112047195 1234.2274169921875 0)	2021-10-18T17:39:31.753	HBT	943879.93	6574430.92			2	1	0	0	0	0			
PointZM (370132.00622197892516851 6582882.4613264175131917 1235.6875 0)	2021-10-18T17:40:05.523	HBT	943880.14	6574432.62			1	0	0	0	0	0			
PointZM (370137.05543785716872662 6582885.92268880736082792 1233.743408203125 0)	2021-10-18T17:40:35.516	HBT	943885.38	6574435.81			2	2	1	0	0	0			
PointZM (370149.12386920384597033	2021-10-18T17:43:34.684	HBT	943896.39	6574415.27	Excorticating bark		2	0	7	0	0	0			

wkt_geom	Date-Time	Type	Easting	Northing	Notes1	Comments	Small Holl	Medium Hol	Large Holl	Small Ho_1	Medium H_1	Large Ho_1	Hollow Hei	Fissuring	Decorticat
6582866.044990680180490020 0)															
PointZM (370148.64309872302692384 6582850.53713017515838146 1236.555419921875 0)	2021-10-18T17:44:47.984	HBT	943895.07	6574399.78			1	2	2	0	0	0			
PointZM (370154.66914549592183903 6582863.313408378511667250 0)	2021-10-18T17:45:10.615	HBT	943901.79	6574412.24	Excorticating bark		5	0	0	0	0	0			
PointZM (370141.99401584605220705 6582854.71966003347188234 1238.2628173828125 0)	2021-10-18T17:46:42.022	HBT	943888.64	6574404.32			2	1	0	0	0	0			
PointZM (370155.51978764624800533 6582856.267882853746414180 0)	2021-10-18T17:46:47.726	Stag	943902.26	6574405.14	Excorticating bark		0	0	1	0	0	0		3	
PointZM (370158.00136590813053772 6582853.481275683268904690 0)	2021-10-18T17:47:56.142	HBT	943904.59	6574402.21	Excorticating bark		10	0	0	0	0	0			
PointZM (370158.58359211205970496	2021-10-18T17:48:37.896	Stag	943904.89	6574396.92	Excorticating bark		4	0	0	0	0	0		3	

wkt_geom	Date-Time	Type	Easting	Northing	Notes1	Comments	Small Holl	Medium Hol	Large Holl	Small Ho_1	Medium H_1	Large Ho_1	Hollow Hei	Fissuring	Decorticat
6582848.22167219128459692 0 0)															
PointZM (370161.23326237755827606 6582840.2456625159829855 1235.835693359375 0)	2021-10-18T17:48:58.743	HBT	943907.11	6574388.8			2	0	0	0	0	0			
PointZM (370171.76546479837270454 6582844.38246452249586582 0 0)	2021-10-18T17:50:22.985	HBT	943917.88	6574392.37	Excorticating bark		5	0	0	0	0	0			
PointZM (370168.29586569441016763 6582821.40877708420157433 1236.4073486328125 0)	2021-10-18T17:51:01.989	HBT	943913.17	6574369.56			12	0	0	0	0	0			
PointZM (374677.03696306073106825 6588326.48582131415605545 1328.858642578125 0)	2021-10-19T10:30:17.044	Stick Nest	948722.14	6579636.19			0	0	0	0	0	0			
PointZM (374713.62909706856589764 6587748.22634700872004032 1297.3685302734375 0)	2021-10-19T12:16:23.676	HBT	948727.63	6579055.47			1	0	0	0	0	0			
PointZM (366719.46257105434779078	2021-10-19T14:09:39.499	HBT	940963.14	6583874.81			2	1	0	0	0	0			

wkt_geom	Date-Time	Type	Easting	Northing	Notes1	Comments	Small Holl	Medium Hol	Large Holl	Small Ho_1	Medium H_1	Large Ho_1	Hollow Hei	Fissuring	Decorticat
6592133.92698641121387482 1151.38232421875 0)															
PointZM (366657.12524199258768931 6592050.48901958577334881 0 0)	2021-10-19T14:15:24.487	HBT	940896.27	6583794.67			0	0	0	0	0	0			
PointZM (366662.09086843079421669 6592052.92277056910097599 1163.71142578125 0)	2021-10-19T14:15:47.871	HBT x30	940901.37	6583796.83			10	0	0	0	0	0			
PointZM (366686.10912099643610418 6592114.50896913558244705 1159.4521484375 0)	2021-10-19T14:19:10.476	HBT	940928.72	6583857.17			3	2	0	0	0	0			
PointZM (366589.17958525917492807 6592296.83217009156942368 1161.017333984375 0)	2021-10-19T14:26:37.589	HBT	940841.52	6584044.84			2	0	0	0	0	0			
PointZM (366616.13531131064519286 6592322.60585855506360531 1164.7750244140625 0)	2021-10-19T14:26:50.326	HBT	940869.89	6584069.18			2	0	0	0	0	0			
PointZM (366668.4209696602774784	2021-10-19T14:27:17.093	HBT	940923.06	6584082.14			2	2	0	0	0	0			

wkt_geom	Date-Time	Type	Easting	Northing	Notes1	Comments	Small Holl	Medium Hol	Large Holl	Small Ho_1	Medium H_1	Large Ho_1	Hollow Hei	Fissuring	Decorticat
6592338.36777481436729431 1161.14990234375 0)															
PointZM (366666.50193247781135142 6592338.15985493734478951 1164.1544189453125 0)	2021-10-19T14:27:42.137	Stag x4	940921.13	6584082.04			0	0	0	0	0	0			
PointZM (366708.7047227545408532 6592378.37907032016664743 1169.6531982421875 0)	2021-10-19T14:28:29.074	Stag x15	940965.52	6584120.02			5	4	0	0	0	0			
PointZM (366690.00438435724936426 6592433.00588436797261238 1167.0860595703125 0)	2021-10-19T14:29:34.812	Stag x5	940949.75	6584175.69			4	2	0	0	0	0			
PointZM (366613.34571907034842297 6592411.92982478626072407 1162.039306640625 0)	2021-10-19T14:31:11.492	Stag	940871.9	6584158.72			1	0	0	0	0	0			
PointZM (380322.47842128452612087 6580031.9938802644610405 0 0)	2021-10-19T17:38:49.218	HBT	953925.45	6571030.1	Stick nest		2	0	0	0	0	0			
PointZM (380294.5306265142862685	2021-10-19T17:41:39.969	Stag	953895.92	6571002.71			5	0	0	0	0	0			

wkt_geom	Date-Time	Type	Easting	Northing	Notes1	Comments	Small Holl	Medium Hol	Large Holl	Small Ho_1	Medium H_1	Large Ho_1	Hollow Hei	Fissuring	Decorticat
6580003.12392257340252399 0 0)															
PointZM (380291.4946733625838533 6580006.55388935655355453 0 0)	2021-10-19T17:42:43.746	Stag	953893.07	6571006.31			5	0	0	0	0	0			
PointZM (380087.25934185786172748 6580125.23765691556036472 0 0)	2021-10-19T17:54:43.211	Stag	953695.05	6571136.12			5	2	0	0	0	0			
PointZM (380365.18593627226073295 6580103.44743858836591244 0 0)	2021-10-19T18:11:07.725	Stag	953972.06	6571099.32			5	3	2	0	0	0		3	
PointZM (380431.52563420165097341 6580077.88826583418995142 0 0)	2021-10-19T18:13:19.305	HBT	954037.08	6571070.16			3	2	1	0	0	0		2	
PointZM (382014.76581794593948871 6582574.41636440344154835 0 0)	2021-10-20T09:01:52.353	Stag	955756.47	6573483.59			0	3	0	0	0	0			
PointZM (382020.7248431007610634	2021-10-20T09:03:42.990	HBT	955762.57	6573485.86			0	0	0	0	0	0			

wkt_geom	Date-Time	Type	Easting	Northing	Notes1	Comments	Small Holl	Medium Hol	Large Holl	Small Ho_1	Medium H_1	Large Ho_1	Hollow Hei	Fissuring	Decorticat
6582577.00408410374075174 0 0)															
PointZM (382043.93532460852293298 6582510.77326885052025318 0 0)	2021-10-20T09:16:50.799	HBT	955782.23	6573418.31			2	0	0	0	0	0		1	
PointZM (382006.81264865008415654 6582645.23357287794351578 1159.6868896484375 0)	2021-10-20T09:17:52.496	Stick nest	955752.33	6573554.9			0	0	0	0	0	0			
PointZM (382039.48354324721731246 6582486.69864069484174252 0 0)	2021-10-20T09:18:08.016	Stag x2	955776.48	6573394.46			0	0	0	0	0	0			
PointZM (382075.42307802964933217 6582478.60275986511260271 0 0)	2021-10-20T09:19:16.927	HBT	955812.01	6573384.41			0	0	0	0	0	0			
PointZM (382073.13939561962615699 6582478.45430414192378521 1159.6376953125 0)	2021-10-20T09:19:21.536	Casuarinas	955809.72	6573384.38			0	0	0	0	0	0			
PointZM (381999.49189844832289964	2021-10-20T09:20:06.046	Stag x20	955746.74	6573587.6			15	0	0	0	0	0			

wkt_geom	Date-Time	Type	Easting	Northing	Notes1	Comments	Small Holl	Medium Hol	Large Holl	Small Ho_1	Medium H_1	Large Ho_1	Hollow Hei	Fissuring	Decorticat
6582677.50386150926351547 1155.82275390625 0)															
PointZM (382002.28860653674928471 6582751.81355533562600613 1155.8375244140625 0)	2021-10-20T09:23:22.216	HBT	955753.54	6573661.82			1	1	0	0	0	0			
PointZM (382004.04521946900058538 6582777.19521753210574389 1157.601318359375 0)	2021-10-20T09:25:42.670	HBT	955756.67	6573687.14			1	1	0	0	0	0			
PointZM (382150.36006758938310668 6582410.99151986092329025 1191.021240234375 0)	2021-10-20T09:26:18.344	Stag	955883.37	6573312.69			0	0	0	0	0	0			
PointZM (381989.49475226452341303 6582776.27163396868854761 1153.977783203125 0)	2021-10-20T09:28:18.043	Stag x20	955742.06	6573686.99			20	5	0	0	0	0			
PointZM (382207.07577899016905576 6582394.72208270244300365 0 0)	2021-10-20T09:40:18.422	Stag	955939.27	6573293.35			0	0	0	0	0	0			
PointZM (382203.48755477298982441	2021-10-20T09:40:33.023	Stag	955935.61	6573292.27			0	0	0	0	0	0			

wkt_geom	Date-Time	Type	Easting	Northing	Notes1	Comments	Small Holl	Medium Hol	Large Holl	Small Ho_1	Medium H_1	Large Ho_1	Hollow Hei	Fissuring	Decorticat
6582393.44981830567121506 0 0)															
PointZM (382187.57302505051484331 6582412.46643812581896782 0 0)	2021-10-20T09:41:26.541	Stick nest	955920.7	6573312.16	30-40cm diameter		0	0	0	0	0	0			
PointZM (382189.10812618676573038 6582415.00077098794281483 0 0)	2021-10-20T09:43:04.748	HBT stag	955922.38	6573314.62			0	0	0	0	0	0			
PointZM (382183.79759953136090189 6582430.30688363686203957 0 0)	2021-10-20T09:43:29.114	HBT stag	955917.89	6573330.22			0	0	0	0	0	0			
PointZM (382144.57454642513766885 6582477.87261155433952808 0 0)	2021-10-20T09:44:48.939	HBT stag	955881.19	6573379.95			0	0	0	0	0	0			
PointZM (382303.78697077906690538 6582072.73416067473590374 1178.1370849609375 0)	2021-10-20T10:00:14.168	HBT	956018.7	6572965.85	Stick Nest		0	0	0	0	0	0			

wkt_geom	Date-Time	Type	Easting	Northing	Notes1	Comments	Small Holl	Medium Hol	Large Holl	Small Ho_1	Medium H_1	Large Ho_1	Hollow Hei	Fissuring	Decorticat
PointZM (381562.68735388841014355 6581619.76543490309268236 1251.655029296875 0)	2021-10-20T10:16:17.029	Stick nest	955252.47	6572552.43	- approx. 70cm diam 30cm		0	0	0	0	0	0		2	
PointZM (378646.33743770531145856 6582879.84375948831439018 1170.631103515625 0)	2021-10-20T11:12:15.061	Stick nest	952401.42	6573970.94	30cm diameter		0	0	0	0	0	0			
PointZM (378650.78788971836911514 6582882.12136480025947094 1175.5596923828125 0)	2021-10-20T11:13:09.492	Stick nest	952406	6573972.98	small x 2		0	0	0	0	0	0			
PointZM (378634.96277972619282082 6582891.62746306601911783 1171.412353515625 0)	2021-10-20T11:13:41.217	Stick nest	952390.67	6573983.35	20cm diameter		0	0	0	0	0	0			
PointZM (378651.38523309078300372 6582903.99450558982789516 1173.558349609375 0)	2021-10-20T11:14:14.352	Stick nest	952407.78	6573994.84	small/medium		0	0	0	0	0	0			
PointZM (378632.05799194180872291 6582906.52264108508825302 1177.2017822265625 0)	2021-10-20T11:15:30.243	Stick nest	952388.57	6573998.41	small/medium		0	0	0	0	0	0			

wkt_geom	Date-Time	Type	Easting	Northing	Notes1	Comments	Small Holl	Medium Hol	Large Holl	Small Ho_1	Medium H_1	Large Ho_1	Hollow Hei	Fissuring	Decorticat
PointZM (378636.46374761854531243 6582891.4532471802085638 0 0)	2021-10-20T11:18:13.381	Stick nest	952392.16	6573983.1	20cm diameter		0	0	0	0	0	0			
PointZM (378739.35589262552093714 6582949.09874560870230198 1138.793212890625 0)	2021-10-20T11:23:26.454	Stag	952498.26	6574035.24			2	0	0	0	0	0		4	
PointZM (378874.43247205932857469 6583402.12391514703631401 1160.56640625 0)	2021-10-20T11:30:11.718	Stag	952657.88	6574481.39			3	6	0	0	0	0		8	
PointZM (378923.62766692345030606 6583401.47062812745571136 1163.4053955078125 0)	2021-10-20T11:32:13.822	Stick nest	952707.09	6574478.09	20cm diameter		0	0	0	0	0	0			
PointZM (378938.98679041810100898 6583465.18863922916352749 1155.660400390625 0)	2021-10-20T11:35:04.578	HBT	952725.89	6574541.03			2	0	1	0	0	0		3	
PointZM (379072.98752951971255243 6583434.03382985014468431 1159.7867431640625 0)	2021-10-20T11:37:42.999	HBT	952858.33	6574502.63			0	28	0	0	0	0		5	

wkt_geom	Date-Time	Type	Easting	Northing	Notes1	Comments	Small Holl	Medium Hol	Large Holl	Small Ho_1	Medium H_1	Large Ho_1	Hollow Hei	Fissuring	Decorticat
PointZM (378971.47603370802244172 6583268.41715572215616703 0 0)	2021-10-20T11:39:30.922	Stick nest	952747.8	6574342.33		Stick nest 30cm diameter	0	0	0	0	0	0			
PointZM (379174.08636981633026153 6583406.24828022718429565 1157.6544189453125 0)	2021-10-20T11:41:12.658	Stick nest	952958.03	6574469.36		Stick nest 30cm diameter	0	0	0	0	0	0			
PointZM (379130.8262905206065625 6583415.3069852776825428 1159.567626953125 0)	2021-10-20T11:42:20.878	HBT	952915.22	6574480.76			1	0	0	0	0	0		3	
PointZM (379006.73820609832182527 6583422.41366555448621511 0 0)	2021-10-20T11:46:13.517	HBT stag	952791.4	6574494.57			0	0	0	0	0	0			
PointZM (379012.31581616634503007 6583419.49947182089090347 0 0)	2021-10-20T11:46:51.186	Stick nest	952796.82	6574491.34	25cm diameter		0	0	0	0	0	0			
PointZM (379031.75510293047409505 6583410.69998385943472385 0 0)	2021-10-20T11:47:30.467	Stag	952815.81	6574481.49			0	0	0	0	0	0			

wkt_geom	Date-Time	Type	Easting	Northing	Notes1	Comments	Small Holl	Medium Hol	Large Holl	Small Ho_1	Medium H_1	Large Ho_1	Hollow Hei	Fissuring	Decorticat
PointZM (379059.92649168451316655 6583353.06797139532864094 0 0)	2021-10-20T11:53:09.078	Stag	952840.9	6574422.29			3	0	2	0	0	0			
PointZM (379005.41458670049905777 6583380.04094249289482832 1166.599365234375 0)	2021-10-20T11:56:51.081	Stag	952787.79	6574452.23			1	2	0	0	0	0			
PointZM (379021.03007333044661209 6583368.13976223766803741 1163.87890625 0)	2021-10-20T11:58:21.288	HBT	952802.78	6574439.47			3	1	0	0	0	0			
PointZM (379019.32372073770966381 6583357.30553476139903069 0 0)	2021-10-20T11:58:28.438	HBT	952800.49	6574428.72			0	3	3	0	0	0			
PointZM (379020.26917411404429004 6583349.48724991269409657 1162.634521484375 0)	2021-10-20T11:59:31.961	Stag	952801.01	6574420.84			2	0	0	0	0	0			
PointZM (379013.64857930212747306 6583329.70857191551476717 1163.599853515625 0)	2021-10-20T12:00:11.810	Stag	952793.32	6574401.4			1	1	0	0	0	0			

wkt_geom	Date-Time	Type	Easting	Northing	Notes1	Comments	Small Holl	Medium Hol	Large Holl	Small Ho_1	Medium H_1	Large Ho_1	Hollow Hei	Fissuring	Decorticat
PointZM (379015.78667980816680938 6583335.1731204790994525 0 0)	2021-10-20T12:00:12.268	HBT	952795.75	6574406.76			3	3	0	0	0	0		1	
PointZM (379012.95355560886673629 6583324.64259905926883221 1162.6973876953125 0)	2021-10-20T12:00:50.754	HBT	952792.35	6574396.37			1	1	0	0	0	0			
PointZM (378992.19959118950646371 6583315.4159858413040638 0 0)	2021-10-20T12:01:38.793	Stag	952771.08	6574388.26			0	0	2	0	0	0		1	
PointZM (379028.68327772838529199 6583316.31983999907970428 1161.736083984375 0)	2021-10-20T12:02:00.865	Stag	952807.64	6574387.19			0	0	0	0	0	0			
PointZM (378979.69985633547184989 6583316.0446350947022438 0 0)	2021-10-20T12:02:21.633	HBT	952758.6	6574389.56			3	0	0	0	0	0			
PointZM (379033.52781108958879486 6583324.67854554019868374 1161.69384765625 0)	2021-10-20T12:02:47.086	HBT	952812.94	6574395.29			1	1	0	0	0	0			

wkt_geom	Date-Time	Type	Easting	Northing	Notes1	Comments	Small Holl	Medium Hol	Large Holl	Small Ho_1	Medium H_1	Large Ho_1	Hollow Hei	Fissuring	Decorticat
PointZM (378959.32380658143665642 6583286.64085174817591906 0 0)	2021-10-20T12:04:54.756	HBT	952736.62	6574361.22			2	1	0	0	0	0		2	
PointZM (379022.73985972657101229 6583264.39010525401681662 1169.7867431640625 0)	2021-10-20T12:05:41.244	Stag	952798.9	6574335.53			1	0	0	0	0	0			
PointZM (378956.68686509563121945 6583292.62345289811491966 0 0)	2021-10-20T12:05:48.179	Stag	952734.31	6574367.36	decorticating bark		0	3	0	0	0	0		2	Yes
PointZM (379006.35084154410287738 6583275.54868386127054691 1165.4620361328125 0)	2021-10-20T12:06:54.304	Stick nest	952783.09	6574347.59	Active nest - black faced cuckoo shrike		0	0	0	0	0	0			
PointZM (378957.97355736693134531 6583309.83867134898900986 0 0)	2021-10-20T12:06:58.265	HBT	952736.52	6574384.52			0	0	2	0	0	0			
PointZM (378972.64049347210675478 6583338.15100453607738018 0 0)	2021-10-20T12:07:49.859	HBT	952752.73	6574412.07			8	1	1	0	0	0			

wkt_geom	Date-Time	Type	Easting	Northing	Notes1	Comments	Small Holl	Medium Hol	Large Holl	Small Ho_1	Medium H_1	Large Ho_1	Hollow Hei	Fissuring	Decorticat
PointZM (378975.4138435028726235 6583336.14101112820208073 0 0)	2021-10-20T12:08:40.209	HBT	952755.4	6574409.91			0	0	0	0	0	0			
PointZM (379007.70816067600389943 6583382.39695074502378702 0 0)	2021-10-20T12:09:23.423	HBT	952790.21	6574454.46			0	0	0	0	0	0			
PointZM (378999.44112535601016134 6583371.80902659147977829 0 0)	2021-10-20T12:09:26.995	HBT stag	952781.37	6574444.31			0	0	0	0	0	0			Yes
PointZM (378994.18865908228326589 6583383.50740878470242023 1170.3026123046875 0)	2021-10-20T12:10:01.558	HBT	952776.74	6574456.3			1	1	0	0	0	0			
PointZM (386185.81014463637256995 6587304.96348054241389036 0 0)	2021-10-20T13:53:49.529	Stick nest	960186.55	6577993.92	20cm diameter		0	0	0	0	0	0			
PointZM (386127.23987201135605574 6587305.48990757018327713 0 0)	2021-10-20T13:59:45.646	Stag	960127.95	6577997.59			10	0	0	0	0	0		1	

wkt_geom	Date-Time	Type	Easting	Northing	Notes1	Comments	Small Holl	Medium Hol	Large Holl	Small Ho_1	Medium H_1	Large Ho_1	Hollow Hei	Fissuring	Decorticat
PointZM (386024.13408946432173252 6587261.34780252538621426 1188.4871826171875 0)	2021-10-20T14:12:32.995	Stick nest	960022.36	6577958.97	30cm diameter		0	0	0	0	0	0			
PointZM (385992.9177469820715487 6587267.64229988027364016 1172.134521484375 0)	2021-10-20T14:16:23.271	stick nest	959991.45	6577966.95	30 diameter		0	0	0	0	0	0			
PointZM (369176.93511770066106692 6576957.3625287152826786 1266.2164306640625 0)	2021-10-21T08:19:45.931	Stag	942604.67	6568554.54			1	0	0	0	0	0			
PointZM (369181.19330486637772992 6577067.56111410725861788 1264.9527587890625 0)	2021-10-21T08:23:49.210	HBT	942614.88	6568664.58			1	1	0	0	0	0		1	
PointZM (369186.1023148613749072 6577107.22242032736539841 1256.58251953125 0)	2021-10-21T08:25:41.901	Stick nest 20cm diameter	942621.94	6568704.01			0	0	0	0	0	0			
PointZM (369164.79102399118710309 6577097.59990324266254902 1257.1329345703125 0)	2021-10-21T08:27:49.596	Stick nest	942600.09	6568695.53	20cm diameter		0	0	0	0	0	0			

wkt_geom	Date-Time	Type	Easting	Northing	Notes1	Comments	Small Holl	Medium Hol	Large Holl	Small Ho_1	Medium H_1	Large Ho_1	Hollow Hei	Fissuring	Decorticat
PointZM (369048.93124373076716438 6577124.39499285817146301 1268.18701171875 0)	2021-10-21T08:32:09.732	Stag	942485.59	6568728.6			1	1	0	0	0	0			
PointZM (369030.94811891409335658 6577122.48768404312431812 1268.513427734375 0)	2021-10-21T08:33:09.058	Stag	942467.49	6568727.66			2	1	0	0	0	0			
PointZM (368987.21519478160189465 6577045.47575414180755615 1256.9937744140625 0)	2021-10-21T08:34:52.215	stick nest	942419.57	6568652.95	40cm diameter		0	0	0	0	0	0			
PointZM (391055.21372736181365326 6570262.30881336145102978 1324.5277099609375 0)	2021-10-21T10:09:36.955	Stag	964140.76	6560670.82			1	1	0	0	0	0			
PointZM (391044.11869173322338611 6570236.26453028433024883 1318.5821533203125 0)	2021-10-21T10:11:42.225	HBT	964128.25	6560645.35			2	2	0	0	0	0			
PointZM (391003.28790554916486144 6570182.19112094864249229 1321.2781982421875 0)	2021-10-21T10:15:21.609	HBT	964084.45	6560593.43			3	1	0	0	0	0			

wkt_geom	Date-Time	Type	Easting	Northing	Notes1	Comments	Small Holl	Medium Hol	Large Holl	Small Ho_1	Medium H_1	Large Ho_1	Hollow Hei	Fissuring	Decorticat
PointZM (390992.39192325109615922 6570144.40345083363354206 1324.9366455078125 0)	2021-10-21T10:17:19.684	HBT and stick nest	964071.5	6560556.19	approx 30cm diameter		1	4	1	0	0	0			
PointZM (390971.26346040680073202 6570140.29804611578583717 1320.59619140625 0)	2021-10-21T10:20:36.731	HBT	964050.12	6560553.22			3	1	0	0	0	0			
PointZM (393135.18865965737495571 6566191.75253398716449738 1342.0008544921875 0)	2021-10-21T12:19:27.286	HBT	966002.54	6556483.31			2	0	0	0	0	0		1	
PointZM (393133.39001082093454897 6566174.45226442068815231 1342.45068359375 0)	2021-10-21T12:20:50.101	Stick nest	965999.8	6556466.09	20cm diameter		0	0	0	0	0	0			
PointZM (393276.34934006596449763 6566072.28218115027993917 1324.3883056640625 0)	2021-10-21T12:23:59.298	Stick nest	966137.38	6556356.06	60cm diameter		0	0	0	0	0	0			
PointZM (393240.70259437395725399 6565714.0917388591915369 1307.4151611328125 0)	2021-10-21T13:08:04.030	Stick nest	966082.29	6555999.42	x 2 approx 30cm each		0	0	0	0	0	0			

wkt_geom	Date-Time	Type	Easting	Northing	Notes1	Comments	Small Holl	Medium Hol	Large Holl	Small Ho_1	Medium H_1	Large Ho_1	Hollow Hei	Fissuring	Decortical
PointZM (366129.1215000000083819 6581859.24849999975413084 0 0)		HBT	366129.122	6581859.25			0	0	0	0	0	0			
PointZM (389036.57346733118174598 6566155.75088605098426342 0 0)		HBT	389036.573	6566155.75			3	0	0	0	0	0		1	
PointZM (389026.8481160377850756 6566139.23338531702756882 0 0)		Stag	389026.848	6566139.23			0	0	1	0	1	0			
PointZM (389042.87960613728500903 6566183.72372373752295971 0 0)		HBT	389042.88	6566183.72			2	0		0	0	0		1	Yes
PointZM (390587.61938911303877831 6569723.11299631558358669 0 0)		HBT	390587.619	6569723.11			0	0	1	0	0	0		3	
PointZM (390880.5190953912679106 6568253.8942828681319952 0 0)		HBT	390880.519	6568253.89			0	0	1	0	0	0		1	

wkt_geom	Date-Time	Type	Easting	Northing	Notes1	Comments	Small Holl	Medium Hol	Large Holl	Small Ho_1	Medium H_1	Large Ho_1	Hollow Hei	Fissuring	Decorticat
PointZM (389030.21584240038646385 6566132.70230456814169884 0 0)		HBT	389030.216	6566132.7			0	0	1	0	1	0			
PointZM (390632.36247678590007126 6569765.17768345959484577 0 0)		HBT	390632.362	6569765.18			0	0	1	0	0	0	10	1	
PointZM (390881.08554288034792989 6570262.00001638289541006 0 0)		HBT	390881.086	6570262	Raptor stick nest		0	0	0	0	0	0			
PointZM (390618.85445054020965472 6569740.38653908669948578 0 0)		Stag	390618.854	6569740.39			0	0	1	0	0	0			
PointZM (389094.95439311064546928 6572027.54581586364656687 0 0)		HBT	389094.954	6572027.55			2	0	0	0	0	0		1	
PointZM (389104.74708973080851138 6572024.00763393193483353 0 0)		HBT	389104.747	6572024.01			3	0	0	1	0	0			

wkt_geom	Date-Time	Type	Easting	Northing	Notes1	Comments	Small Holl	Medium Hol	Large Holl	Small Ho_1	Medium H_1	Large Ho_1	Hollow Hei	Fissuring	Decorticat
PointZM (388979.34215772338211536 6572170.17204668279737234 0 0)		HBT	388979.342	6572170.17			0	0	1	0	1	0	7	1	
PointZM (389041.46818913862807676 6572011.21253936924040318 0 0)		HBT	389041.468	6572011.21			0	1	0	0	0	0			
PointZM (389041.49352164776064456 6572008.78589487355202436 0 0)		Stag	389041.494	6572008.79			0	0	1	0	0	0			
PointZM (389033.77250233793165535 6566108.11595841590315104 0 0)		HBT	389033.773	6566108.12			1	0	0	1	0	0		1	
PointZM (389038.15540488820988685 6572094.90692147612571716 0 0)		HBT	389038.155	6572094.91			2	1	0	0	0	0	10	1	
PointZM (388671.17727546801324934 6571828.78117433935403824 0 0)		HBT	388671.177	6571828.78			1	1	0	0	0	0	8	1	Yes

wkt_geom	Date-Time	Type	Easting	Northing	Notes1	Comments	Small Holl	Medium Hol	Large Holl	Small Ho_1	Medium H_1	Large Ho_1	Hollow Hei	Fissuring	Decorticat
PointZM (388721.8317158175050281 6571926.22371653094887733 0 0)		Stag	388721.832	6571926.22			0	0	1	0	0	0			
PointZM (389043.93219808931462467 6572008.81135642807930708 0 0)		HBT	389043.932	6572008.81			0	1	0	0	0	0			
PointZM (388631.03994534659432247 6571949.67498723790049553 0 0)		HBT	388631.04	6571949.67			0	1	0	0	0	0	6	1	
PointZM (388542.6798055573599413 6572169.06334036402404308 0 0)		HBT	388542.68	6572169.06			0	1	3	0	0	0		1	
PointZM (388592.86008704651612788 6572117.68160763382911682 0 0)		HBT	388592.86	6572117.68			3	0	0	0	0	0		1	
PointZM (390878.44977164710871875 6568255.91149908676743507 0 0)		Stag	390878.45	6568255.91			0	0	1	0	0	0			

wkt_geom	Date-Time	Type	Easting	Northing	Notes1	Comments	Small Holl	Medium Hol	Large Holl	Small Ho_1	Medium H_1	Large Ho_1	Hollow Hei	Fissuring	Decorticat
PointZM (386871.2159817031933926 6569514.13948307186365128 0 0)		HBT	386871.216	6569514.14			0	1	0	0	1	0		1	
PointZM (389033.65227926836814731 6566119.60569280758500099 0 0)		HBT	389033.652	6566119.61			0	0	1	0	0	0		1	
PointZM (389030.3532427396858111 6566119.57118184398859739 0 0)		Stag	389030.353	6566119.57			0	0	1	0	0	0		1	
PointZM (388643.78049580188235268 6571960.46705303713679314 0 0)		HBT	388643.78	6571960.47			2	1	0	0	0	0	4	1	Yes
PointZM (389023.63495556637644768 6566130.99188589304685593 0 0)		HBT	389023.635	6566130.99			0	0	1	0	0	0		1	
PointZM (386910.48090000002412125 6585810.29030000045895576 0 0)		HBT	386910.481	6585810.29			0	0	1	0	0	0			

wkt_geom	Date-Time	Type	Easting	Northing	Notes1	Comments	Small Holl	Medium Hol	Large Holl	Small Ho_1	Medium H_1	Large Ho_1	Hollow Hei	Fissuring	Decorticat
PointZM (383607.63780000002589077 6577431.9988000001758337 0 0)		HBT	383607.638	6577432		Large	0	0	1	0	0	0			
PointZM (389152.41230000002542511 6565069.59460000041872263 0 0)		HBT	389152.412	6565069.59			0	0	2	0	0	0			
PointZM (374424.09330000000772998 6588081.598000000230968 0 0)		HBT	374424.093	6588081.6			0	0	1	0	0	0			
PointZM (379174.64120000001275912 6583204.18589999992400408 0 0)		HBT	379174.641	6583204.19		Medium hollow bearing tree	0	0	1	0	0	0			
PointZM (380151.05749999999534339 6585051.10580000001937151 0 0)		HBT	380151.057	6585051.11		4 x medium limb hollw 1 x potential trunk hollow (large)	0	4	1	0	0	0			
PointZM (379953.49800000002142042		HBT	379953.498	6587150.67		Large	0	0	2	0	0	0			

wkt_geom	Date-Time	Type	Easting	Northing	Notes1	Comments	Small Holl	Medium Hol	Large Holl	Small Ho_1	Medium H_1	Large Ho_1	Hollow Hei	Fissuring	Decorticat
6587150.66689999960362911 0 0)															
PointZM (374156.27549999998882413 6582885.93950000032782555 0 0)		HBT	374156.276	6582885.94	nesting habitat little lori. g glider habitat	Little lorikeet- (abundant small trunk hollows in living trees)	1	0	0	0	0	0			
PointZM (379318.55920000001788139 6583378.97099999990314245 0 0)		HBT	3871110.41	56567252.7			0	0	2	0	0	0			
PointZM (391062.18910000001778826 6569766.17420000024139881 0 0)		HBT	391062.189	6569766.17		2xlarge pot. Hollows approx. 4xmedium hollows. E. Obliqua DBH 130 height 35 - 40.	0	4	2	0	0	0			
PointZM (388920.33769999997457489 6564973.79769999999552965 0 0)		HBT	388920.338	6564973.8		Multiple hollows	0	0	5	0	0	0			

wkt_geom	Date-Time	Type	Easting	Northing	Notes1	Comments	Small Holl	Medium Hol	Large Holl	Small Ho_1	Medium H_1	Large Ho_1	Hollow Hei	Fissuring	Decorticat
PointZM (391493.61869999999180436 6569014.2346000000834465 0 0)		HBT	391493.619	6569014.23		Large stag w to 2xlarge >30 1xsmall<10	1	0	2	0	0	0			

Appendix J EPBC Protected Matters Search

Appendix K EPBC habitat assessment

Entities highlighted in blue have been determined to be present onsite or potentially impacted by the proposal.

Scientific Name	Common Name	EPBC ACT	Presence of habitat	Likelihood of Occurrence	SEARs requirement	Impacts likely, species presence, AOS results
Litoria castanea	Yellow-spotted Tree Frog	E	Present	Moderate	NA	Absent – not detected during targeted surveys in December 2021(See sect.4.2).
Litoria piperata	Peppered Tree Frog	V	Present	Moderate	NA	Absent – not detected during targeted surveys in December 2021 (See sect.4.2).
Anthochaera phrygia	Regent Honeyeater	CE	Marginal	Moderate	NA	Potential foraging habitat. AoS – Nonsignificant.
Apus pacificus	Fork-tailed Swift	M	Present	Moderate	Impact Likely	AoS – Significant. Risk stated as moderate by NA for collision risk,
Gallinago hardwickii	Latham's Snipe	M	Marginal	Moderate	NA	Potential foraging habitat. AoS – Nonsignificant.
Grantiella picta	Painted Honeyeater	V	Present	Moderate	NA	Potential foraging habitat. AoS – Nonsignificant.
Lathamus discolor	Swift Parrot	CE	Marginal	Moderate	NA	Potential foraging habitat. AoS – Nonsignificant.
Arthraxon hispidus	Hairy Jointgrass	V	Marginal	Moderate	NA	Absent – not detected during targeted surveys in March 2021; April 2021; November 2020 & 2021; December 2021 (See sect.4.2).
Bertya ingramii	Narrow-leaved Bertya	E	Marginal	Moderate	Potential Impact	Absent – not detected during targeted surveys in March 2021; April 2021; September 2020; October 2020 & 2021;

Scientific Name	Common Name	EPBC ACT	Presence of habitat	Likelihood of Occurrence	SEARs requirement	Impacts likely, species presence, AOS results
						November 2020 & 2021; December 2021 (See sect.4.2).
Callistemon pungens		V	Marginal	Moderate	NA	Absent – not detected during targeted surveys in September 2020; October 2020 & 2021; November 2020 & 2021; December 2021 (See sect.4.2).
Dichanthium setosum	Bluegrass	V	Present	Recorded	NA	AoS – Significant. Species detected. Offsets have been generated under the BOS.
Diuris eborensis		E	Marginal	Moderate	NA	Absent – not detected during targeted surveys in November 2020 & 2021; December 2021 (See sect.4.2).
Diuris pedunculata	Small Snake Orchid	E	Present	High	NA	Absent – not detected during targeted surveys in September 2020; October 2020 & 2021 (See sect.4.2).
Eucalyptus mckieana	McKie's Stringybark	V	Present	Moderate	NA	Absent – not detected during targeted surveys in March 2021; April 2021; September 2020; October 2020 & 2021; November 2020 & 2021; December 2021 (See sect.4.2).
Eucalyptus nicholii	Narrow-leaved Black Peppermint	V	Present	Recorded	Impact Likely	AoS – Detected. Offsets have been generated under the BOS.
Euphrasia arguta		CE	Marginal	Moderate	NA	Absent – not detected during targeted surveys (See sect.4.2).
Grevillea beadleana	Beadle's Grevillea	E	Marginal	Moderate	NA	Absent – not detected during targeted surveys in November 2020 & 2021; December 2021; March 2021 (See sect.4.2).

Scientific Name	Common Name	EPBC ACT	Presence of habitat	Likelihood of Occurrence	SEARs requirement	Impacts likely, species presence, AOS results
Hirundapus caudacutus	White-throated Needletail	M	Present	Assumed Present	Impact Likely	AoS – Significant. Risk stated as moderate by NA for collision risk, not detected during surveys but multiple EBird records
Persicaria elatior	Tall Knotweed	V	Marginal	Moderate	NA	Absent – not detected during targeted surveys in March 2021; April 2021; & December 2021 (See sect.4.2).
Picris evae	Hawkweed	V	Present	High	NA	Absent – not detected during targeted surveys (See sect.4.2).
Thesium australe	Austral Toadflax	V	Present	High	Transport route	Absent – not detected during targeted surveys (See sect.4.2).
Dasyurus maculatus maculatus	Spotted-tailed Quoll	E	Present	Recorded	Impact Likely	AoS – Significant,. Detected, is an ecosystem credit generating species, and credits have been generated under the BOS.
Petauroides volans	Greater Glider	V	Present	Recorded	Impact likely	AoS – Species detected. Species credits have been generated under the BOS.
Petrogale penicillata	Brush-tailed Rock-Wallaby		Present	Moderate	Potential Impact	Absent – not detected during targeted surveys (See sect.4.2).
Phascolarctos cinereus	Koala	V	Present	Recorded	Impact likely	AoS – Species detected. Species credits have been generated under the BOS.
Pseudomys oralis	Hastings River Mouse	E	Marginal	Moderate	NA	Absent – not detected during targeted surveys in December (See sect.4.2).
Pteropus poliocephalus	Grey-headed Flying-fox	V	Marginal	Moderate	NA	–Absent – breeding habitat not detected during surveys, however foraging habitat is present. AOS nonsignificant.

Scientific Name	Common Name	EPBC ACT	Presence of habitat	Likelihood of Occurrence	SEARs requirement	Impacts likely, species presence, AOS results
Uvidicolus sphyrurus	Border Thick-tailed Gecko	V	Present	Moderate	NA	Absent – not detected during targeted surveys (See sect.4.2).
New England Peppermint (Eucalyptus nova-anglica) Grassy Woodlands		CE	Present	Known	Impact likely	AoS – Ecosystem credits have been generated under the BOS.
White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland		CE	Present	Known	Transport Route	AoS – Ecosystem credits have been generated under the BOS.

Appendix L EPBC Assessment of significant impact

The EPBC Act specifies factors to be taken into account in deciding whether a development is likely to significantly affect EEC, threatened species and migratory species, listed at the Commonwealth level. Section 7.5 details the EPBC species that were required to be assessed as part of the BDAR. The following assesses the significance of the likely impacts associated with the proposed works on species that were either detected onsite or are considered at risk due to the proposed wind farm operation:

- New England Peppermint (*Eucalyptus nova-anglica*) Grassy Woodlands ecological community (critically endangered)
- White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland (Critically Endangered)
- Spotted-tail Quoll *Dasyurus maculatus* (Endangered)
- Koala *Phascolarctos cinereus* (Vulnerable)[7]
- Greater Glider *Petauroides volans* (Vulnerable)
- Narrow-leaved Black Peppermint *Eucalyptus nicholii* (Vulnerable)
- Swift Parrot *Lathamus discolor* (Critically Endangered)
- Regent Honeyeater *Anthochaera phrygia* (Critically Endangered)
- Painted Honeyeater *Grantiella picta* (Vulnerable)
- Bluegrass *Dichanthium setosum* (Vulnerable)
- White-throated Needletail *Hirundapus caudacutus* (Vulnerable)
- Fork-tailed Swift *Apus pacificus* (Vulnerable)
- Latham's Snipe *Gallinago hardwickii* (Migratory)
- Grey-headed Flying-fox *Pteropus poliocephalus* (Vulnerable)

Different significant impact criteria apply depending on the level at which a species or community is listed (i.e., vulnerable, endangered, critically endangered etc.). The appropriate criteria have been applied to the entities listed above.

In the context of the assessments below, 'the action' refers to 'the proposal' as described in Section 1.1. All MNES entities proposed to be impacted by the proposal are mapped in Figure 7-2.

Significant impact criteria

a) An action is likely to have a significant impact on a critically endangered or endangered species if there is a real chance or possibility that it will:
    - *reduce the area of occupancy of the species*
    - *fragment an existing population into two or more populations*
    - *adversely affect habitat critical to the survival of a species*
    - *disrupt the breeding cycle of a population*

[7] Koala has since been up-listed from Vulnerable to Endangered, however under the EPBC Act the project was declared a controlled action when Koala was vulnerable, and therefore this assessment continues to assess Koala as vulnerable.

- _modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline_
- _result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat_
- _introduce disease that may cause the species to decline, or_
- _interfere with the recovery of the species._

b) A 'population of a species' is defined under the EPBC Act as an occurrence of the species in a particular area. In relation to critically endangered, endangered or vulnerable threatened species, occurrences include but are not limited to:

- _a geographically distinct regional population, or collection of local populations, or_
- _a population, or collection of local populations, that occurs within a particular bioregion._

c) An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:

- _lead to a long-term decrease in the size of an important population of a species_
- _reduce the area of occupancy of an important population_
- _fragment an existing important population into two or more populations_
- _adversely affect habitat critical to the survival of a species_
- _disrupt the breeding cycle of an important population_
- _modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline_
- _result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat_
- _introduce disease that may cause the species to decline, or_
- _interfere substantially with the recovery of the species._

d) Each of these criteria are addressed below. An 'important population' is a population that is necessary for a species' long-term survival and recovery. This may include populations identified as such in recovery plans, and/or that are:

- _key source populations either for breeding or dispersal_
- _populations that are necessary for maintaining genetic diversity, and/or_
- _populations that are near the limit of the species range._

L.1 New England Peppermint (_Eucalyptus nova-anglica_) Grassy Woodlands

a) reduce the extent of an ecological community?
New England Peppermint (_Eucalyptus nova-anglica_) Grassy Woodland CEEC in the New England Tableland Bioregion is considered to be very poorly reserved throughout its range, with less than 3% of the remaining area thought to occur within the conservation estate (Benson & Ashby, 2000; Benson et al. 2010). Reserves containing the community include Bolivia Hill, Booroolong, Duval, Imbota and Yina Nature Reserves.

There is native vegetation within the development site which conforms to New England Peppermint (*Eucalyptus nova-anglica*) Grassy Woodlands, with 143.45ha occurring in the Development site. This CEEC was a key focus during project design to best avoid impacts (see Section 6). Less than 1% of the CEEC within the Development site (1.42ha) will be removed due to the project. Of this, all of it is woodland.

The project is not likely to significantly reduce the local extent of the community.

b) fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines

The CEEC occurring within the development site has poor connectivity generally. Historical clearing for agricultural (predominantly livestock grazing) has meant that most areas of the CEEC that exist within and outside of the development footprint do not connect with one another. As much of the community that would be removed constitutes small patches with an already sparse, poorly connected canopy, the project would result in only minor further fragmentation of the community.

c) Will modify or destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for an ecological community's survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns

Whilst surface flows will be temporarily altered during construction, it is considered unlikely that the abiotic factors necessary for the community's survival would be modified or destroyed by the project with standard controls put into place (i.e., see Section 8).

d) cause a substantial change in the species composition of an occurrence of an ecological community, including causing a decline or loss of functionally important species, for example through regular burning or flora or fauna harvesting?

The project will remove an area of 1.42ha of New England Peppermint Grassy Woodland CEEC. These areas are already influenced by the invasion of exotic improved pasture species but contain enough native understory to be considered analogous with this community.

There are three discrete patches of New England Peppermint Grassy Woodland CEEC within the Development site. Of these, one is already bisected by Bark Hut Road and all three are currently under grazing.

Weed management and other mitigation measures will limit impacts from edge effects and the project is not expected to exasperate the invasion of exotic improved pasture species within CEEC outside of the development footprint.

As such, the project will not cause a substantial change in the species composition of the CEEC within the Development site.

e) cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to:

- **assisting invasive species, that are harmful to the listed ecological community, to become established, or**
- **causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community, or**
- **interfere with the recovery of an ecological community**

The project is not considered likely to generate an increase in invasive species harmful to the ecological community. Mitigation measures implemented during construction will manage and restrict weed movement through the project site. It is considered unlikely that project would kill or inhibit the growth of the community from the regular mobilisation of fertilisers, herbicides or other chemicals. Weed control will be done in accordance with the project BMP and will be sensitive to CEEC presence within the Development site and beyond. The New England Peppermint Grassy Woodland CEEC that occurs within the development site is already highly modified and subject to ongoing land use pressures, lowering its overall conservation value.
Conclusion
The project will impact on 1.42ha of New England Peppermint Grassy Woodland CEEC. This is considered unlikely to generate a significant impact to the community and impacts to this community will be managed by the BOS under the NSW Bilateral Agreement.

L.2 White Box – Yellow Box – Blakely's Red Gum grassy woodland and derived native grassland

a) reduce the extent of an ecological community?
Australia-wide, there are an estimated 416,325ha of EPBC Act listed White Box-Yellow Box Blakley's Red Gum Grassy Woodland and Derived Native Grassland remaining, which is only 8% of its original pre-1750 extent (Threatened Species Scientific Committee, 2006). Within NSW, there are an estimated 250,729ha of this TEC remaining, 7% of the pre-1750 extent (Threatened Species Scientific Committee, 2006). As these are 15-year-old estimates, the current extent within NSW and Australia-wide is likely to be lower. This community is considered to be critically endangered under the EPBC Act. Native vegetation that is considered to conform to White Box – Yellow Box – Blakeley's Red Gum – Grassy Woodland and Derived Native Grassland (Box-gum Woodland and grasslands CEEC) occurs within the development site. This represents areas of both PCT 510, which occurs within the development site as a woodland and derived native grassland, and of PCT 567 that have co-dominance of Yellow Box and Blakely's Red Gum. There is 217.19ha of White Box-Yellow Box Blakley's Red Gum Grassy Woodland and Derived Native Grassland CEEC within the development site. The total area of the CEEC to be directly impacted by the proposal is 36.1ha (17% of the extent within the broader development site). As such, the project is likely to reduce the local extent of the community
b) fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines
The Box-gum Woodland and grasslands CEEC occurring within the development site has low connectivity generally. Historical clearing for agricultural livestock grazing has meant that most areas of the CEEC that exist within and outside of the development footprint do not connect with one another. As much of the community that would be removed constitutes small patches with a sparse, poorly connected canopy, the project would result in only minor additional fragmentation of the community.

c) Will modify or destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for an ecological community's survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns
Whilst surface flows will be temporarily altered during construction, it is considered unlikely that the abiotic factors necessary for the community's survival would be modified or destroyed by the project with standard controls put into place (i.e., see Section 8).
d) cause a substantial change in the species composition of an occurrence of an ecological community, including causing a decline or loss of functionally important species, for example through regular burning or flora or fauna harvesting?
The project will remove an area of approximately 36.1ha of Box-gum Woodland and grasslands CEEC. These areas are already influenced by the invasion of exotic improved pasture species but contain enough native understory to be considered analogous with this community. Weed management and other mitigation measures will limit impacts from edge effects and the project is not expected to exacerbate the invasion of exotic improved pasture species within CEEC outside of the development footprint. As such, the project will not cause a substantial change in the species composition of the CEEC within the Development site.
f) cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to: **assisting invasive species, that are harmful to the listed ecological community, to become established, or** **causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community, or** **interfere with the recovery of an ecological community**
The project is not considered likely to generate an increase in invasive species harmful to the ecological community. Mitigation measures implemented during construction will manage and restrict weed movement through the project site. It is considered unlikely that project would kill or inhibit the growth of the community from the regular mobilisation of fertilisers, herbicides or other chemicals. Weed control will be done in accordance with the project BMP and will be sensitive to CEEC presence within the Development site and beyond. The Box-gum Woodland and grasslands CEEC that occurs within the development site is already highly modified and subject to ongoing land use pressures, lowering its overall conservation value.
Conclusion
The project will impact on 36.1ha of Box-gum Woodland and grasslands CEEC. This is considered likely to generate a significant impact to the community and impacts to this community will be managed by the BOS under the NSW Bilateral Agreement.

L.3 Spotted-tail Quoll (*Dasyurus maculatus maculatus)*

a) Lead to a long-term decrease in the size of a population of a species?

Evidence of the EPBC Act endangered Spotted-tail Quoll was observed twice in November 2019, both times within dense patches of woodland outside of the development footprint in the centre of the development boundary. The project contains approximately 426ha of suitable habitat for this species. Suitable habitat for Spotted-tail Quoll includes mature, wet forest with greater than 600 mm rainfall per annum (Belcher, 2000; Edgar & Belcher, 2008). Belcher (2000) also identified that this species prefers cliffs, caves, escarpments and other rocky habitat.

Areas of denser vegetation contain an abundance of fallen logs and some rocky areas. 426ha of potential habitat will be removed or modified as a result of the project. This includes isolated areas of rock outcrop within the development site, mostly consisting of largely embedded rock and sporadic loose rock. This area represents approximately 7% of suitable habitat available to this species in the wider development site.

The risk of direct mortality as a result of clearing is considered unlikely given the mitigation measures which will be applied (Section 8, i.e., clearing will be undertaken with supervision by an ecologist or trained spotter catcher to allow for resident fauna to relocate). The other associated impacts including habitat fragmentation and direct removal of potential foraging habitat are likely to have significant residual impact to the species.

b) Reduce the area of occupancy of a population

As noted above, 426ha of potential habitat will be removed or modified as a result of the project. Whilst the project has been designed to minimise impacts to areas of good quality vegetation where possible, impacts to potential Spotted-tail Quoll habitat cannot be avoided. However, large stands of protected, good quality habitat are available within the wider development site and the adjacent Oxley Wild Rivers.

As such, the project is likely to reduce the local area of occupancy of this species but not the total range of the population.

c) Fragment an existing population into two or more populations;

The project will result in the direct loss of foraging habitat and shelter which may interrupt the species ability to move freely throughout the landscape, however areas of clearing and hardstand associated with access tracks to wind turbines will not present a significant barrier to this mobile species.

Intact patches of dense vegetation and higher condition vegetation have been preferentially avoided through design.

Due to the above, the linear nature of the project and the species being highly mobile, the project is unlikely to fragment an existing important population into two or more populations.

d) Adversely affect habitat critical to the survival of a species

While there is no current critical habitat declared for this species, Spotted-tail Quolls are known to depend on woodland areas with an abundance of rocky areas and fallen logs to provide potential den sites.

Approximately 426ha of suitable habitat would be removed, this does not represent continuous habitat but rather fragmented portions. This species has a substantial home range, with an estimate of 620–2,560ha for males, and 90–650ha for females (Claridge, et al., 2005). Spotted-tail Quoll range has reduced significantly over the years, and in NSW is now limited to within 200km of the coast between Kosciuszko

National Park and the Queensland border, including gorges and escarpments of the New England Tableland (Maxwell, Burbidge, & Morris, 1996). Considering the large home range and distribution of the Spotted-tail Quoll, along with the availability of quality habitat adjacent to the development site, it is unlikely that the habitat to be impacted by the project is critical to the survival of this species, though is likely to be valuable to local individuals.
e) Disrupt the breeding cycle of a population
Research by Belcher and Darrant (2004) show that Spotted-tail Quoll require suitable den sites for breeding. Where available, complex rocky outcrops and large hollow logs are preferentially used as denning sites for Spotted-tail Quoll (Belcher & Darrant, 2004; Glen & Dickman, 2006). Where preferred denning habitat is absent, Spotted-tail Quoll have been recorded using HBTs. Spotted-tail Quoll are known to occupy very large home ranges (up to several thousand hectares) and use multiple dens (up to 20) (Long & Nelson, 2010; Claridge, et al., 2005). 426ha of potential breeding habitat would be removed, however, the availability of quality habitat adjacent to the development site would remain untouched. As such, the project is considered unlikely to disrupt the breeding cycle of an important population.
f) Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline
It is considered that the project will not impact the availability of quality of habitat to the extent that the species is likely to decline. However, the direct loss of 426ha may contribute to the local population declining.
g) Result in invasive species that are harmful to an vulnerable species becoming established in the endangered species' habitat
Dietary overlap between Spotted-tail Quoll and invasive species such as the Red Fox (*Vulpes vulpes*), Feral Cat (*Felis catus*) and Wild Dog (*Canis lupus ssp.*) presents strong competition for resources, with small-medium mammals being an important prey item for all of them. Glen & Dickman (2006) found the most important prey for all these predators were small to medium-sized mammals, with Greater Glider the most frequently consumed mammal by Spotted-tail Quoll. The invasive Red Fox, Feral Cat and Feral Dog are known to already exist within the development site. The Biodiversity Management Plan (see Section 8) will include weed and pest management measures to reduce the likelihood of spreading and increasing the number of invasive fauna. As such, it is considered unlikely that the project will result in invasive species that are harmful to Spotted-tail Quoll.
h) Introduce disease that may cause the species to decline;
Ectoparasites have been recorded on Spotted-tail Quoll within NSW, causing a mange-like skin condition when coupled with environmental stressors (Vilcins, Old, Kortner, & Deane, 2008). Feral cats may spread disease which affects Spotted-tail Quoll (Department of Planning and Environment, 2022). With the implementation of pest animal management measures, it is considered unlikely that diseases will be introduced as a result of the project.
i) Interfere substantially with the recovery of the species;

The National Recovery Plan for the Spotted-tailed Quoll evaluates success of the recovery plan against a number of criteria with the follow of particular relevance: • Reduce the rate of habitat loss and fragmentation on private land. • Determine and manage the threat posed by introduced predators (foxes, cats, wild dogs) and of predator control practices on Spotted-tailed Quoll populations. Introduced predators will be actively managed across the development site through both construction and operation. Habitat within the development site is already fragmented, and patches of dense and/or higher condition habitat has preferentially been avoided by the project design. Notwithstanding this, the project will result in the loss of up to 426ha potential habitat for this species and therefore is inconsistent with the objectives of the recovery plan and may interfere with the recovery of this species.
Conclusion
The project will result in the loss of up to 426ha potential habitat for this species which may lead to a long-term decrease in the local population, reduce the area of occupancy for the local population and interfere with the recovery of the species. Considering the above, a significant residual impact is considered likely. Impacts to this species will be managed by the BOS under the NSW Bilateral Agreement.

L.4 Koala (*Phascolarctos cinereus)*

a) Lead to a long-term decrease in the size of an important population
Targeted surveys undertaken revealed evidence of the EPBC Act Vulnerable[8] Koala via scats at three (3) locations within the development site. Despite more than 2,600 survey hours spent on site by the NGH ecology team over 2021 and 2022, no other sign was recorded and there was no direct sighting (see section 4.2.5 for information on targeted surveys). As such, this species is considered to exist on site, albeit in low numbers or potentially in a transient manner. The Project is located at the edge of an area of much larger and well-connected Koala habitat, which forms a contiguous landscape across the adjacent protected areas, with patchy connectivity in the flats through agricultural lands. It is acknowledged that the severe bushfires of 2019/20 significantly impacted the combined Koala population of Qld, NSW and the ACT, with 12% of the Koala population within the fire extent (Department of Agriculture, Water and the Environment, 2020a). As a result, Koala has been identified as high priority mammal species recommended for urgent management intervention to support ecological recovery (Department of Agriculture, Water and the Environment, 2020b). There is 1,605.59ha of Koala habitat across the development site, with 206.73ha in the development footprint directly impacted (13% of the available habitat in immediate proximity). Given the linear nature of the proposed project and the minimisation, avoidance and mitigation measures which will be applied (see Sections 6 and 8), a long-term decrease in the local population size is considered unlikely.
b) Reduce the area of occupancy of an important population

[8] Koala status was Vulnerable at the time of the controlled action decision on the EPBC referral. Despite up-listing to Endangered in February 2022, this species will be assessed against the Vulnerable criteria.

Koalas are known to be associated with all PCTs recorded on site, as such up to 206.73ha of suitable koala habitat will be cleared. Whilst the project has been designed to minimise impacts to areas of good quality vegetation where possible, impacts to Koala habitat cannot be avoided. However, large stands of protected, good quality habitat is available within Oxley Wild Rivers.

As such, the project is likely to reduce the local area of occupancy of this species but not the extent of occurrence of the population.

c) Fragment an existing important population into two or more populations;

Large remnant vegetation patches occur to the east outside of the development site, which provide opportunities for long-term Koala habitat and movement.

The Project will result in localised loss of habitat from areas immediately adjacent to the existing tracks, but also from the construction of new tracks/roads through the ridge lines. Project design has sought to minimize clearing widths.

Construction activities may disturb Koalas and have a short-term impact on their movement. This impact will be mitigated by education and awareness campaigns for site personnel and visitors, signage, and enforced speed limits. While roads and turbine hardstand could disrupt movement during operation, access to these will be restricted to private use only (for farmers and wind farm staff) and will have strict speed limits. With these measures in place, it is not expected that the roads will pose a physical barrier to Koala movement. Koalas will be able to move across roads without being injured or killed due to the low number and slow movement of vehicles, particularly at night when Koalas are more likely to move (although daytime movements are also undertaken by Koala), and when there would be almost no vehicle movements unless in the event of an emergency or urgent maintenance matter.

Ecological connectivity for this species will therefore not be impacted by the development.

d) Adversely affect habitat critical to the survival of a species

The habitat assessment tool was applied to the proposed site and resulted in the entire proposal site being considered critical habitat for this species (score of 8).

206.73ha of potential habitat would be removed. Considering this, it is likely that the proposal will adversely affect habitat critical to the survival of the species.

e) Disrupt the breeding cycle of an important population

Outside of quality habitat with the capacity to support population growth, Koalas appear to have no specific microhabitats required for breeding. As such, and considering the lack of isolation impacts on the species, the project is unlikely to disrupt the breeding cycle of this species.

f) Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline

The distribution of Koala occurs from Queensland to South Australia, as such, it is considered that the project will not impact the availability of quality of habitat to the extent that the species is likely to decline. However, the direct loss of 206.73ha may contribute to the local population declining.

g) Result in invasive species that are harmful to an vulnerable species becoming established in the vulnerable species' habitat

Predation by dogs is one of the key threats facing Koala (Threatened Species Scientific Committee, 2012), and Wild Dog is known to occur in the area. There is potential for their impact on Koala to increase because of the project. Clearing vegetation may require Koala to become grounded as they move through the landscape, where they are more susceptible to dog attack. Predators (such as dogs) also hunt more efficiently in cleared areas, however it is noted that much of the development site is already cleared or partially cleared.

Active pest animal management (see Section 8) throughout the project will address the risk from feral dogs and it is considered unlikely that the project will result in the establishment of invasive species that are harmful to Koalas.

h) Introduce disease that may cause the species to decline;

Two diseases are known to affect Koalas which are Chlamydia and Koala retro virus.

Chlamydia is harmless in populations with unlimited resources, but manifests in times of stress, which happens when habitat is reduced (Australian Koala Foundation, 2020). The proposed clearing of vegetation may cause some stress to existing Koala located within the development footprint. However, the site will clear approximately 12.88% of the vegetation available to Koala in the development site, and an extensive area of additional habitat will be retained outside of this.

Mitigation measures will be put in place to reduce or manage the risk of disease for Koala. Measures involving washing down vehicle and equipment that may carry vegetation pathogens known to affect Koala food trees will be enforced. Quarantine and biosecurity procedures will be maintained throughout the life of the action’s impact and a procedure will be in place for Koalas which are found to be affected by disease to manage the spread of disease through the site from wind farm activities.

Additional mitigation measures include those designed to reduce stress to Koalas during vegetation clearing, including the use of a fauna spotter during all clearing activities. The fauna spotter team will include staff with wildlife health experience, who can identify suffering individuals and transport them to a wildlife vet for treatment. It is unlikely that the proposed clearing will stress existing Koalas and increase the occurrence of chlamydia within the area.

i) Interfere substantially with the recovery of the species

The National Recovery Plan for the Koala is yet to be finalised, however, an interim recovery objective for this species is:

Protect and conserve large, connected areas of koala habitat, particularly large, connected areas that support koalas.

The impacts of the proposed project will result in the loss of up to 206.73ha potential habitat for this species, as such, the project is inconsistent with this objective and may exacerbate this threat to the local population resulting in the potential interference with the recovery of this species.

Conclusion

The project will result in the loss of up to 206.73ha of potential habitat for this species which may lead to a long-term decrease in the local population, reduce the area of occupancy for the local population and interfere with the recovery of the species.

Considering the above, a significant residual impact is considered likely. Impacts to this species will be managed by the BOS under the NSW Bilateral Agreement.

L.5 Greater Glider *(Petauroides volans)* [9]

a) **Lead to a long-term decrease in the size of an important population of a species?**
Targeted nocturnal surveys undertaken in February 2020 detected 13 Vulnerable Greater Gliders within a vegetated area connected to bushland outside of the development site, near the development site's south-eastern boundary. The Greater Glider are known to occur along the east coast of mainland Australia, from central Queensland to central Victoria. Within NSW, the species is known to exist as far west as Mount Kaputar National Park. This indicates Greater Glider may inhabit suitable habitat from the coast to Mount Kaputar National Park, such that the development site is not near the limit of the species' range. Oxley Wild Rivers State Conservation Area (Conservation Area) borders the eastern boundary of the development site, with numerous Bionet records existing within the Conservation Area. The individuals recorded within the development site are likely to form part of the population present within the Conservation Area, whose range includes connected bushland which enters the development along the eastern boundary. This population is considered important as it may be a source population for breeding or dispersal. Habitat for Greater Glider within the development footprint is limited to treed areas with good connectivity as the species are unable to traverse large disconnects in canopy. Up to 205.7ha of foraging habitat would be removed, which is 12% of the total available within the development site (1,487.55 ha). Although foraging resources are poor in quality due to historical disturbance (i.e., bushfire and drought), they may contain forage species preferred by Greater Glider which provide seasonally important resources and provide shelter for the population to move across the landscape. Given the above, the project is unlikely to lead to a long-term reduction in the population, though has the potential to impact the local population by removing seasonally important resources and limiting safe-passage for individuals moving across the landscape.
b) Reduce the area of occupancy of an important population
While there will be habitat removal as above, this unlikely to reduce the area of occupancy for this population.
c) Fragment an existing important population into two or more populations;
Due to historical land use and clearing, connectivity of Greater Glider habitat across the development site is relatively poor. However, some good condition corridors within the development site remain. Where possible, habitat corridors will be avoided and opportunities for post-works restoration of habitat connectivity will be explored as part of the final design. Given the mitigation measures and nature of the project, it is considered unlikely to fragment an existing important population into two or more populations. Linear clearing associated with the project design is typically only 25m wide. There is potential for reduced connectivity between habitat patches in areas where clearing widths are greater than 50m (see Section 7.3.1 for a discussion of average glide distances for this species). Given the current design, it is unlikely that linear clearing will exceed 40m. If landscape constraints necessitate clearing widths in excess of 40m (not currently planned), the project will commit to the installation of crossing infrastructure, including glider poles and removeable rope bridges to ensure that Greater Glider can safely move across the project footprint. This would not be expected to occur to the extent that it would result in fragmentation of a population.

[9] Greater Glider has been up-listed from Vulnerable to Endangered, however as it was declared a controlled action when this species was Vulnerable, it will continue to be assessed under EPBC as Vulnerable.

d) Adversely affect habitat critical to the survival of a species
There is currently no specific definition of habitat critical to the survival of Greater Glider (Threatened Species Scientific Committee, 2016). Greater Glider are typically found in highest abundance in taller, montane, moist eucalypt forests with relatively old trees and abundant hollows. Greater Glider prefer forests with a diversity of eucalypt species, and the habitat within the project site is likely to be important to this species. 205.7ha of habitat will be impacted by the project. The project will avoid removing large tree hollows wherever possible through detailed design. To date, the project has been designed to avoid intact patches of mature vegetation with dense HBTs. The habitat to be impacted is unlikely to be critical for the survival of this species though is likely to be important to individuals within the locality.
e) Disrupt the breeding cycle of an important population
Females give birth to a single young between March and June, with sexual maturity reached in the second year. Generation length is likely to be 7−8 years. A low reproductive rate means that isolated populations in small remnant vegetation patches are prone to extinction (TSSC, 2016). Greater Gliders depend on hollows for breeding. During the day they shelter in tree hollows, with a particular selection for large hollows in large, old trees (TSSC, 2016). Greater Glider require at least 2-4 live den trees for every 2ha of suitable forest habitat (Eyre, 2002). In northern NSW, this species is absent from forests with less than 6 hollows per ha (Smith, Mathieson, & Hogan, 2007). Numerous trees with large hollows occur throughout the development site. Large trees with hollows will be avoided where possible, though many will be unavoidable. Due to the protected, good quality, contiguous habitat available adjacent to the site, the project is considered unlikely to disrupt the breeding cycle of an important population, however, has the potential to disrupt the breeding cycle for the local population.
f) Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline
The distribution of the Greater Glider occurs from Central Queensland to Central Victoria, as such, it is considered that the project will not impact the availability of quality of habitat to the extent that the species is likely to decline. However, given the small home range and low dispersal ability of this species, it is likely that this habitat is relied upon by local Greater Gliders and would generate a significant residual impact for local populations.
g) Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat
Several invasive flora and fauna species have been recorded within the development site. Mitigation measures such as a Biodiversity Management Plan will include weed and pest management which will outline mitigation and monitoring measures to reduce the likelihood of spreading and increasing the number of invasive flora and fauna. As such, it is considered unlikely that the project will result in invasive species that are harmful to the Greater Glider becoming established in its habitat.
h) Introduce disease that may cause the species to decline;

Chlamydia has been recorded in Greater Gliders in the past (Bodetti, Viggers, & Swan, 2003; Maloney, 2007). Although not debilitating, the disease has the potential to decrease the vigour of the population. Stress is regarded as a major factor in an animal's susceptibility to Chlamydia (Maloney, 2007). The Development would impact up to 144.73ha of suitable habitat which has the potential to cause a stress response in individuals within the immediate vicinity.

Spread of Root-rot Fungus *Phytophthora cinnamomi* causing tree dieback is another potential threat to the Greater Glider by reducing available foraging and nesting habitat.

These threats will be mitigated through hygiene protocols applied throughout the project and ongoing management. No other diseases are considered likely to be introduced as a result of the project. As such, the introduction of disease that may cause the decline of this species is considered unlikely.

i) Interfere substantially with the recovery of the species;

There is currently no recovery plan for this species but known threats to the species includes habitat removal, loss of hollow bearing trees and inappropriate fire regimes. The project will impact up to 205.7ha of habitat for Greater Glider, which may interfere with the recovery of this species.

Conclusion

Considering the small home range and low dispersal ability of this species, the habitat to be removed may provide an important resource and ongoing shelter for the species to move safely across the landscape. This may lead to malnourishment or decreased reproductive output reducing the carrying capacity of the population.

Considering the above, a significant residual impact is considered likely. Impacts to this species will be managed by the BOS under the NSW Bilateral Agreement.

L.6 Narrow-leaved Black Peppermint (*Eucalyptus nicholii)*

a) Lead to a long-term decrease in the size of an important population of a species?

Targeted flora surveys throughout 2020 and 2021 detected 13 Narrow-leaved Black Peppermint individuals within the development footprint.

Narrow-leaved Peppermint is known from less than 40 localities on the NSW Northern Tablelands (Peacock, 1996), stretching northwards from the Walcha–Niangala district just east of Tamworth, to just north of Glen Innes (CHAH, 2008). The development footprint is located within the eastern extent for this species. The individuals recorded within the development site are likely to form part of the population present within the Oxley Wild Rivers State Conservation Area whose range includes connected bushland which enters the development along the eastern boundary. This population is considered an important population as it may be a source population for breeding or dispersal and a population key to maintaining genetic diversity to the eastern extent of this species.

Due to historical clearing for agricultural practices, habitat for this species within the development footprint is limited to areas of poor connectivity and individuals often exist in the form of paddock trees. Whilst the project would aim to avoid the removal of individuals where possible, up to 13 individuals may be removed as a result of the project. The project has been able to avoid over 85 individuals.

Considering the above, the project is likely to lead to a long-term decrease in the size of an important population.

b) Reduce the area of occupancy of an important population

This species is known from only 40 locations in the tablelands, with majority of trees occurring on private property, with the exception of a small population within Oxley Wild Rivers National Park and Single National Park (Copeland 2001, cited in (Department of the Environment, Water, Heritage and the Arts, 2008).

Up to 13 individual trees would be removed as a result of the project. As such, the project will reduce the area of occupancy of this species.

c) Fragment an existing important population into two or more populations;

Due to historical land use and clearing, connectivity of habitat for Narrow-Leaved Black Peppermint across the development site and immediate surrounds is poor. Although the project has aimed to avoid impacts to this species (Section 6), 13 individuals would be removed as a result of the project.

As the removal of individuals and habitat would be in a linear fashion and the existing project site is already subject to relatively poor connectivity, the project is unlikely to fragment the local population.

d) Adversely affect habitat critical to the survival of a species

No habitat critical for the survival of the species has been declared, however, the species typically grows in dry grassy woodland, on shallow soils of slopes and ridges. It is found primarily on infertile soils derived from granite or metasedimentary rock.

The project will result in the loss of up to 13 individuals. As such, the project is likely to adversely affect habitat critical to the survival of this species.

e) Disrupt the breeding cycle of an important population

Seedling recruitment is common, even in disturbed soils, if protected from grazing and fire. The species is likely to regenerate well after soil disturbance, but over grazing and fire frequencies of more than one per decade may inhibit long-term seedling recruitment (Binns 1995).

As the nature of the project is restricted and linear in nature, although a reduction in an area of occupancy and individuals is considered to occur, the significance of this in regard to disrupting the breeding cycle is considered negligible. Stringent mitigation measures will be implemented to ensure no direct and indirect impacts to individuals of this species outside of the development.

f) Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline

The project will result in the loss of up to 13 individuals of this species. Given the current population is not well represented in reserves, private property occurrences are therefore particularly relevant to conserving representative populations of the species (Peacock, 1996). As such, the project is considered likely to contribute to the loss of habitat and this species could be at risk of further decline.

g) Result in invasive species that are harmful to an vulnerable species becoming established in the vulnerable species' habitat

This species is at risk to invasion and spread of exotic grasses, such as Coolatai and African love grass, which outcompete juveniles and increase the frequency and intensity of fires.

Several invasive flora species have been recorded within the development site. The Biodiversity Management Plan (Section 8) will include weed and pest management measures to reduce the likelihood of spreading and increasing the number of invasive flora. As such, it is considered unlikely that the project will result in invasive species that are harmful to Narrow-leaved Black Peppermint becoming established in its habitat.
h) Introduce disease that may cause the species to decline;
The project is not considered likely to introduce disease harmful to this species. Mitigation measures implemented during construction such as strict hygiene protocols applied throughout the project and ongoing management.
i) Interfere substantially with the recovery of the species;
The Approved Conservation Advice for the Narrow-leaved Black Peppermint states the following Regional Priority Actions which are relevant to the project include: Habitat Loss, Disturbance and Modification in order to address this the following is recommended: • Monitor known populations to identify key threats. • Monitor the progress of recovery, including the effectiveness of management actions and the need to adapt them if necessary. • Identify populations of high conservation priority. • Manage threats to areas of vegetation that contain populations/occurrences/remnants of Narrow-leaved Peppermint. • Ensure road widening and maintenance activities (and other infrastructure or development activities involving substrate or vegetation disturbance) in areas where Narrow-leaved Peppermint occurs do not adversely impact on known populations. • Develop and implement a suitable fire management strategy for Narrow-leaved Peppermint. • Raise awareness of Narrow-leaved Peppermint within the local community, particularly among land-holders with this species on their properties. The project will result in the loss of up to 13 individuals of this species, as such, the project is inconsistent with the objectives of the priority actions and may interfere with the recovery of this species.
Conclusion
The project will result in the loss of up to 13 individuals of this species which may lead to a long-term decrease in the local population, reduce the area of occupancy for the local population and interfere with the recovery of the species. Considering the above, a significant residual impact to Narrow-leaved Black Peppermint is considered likely. Impacts to this species will be managed by the BOS under the NSW Bilateral Agreement.

L.7 Swift Parrot (*Lathamus discolor*) & Regent Honeyeater (*Anthochaera phrygia*)

An action is likely to have a significant impact on a critically endangered or endangered species if there is a real chance or possibility that it will:

a) Lead to a long-term decrease in the size of a population
Up to 286ha (Regent Honeyeater) and 426ha (Swift Parrot) of potential habitat (marginal foraging resources) for these species would be cleared. Potential habitat for both Swift Parrots and Regent Honeyeaters occurs throughout the site with these species being associated with the following PCTs : • Swift Parrot (PCTs: 1194, 997, 970, 954, 766, 571, 568, 567, 565, 554, 534, 526 & 510) and • Regent Honeyeater (PCTs: 997, 970, 766, 571, 567 & 510) Despite this, few records of either species exist in the Walcha area suggesting the region is not a critical foraging area. Additionally, this habitat is plentiful in the surrounding areas, such that clearing is considered unlikely to lead to a long-term decrease in the size of a population of Swift Parrot and Regent Honeyeaters.
b) Reduce the area of occupancy of the species
Swift Parrots area of occupancy spans both Tasmania and the mainland as far north as Southern Queensland, and therefore the proposal is considered unlikely to reduce the area of occupancy of Swift Parrot. Similarly, Regent Honeyeaters occur throughout the western slopes of the Great Dividing Range within NSW and VIC. Both species have large areas of occupancy which would not be reduced significantly by this proposal.
c) Fragment an existing population into two or more populations
Due to the narrow linear nature of the development footprint and the strong dispersal ability of these two species, the proposal would not fragment an existing population.
d) Adversely affect habitat critical to the survival of a species
Habitat critical to the survival of the Swift Parrot and Regent Honeyeater is known generally. When in NSW, Swift Parrots inhabit a wide range of plant community types but do show an affinity for inland box-gum woodlands. Regent Honeyeaters occupy a similar habitat niche to the Swift parrot, which occurs throughout the subject site. Despite this, few records of these species occur in the surrounding area indicating the study site does not represent significantly important habitat for these species. In the NSW planning system, the study area is not considered important habitat for these species. Approximately 7% of suitable habitat for these species within the development site will be impacted by this project. Considering the large extent of vegetation being retained, the similar extensive habitat within adjacent National Parks and the linear nature of the proposed works, even though a sizeable amount of potential habitat would be impacted, large patches of the existing habitat remain unimpacted and fragmentation of these patches would not be considered significant to these species. Considering this, the proposal is considered unlikely to adversely affect habitat critical to the survival of Swift Parrot or Regent Honeyeater.
e) Disrupt the breeding cycle of a population
Swift Parrot breed in Tasmania only and no important foraging habitat for this species is noted within the study site. Therefore, the proposal would not disrupt the breeding cycle of this species. The subject area is not known to be a significant breeding area for Regent Honeyeaters, however, pre-clearance surveys will be employed to ensure any nests within the subject site are identified and avoided. As such, the proposal would not disrupt the breeding cycle of this species.

f) Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline
The habitat that would be removed represents a marginal foraging resource in a locality that has ample mount of similar resources. The removal of this vegetation is considered unlikely to cause these species to decline.
g) Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat
Mitigation measures during the proposal is proposed which would reduce the potential establishment of exotic species.
h) Introduce disease that may cause the species to decline, or
Mitigation measures during the proposal is proposed which would reduce the potential establishment of disease.
i) Interfere with the recovery of the species
Recovery objectives for Regent honeyeater are listed as: • Improve the extent and quality of regent honeyeater habitat. • Bolster the wild population with captive-bred birds until the wild population becomes self-sustaining. • Increase understanding of the size, structure, trajectory and viability of the wild population. • Maintain and increase community awareness, understanding and involvement in the recovery program. Recovery objectives for Swift parrot are: • Identify the extent and quality of habitat. • Manage and protect Swift Parrot habitat at the landscape scale. • Monitor and manage the impact of collisions, competition and disease. • Monitor population and habitat. The proposal would not directly impact on any of the recovery objectives listed in the National recovery guidelines for both species. As such, the proposal is considered unlikely to interfere with the recovery of Swift Parrot or the Regent Honeyeater.
Conclusion
The proposal would linearly remove 426ha of marginal foraging habitat for Swift Parrot and 286ha of marginal foraging habitat for Regent Honeyeaters. Through avoidance and preclearance surveys no individuals would be directly impacted. While the extent of habitat that would be removed appears extensive, contextually it is far outweighed by the habitat that would remain untouched that is contiguous with the subject site. The application of safeguards concerning pest plant and pathogen management would ensure that adjacent areas of viable habitat adjacent to the subject site are not compromised.

In light of the above, the proposal is considered unlikely to generate a significant impact to the Swift Parrot or the Regent Honeyeater.

L.8 Painted Honeyeater (*Grantiella picta*)

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:
a) Lead to a long-term decrease in the size of an important population of a species
Up to 426ha of potential habitat for this species would be removed under this proposal, and this habitat contains marginal foraging resources for this species associated with the following PCTs: 1194, 997, 970, 954, 766, 571, 568, 567, 565, 534, 526 & 510. Despite this, few records of either species exist in the Walcha area suggesting the region is not a critical foraging area. Additionally, this habitat is plentiful in the surrounding areas, such that clearing is considered unlikely to lead to a long-term decrease in the size of a population of Painted Honeyeaters.
b) Reduce the area of occupancy of an important population
Painted Honeyeaters occur throughout the western slopes of the Great Dividing Range within NSW and VIC and QLD. This species has large areas of occupancy which would not be reduced significantly by this proposal.
c) Fragment an existing important population into two or more populations
Due to the narrow linear nature of the development footprint and the strong dispersal ability of this species, the proposal would not fragment an existing population.
d) Adversely affect habitat critical to the survival of a species
Critical habitat for this species is listed in the National Recovery Plan. The nearest critical area is the Pilliga Forest 250km to the west. Given this context, the proposal is considered unlikely to adversely affect habitat critical to the survival of this species.
e) Disrupt the breeding cycle of an important population
The subject area is not known to be a significant breeding area for Painted Honeyeaters, which favour woodland on the inland slopes of the Great Dividing Range as opposed to the hills and ridgelines rising out of the Walcha Platea. Despite this, pre-clearance surveys will be employed to ensure any nests within the subject site are identified and avoided. As such, the proposal would not disrupt the breeding cycle of this species.

f) Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline
Due to the linear design of the project large areas of vegetation will remain on site. The habitat that would be removed has been estimated at up to 426 ha. Despite this, habitat is plentiful within the subject site and the study area. The vegetation impacted represents 7% of suitable habitat within the development site. Given this context, the proposal is considered unlikely to decrease the availability or quality of habitat as such that these species are likely to decline.
g) Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat
The application of safeguards and mitigation measures outlined in Section 8 of the BDAR, concerning feral animals, pest plant and pathogen management would ensure that adjacent areas of viable habitat adjacent to the subject site are not compromised.
h) Introduce disease that may cause the species to decline
The application of safeguards concerning pest plant and pathogen management outline in Section 8 of the BDAR, would ensure that adjacent areas of viable habitat adjacent to the subject site are not compromised.
i) Interfere substantially with the recovery of the species
The relevant recovery objectives for Painted Honeyeater is: • Protect, manage and restore Painted Honeyeater breeding and foraging habitats at the local regional and landscape scales . The proposal would have only minor impacts to the recovery objectives listed in the National recovery guidelines for this species, with the study area considered marginal foraging habitat . As such, the proposal is considered unlikely to interfere with the recovery of the Painted Honeyeater.
Conclusion
The proposal would linearly remove up to 426ha of marginal foraging habitat for Painted Honeyeaters Through avoidance, no individuals would be removed. While the extent of habitat that would be removed is extensive, it is far outweighed by what would remain untouched that is contiguous with the subject site. The application of safeguards concerning pest plant and pathogen management would ensure that adjacent areas of viable habitat adjacent to the subject site are not compromised. In light of the above, the proposal is considered unlikely to generate a significant impact to Painted Honeyeaters.

L.9 Bluegrass (*Dichanthium setosum*)

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:
j) Lead to a long-term decrease in the size of an important population of a species
An 'important population' is a population that is necessary for a species' long-term survival and recovery. This may include populations identified as such in recovery plans, and/or that are: key source populations either for breeding or dispersal populations that are necessary for maintaining genetic diversity, and/or populations that are near the limit of the species range. Bluegrass populations in the subject site do not meet any of the above stated criteria and there is not considered part of an important population. The species is widely distributed in the New England Tablelands, North West Slopes and Plains and the Central Western Slopes of NSW as well as south QLD. Considering the narrow and linear nature of the vegetation being removed, and considering the completed surveys for this species, direct and indirect impacts are considered minor and not likely to result in a long term decrease in population size.
k) Reduce the area of occupancy of an important population
Any local populations of this species are not considered to represent important populations within the study area. An important population, or part thereof, is not considered to have its area of occupancy reduced.
l) Fragment an existing important population into two or more populations
Any local populations of this species are not considered to represent important populations within the study area. An important population, or part thereof, is not considered to be fragmentated. Regardless, the width of the project design is considered narrow enough that gene flow between either side is highly likely to remain intact.
m) Adversely affect habitat critical to the survival of a species
Whilst vegetation on site may provide habitat for this species it is not considered critical habitat due to the widespread distribution in the region and the condition status of the vast majority of vegetation on site. Given this context, the proposal is considered unlikely to adversely affect habitat critical to the survival of this species.
n) Disrupt the breeding cycle of an important population
Any local populations of this species are not considered to represent important populations within the study area. Regardless, the width of the project boundary is narrow enough to reasonably expect that pollination and seed dispersal would not be significantly impacted for each of these species. As individuals of each species would still be able achieve pollination and setting of seed, none of the above species is considered to have breeding cycles inhibited.

o) Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline
Due to the linear design of the project large areas of vegetation will remain on site. The habitat that would be removed has been estimated at up to 13.2ha of the 1693ha of suitable habitat on site. This represents <1% of the areas of suitable habitat on site. Despite this, habitat is plentiful within the subject site and the study area. Given this context, the proposal is considered unlikely to decrease the availability or quality of habitat as such that this species is likely to decline.
p) Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat
The application of safeguards and mitigation measures outline in Section 8 of the BDAR, concerning, feral animals, pest plant and pathogen management would ensure that adjacent areas of viable habitat adjacent to the subject site are not compromised.
q) Introduce disease that may cause the species to decline
The application of safeguards concerning pest plant and pathogen management outline in Section 8 of the BDAR, would ensure that adjacent areas of viable habitat adjacent to the subject site are not compromised.
r) Interfere substantially with the recovery of the species
The proposal would not result in the direct loss of individuals of this species through avoidance. However, the proposal would remove up to 13.2ha of potential habitat. Contextually, extensive amounts of habit would remain untouched that is contiguous with that of the subject site. As such, the proposal is considered unlikely to interfere substantially with the recovery of this species.
Conclusion
The proposal would linearly remove habitat up to 13.2ha for Bluegrass. No-go zones would limit the potential for indirect or inadvertent impacts to known locations of these species. While the extent of habitat that would be removed is extensive, it is far outweighed by what would remain untouched that is contiguous with the subject site. The application of safeguards concerning pest plant and pathogen management would ensure that adjacent areas of viable habitat adjacent to the subject site are not compromised. In light of the above, the proposal is considered unlikely to generate a significant impact to Bluegrass.

L.10 White-throated Needletail (*Hirundapus caudacutus*) & Fork-tailed Swift (*Apus pacificus*)

An action is likely to have a significant impact on a migratory species if there is a real chance or possibility that it will:

a) substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species
Given site habitat conditions and the lack of observations, the site is considered to provide less favourable habitat for foraging and few opportunities for roosting by needletails. As such habitat on site is not considered important habitat for this species (See Appendix Q). As such the project will not substantially modify, destroy or isolate an area of important habitat.
b) result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species, or
The application of safeguards and mitigation measures outlined in Section 8 of the BDAR, concerning, feral animals, pest plant and pathogen management would ensure that adjacent areas of viable habitat adjacent to the subject site are not compromised. The BBAMP to be developed should manage any future risks of turbine strike.
c) seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.
The White-throated Needletail is known to fly at heights within the range of the RSA (Appendix Q). As such direct strike from wind turbines is a possibility for this species. Direct mortality of these species is considered likely to seriously disrupt the lifecycle of these species populations due to unknown population numbers and little understood migratory patterns..
Conclusion
Although the proposed vegetation clearing is insignificant to these species and the application of safeguards concerning pest plant and pathogen management would ensure that the risk of spread is minimal, the risk of direct mortality of individuals from turbine strike is a possible threat. In light of the above, the proposal is considered likely to generate a significant impact to both the White-throated Needletail and the Fork-tailed Swift.

L.11 Latham's Snipe (Gallinago hardwickii)

An action is likely to have a significant impact on a migratory species if there is a real chance or possibility that it will:
d) substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species

Potential habitat for this species occurs throughout the development footprint in the form of Dams and small lagoons of streams. Despite this these habitat features will not be directly impacted by the proposal and indirect impacts are unlikely to modify this habitat to a point that it is unsuitable. Given this, habitat for this species on site is unlikely to be significantly modified, destroy or isolated.
e) result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species, or
The application of safeguards and mitigation measures outline in Section 8of the BDAR, concerning, feral animals, pest plant and pathogen management would ensure that adjacent areas of viable habitat adjacent to the subject site are not compromised.
f) seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.
Temporary indirect disturbance to water features on site may result from the construction of the proposed development, and these areas are considered potential foraging habitat for this species. Short term disturbance is considered minor due to the extensive number of similar water features in the broader area. Long term impacts on the water features, and therefore this species, are expected to be negligible. This species is not identified as likely to be impacted directly by wind turbines. The lifecycle of this species is unlikely to seriously disrupted by the proposal.
Conclusion
The proposal is expected to have minor, temporary impacts on the potential feeding habitat for this species however surrounding areas of similar habitat would minimise any potential impacts. The application of safeguards concerning pest plant and pathogen management would ensure that adjacent areas of viable habitat adjacent to the subject site are not compromised. In light of the above, the proposal is considered unlikely to generate a significant impact to Latham's Snipe.

L.12 Grey-headed Flying-fox (*Pteropus poliocephalus*)

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:
a) Lead to a long-term decrease in the size of an important population of a species
This species was not recorded on site but is assumed present due to potential foraging habitat occurring on site and proximity (<50km) from a known roost site in Armidale (Not listed as a Nationally important camp). All PCTs within the study area (bar PCT 766) are considered suitable foraging habitat for this species however none support a significant composition of primary feed species listed in the National Recovery

Plan for Grey-headed Flying-fox. Although the camp in Armidale is within foraging distance of the site, no Nationally important camp location occurs within 20km of the site. As such the subject site is not considered important habitat for this species. In light of the above, and the stringent mitigation measures in place, the proposal is considered unlikely to lead to long-term decrease in the size of an important population of this species.
b) Reduce the area of occupancy of an important population
Due to the linear nature of the project there is no expected reduction in the area of occurrence of this species in the region
c) Fragment an existing important population into two or more populations
Due to the linear nature of this proposal and the dispersal ability of this species, it is considered unlikely to fragment an existing important population into two or more populations. The already fragmented landscape will not be altered significantly in relation to fragmentation with the proposal avoiding treed areas where possible.
d) Adversely affect habitat critical to the survival of a species
All native vegetation within the study area (with the exception of PCT 766) are considered suitable habitat for this species, however, no PCTs on site support a significant composition of primary feed species listed in the National Recovery Plan for Grey-headed Flying-fox. Some Melliodora is present but does not dominate the PCTs within the proposal area. Although the camp in Armidale is within foraging distance of the site, no Nationally important camp location occurs within 20km of the site. As such the subject site is not considered critical habitat for this species.
e) Disrupt the breeding cycle of an important population
It is not considered likely, due to the linear nature of the works and the vegetation to remain throughout the area, that the removal of 426ha of foraging habitat will lead to disruption of the breeding cycle for either this species considering that none of the site is known breeding habitat. If mitigation measures are adequately followed, breeding habitat for these species would not be impacted and the proposal would not prevent any individuals from traversing their range for the purpose of completing their life cycle.
f) Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline
Given that the vegetation on site is considered marginal foraging habitat as well as the relatively small amount of vegetation clearing required (426ha) when considering the extent of suitable habitat in the surrounding area (3188ha within the development site), the proposal is considered unlikely to decrease the availability or quality of habitat such that either species is likely to decline.
g) Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat

Mitigation measures during the proposal is proposed which would reduce the potential establishment of exotic species.
h) Introduce disease that may cause the species to decline
Mitigation measures during the proposal is proposed which would reduce the potential establishment of disease.
i) Interfere substantially with the recovery of the species
Relevant specific objectives for this species include: • Identify, protect and increase native foraging habitat that is critical to the survival of the Grey-headed Flying-fox. No foraging habitat is considered critical. • Identify, protect and increase roosting habitat of Grey-headed Flying-fox camps – none are present within the proposal area. • Reduce the impact on Grey-headed Flying-foxes of electrocution on power lines, and entanglement in netting and on barbed-wire. This can be done by ensuring adequate clearance around any above ground electrical transmission cables between GHFF food source and infrastructure. Habitat on site is not considered critical to the survival of the species, nor does the site support any known camps. The project therefore does not directly conflict relevant objectives for the recovery of this species. Given the above, the proposal is considered unlikely to interfere substantially with the recovery of the species.
Conclusion
The proposal would linearly remove up to 426ha of marginal potential foraging habitat for Grey-headed Flying-fox (approximately 7% of the suitable vegetation available and suitable for this species on site). While the extent of habitat that would be removed appears extensive, contextually it is far outweighed by what would remain within the surrounding area. This habitat is not considered critical to the survival of the species. No breeding habitat for this species is known on site. The application of safeguards concerning pest plant and pathogen management would ensure that adjacent areas of viable habitat adjacent to the proposal site are not compromised. In light of the above, the proposal is considered unlikely to generate a significant impact to Grey-headed Flying-fox.

Appendix M Example tables of contents for post approval management plans

M.1 Construction environmental management plan

Heading	Description of content
Introduction	Context Project background Certification process (if any), approval and review Distribution
Project description	Detail of works to be undertaken during construction, including but not limited to access tracks, underground and overhead transmission lines, concrete batch plants, met masts, turbines and crane hardstand, substation and switchyard. Detail of construction activities.
Planning framework	Project environmental obligations Legal and other requirements Approvals, permits and licences Objectives and targets
Risk identification and assessment	Environmental risk assessment Identification of potential impacts Risk assessment, including mitigated risk rating
Implementation and operation	Documentation Relationship to sub-plans and strategies Environmental work method statements Procedures, forms and other documents
Resources, roles, responsibility and authority	Flow chart depicting relationships between key personnel, including regulator Environmental management team and their roles Sub-contractor roles and management
Competence, training and awareness	Environmental induction process Toolbox talks, training and general awareness opportunities Environmental awareness training commitment
Communication	Internal External, including with government authorities Stakeholder and community engagement

Heading	Description of content
Incidents and emergencies	Incident management procedure
Inspections, monitoring and auditing	Environmental inspections Daily pre-start inspections Compliance audits Non-conformity, corrective and preventative actions
CEMP review and improvement	Continuous improvement process
Documentation	Environmental records Document control
Appendix: Applicable legislation	Requirement under relevant legislation Applicabiilty to the Project Relevant approvals/permits/licences Responsibility to comply
Appendix: Environmental policy	
Appendix: Forms, checklists and procedures register	
Appendix: Environmental aspects, impacts and mitigation measures	
Appendix: Template checklists	

M.2 Biodiversity management plan

Heading	Description of content
Introduction	Context Background Project description Key infrastructure components Schedule (pre-construction, construction, operation, decommissioning) Objectives: both project, as well as environmental objectives and performance indicators Environmental legislation
Relevant conditions of approval	i.e., Commonwealth, State
Existing environment	Overview of surveys and assessment to date Flora species and plant community types Fauna species and habitat, including habitat features such as HBT Matters of national environmental significance, as well as state threatened species and communities
Impacts	Key aspects and impacts
Management actions and risk assessment	Avoid and minimise actions Pre-clearance management actions Clearing phase management actions Operational/post clearing management actions Risk assessment, identifying residual risk, trigger detection, and contingency response/corrective action(s)
Monitoring and reporting	Monitoring schedule, including performance indicators, timing and frequency Environmental inspections Data management Reporting, including for any permits and licences
Compliance	Non-conformity, corrective, and preventative actions Training Relevant permits and licences Roles and responsibilities Audit and review Adaptive management approach

Heading	Description of content
Training and personnel	Definition of suitably qualified personnel Required training and competencies.

M.3 Bird and bat adaptive management plan

Heading	Description of content
Project description	Background, overview of project
Legislative requirements	Specific condition(s) of approval, guidelines.
Environmental outcomes	BBAMP objectives
Existing environment	Site description Description of survey effort to date At-risk species present or likely to be present
Risk assessment	Method Results
Monitoring program	BUS Collision monitoring (turbine selection, search protocol, carcass detection protocol, incidental carcass protocol, scavenger rates and trials, detectability [searcher efficiency] trials, analysis of results and mortality estimation, injured wildlife handling protocol).
Adaptive management approach	Defined impact triggers Corrective actions
Roles and responsibilities	Key roles and required tasks
Reporting	Annual Incident notification Investigation reports Audit and review
Training and personnel	Definition of suitably qualified personnel Required training and competencies.

Appendix N Detailed Mapping

N.1 Figure 1-1 Development site Subject Land

N.2 Figure 2-6 Biodiversity corridors

N.3 Figure 2-7 Native Vegetation within assessment area

N.4 Figure 3-1 PCT and TEC mapping

N.5 Figure 3-2 Vegetation Zones and BAM plot locations

N.6 Figure 4-2 Threatened flora survey locations

N.7 Figure 4-3 Threatened fauna survey locations

N.8 Figure 4-4 Threatened flora and fauna survey results

N.9 Figure 4-5 Threatened species polygons

N.10 Figure 7-2 MNES species polygons

N.11 Figure 9-1 SAII impacts

N.12 Figure 10-1 Areas requiring offsets

N.13 Figure 10-2 Project layout

Appendix O Consultation with BCS

Appendix P Biodiversity constraints report – ERM

Appendix Q White Throated Needletail survey report