Appendix A: Figures

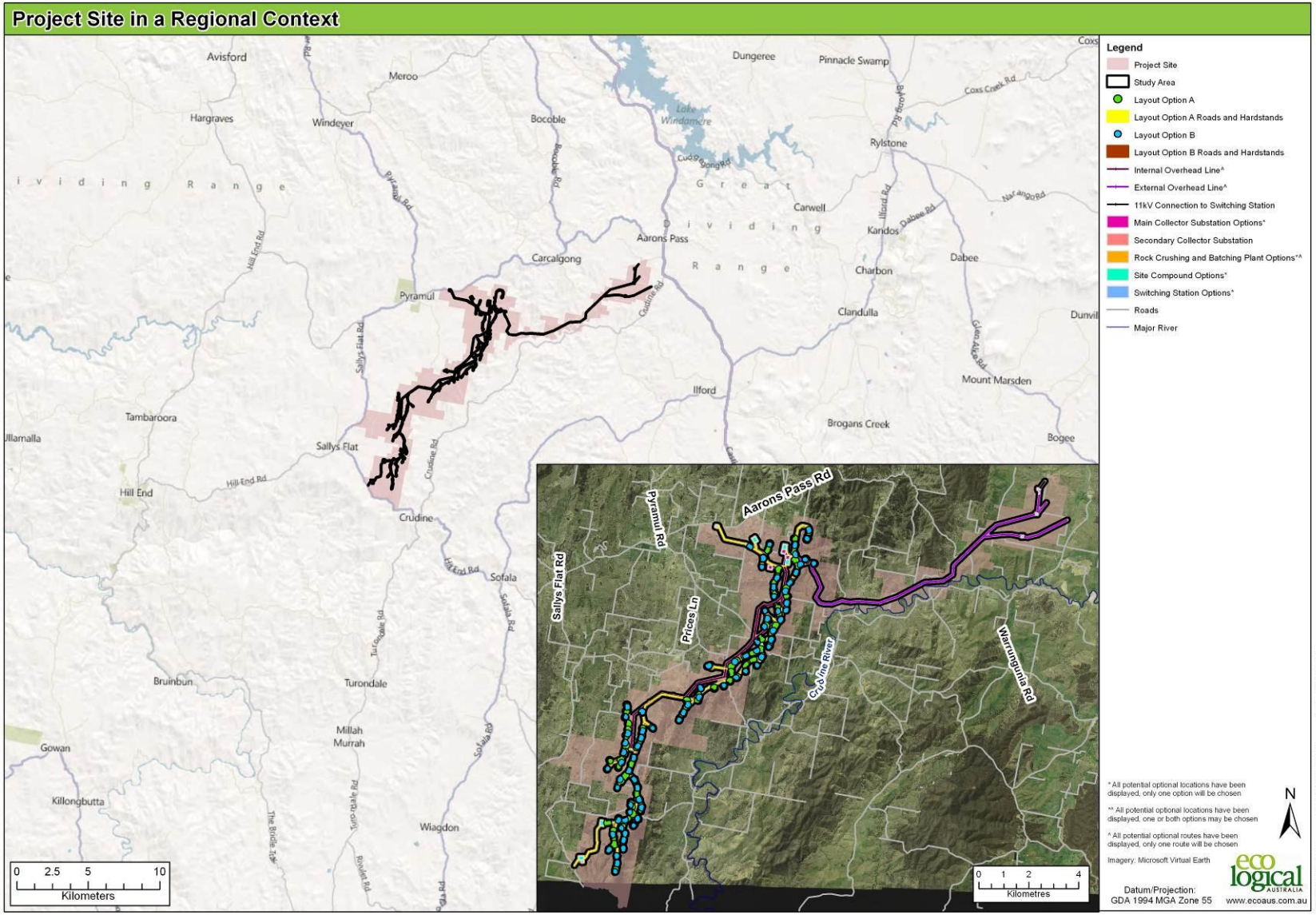

Figure 1: Project site in a regional context

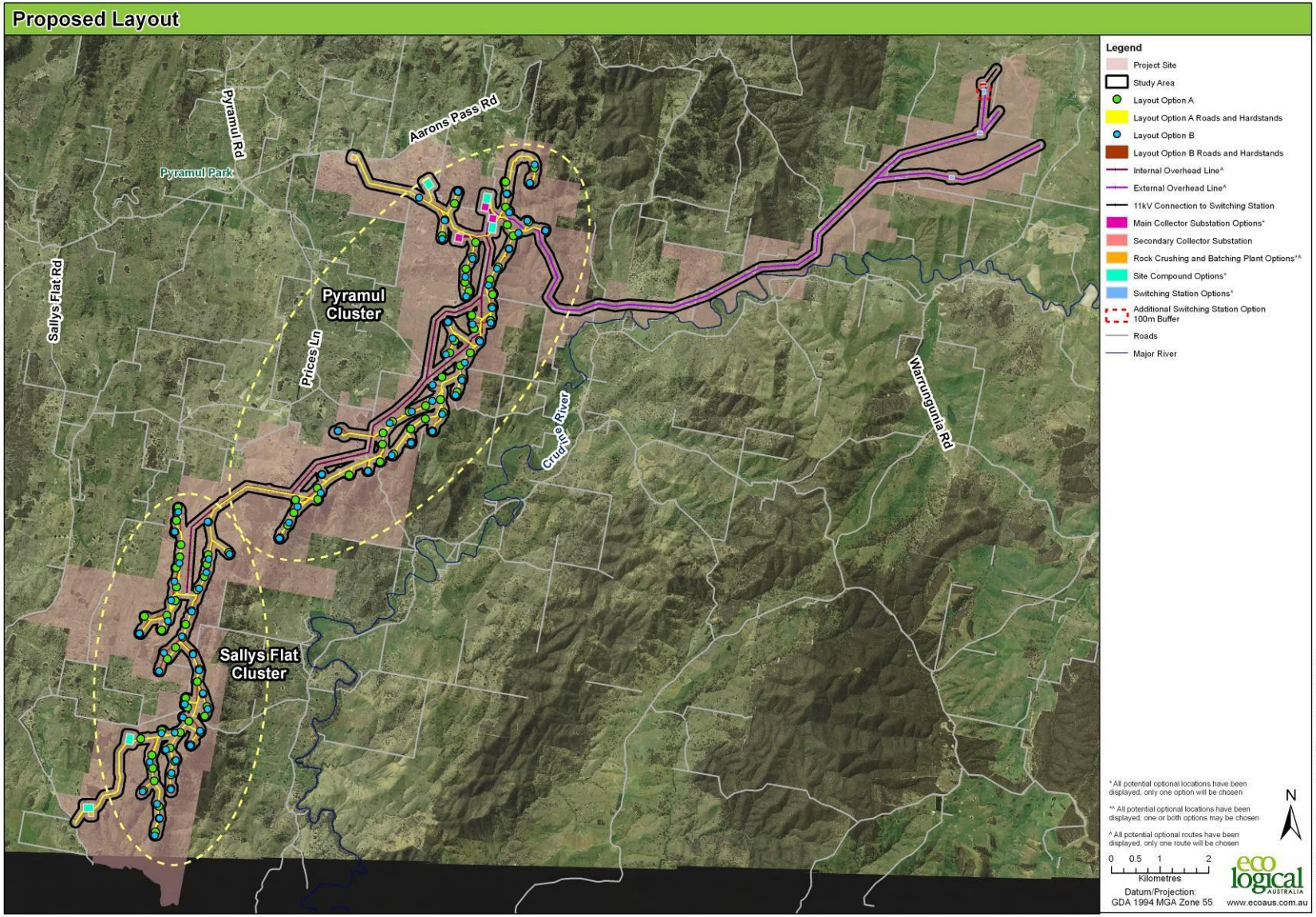

Figure 2: Proposed turbine layout, access roads, reticulation and infrastructure

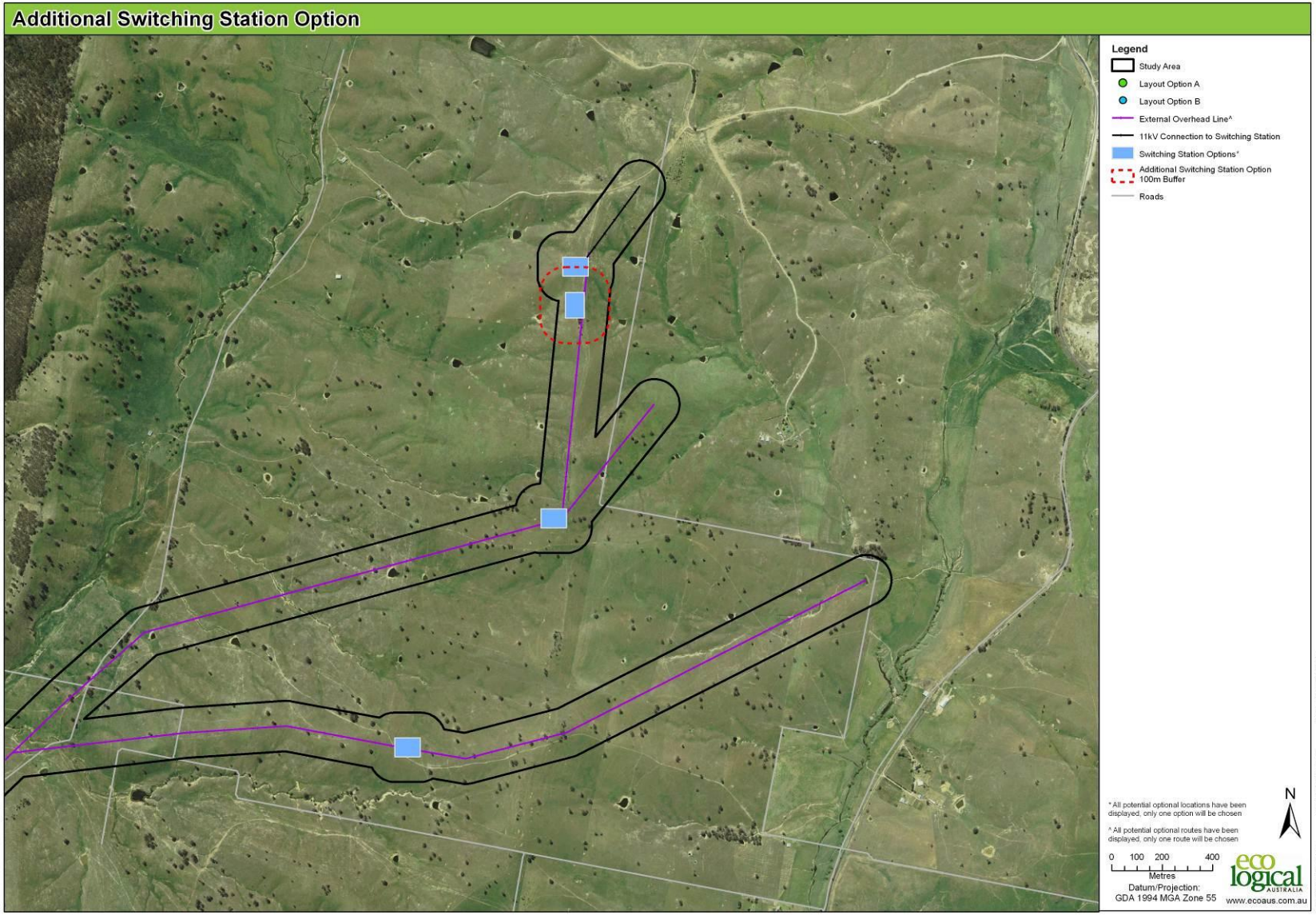

Figure 3: Alternative switching station / infrastructure locations

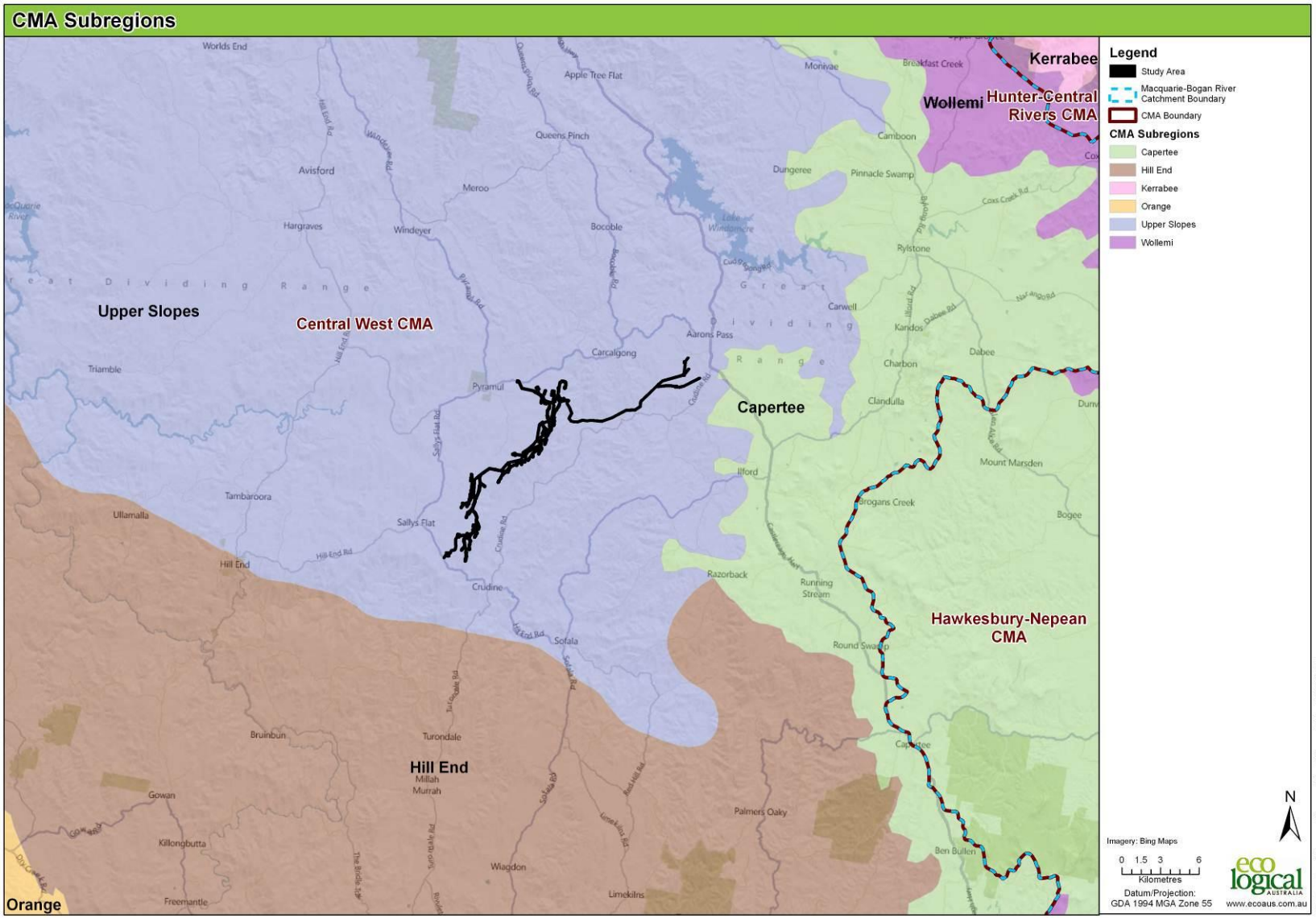

Figure 4: CMA Sub-regions

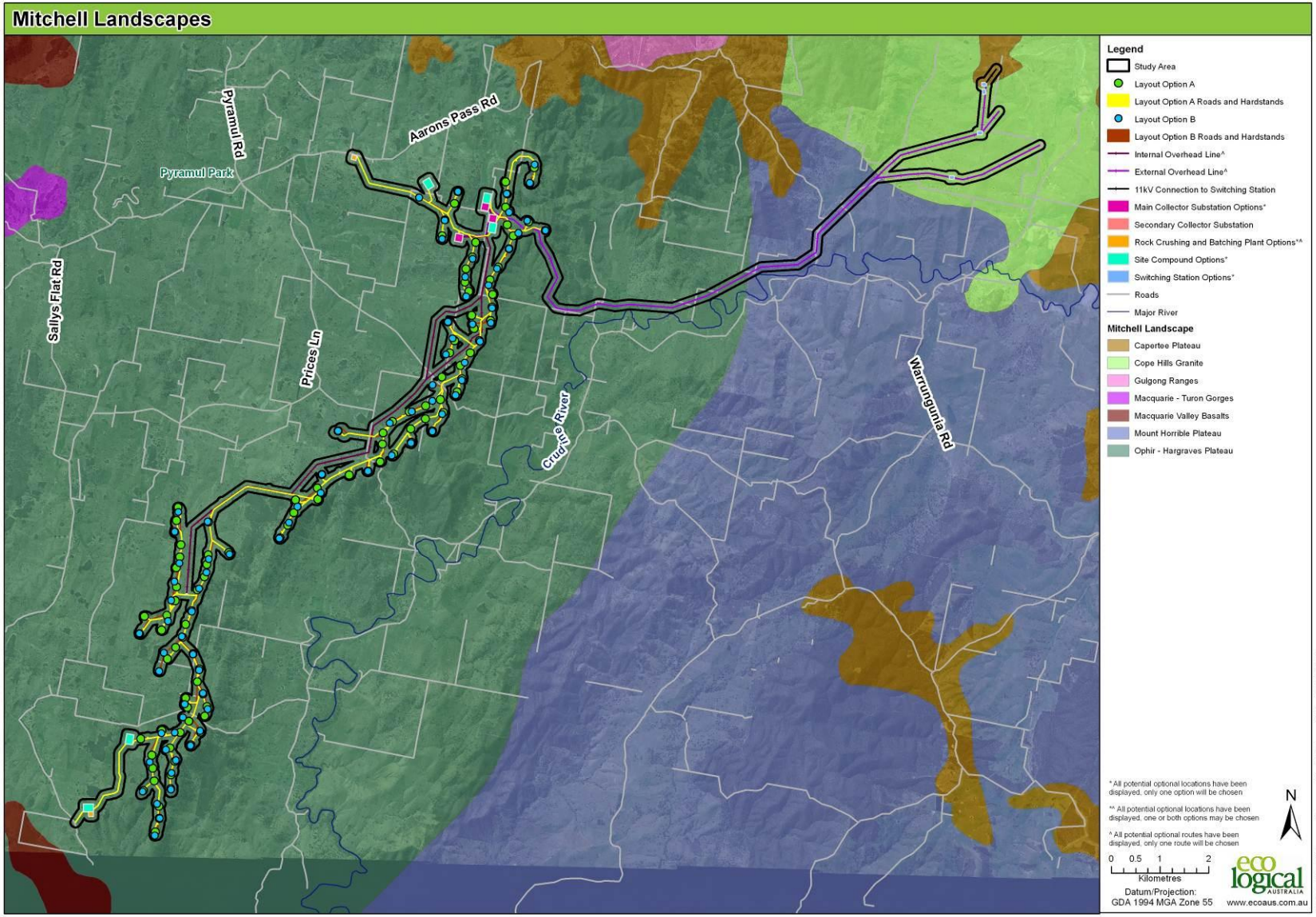

Figure 5: Mitchell Landscapes

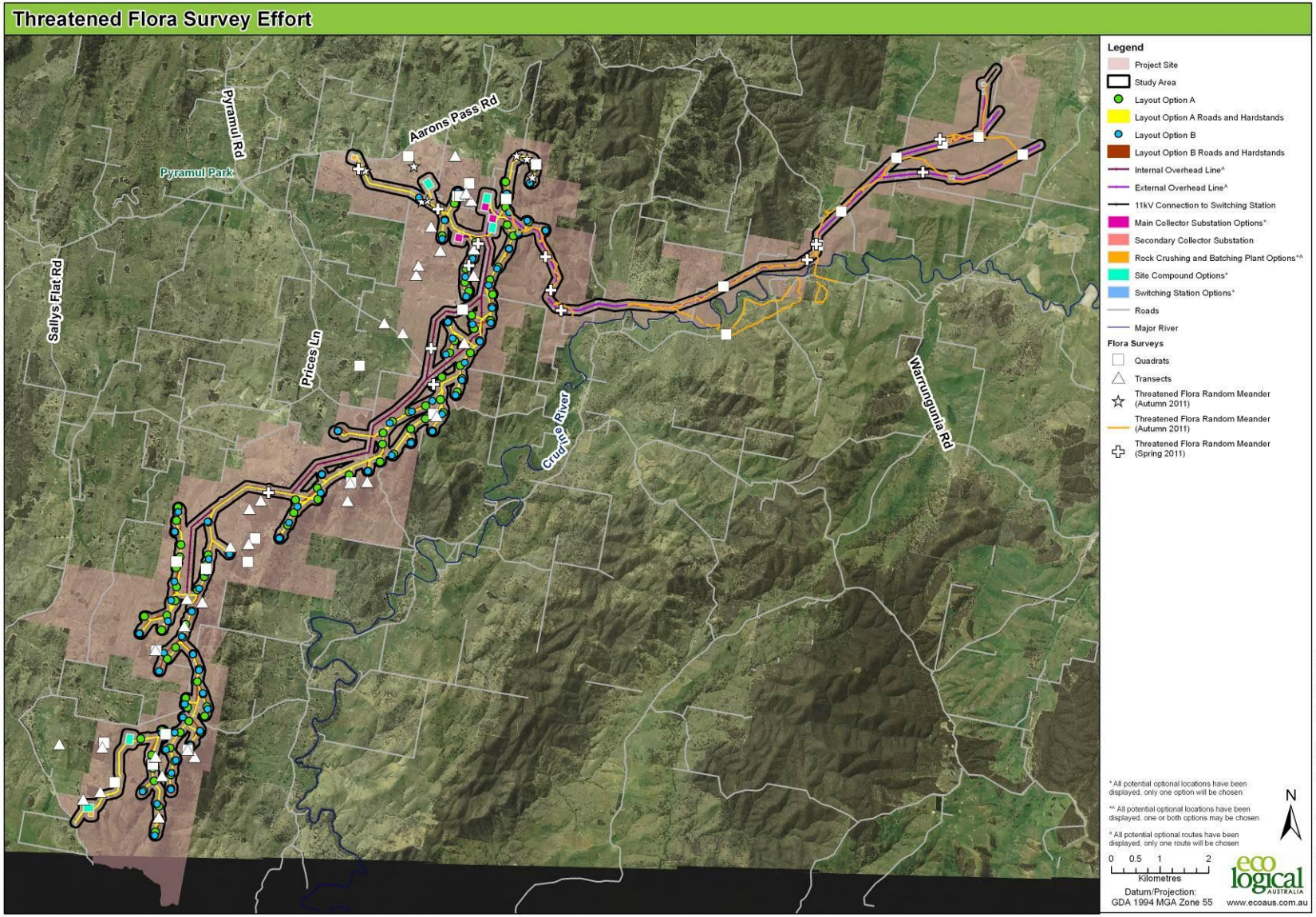

Figure 6: Survey locations - flora

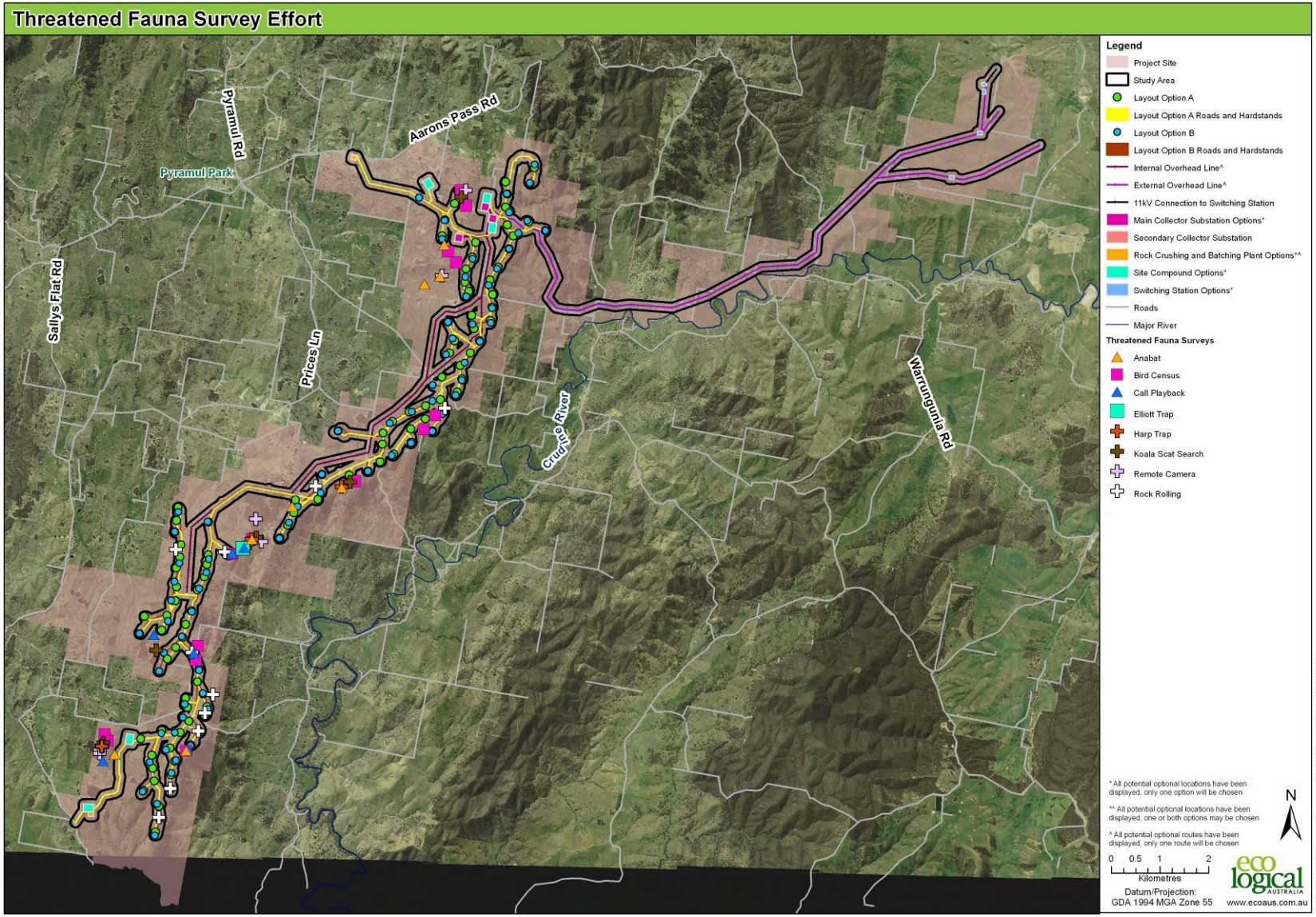

Figure 7: Survey locations - fauna

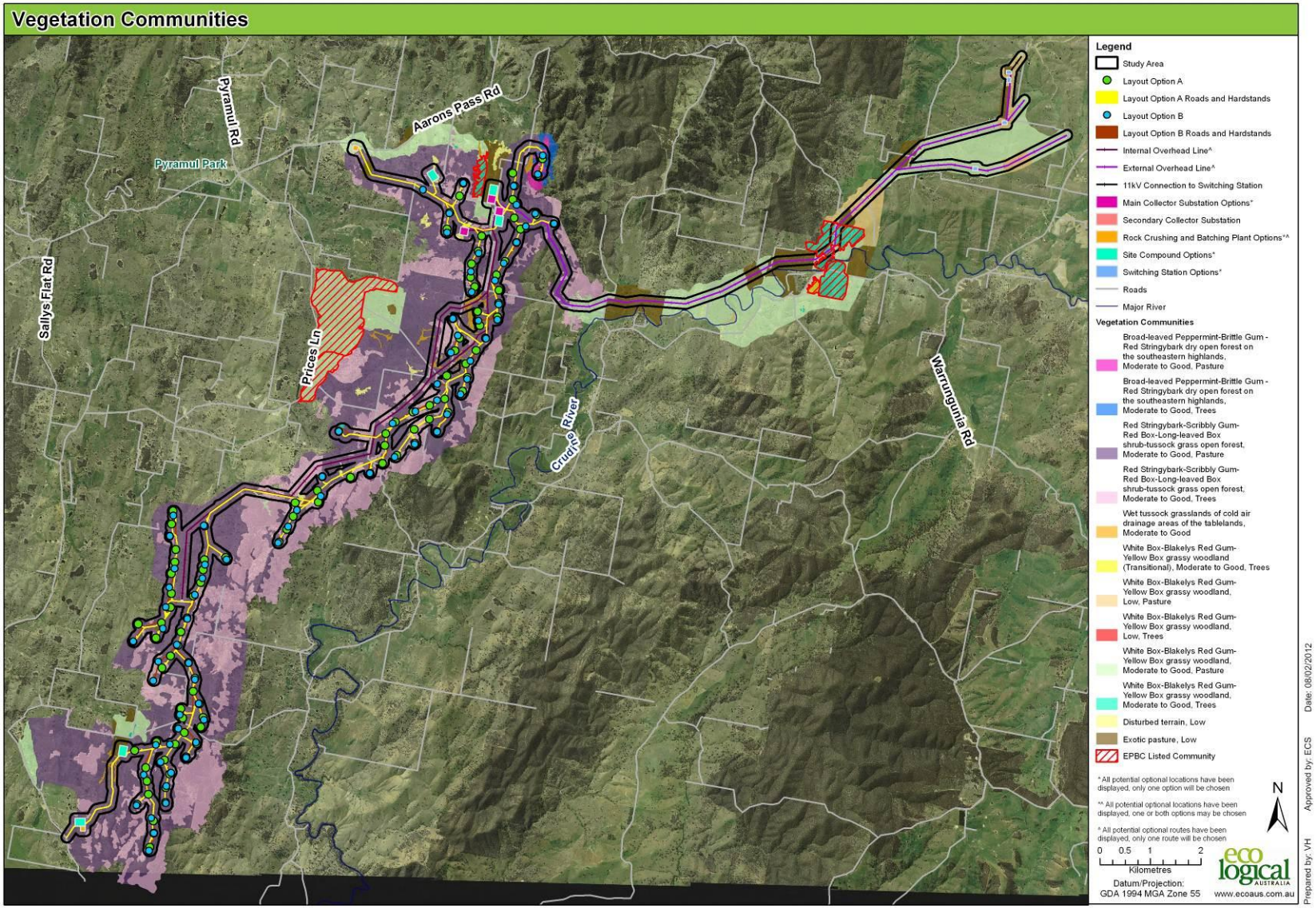

Figure 8: Vegetation mapping

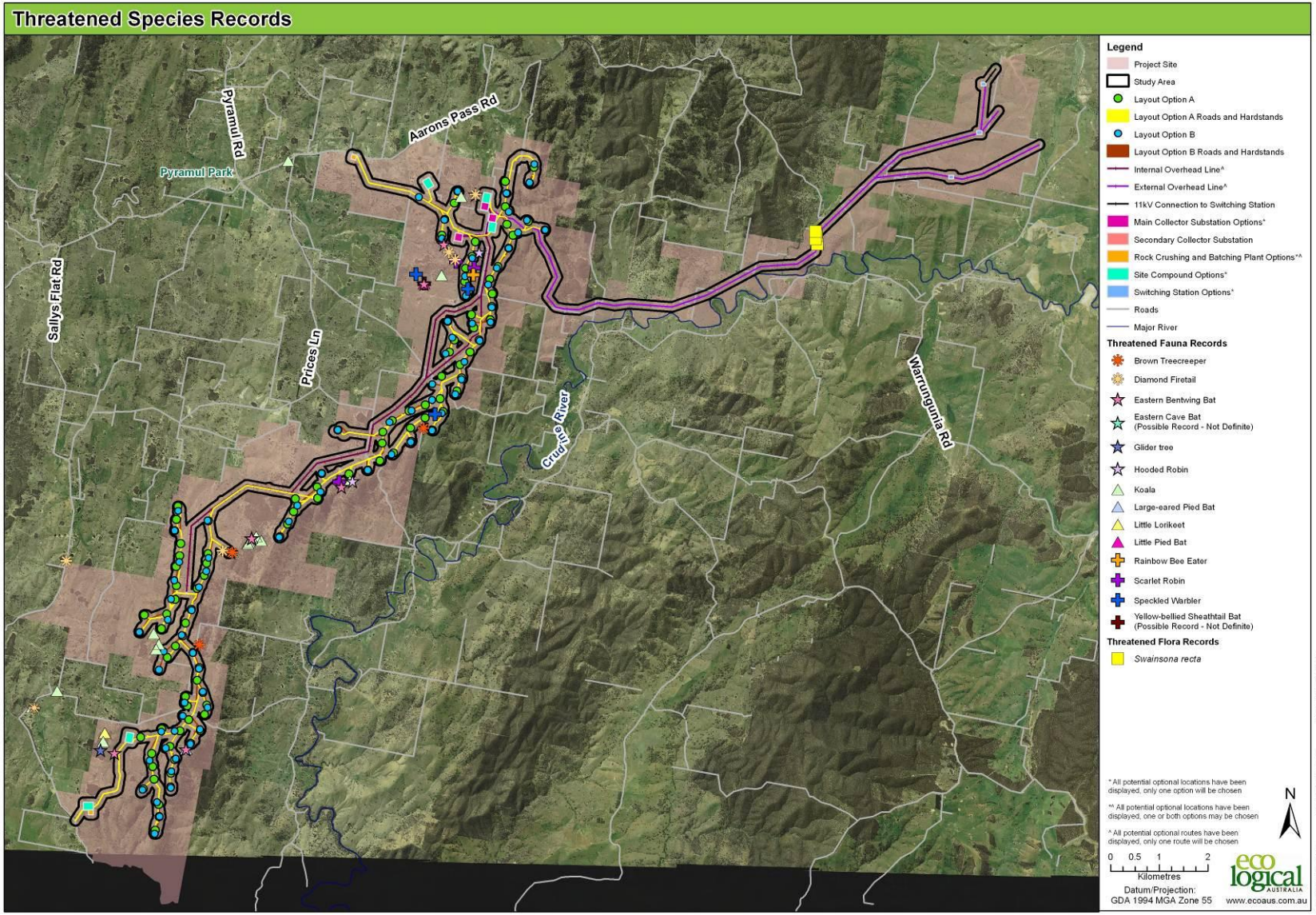

Figure 9: Threatened species records

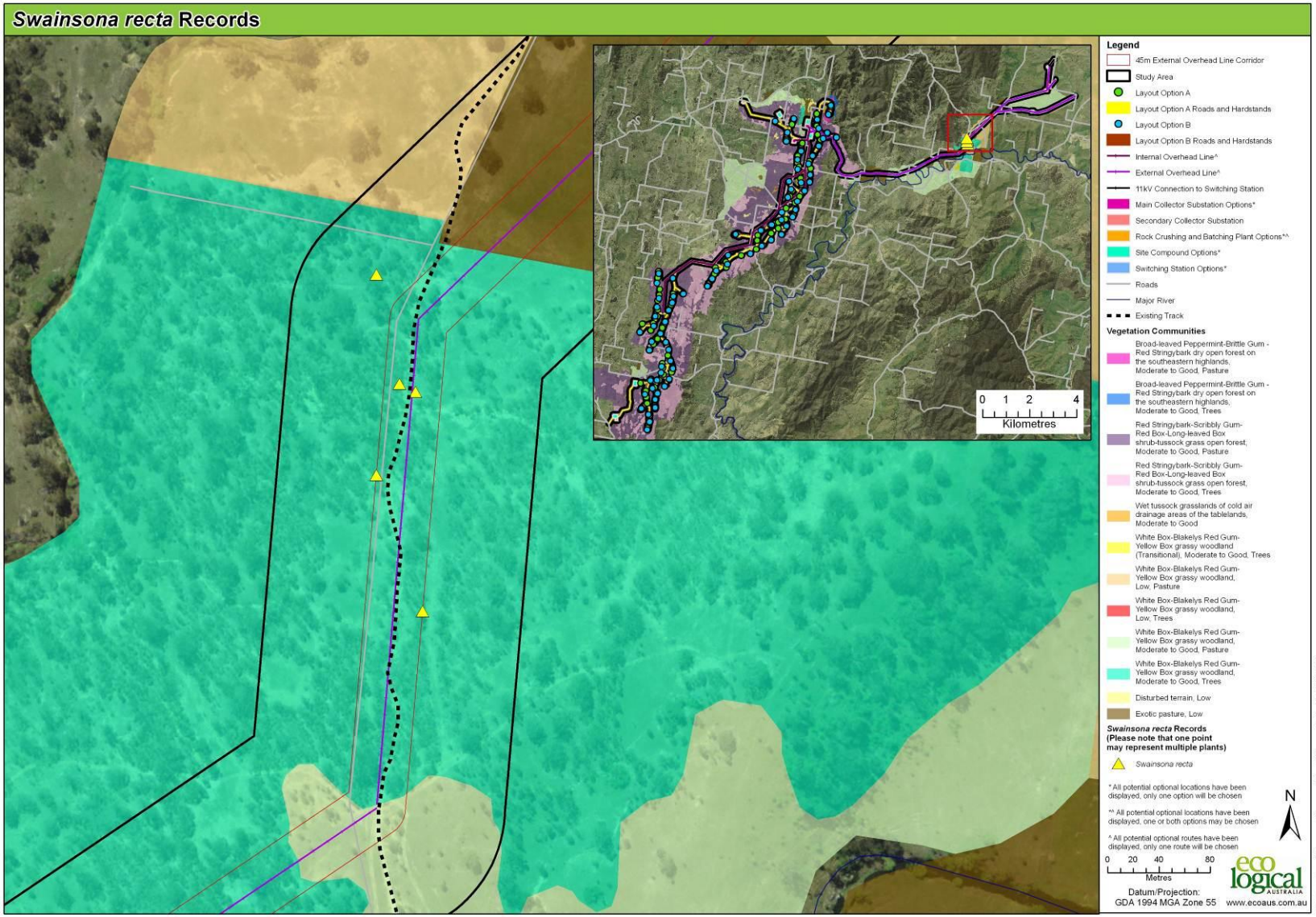

Figure 10: *Swainsona recta* locations

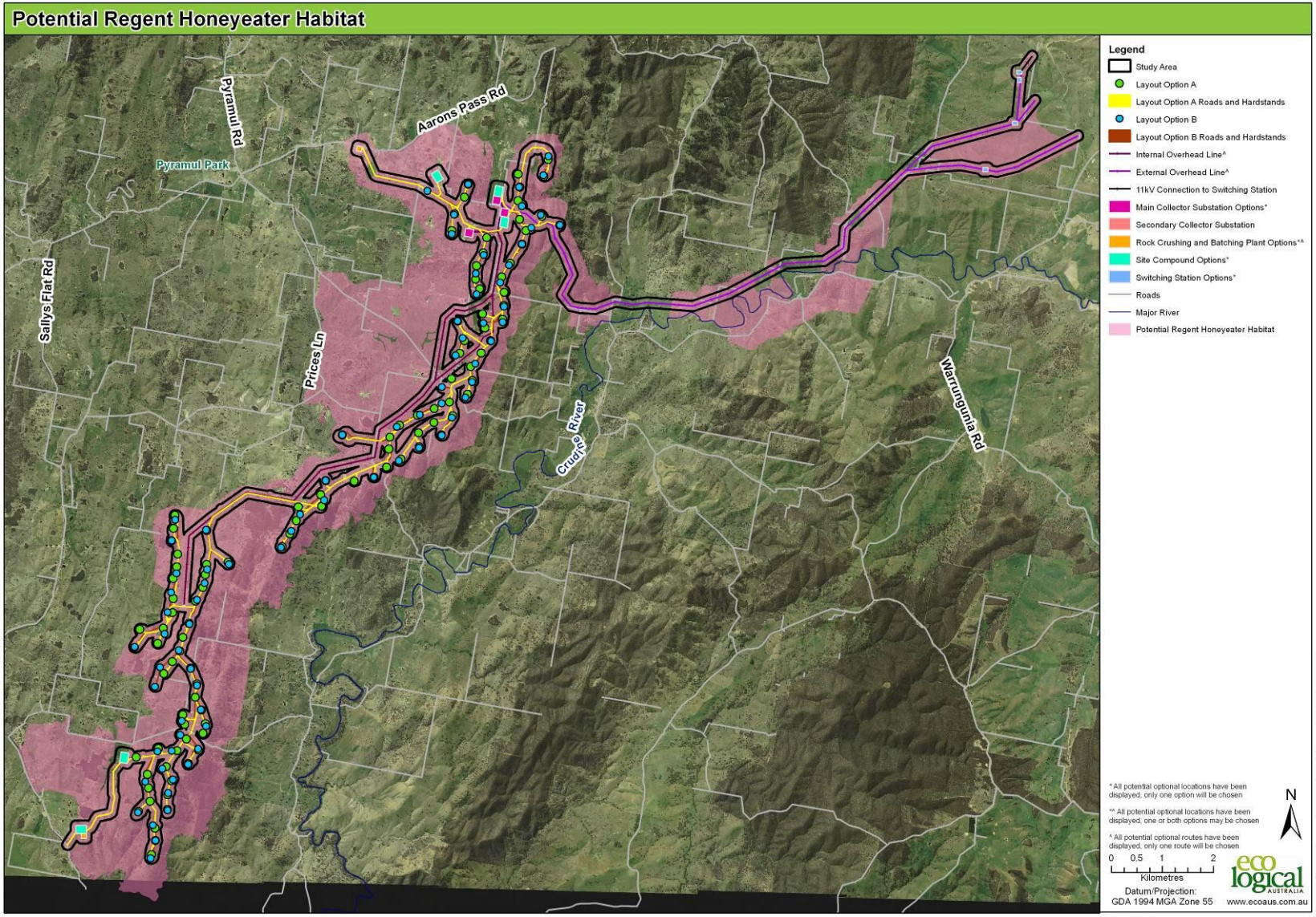

Figure 11: Regent Honeyeater potential habitat

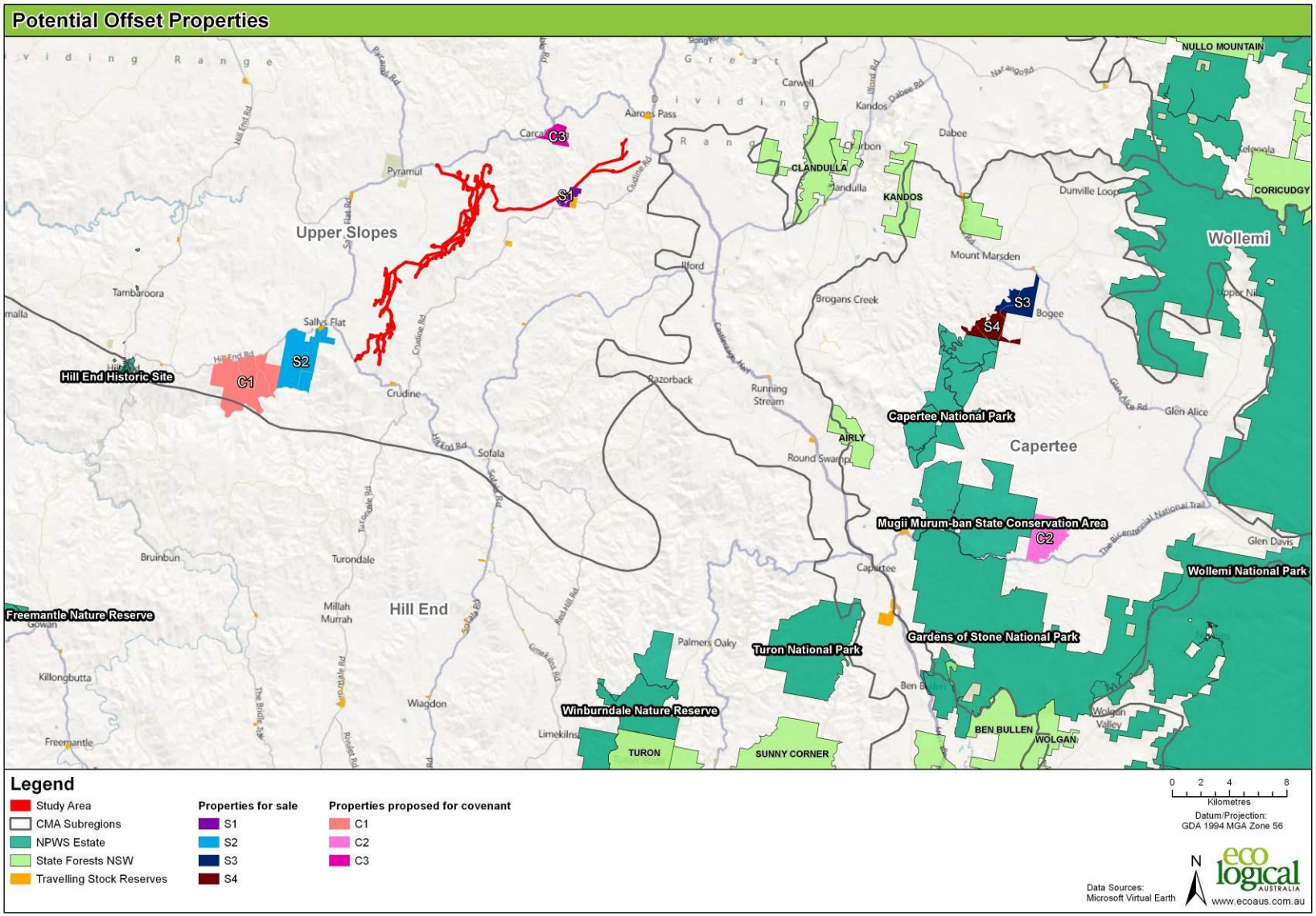

Figure 12: Overview of potential offset sites

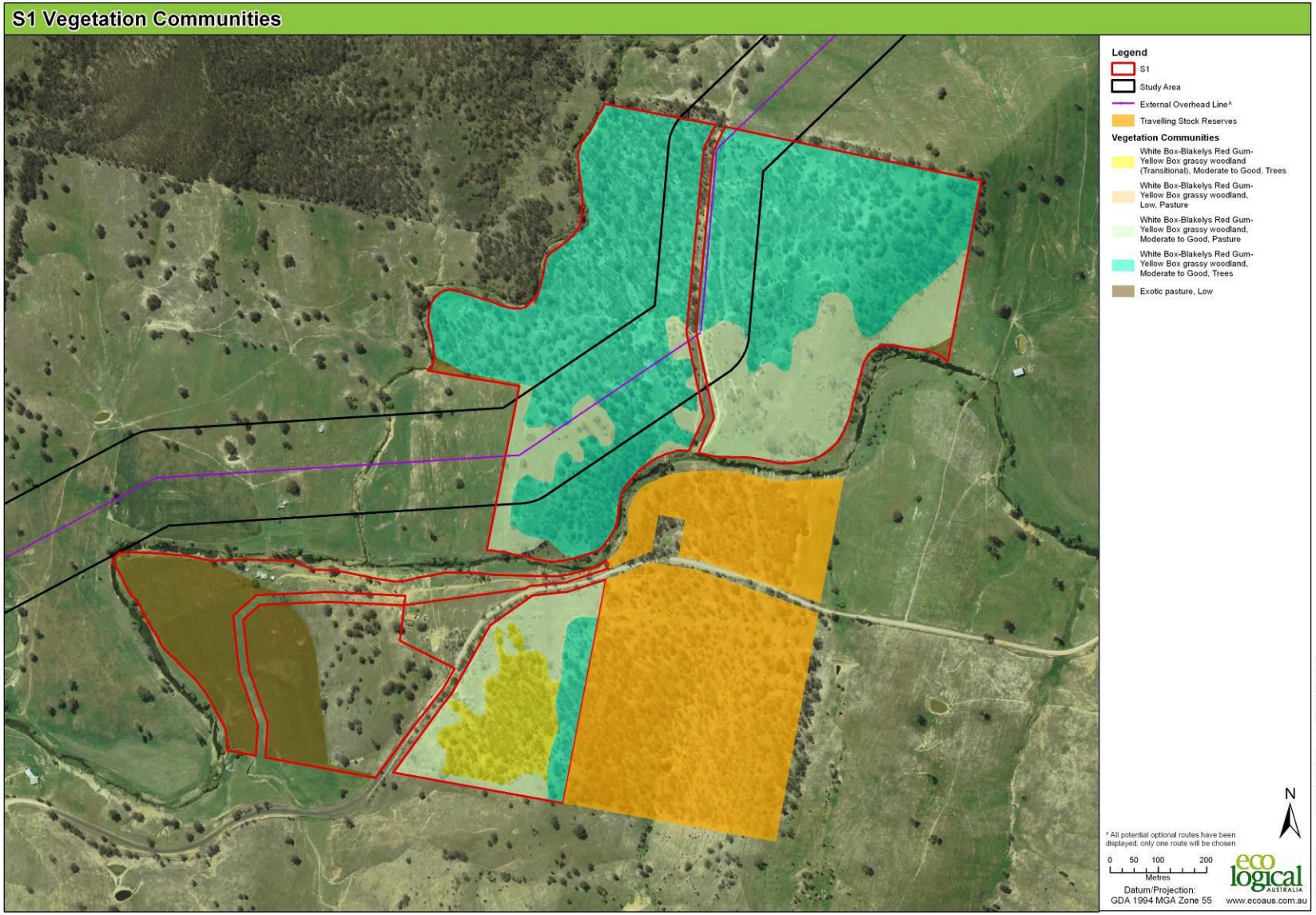

Figure 13: Mapped vegetation types and condition on purchase property S1

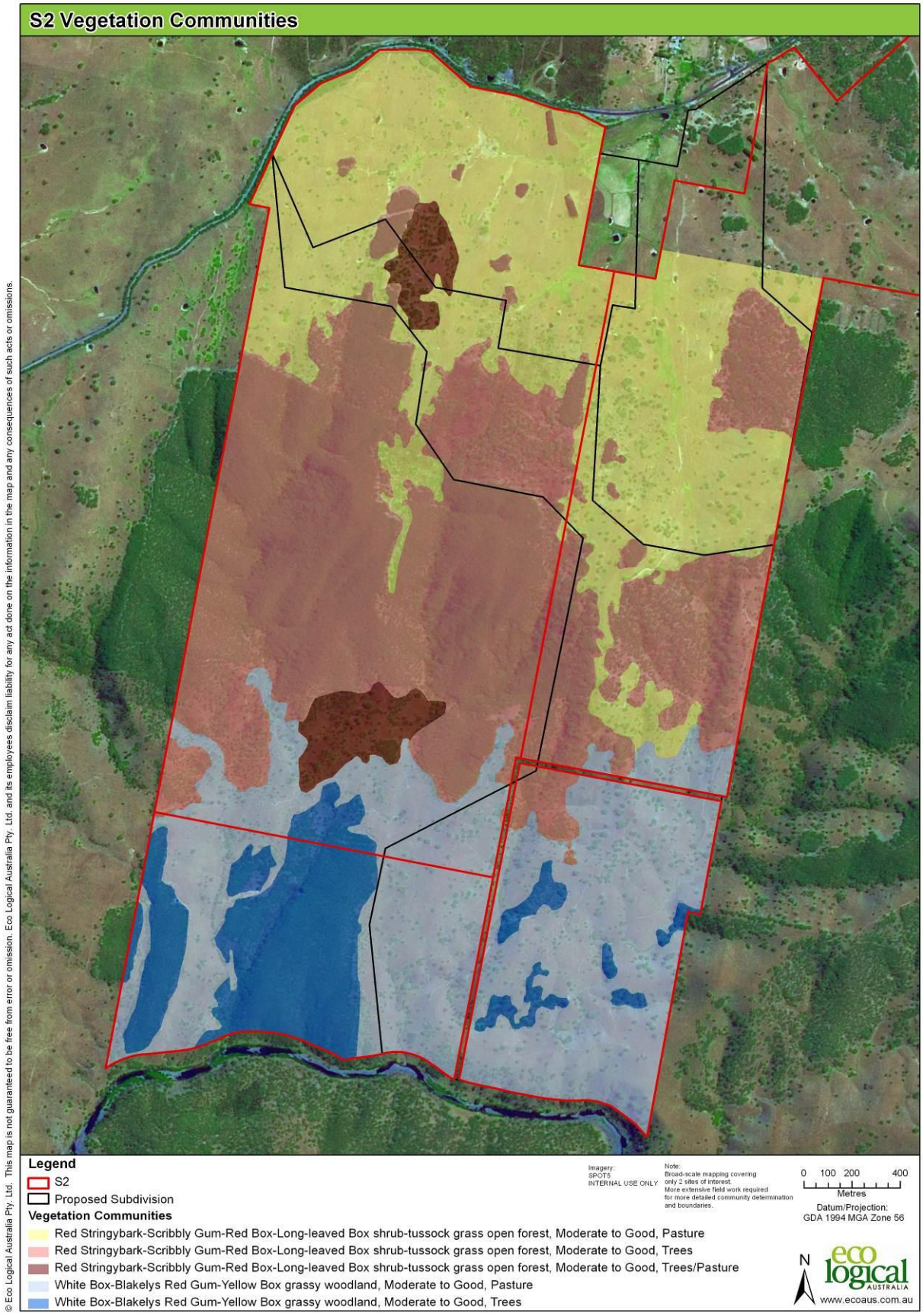

Figure 14: Mapped vegetation types and condition on purchase property S2

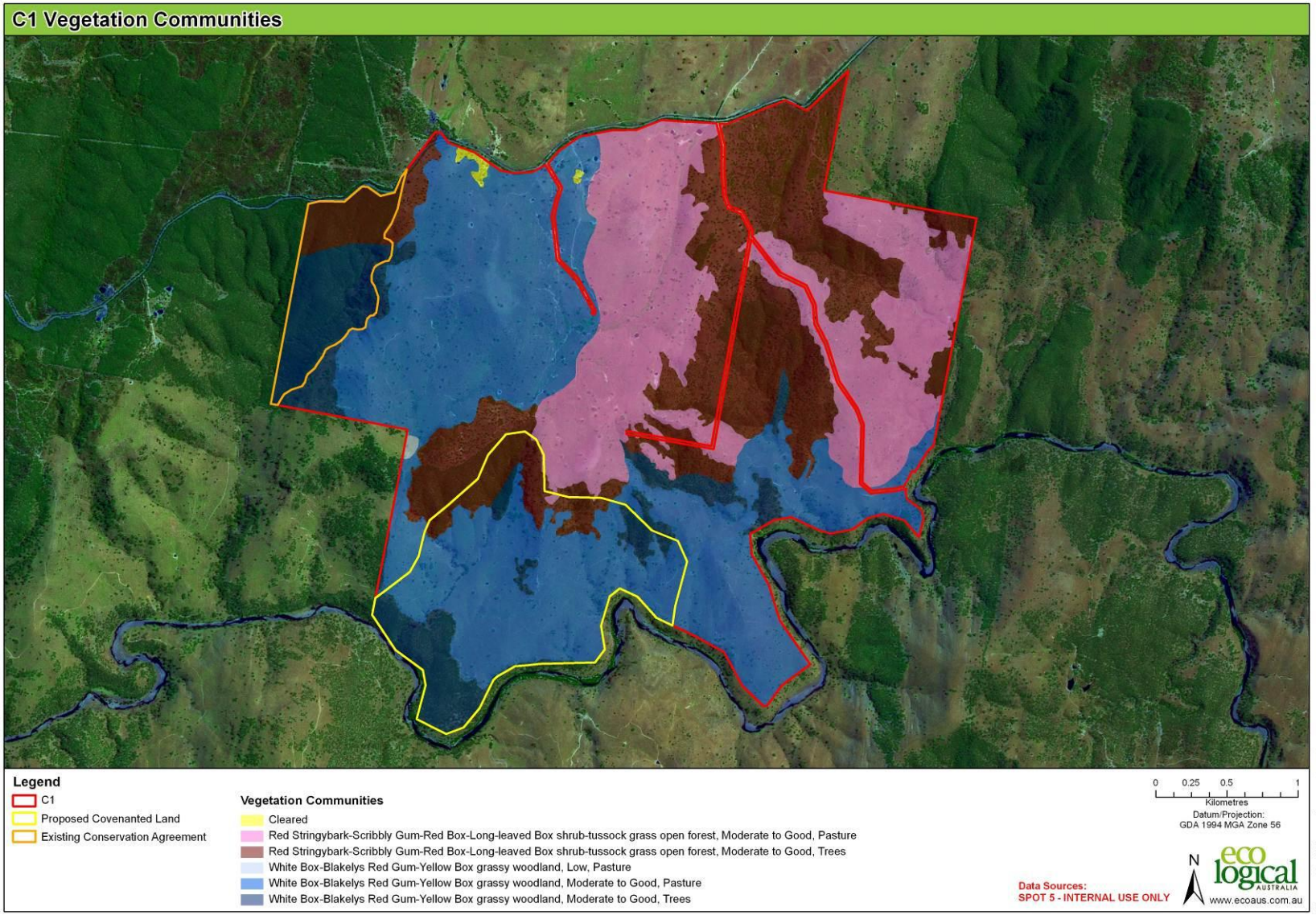

Figure 15: Mapped vegetation types and condition on potential covenant property C1

Appendix B: Director-General's Requirements

SUBJECT OF IMPACT	REQUIREMENTS	EA REFERENCE
Department of Planning		
Flora and fauna	**1.** an ecological assessment considering terrestrial ecosystems, including groundwater dependant ecosystems, consistent with *Guidelines for Threatened Species Assessment* (DEC, 2005) including:	No groundwater dependant ecosystems present at site.
	i. identification of threatened species, populations and communities listed under both State and Commonwealth legislation that have the potential to occur on site	Section 4.3, Appendix C
	ii. mapping of existing vegetation by vegetation/community type and inclusion of details on existing site conditions, including whether the vegetation comprises a highly modified or over-cleared landscape and the types and quality of habitat resources available. (Vegetation mapping should consider any Environmentally Sensitive Area Mapping held by Bathurst Regional Council and Mid-Western Regional Council)	Section 4.3.1, Figure 7.
	iii. provision of details of the survey methodology employed including survey effort and representativeness for each species targeted and clear justification for species that were discounted from requiring field surveys or assessment.	Section 4.2
	iv. demonstration of a design philosophy of impact avoidance on ecological values and, in particular, ecological values of high significance	Section 5.2
	v. provision of a worst-case estimate of vegetation to be cleared (in ha) including quantifying impacts (in ha) by vegetation type and threatened species habitat (as relevant)	Section 5.4
	vi. assessment of the significance of impacts to native vegetation, listed threatened species, populations and communities and their habitats with consideration to local and region-based ecological implications, including habitat connectivity and distribution of species.	Section 5.4, Appendices H & J
	vii. assessment of the risk of weed spread and identification of mitigation measures	Section 5.3 & 5.4
	viii. assessment of impacts to in-stream and riparian ecology from works close to waterways and/or waterway crossings	Riparian Assessment

SUBJECT OF IMPACT	REQUIREMENTS	EA REFERENCE
	ix. assessment of impacts 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 from the turbines including demonstration of how the project has been sited to avoid and/or minimise such impacts.	Section 5.2, 5.3 & 5.5
	3. details of how flora and fauna impacts would be managed during construction and operation including adaptive management, rehabilitation/regeneration measures and maintenance protocols	Section 5.3
	4. demonstrate how the project (with incorporation of all proposed measures to avoid, mitigate and/or offset impacts) achieves a biodiversity outcome consistent with 'maintain or improve' principles. Sufficient details must be provided to demonstrate the availability of viable and achievable options to offset the impacts of the project and to secure these measures in perpetuity	Chapter 6
Department of Environment and Climate Change & Water		
General	A comprehensive description of the production processes, all discharges and emission to the environment, an assessment of likely impacts, and a comprehensive description of any proposed control measures.	Chapter 2, Section 5.3
	Details are required on the location of the proposed development, including the affected environment, to place the proposal in its local and regional context including surrounding land uses, planning zonings and potential sensitive receptors.	Chapter 1
	The EA should describe mitigation and management options that will be used to prevent, control, abate or mitigate identified environmental impacts associated with the project and to reduce risks to human health and the environment. This should include an assessment of the effectiveness and reliability of the measures and any residual impacts after these measures are implemented.	Section 5.3
Threatened Species	A number of threatened entities are known to occur or have potential to occur in the Crudine area. A field survey of the site should be conducted and documented in accordance with the draft "*Guidelines for Threatened Species Assessment*" (DEC and DPI, 2005) as it provides the assessment framework for threatened species issues associated with the site.	Section 4.3
	Likely impacts on regionally significant, protected and threatened species and their habitats need to be assessed, evaluated and reported. The assessment should specifically report on the considerations listed in Step 3 of the Draft Threatened Species Guidelines (DECC and DPI, 2005) as stated below. Step 3, Involves identifying not only the magnitude and extent of impacts but also the significance of the impacts as related to conservation importance of the habitat, individuals and population likely to be affected.	Chapter 5

SUBJECT OF IMPACT	REQUIREMENTS	EA REFERENCE
	The EA should clearly state whether it meets each of the key thresholds set out in Step 5 of the draft guidelines and describe the actions that will be taken to avoid or mitigate impacts or compensate to prevent unavoidable impacts of the project on threatened species, populations, ecological communities, or their habitats. This should include and assessment of the effectiveness and reliability of the measures and any residual impacts after the measures are implemented.	Section 5.2
Biodiversity	Biodiversity impacts can be assessed using **either** the Biobanking Assessment Methodology (scenario 1) or a detailed biodiversity assessment (scenario 2). The requirements for each of these approaches are detailed below. The Biobanking Assessment Methodology can be used either to obtain a BioBanking statement, or to assess impacts of the proposal and to determine required offsets without obtaining a statement. In the latter instances, if the required credits are not available for offsetting, appropriate alternative options may be developed in consultation with DECCW officers and in accordance with DECCW policy.	Section 4.2, Chapter 6
	Scenario 1 – Where a proposal is assessed using the BioBanking Assessment Methodology (BBAM)	
	1. Where a Biobanking Statement is being sought under Part 7A of the Threatened Species Conservation Act 1995 (TSC Act), the assessment must be undertaken by an accredited Biobanking assessor (as specified under section 142B (1)(c) of the TSC Act 1995) and done in accordance with the *Biobanking Assessment Methodology and Credit Calculator Operational Manual* (DECCW, 2008). To qualify for a Biobanking Statement the proposal must meet the 'maintain or improve standard'.	NA
	1a. The EA should include a specific Statement of Commitment that reflects all of the requirements of the Biobanking Statement including the number of credits required and any DG approved variations to impact on Red Flags.	NA
	2. Where the Biobanking Assessment Methodology is being used to assess impacts of a proposal and to determine required offsets, and a Biobanking Statement is not being obtained, the EA should contain a detailed biodiversity assessment and all components of the assessment must be undertaken in accordance with the *Biobanking Assessment Methodology and Credit Calculator Operational Manual* (DECCW, 2008).	Chapters 4 – 6, Appendix I
	2a. The EA should include a specific Statement of Commitment which: is informed by the outcomes of the proposed Biobanking assessment offset package;	Section 5.3, Chapter 6

SUBJECT OF IMPACT	REQUIREMENTS	EA REFERENCE
	sets out the ecosystems and species credits required by the Biobanking Assessment Methodology and how these ecosystem and/or species credits will be secured and obtained;	Chapters 6, Appendix I
	if the ecosystem or species credits cannot be obtained, provides appropriate alternative options to offset expected impacts, noting that an appropriate alternative option may be developed in consultation with DECCW officers and in accordance with DECCW policy;	Chapters 6, Appendix I
	demonstrates how all options have been explored to avoid red flag areas;	
	includes all relevant 'Biobanking files (e.g. *.xml output files), data sheets and documentation (including maps, aerial photographs, GIS files, other remote sensing imagery etc.) to ensure DECWW can conduct an appropriate review of the assessment.	Chapters 6, Appendix I Other relevant files to be submitted with the EA.
	3. Where appropriate, likely impacts (both direct and indirect) on any adjoining and/or nearby DECCW estate reserved under the *National Parks and Wildlife Act 1974* or any marine and estuarine protected areas under the *Fisheries Management Act* or the *Marine Parks Act 1997* should be considered. Please refer to the *Guidelines for developments adjoining land and water managed by the Department of Environment, Climate Change and Water* (DECCW, 2010).	NA
	4. With regard to the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*, the assessment should identify and assess any relevant Matters of Environmental Significance and whether the proposal has been referred to the Commonwealth or already determined to be a controlled action.	Section 3.1.1, Section 4.3, Chapter 5 & Appendix J
	Scenario 2 – Where a proposal is assessed outside the Biobanking Assessment Methodology:	
	1. The EA should include a detailed biodiversity assessment, including assessment of impacts on threatened biodiversity, native vegetation and habitat. This assessment should address the matters included in the following sections.	Chapter 4 & Chapter 5
	2. A field survey of the site should be conducted and documented in accordance with relevant guidelines, including:	
	the *Threatened Species Survey and Assessment Guidelines: Field Survey Methods for Fauna - Amphibians* (DECWW, 2009)	Section 4.2
	Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities – Working Draft (DEC, 2004), and	Section 4.2

SUBJECT OF IMPACT	REQUIREMENTS	EA REFERENCE
	Threatened species surveys and assessment guideline information on www.enviornment.nsw.gov.au/threatenedspecies/surveyassessmentgdlns.htm.	Section 4.2
	If a proposed survey methodology is likely to vary significantly from the above methods, the proponent should discuss the proposed methodology with DECCW prior to undertaking the EA, to determine whether DECCW considers that it is appropriate.	Section 4.2
	Recent (less than five years old) surveys and assessments may be used. However, previous surveys should not be used if they have: • been undertaken in seasons weather conditions or following extensive disturbance events when the subject species are unlikely to be detected or present, or • utilised methodologies, survey sampling intensities, timeframes and baits that are not the most appropriate for detecting the target subject species. unless these differences can be clearly demonstrated to have had an insignificant impact upon the outcomes of the surveys. If a previous surveys is used, any additional species listed under the TSC Act since the previous survey took place, must be surveyed for.	Section 4
	Determining the list of potential threatened species for the site must be done in accordance with the *Threatened Biodiversity Survey Assessment: Guidelines for Development and Activities – Working Draft* (DEC, 2004) and the *Guidelines for Threatened Species Assessment* (Department of Planning, July 2005).	Chapter 5
	The DECCW Threatened Species website http://www.environment.nsw.gov.au/threatenedspecies/ and the Atlas of NSW Wildlife database must be the primary information source for the list of threatened species present.	Section 4.1
	The Biobanking Threatened Species database, the Vegetation Types databases (available on DECCW website at http://www.enviornment.nsw.gov.au/biobankingtspd.htm and http://www.enviornment.nsw.gov.au/biobanking/vegetypedatabase.htm, respectively) and other data sources (e.g. PlantNet, Online Zoological Collections of Australian Museums (http://ozcam.org/), previous or nearby surveys etc.) may also be used to compile the list.	Section 4.2.5
	3. The EA should contain the following information as a minimum: a. The requirements set out in the *Guidelines for Threatened Species Assessment* (Department of Planning, July 2005).	Chapter 4 - 6

SUBJECT OF IMPACT	REQUIREMENTS	EA REFERENCE
	b. Description and geo-referenced mapping of the study area (and spatial files), e.g. overlays on topographic maps, satellite images and/or aerial photos, including details of map datum, projection and zone, all survey locations, vegetation communities (including classification and methodology used to classify), key habitat features and reported locations of threatened species, populations and ecological communities present in the subject site and study area.	Appendix A
	c. Description of survey methodologies used, including timing, location and weather conditions.	Section 4.2
	d. Details, including qualifications and experience of all staff undertaking the surveys, mapping and assessment of impacts as part of the EA.	Section 4.2
	e. Identification of national and state listed threatened biota known or likely to occur in the study area and their conservation status.	Appendix C
	f. Description of the likely impacts of the proposal on biodiversity and wildlife corridors, including direct and indirect and construction and operation impacts. Wherever possible, quantify these impacts such as the amount of each vegetation community or species habitat to be cleared or impacted, or any fragmentation of a wildlife corridor.	Chapter 5
	g. Identification of the avoidance, mitigation and management measures that will be put in place as part of the proposal to avoid or minimise impacts, including details about alternative options considered and how long term management arrangements will be guaranteed.	Section 5.2 & 5.3
	h. Description of the residual impact of the proposal. If the proposal cannot adequately avoid or mitigate impacts on biodiversity, then a biodiversity offset package is expected (see the requirements for this at point 6 below).	Chapter 6
	i. Provision of specific Statement of Commitments relating to biodiversity.	Section 5.3
	4. An assessment of the significance of direct and indirect impacts of the proposal must be undertaken for threatened biodiversity known or considered likely to occur in the study area based on the presence of suitable habitat.	Chapter 5. Appendix H & J
	This assessment must take into account: a. the factors identified in s.5A of the EP&A Act, and	Appendix H – Part 3A significance assessments

SUBJECT OF IMPACT	REQUIREMENTS	EA REFERENCE
	b. the guidance provided by the *Threatened Species Assessment Guideline – The Assessment of Significance* (DECCW, 2007) which is available at http://www.enviornment.nsw.gove.au/resources/threatenedspecies/tsaguide07393.pdf	Appendix H – Part 3A significance assessments Section 5A assessments not relevant to Part 3A.
	5. Where an offsets package is proposed by a proponent for impacts to biodiversity (and a BioBanking Statement has not been sought) this package should: a) Meet DECCW's Principles for the use of biodiversity offsets in NSW, which are available at: www.enviornment.nsw.gove.au/biocertification/offsets.htm	Section 6.2
	b) Identify the conservation mechanisms to be used to ensure the long term protection and management of the offset sites.	Section 6.5
	c) Include an appropriate Management Plan (such as vegetation or habitat) that has been developed as a key amelioration measure to ensure any proposed compensatory offsets, retained enhancement features within the development footprint and/or impact mitigation measures (including proposed rehabilitation and/or monitoring programs) are appropriately managed and funded.	Management plans are to be prepared following consent – Chapter 6
	6. Where appropriate, likely impacts (both direct and indirect) on any adjoining and/or nearby DECCW estate reserved under the *National Parks and Wildlife Act 1974* or any marine and estuarine protected areas under the *Fisheries management Act 1994* or the *Marine Parks Act 1997* should be considered.	NA
	Refer to the *Guidelines for developments adjoining land and water managed by the Department of Environment, Climate Change and Water (DECC, 2010).*	NA
	7. Which regard to the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*, the assessment should identify any relevant Matters of National Environmental Significance and whether the proposal has been referred to the Commonwealth or already determined to be a controlled action.	Section 3.1.1 & Appendix J
Department of Sustainability, Environment, Water, Population and Communities		

SUBJECT OF IMPACT	REQUIREMENTS	EA REFERENCE
General Information	1. The background of the action, including: a. the title of the action; b. the full name and postal address of the designated proponent; c. a clear outline of the action; d. the location of the action; e. the background to the development of the action; f. how the action relates to any other actions (of which the proponent should be reasonably aware) that have been, or are being, taken or that have been approved in the region affected by the action; g. the current status of the action; and h. the consequences of not proceeding with the action.	Section 1 & 2
Description of ccontrol action	2. A description of the action, including: a. all the components of the action; b. the precise location of any works to be undertaken, structures to be built or elements of the action that may have relevant impacts; c. 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;	Chapter 2 and Sections 5.2 & 5.4.1
	d. to the extent reasonably practicable, a description of any feasible alternatives to the controlled action that have been identified through the assessment, and their likely impact, including: i. if relevant, the alternative of taking no action; ii. a comparative description of the impacts of each alternative on the matters protected by the controlling provisions for the action; and iii. sufficient detail to clarify why any alternative is preferred to another.	Chapter 2 and Sections 5.2 & 5.4.1

SUBJECT OF IMPACT	REQUIREMENTS	EA REFERENCE
Description of the relevant impacts of the controlled action	3. An assessment of all relevant impacts with reference to the *EPBC Act Policy Statement 1.1 Significant Impact Guidelines Matters of National Environmental Significance (2009)* that the controlled action has, will have, or is likely to have on relevant migratory and threatened species and/or ecological communities listed under sections 18, 18A, 20 and 20A of the EPBC Act, including, but not limited to: a. White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland (Box-Gum Woodland); b. Regent Honeyeater (*Anthochaera phrygia*); c. Small Purple-pea (*Swainsona recta*); d. Cannon's Stringybark (*Eucalyptus macrorhyncha* subsp. *Cannonii*); and e. *Prasophyllum* sp. *Wybong*	Appendix J
	4. Information must include: a. a description of the nature, location and extent of all vegetation types occurring on-site; b. justification of the likelihood of occurrence within the proposed development envelope for each relevant species and ecological community;	Section 4.3 & Appendix C
	c. a description and analysis of significance of the potential *inter alia*, direct, indirect, cumulative and facilitative impacts, both in the short and long term, of the action to each relevant species and ecological community, including, but not limited to: i. disruption to breeding, foraging or other key life-cycle stages; ii. habitat loss and fragmentation; iii. aviation lighting; iv. turbine collision (i.e. blade strike) and barotraumas (i.e. low pressure zones around the blades); and v. alienation (i.e. behavioural avoidance of species to habitat near turbines).	Appendix J & Chapter 5
	d. evidence and outcome of consultation with experts in relation to potential impacts to the Regent Honeyeater (*Anthochaera phrygia*);	Section 5.5.2

SUBJECT OF IMPACT	REQUIREMENTS	EA REFERENCE
	e. relevant technical data or other information, within the context of the proposed development site and region, for example: i. the area of occupancy; ii. the availability and condition of potential foraging, roosting, sheltering and breeding habitat for the species; iii. the relative activity levels and areas of importance (e.g. roost sites, breeding sites) of threatened birds; iv. the abiotic (non-living) factors which may be necessary for the survival and functioning of the community, for example ground or surface water levels, soil and nutrients; and v. a map (or maps) showing the hydrology and topography within the development envelope; and	Section 4.3. Appendix A & J
	f. a statement as to whether any relevant impacts are likely to be unknown, unpredictable or irreversible	Chapter 5, Appendix J
	These impacts should be described for the construction and operation phases of the controlled action.	Section 5.5-5.9.
	5. Where there is a potential habitat for EPBC Act listed species, surveys should be undertaken, or justification why surveys are not necessary. Any surveys must be timed appropriately and undertaken for a suitable period of time by a qualified person.	Section 4.2

SUBJECT OF IMPACT	REQUIREMENTS	EA REFERENCE
Proposed safeguards and mitigation measures	6. A description of feasible mitigation measures, changes to the controlled action or procedures, which have been proposed by the proponent or suggested in public submissions, and which are intended to prevent or minimise relevant impacts. Information must include: a. a consolidated list of mitigation measures proposed to be undertaken to prevent, minimise or compensate for the relevant impacts of the action; b. a description and assessment of the expected or predicted effectiveness of the mitigation measures; c. any statutory or policy basis for the mitigation measures; d. the cost of the mitigation measures; e. 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; and f. the name of the agency responsible for endorsing or approving each mitigation measure or monitoring program.	Section 5.2 & 5.3.
Offsets	7. Should any residual impact exist that cannot be mitigated it may be necessary for offset measures to be considered in order to ensure the protection of matters of national environmental significance in perpetuity. Information required includes: a. a description of the proposed offset measure/s, such as how, when and where the offset will be delivered and managed; b. detail of how the offset/s compensate for the impact on each relevant matter of NES, resulting from the action; c. a description of how the offset/s will ensure the protection, conservation and management of the relevant matter of NES, in perpetuity; d. description of how the offset/s are consistent with relevant Commonwealth policies or advice on offsets under the EPBC Act; and e. the cost (financial and other) of the offset/s.	Chapter 6

SUBJECT OF IMPACT	REQUIREMENTS	EA REFERENCE
Other approvals and conditions	8. Any other requirements for approval or conditions that apply, or that the proponent reasonably believes are likely to apply, to the proposed action. Information must include: a. details of any local, State government planning scheme, or plan or policy under any local or State government planning system that deals with the proposed action, including: i. what environmental assessment of the proposed action has been, or is being, carried out under the scheme, plan or policy; and ii. how the scheme provides for the prevention, minimisation and management of any relevant impacts; b. a description of any approval that has been obtained from a State, Territory or Commonwealth agency or authority (other than an approval under the Act), including any conditions that apply to the action; c. a statement identifying any additional approval that is required; and d. a description of the monitoring, enforcement and review procedures that apply, or are proposed to apply, to the action.	Chapter 3
Economic and social matters	9. A description of the short-term and long-term social and economic implications and/or impacts of the project.	Chapter 19 of Environmental Assessment
Environmental record of person proposing to take the action	10. Details of any proceedings under a Commonwealth, State or Territory law for the protection of the environment or the conservation and sustainable use of natural resources against: e. the proponent; and f. for an action for which a person has applied for a permit, the person making the application	Chapter 2 of Environmental Assessment
	11. Details of the proponent's environmental policy and planning framework.	Chapter 2 of Environmental Assessment
Information sources	12. For information given in an environment assessment, the draft must state: g. the source of the information; h. how recent the information is; i. how the reliability of the information was testes; and j. what uncertainties (if any) are in the information	Chapter 23 of Environmental Assessment

SUBJECT OF IMPACT	REQUIREMENTS	EA REFERENCE
Consultation	13. Any consultation about the action, including: k. any consultation that has already taken place; l. proposed consultation about the relevant impacts of the action; and m. if there has been consultation about the proposed action – any documented response to, or result of, the consultation	Section 5.5.2 Chapter 6 of Environmental Assessment,
	14. Identification of affected parties, including a statement mentioning any communities that may be affected and describing their views.	Chapter 6 of Environmental Assessment
Agency Specific Requirements		
Bathurst Regional Council	BRC maintains and extensive list of threatened flora and fauna gleaned from actual studies throughout the LGA.	Chapter 4, Section 4.1
Central West Catchment Management Authority	There is a need to specifically assess the impact of the project on nesting trees for raptor bird species.	None recorded
Industry & Investment	The aquatic ecological environmental assessment should include the following information:	Riparian Assessment Report
	A recent aerial photograph (preferably colour) of the locality (or reproduction of such a photograph) should be provided.	Appendix A
	Area which may be affected either by the development or activity should be identified and shown on an appropriately scaled map (and aerial photographs).	Appendix A
	Waterways within the area of development are to be identified.	Riparian Assessment Report
	Description of aquatic and riparian vegetation should be presented and mapped.	Chapter 4, Riparian Assessment Report
	The extent of aquatic habitat removal or modification which may result from the proposed development,	Riparian Assessment Report
	Details of the location of any waterways crossings, including any access tracks.	Riparian Assessment Report

SUBJECT OF IMPACT	REQUIREMENTS	EA REFERENCE
	Details of the methodology (e.g. trenching, boring) for powerlines passing through waterways.	Chapter 2 & Riparian Assessment Report

Appendix C: Threatened Species Likelihood of Occurrence

Table 35: Threatened flora likelihood of occurrence

SPECIES	TSC ACT	EPBC ACT	HABITAT REQUIREMENTS	LIKELIHOOD OF OCCURRENCE	REQUIRES SURVEY UNDER BIOBANKING METHODOLOGY	PREDICTED BY EPBC REPORTING TOOL	OEH ATLAS RECORDS	ROYAL BOTANIC GARDENS	BATHURST REGIONAL COUNCIL RECORD*	MID-WESTERN REGIONAL COUNCIL RECORD
Acacia ausfeldii Ausfeld's Wattle	V	-	Found to the east of Dubbo in the Mudgee, Ulan - Gulgong area of the NSW South Western Slopes bioregion, with some records in the adjoining Brigalow Belt South, South Eastern Highlands and the Sydney Basin bioregions. Associated species include *Eucalyptus albens, E. blakelyi* and *Callitris* spp., with an understorey dominated by *Cassinia* spp. and grasses. Flowers from August to October. Likely to be killed by fire but regenerates from soil seed bank (DECC 2005).	Unlikely	x					

SPECIES	TSC ACT	EPBC ACT	HABITAT REQUIREMENTS	LIKELIHOOD OF OCCURRENCE	REQUIRES SURVEY UNDER BIOBANKING METHODOLOGY	PREDICTED BY EPBC REPORTING TOOL	OEH ATLAS RECORDS	ROYAL BOTANIC GARDENS	BATHURST REGIONAL COUNCIL RECORD*	MID-WESTERN REGIONAL COUNCIL RECORD
Bothriochloa biloba Lobed Blue-grass	-	V	Grows in grasslands and previously cleared eucalyptus forests along the Darling Downs district in Queensland and along the western slopes of the Great Dividing Range in NSW. Described as an erect grass to 1m high distinguished from similar species by its lobed upper lemma. Flowers in summer through to early winter. It is no longer listed as vulnerable in QLD or NSW (TSSC 2008).	Potential		x				
Eucalyptus alligatrix subsp. alligatrix (Synonym: *Eucalyptus alligatrix subsp. miscella*)	V	V	Entire population is confined to a single 10 hectare area, south-west of Rylstone, NSW. Inhabits sclerophyll woodland on shallow relatively infertile soils. Juvenile leaves are opposite, grey-green in colour and ovate to circular in shape. Little is known about the flowering period of this species or its response to fire regimes (OEH 2011b).	No	x		x			

SPECIES	TSC ACT	EPBC ACT	HABITAT REQUIREMENTS	LIKELIHOOD OF OCCURRENCE	REQUIRES SURVEY UNDER BIOBANKING METHODOLOGY	PREDICTED BY EPBC REPORTING TOOL	OEH ATLAS RECORDS	ROYAL BOTANIC GARDENS	BATHURST REGIONAL COUNCIL RECORD*	MID-WESTERN REGIONAL COUNCIL RECORD
Eucalyptus macrorhyncha subsp. *cannonii* Capertee Stringybark	V	V	Also referred to as *E. cannonii*, it is geographically confined to a small area in the central tablelands of NSW. This species has been recorded in at least 55 locations within the Greater Lithgow City, Rylstone and Bathurst City local government areas. It can be distinguished *E. macrorhyncha*, a close relative and co-existing species, by the larger and angular buds on a short pedicel and the presence of a medial rim on the fruit. White flowers are produced between January and April. Seeds are dispersed in proximity to the parent plant. This species is threatened by a loss of habitat through clearing and inappropriate fire regimes (OEH 2011b).	Potential	x	x	x	x		x

SPECIES	TSC ACT	EPBC ACT	HABITAT REQUIREMENTS	LIKELIHOOD OF OCCURRENCE	REQUIRES SURVEY UNDER BIOBANKING METHODOLOGY	PREDICTED BY EPBC REPORTING TOOL	OEH ATLAS RECORDS	ROYAL BOTANIC GARDENS	BATHURST REGIONAL COUNCIL RECORD*	MID-WESTERN REGIONAL COUNCIL RECORD
Eucalyptus robertsonii subsp. hemisphaerica Robertson's Peppermint	V	V	Inhabits grassy or dry sclerophyll woodlands or forests on quartzite ridges, upper slopes and shallow clay deposits overlaying volcanic soils. Occurs frequently in sheltered closed grassy woodlands of the central tablelands near Bathurst and Orange, NSW. Populations are highly localised within the Glengowan, Burraga, Mullion Creek, west of Bocoble Mountain and Isobella River areas (OEH 2011b). Threats include land clearing and loss of genetic flow between fragmented populations (TSSC 2008).	Potential	x		x			x

SPECIES	TSC ACT	EPBC ACT	HABITAT REQUIREMENTS	LIKELIHOOD OF OCCURRENCE	REQUIRES SURVEY UNDER BIOBANKING METHODOLOGY	PREDICTED BY EPBC REPORTING TOOL	OEH ATLAS RECORDS	ROYAL BOTANIC GARDENS	BATHURST REGIONAL COUNCIL RECORD*	MID-WESTERN REGIONAL COUNCIL RECORD
Grevillea divaricata	E	-	Known only from the type collection made in 1823, north of Bathurst. Another specimen which is possibly part of the type collection is from the Cox's River. Specimen notes describe the plant as occurring frequently in dry open forest lands and as possibly growing on rocky-river margins. Flowers recorded in April, but the species probably also flowers in the spring months; probably bird-pollinated (OEH 2011b).	Unlikely	x					

SPECIES	TSC ACT	EPBC ACT	HABITAT REQUIREMENTS	LIKELIHOOD OF OCCURRENCE	REQUIRES SURVEY UNDER BIOBANKING METHODOLOGY	PREDICTED BY EPBC REPORTING TOOL	OEH ATLAS RECORDS	ROYAL BOTANIC GARDENS	BATHURST REGIONAL COUNCIL RECORD*	MID-WESTERN REGIONAL COUNCIL RECORD
Grevillea obtusiflora Grey Grevillea	E	E	Subspecies *obtusiflora* occurs near Rylstone, while subspecies *fecunda* occurs in the Capertee Valley, north-west of Lithgow, and in the Gardens of Stone National Park. Occurrences of both subspecies are within the Central Tablelands botanical subdivision. Subspecies *obtusiflora* occurs as scattered groups in the understorey of low open eucalypt forest at an altitude of 730 metres above sea level. Associated species include *Eucalyptus crebra*, *E. dealbata*, *E. tenella*, *Callistemon linearis*, *Acacia buxifolia*, *Acacia elongata*, *Leucopogon* sp., *Caustis flexuosa*, *Dianella* sp. and *Patersonia* sp.	Unlikely			x			

SPECIES	TSC ACT	EPBC ACT	HABITAT REQUIREMENTS	LIKELIHOOD OF OCCURRENCE	REQUIRES SURVEY UNDER BIOBANKING METHODOLOGY	PREDICTED BY EPBC REPORTING TOOL	OEH ATLAS RECORDS	ROYAL BOTANIC GARDENS	BATHURST REGIONAL COUNCIL RECORD*	MID-WESTERN REGIONAL COUNCIL RECORD
Persoonia marginata Clandulla Geebung	V	V	Known from only four disjunct locations on the Central Tablelands and Central Coast. Core of the species distribution is within Clandulla State Forest, west of Kandons. Disjunct populations occur; to the north at Dingo Creek and Mount Dangar within the Wollemi and Goulburn River National Parks; to the south within Ben Bullen State Forest, south-east of Capertee; and to the south-east at Devils Hole, north of Colo Heights within Parr State Recreation Area. Grows in dry sclerophyll forest and woodland communities on sandstone (OEH 2011b)	Unlikely	x		x			

SPECIES	TSC ACT	EPBC ACT	HABITAT REQUIREMENTS	LIKELIHOOD OF OCCURRENCE	REQUIRES SURVEY UNDER BIOBANKING METHODOLOGY	PREDICTED BY EPBC REPORTING TOOL	OEH ATLAS RECORDS	ROYAL BOTANIC GARDENS	BATHURST REGIONAL COUNCIL RECORD*	MID-WESTERN REGIONAL COUNCIL RECORD
Philotheca ericifolia	-	V	Distribution is infrequently scattered across dry sclerophyll forests, woodlands and heath communities from upper Hunter Valley to Pilliga and Peak Hill districts of NSW. Prefers moist environments including; drainage lines along ridgetops, alluvial dry creek beds and moist sandy flats. Co-existing species include; *Eucalyptus crebra*, *Beyeria viscosa* and *Philotheca australis*. Individual plants can reach 1-2m in height covered in sparsely warty branchlets. Pink warty flowers are produced in Spring (DSEWPAC 2011b).	No		x				

SPECIES	TSC ACT	EPBC ACT	HABITAT REQUIREMENTS	LIKELIHOOD OF OCCURRENCE	REQUIRES SURVEY UNDER BIOBANKING METHODOLOGY	PREDICTED BY EPBC REPORTING TOOL	OEH ATLAS RECORDS	ROYAL BOTANIC GARDENS	BATHURST REGIONAL COUNCIL RECORD*	MID-WESTERN REGIONAL COUNCIL RECORD
Prasophyllum petilum Tarengo Leek Orchid	E	E	Natural populations are known from a total of four sites in NSW: at Boorowa, Captains Flat, Ilford and Delegate. Grows in open sites within Natural Temperate Grassland at the Boorowa and Delegate sites. Also grows in grassy woodland in association with River Tussock *Poa labillardieri* Black Gum *Eucalyptus aggregata* and tea-trees *Leptospermum* spp. at Captains Flat and within the grassy groundlayer dominated by Kangaroo Grass under Box-Gum Woodland at Ilford (OEH 2011b).	Unlikely			x			

SPECIES	TSC ACT	EPBC ACT	HABITAT REQUIREMENTS	LIKELIHOOD OF OCCURRENCE	REQUIRES SURVEY UNDER BIOBANKING METHODOLOGY	PREDICTED BY EPBC REPORTING TOOL	OEH ATLAS RECORDS	ROYAL BOTANIC GARDENS	BATHURST REGIONAL COUNCIL RECORD*	MID-WESTERN REGIONAL COUNCIL RECORD
Prasophyllum sp. *Wybong (C.Phelps ORG 5269)* A leek-orchid		CE	A perennial orchid endemic to NSW known from seven populations in eastern NSW near Ilford, Premer, Muswellbrook, Wybong, Yeoval, Inverell and Tenterfield. It is found in grassy and shrubby habitats on wet to dry soils, and its distribution overlaps with Box-Gum Woodland and derived Box-Gum Woodland. A single leaf is produced in winter followed by flowers in spring. The orchid remains as a dormant tuber in summer and autumn. The complex symbiotic relationship with species-specific mycorrhizal fungi and insect pollinators is poorly understood. The remaining seven populations are prone to fragmentation and genetic drift from human activities such as land clearing (DSEWPAC 2011b).	Potential		x				

SPECIES	TSC ACT	EPBC ACT	HABITAT REQUIREMENTS	LIKELIHOOD OF OCCURRENCE	REQUIRES SURVEY UNDER BIOBANKING METHODOLOGY	PREDICTED BY EPBC REPORTING TOOL	OEH ATLAS RECORDS	ROYAL BOTANIC GARDENS	BATHURST REGIONAL COUNCIL RECORD*	MID-WESTERN REGIONAL COUNCIL RECORD
Prostanthera stricta	V	V	*Prostanthera stricta* occurs in the Widden Valley district of New South Wales. The species is also known from Mt Vincent and Genowlan Mountain in the Central Tablelands. *Prostanthera stricta* is often a locally dominant undershrub in heath or scrub communities along cliff edges, or as an understorey species within a range of open forest or tall open forest types, or in adjacent transitional communities. Associated vegetation includes *Eucalyptus blaxlandii*, *E. cannonii* and *E. viminalis* with *Acacia implexa* and *Goodenia ovata*. Other associated species recorded at sites include *Angophora floribunda*, *Eucalyptus punctata*, *Brachychiton populneus*, *Acacia parvipinnula*, *Beyeria viscosa*, *Microlaena stipoides* and *Cheilanthes* species (OEH 2011b).	Unlikely			x			

SPECIES	TSC ACT	EPBC ACT	HABITAT REQUIREMENTS	LIKELIHOOD OF OCCURRENCE	REQUIRES SURVEY UNDER BIOBANKING METHODOLOGY	PREDICTED BY EPBC REPORTING TOOL	OEH ATLAS RECORDS	ROYAL BOTANIC GARDENS	BATHURST REGIONAL COUNCIL RECORD*	MID-WESTERN REGIONAL COUNCIL RECORD
Swainsona recta Small Purple-pea	E	E	Small Purple-pea was recorded historically from places such as Carcoar, Culcairn and Wagga Wagga where it is probably now extinct. Populations still exist in the Queanbeyan and Wellington-Mudgee areas. It is also known from the ACT and a single population of four plants near Chiltern in Victoria. Originally occurred in the grassy understorey of woodlands and open-forests dominated by Blakely's Red Gum*Eucalyptus blakelyi*, Yellow Box *E. melliodora*, Candlebark Gum *E. rubida* and Long-leaf Box *E. goniocalyx*. Plants die back in summer, surviving as rootstocks until they shoot again in autumn. (OEH 2011b).	Potential	x					

SPECIES	TSC ACT	EPBC ACT	HABITAT REQUIREMENTS	LIKELIHOOD OF OCCURRENCE	REQUIRES SURVEY UNDER BIOBANKING METHODOLOGY	PREDICTED BY EPBC REPORTING TOOL	OEH ATLAS RECORDS	ROYAL BOTANIC GARDENS	BATHURST REGIONAL COUNCIL RECORD*	MID-WESTERN REGIONAL COUNCIL RECORD
Swainsona sericea Silky Swainson-pea	V	-	In NSW recorded from the Northern Tablelands to the Southern Tablelands and further inland on the slopes and plains. There is one isolated record from the far north-west of NSW. Found in Natural Temperate Grassland and Snow Gum *Eucalyptus pauciflora* Woodland on the Monaro. Found in Box-Gum Woodland in the Southern Tablelands and South West Slopes. Sometimes found in association with cypress-pines *Callitris* spp.	Potential	x					

SPECIES	TSC ACT	EPBC ACT	HABITAT REQUIREMENTS	LIKELIHOOD OF OCCURRENCE	REQUIRES SURVEY UNDER BIOBANKING METHODOLOGY	PREDICTED BY EPBC REPORTING TOOL	OEH ATLAS RECORDS	ROYAL BOTANIC GARDENS	BATHURST REGIONAL COUNCIL RECORD*	MID-WESTERN REGIONAL COUNCIL RECORD
Thesium australe Austral Toadflax	V	V	Occurs in grassland or grassy woodland in Qld, NSW and Vic (TAS DIPWE 2003). Often found in damp sites in association with Kangaroo Grass (*Themeda australis*) (OEH 2011b). It is a short-lived herbaceous shrub known to absorb nutrients through the roots of Kangaroo Grass species. Flowers in spring–summer. Widespread across eastern NSW but occurs in very small populations (OEH 2011b).	Potential		x				

SPECIES	TSC ACT	EPBC ACT	HABITAT REQUIREMENTS	LIKELIHOOD OF OCCURRENCE	REQUIRES SURVEY UNDER BIOBANKING METHODOLOGY	PREDICTED BY EPBC REPORTING TOOL	OEH ATLAS RECORDS	ROYAL BOTANIC GARDENS	BATHURST REGIONAL COUNCIL RECORD*	MID-WESTERN REGIONAL COUNCIL RECORD
Zieria obcordata	E	E	Occurs at two sites with a geographic range of 105 km -Bulbudgeree Station near Wellington and Crackerjack Rock/Rock Forests area NW of Bathurst. Grows in eucalypt woodland or shrubland dominated by species of *Acacia* on rocky hillsides. Also occurs in *Eucalyptus* and *Callitris* dominated woodland with an open, low shrub understorey, on moderately steep, west to north-facing slopes in sandy loam amongst granite boulders. The altitude range of sites is 500 to 830 metres. Flowering time is in spring (September-October).	Unlikely	x					

* Note: No data provided by Bathurst Regional Council

Table 36: Threatened fauna likelihood of occurrence

SPECIES	TSC ACT	EPBC ACT	HABITAT REQUIREMENTS	LIKELIHOOD OF OCCURRENCE	REQUIRES SURVEY UNDER BIOBANKING METHODOLOGY	PREDICTED BY EPBC REPORTING TOOL	OEH ATLAS RECORDS	BIRDS AUSTRALIA RECORDS	BATHURST REGIONAL COUNCIL	MID-WESTERN REGIONAL COUNCIL*
FISH										
Macquarie Perch *Macquaria australasica*	E (FM Act 1994)	E	Habitat for the Macquarie perch is bottom or mid-water in slow-flowing rivers with deep holes, typically in the upper reaches of forested catchments with intact riparian vegetation. Macquarie perch also do well in some upper catchment lakes. In some parts of its range, the species is reduced to taking refuge in small pools which persist in midland–upland areas through the drier summer periods.	Unlikely					x	
Murray Cod *Maccullochella peelii peelii*	-	V	Widespread throughout the Murray-Darling system originally being found in virtually all waterways of that system. Habitat varies greatly, from quite small clear, rocky, upland streams with riffle and pool structure on the upper western slopes of the Great Dividing Range to large, meandering, slow-flowing, often silty rivers in the alluvial lowland reaches of the Murray-Darling Basin. Prefer deep holes with cover in the form of large rocks, fallen trees, stumps, clay banks and overhanging vegetation (DSEWPAC 2011b).	No		x			x	

SPECIES	TSC ACT	EPBC ACT	HABITAT REQUIREMENTS	LIKELIHOOD OF OCCURRENCE	REQUIRES SURVEY UNDER BIOBANKING METHODOLOGY	PREDICTED BY EPBC REPORTING TOOL	OEH ATLAS RECORDS	BIRDS AUSTRALIA RECORDS	BATHURST REGIONAL COUNCIL	MID-WESTERN REGIONAL COUNCIL*
Silver Perch *Bidyanus bidyanus*	V (FM Act 1994)	-	Prefers fast-flowing waters, especially where there are rapids. This species migrates to spawn. Historical records show that the species was widespread and abundant in most of the Murray-Darling drainage, excluding the cool, high, upper reaches of streams on the western side of the Great Diving Range It is now absent in the wild from the majority of its former range. Only one natural population is known, which occurs downstream of Torrumbarry Weir in the Murray River (Fisheries Scientific Committee, unknown date)	Unlikely					x	

SPECIES	TSC ACT	EPBC ACT	HABITAT REQUIREMENTS	LIKELIHOOD OF OCCURRENCE	REQUIRES SURVEY UNDER BIOBANKING METHODOLOGY	PREDICTED BY EPBC REPORTING TOOL	OEH ATLAS RECORDS	BIRDS AUSTRALIA RECORDS	BATHURST REGIONAL COUNCIL	MID-WESTERN REGIONAL COUNCIL*
FROGS										
Booroolong Frog *Litoria booroolongensis*	E	E	The Booroolong Frog is restricted to NSW and north-eastern Victoria, predominantly along the western-flowing streams of the Great Dividing Range. It has disappeared from the Northern Tablelands and is now rare throughout most of the remainder of its range. Most recent records are from the south-west slopes of NSW. Live along permanent streams with some fringing vegetation cover such as ferns, sedges or grasses. Adults occur on or near cobble banks and other rock structures within stream margins. Shelter under rocks or amongst vegetation near the ground on the stream edge. Sometimes bask in the sun on exposed rocks near flowing water during summer. Breeding occurs in spring and early summer and tadpoles metamorphose in late summer to early autumn. Eggs are laid in submerged rock crevices and tadpoles grow in slow-flowing connected or isolated pools (OEH 2011b).	Likely	x	x			x	

SPECIES	TSC ACT	EPBC ACT	HABITAT REQUIREMENTS	LIKELIHOOD OF OCCURRENCE	REQUIRES SURVEY UNDER BIOBANKING METHODOLOGY	PREDICTED BY EPBC REPORTING TOOL	OEH ATLAS RECORDS	BIRDS AUSTRALIA RECORDS	BATHURST REGIONAL COUNCIL	MID-WESTERN REGIONAL COUNCIL*
REPTILES										
Broad-headed Snake *Hoplocephalus bungaroides*	E	V	Largely confined to the coast and ranges of the Sydney Basin. Inhabits rocky outcrops associated with sclerophyllous vegetative communities of the Hawkesbury, Narrabeen and Shoalhaven sandstone groups and forests on shale slopes. Mature individuals rely on rocky outcrops for foraging, thermal regulation and shelter. The species is vulnerable to habitat loss and removal of bush rock due to the limited dispersion of juvenile species and strong site fidelity for adults (DSEWPAC 2011b).	No		x				
Pink-tailed Legless Lizard *Aprasia parapulchella*	V	V	Only known from the Central and Southern Tablelands, and the South Western Slopes. There is a concentration of populations in the Canberra/Queanbeyan Region. Other populations have been recorded near Cooma, Yass, Bathurst, Albury and West Wyalong. Inhabits sloping, open woodland areas with predominantly native grassy groundlayers, particularly those dominated by *Themeda australis* (Kangaroo Grass) (OEH 2011b).	Potential					x	

SPECIES	TSC ACT	EPBC ACT	HABITAT REQUIREMENTS	LIKELIHOOD OF OCCURRENCE	REQUIRES SURVEY UNDER BIOBANKING METHODOLOGY	PREDICTED BY EPBC REPORTING TOOL	OEH ATLAS RECORDS	BIRDS AUSTRALIA RECORDS	BATHURST REGIONAL COUNCIL	MID-WESTERN REGIONAL COUNCIL*
DIURNAL BIRDS										
Black-chinned Honeyeater (eastern subspecies) *Melithreptus gularis gularis*	V	-	Predominantly associated with box-ironbark association woodlands and River Red Gum. Also associated with drier woodlands of the Cumberland Plain and the Hunter, Richmond and Clarence Valleys. In the Central West, the species occurs in dry sclerophyll forests (including Red Stringybark – Scribbly Gum – Red Box – Long-leaved Box tussock grass open forest of the NSW South Western Slopes Bioregion), forested wetlands, grassy woodlands, and semi-arid woodlands. (OEH 2011b).	Likely			x		x	

SPECIES	TSC ACT	EPBC ACT	HABITAT REQUIREMENTS	LIKELIHOOD OF OCCURRENCE	REQUIRES SURVEY UNDER BIOBANKING METHODOLOGY	PREDICTED BY EPBC REPORTING TOOL	OEH ATLAS RECORDS	BIRDS AUSTRALIA RECORDS	BATHURST REGIONAL COUNCIL	MID-WESTERN REGIONAL COUNCIL*
Blue-billed Duck *Oxyura australis*	V	-	The Blue-billed Duck prefers deep water in large permanent wetlands and swamps with dense aquatic vegetation. The species is completely aquatic, swimming low in the water along the edge of dense cover. It will fly if disturbed, but prefers to dive if approached. Blue-billed Ducks are partly migratory, with short-distance movements between breeding swamps and over-wintering lakes with some long-distance dispersal to breed during spring and early summer. Young birds disperse in April-May from their breeding swamps in inland NSW to non-breeding areas on the Murray River system and coastal lakes (OEH 2011b).	Unlikely				x		

SPECIES	TSC ACT	EPBC ACT	HABITAT REQUIREMENTS	LIKELIHOOD OF OCCURRENCE	REQUIRES SURVEY UNDER BIOBANKING METHODOLOGY	PREDICTED BY EPBC REPORTING TOOL	OEH ATLAS RECORDS	BIRDS AUSTRALIA RECORDS	BATHURST REGIONAL COUNCIL	MID-WESTERN REGIONAL COUNCIL*
Brown Treecreeper *Climacteris picumnus victoriae*	V	-	Found in eucalypt woodlands (including Box Gum Woodland) and dry open forest of the inland slopes and plains inland of the Great Dividing Range; mainly inhabits woodlands dominated by stringybarks or other rough-barked eucalypts, usually with an open grassy understorey, sometimes with one or more shrub species; also found in mallee and River Red Gum (*Eucalyptus camaldulensis*) Forest bordering wetlands with an open understorey of acacias, saltbush, lignum, cumbungi and grasses; usually not found in woodlands with a dense shrub layer; fallen timber is an important habitat component for foraging; also recorded, though less commonly, in similar woodland habitats on the coastal ranges and plains. Hollows in standing dead or live trees and tree stumps are essential for nesting. The species breeds in pairs or co-operatively in territories which range in size from 1.1 to 10.7 ha (mean = 4.4 ha). Each group is composed of a breeding pair with retained male offspring and, rarely, retained female offspring. Often in pairs or cooperatively breeding groups of two to five birds (OEH 2011b).	Yes - Recorded during survey			x	x	x	

SPECIES	TSC ACT	EPBC ACT	HABITAT REQUIREMENTS	LIKELIHOOD OF OCCURRENCE	REQUIRES SURVEY UNDER BIOBANKING METHODOLOGY	PREDICTED BY EPBC REPORTING TOOL	OEH ATLAS RECORDS	BIRDS AUSTRALIA RECORDS	BATHURST REGIONAL COUNCIL	MID-WESTERN REGIONAL COUNCIL*
Bush Stone-curlew *Burhinus grallarius*	E		The Bush Stone-curlew is found throughout Australia except for the central southern coast and inland, the far south-east corner, and Tasmania. Only in northern Australia is it still common. In the south-east it is either rare or extinct throughout its former range. Inhabits open forests and woodlands with a sparse grassy groundlayer and fallen timber. Largely nocturnal, being especially active on moonlit nights. Feed on insects and small vertebrates, such as frogs, lizards and snakes. Nest on the ground in a scrape or small bare patch. Two eggs are laid in spring and early summer (OEH 2011b)	Potential – although no historical records, habitat for this species is present at the site						

SPECIES	TSC ACT	EPBC ACT	HABITAT REQUIREMENTS	LIKELIHOOD OF OCCURRENCE	REQUIRES SURVEY UNDER BIOBANKING METHODOLOGY	PREDICTED BY EPBC REPORTING TOOL	OEH ATLAS RECORDS	BIRDS AUSTRALIA RECORDS	BATHURST REGIONAL COUNCIL	MID-WESTERN REGIONAL COUNCIL*
Diamond Firetail *Stagonopleura guttata*	V	-	Found in grassy eucalypt woodlands, including Box Gum Woodlands and Snow Gum *Eucalyptus pauciflora* Woodlands. Also occurs in open forest, mallee, Natural Temperate Grassland, and in secondary grassland derived from other communities. Often found in riparian areas (rivers and creeks), and sometimes in lightly wooded farmland. Feeds exclusively on the ground, on ripe and partly-ripe grass and herb seeds and green leaves, and on insects (especially in the breeding season). Groups separate into small colonies to breed, between August and January. Nests are globular structures built either in the shrubby understorey, or higher up, especially under hawk's or raven's nests. Birds roost in dense shrubs or in smaller nests built especially for roosting. Appears to be sedentary, though some populations move locally, especially those in the south (OEH 2011b).	Yes - Recorded during survey				x	x	

SPECIES	TSC ACT	EPBC ACT	HABITAT REQUIREMENTS	LIKELIHOOD OF OCCURRENCE	REQUIRES SURVEY UNDER BIOBANKING METHODOLOGY	PREDICTED BY EPBC REPORTING TOOL	OEH ATLAS RECORDS	BIRDS AUSTRALIA RECORDS	BATHURST REGIONAL COUNCIL	MID-WESTERN REGIONAL COUNCIL*
Flame Robin *Petroica phoenicea*	V	Mar	Breeds in upland tall moist eucalypt forests and woodlands, often on ridges and slopes, often on ridges and slopes, in NSW. Prefers clearings or areas with open understoreys, and grassy groundlayer for breeding habitat. Will often occur in recently burnt areas. Shrub density does not appear to be an important habitat factor. Many birds move to the inland slopes and plains in winter, or to drier more open habitats in the lowlands (OEH 2011b).	Potential				x		
Gang Gang Cockatoo *Callocephalon fimbriatum*	V, E2	-	During summer in dense, tall, wet forests of mountains and gullies, alpine woodlands (Morcombe 2004). In winter they occur at lower altitudes in drier more open forests and woodlands, particularly box-ironbark assemblages (Shields and Chrome 1992). They sometimes inhabit woodland, farms and suburbs in autumn/winter (Simpson and Day 2004).	Potential	x			x	x	

SPECIES	TSC ACT	EPBC ACT	HABITAT REQUIREMENTS	LIKELIHOOD OF OCCURRENCE	REQUIRES SURVEY UNDER BIOBANKING METHODOLOGY	PREDICTED BY EPBC REPORTING TOOL	OEH ATLAS RECORDS	BIRDS AUSTRALIA RECORDS	BATHURST REGIONAL COUNCIL	MID-WESTERN REGIONAL COUNCIL*
Glossy black-Cockatoo *Calyptorhynchus lathami*	V	-	The species is uncommon although widespread throughout suitable forest and woodland habitats. Inhabits open forest and woodlands of the coast and the Great Dividing Range up to 1000 m in which stands of she-oak species, particularly Black She-oak (*Allocasuarina littoralis*), Forest She-oak (*A. torulosa*) or Drooping She-oak (*A. verticillata*) occur. Nests in large trees with large hollows (OEH 2011b).	Unlikely				x	x	
Hooded Robin (southeastern subspecies) *Melanodryas cucullata cucullata*	V	-	Associated with a wide range of Eucalypt woodlands, Acacia shrubland and open forests (Blakers *et al.* 1984). In temperate woodlands, the species favours open areas adjoining large woodland blocks, with areas of dead timber and sparse shrub cover. Hooded Robin home ranges are relatively large, averaging 18ha for birds from the New England Tableland (OEH 2011b).	Yes - Recorded during survey			x	x	x	

SPECIES	TSC ACT	EPBC ACT	HABITAT REQUIREMENTS	LIKELIHOOD OF OCCURRENCE	REQUIRES SURVEY UNDER BIOBANKING METHODOLOGY	PREDICTED BY EPBC REPORTING TOOL	OEH ATLAS RECORDS	BIRDS AUSTRALIA RECORDS	BATHURST REGIONAL COUNCIL	MID-WESTERN REGIONAL COUNCIL*
Little Eagle *Hieraaetus morphnoides*	V	-	The Little Eagle is widespread in mainland Australia, central and eastern New Guinea. The Little Eagle is seen over woodland and forested. The population of Little Eagle in NSW is considered to be a single population. This species was recently listed as vulnerable due to a moderate reduction in population size based on geographic distribution and habitat quality lands and open country, extending into the arid zone. It tends to avoid rainforest and heavy forest (OEH 2011b)..	Potential	x		x	x		

SPECIES	TSC ACT	EPBC ACT	HABITAT REQUIREMENTS	LIKELIHOOD OF OCCURRENCE	REQUIRES SURVEY UNDER BIOBANKING METHODOLOGY	PREDICTED BY EPBC REPORTING TOOL	OEH ATLAS RECORDS	BIRDS AUSTRALIA RECORDS	BATHURST REGIONAL COUNCIL	MID-WESTERN REGIONAL COUNCIL*
Little Lorikeet *Glossopsitta pusilla*	V	-	In New South Wales Little Lorikeets are distributed in forests and woodlands from the coast to the western slopes of the Great Dividing Range, extending westwards to the vicinity of Albury, Parkes, Dubbo and Narrabri. Little Lorikeets mostly occur in dry, open eucalypt forests and woodlands. They have been recorded from both old-growth and logged forests in the eastern part of their range, and in remnant woodland patches and roadside vegetation on the western slopes. They feed primarily on nectar and pollen in the tree canopy, particularly on profusely-flowering eucalypts, but also on a variety of other species including melaleucas and mistletoes. On the western slopes and tablelands White Box *Eucalyptus albens* and Yellow Box *E. melliodora* are particularly important food sources for pollen and nectar respectively (OEH 2011b).	Yes - Recorded during survey						

SPECIES	TSC ACT	EPBC ACT	HABITAT REQUIREMENTS	LIKELIHOOD OF OCCURRENCE	REQUIRES SURVEY UNDER BIOBANKING METHODOLOGY	PREDICTED BY EPBC REPORTING TOOL	OEH ATLAS RECORDS	BIRDS AUSTRALIA RECORDS	BATHURST REGIONAL COUNCIL	MID-WESTERN REGIONAL COUNCIL*
Painted Snipe (Australian subspecies) *Rostratula benghalensis australis*	E	V, M	Prefers fringes of swamps, dams and nearby marshy areas where there is a cover of grasses, lignum, low scrub or open timber. Nests on the ground amongst tall vegetation, such as grasses, tussocks or reeds (*ibid.*). Breeding is often in response to local conditions; generally occurs from September to December. Roosts during the day in dense vegetation. Forages nocturnally on mud-flats and in shallow water. Feeds on worms, molluscs, insects and some plant-matter (*ibid.*) (OEH 2011b).	Unlikely		x				
Regent Honeyeater *Anthochaera phrygia*	E	E, M	Associated with temperate eucalypt woodland and open forest including forest edges, wooded farmland and urban areas with mature eucalypts, and riparian forests of River Oak (*Casuarina cunninghamiana*) (Garnett 1993). Areas containing Swamp Mahogany (*Eucalyptus robusta*) in coastal areas have been observed to be utilised (NPWS 1997). The Regent Honeyeater primarily feeds on nectar from box and ironbark eucalypts and occasionally from banksias and mistletoes (NPWS 1995). As such it is reliant on locally abundant nectar sources with different flowering times to provide reliable supply of nectar (Environment Australia 2000).	Likely		x	x		x	

SPECIES	TSC ACT	EPBC ACT	HABITAT REQUIREMENTS	LIKELIHOOD OF OCCURRENCE	REQUIRES SURVEY UNDER BIOBANKING METHODOLOGY	PREDICTED BY EPBC REPORTING TOOL	OEH ATLAS RECORDS	BIRDS AUSTRALIA RECORDS	BATHURST REGIONAL COUNCIL	MID-WESTERN REGIONAL COUNCIL*
Scarlet Robin *Petroica boodang*	V	-	The Scarlet Robin is found in south-eastern and south-western Australia, as well as on Norfolk Island. In Australia, it is found south of latitude 25°S, from south-eastern Queensland along the coast of New South Wales (and inland to western slopes of Great Dividing Range) to Victoria and Tasmania, and west to Eyre Peninsula, South Australia; it is also found in south-west Western Australia. The Scarlet Robin lives in open forests and woodlands in Australia, while it prefers rainforest habitats on Norfolk Island. During winter, it will visit more open habitats such as grasslands and will be seen in farmland and urban parks and gardens at this time (OEH 2011b).	Yes – Recorded during survey			x	x		
Speckled Warbler *Pyrrholaemus sagittatus*	V	-	Occupies a wide range of eucalypt dominated communities with a grassy understorey, often on rocky ridges or in gullies. Typical habitat would include scattered native tussock grasses, a sparse shrub layer, some eucalypt regrowth and an open canopy. Large, relatively undisturbed remnants are required for the species to persist in an area. Pairs are sedentary and occupy a breeding territory of about ten hectares, with a slightly larger home-range when not breeding (OEH 2011b).	Yes - Recorded during survey				x	x	

SPECIES	TSC ACT	EPBC ACT	HABITAT REQUIREMENTS	LIKELIHOOD OF OCCURRENCE	REQUIRES SURVEY UNDER BIOBANKING METHODOLOGY	PREDICTED BY EPBC REPORTING TOOL	OEH ATLAS RECORDS	BIRDS AUSTRALIA RECORDS	BATHURST REGIONAL COUNCIL	MID-WESTERN REGIONAL COUNCIL*
Spotted Harrier *Circus assimilis*	V	-	Occurs mostly commonly in native grassland, but also in grassy open woodland including acacia and mallee remnants, inland riparian woodland, and foraging at the edges of inland wetlands. Can also forage over agricultural land for prey such as rabbits, but most native prey require groundcover. Builds a stick nest in a tree and lays eggs in spring (or sometimes autumn).	Potential	x					

SPECIES	TSC ACT	EPBC ACT	HABITAT REQUIREMENTS	LIKELIHOOD OF OCCURRENCE	REQUIRES SURVEY UNDER BIOBANKING METHODOLOGY	PREDICTED BY EPBC REPORTING TOOL	OEH ATLAS RECORDS	BIRDS AUSTRALIA RECORDS	BATHURST REGIONAL COUNCIL	MID-WESTERN REGIONAL COUNCIL*
Superb Parrot *Polytelis swainsonii*	V	V	The Superb Parrot is restricted to the south-east of Australia. It is closely associated with the major river-systems along the inland slopes of the Great Divide slopes and adjacent plains in NSW and northern Victoria. The breeding range is divided into three distinct locations; Murray River, Murrumbidgee River and the Cowra and Yass regions (DSEWPAC 2011b). Birds in the Cowra to Yass region migrate north during winter (OEH 2011b). Preferred habitat is dominated by River Red Gums (*Eucalyptus camaldulensis*) and Yellow Box (*E.melliodora*) or Grey Box (*E.microcarpa*). Suitable nest sites rely heavily on the proximity to foraging habitats and availability of large tree hollows. Diet consists of grass seeds, acacia seed-pods and eucalyptus flowers and fruit. Population is predicted to be in decline however, population estimates are unreliable (DSEWPAC 2011b).	Potential		x				

SPECIES	TSC ACT	EPBC ACT	HABITAT REQUIREMENTS	LIKELIHOOD OF OCCURRENCE	REQUIRES SURVEY UNDER BIOBANKING METHODOLOGY	PREDICTED BY EPBC REPORTING TOOL	OEH ATLAS RECORDS	BIRDS AUSTRALIA RECORDS	BATHURST REGIONAL COUNCIL	MID-WESTERN REGIONAL COUNCIL*
Swift Parrot *Lathamus discolor*	E	E, Mar	Breeds in Tasmania between September and January. Migrates to mainland in autumn, where it forages on profuse flowering eucalypts (Blakers *et al.* 1984; Schodde and Tidemann 1986). Hence, in this region, autumn and winter flowering eucalypts are important for this species.	Potential		x			x	
Varied Sittella *Daphoenositta chrysoptera*	V	–	Varied Sitellas are endemic and widespread in mainland Australia. Varied Sitellas are found in eucalypt woodlands and forests throughout their range. They prefer rough-barked trees like Stringybarks and Ironbarks or mature trees with hollows or dead branches, mallee and Acacia woodland (OEH 2011b).	Potential				x		

SPECIES	TSC ACT	EPBC ACT	HABITAT REQUIREMENTS	LIKELIHOOD OF OCCURRENCE	REQUIRES SURVEY UNDER BIOBANKING METHODOLOGY	PREDICTED BY EPBC REPORTING TOOL	OEH ATLAS RECORDS	BIRDS AUSTRALIA RECORDS	BATHURST REGIONAL COUNCIL	MID-WESTERN REGIONAL COUNCIL*
NOCTURNAL BIRDS										
Barking Owl *Ninox connivens*	V	-	Associated with a variety of habitats such as savanna woodland, open eucalypt forests, wetland and riverine forest. The habitat is typically dominated by Eucalypts (often Redgum species), however often dominated by Melaleuca species in the tropics. It usually roosts in dense foliage in large trees such as River She-oak (*Allocasuarina cunninghamiana*), other *Casuarina* and *Allocasuarina*, *Eucalyptus*, *Angophora*, *Acacia* and rainforest species from streamside gallery forests. It usually nests near watercourses or wetlands in large tree hollows with entrances averaging 2-29 metres above ground, depending on the forest or woodland structure and the canopy height (Debus 1997).	Potential			x		x	
Powerful Owl *Ninox strenua*	V	-	Powerful Owls are associated with a wide range of wet and dry forest types with a high density of prey, such as arboreal mammals, large birds and flying foxes. Large trees with hollows at least 0.5m deep are required for shelter and breeding (Environment Australia 2000, Debus & Chafer 1994).	Potential			x	x		

SPECIES	TSC ACT	EPBC ACT	HABITAT REQUIREMENTS	LIKELIHOOD OF OCCURRENCE	REQUIRES SURVEY UNDER BIOBANKING METHODOLOGY	PREDICTED BY EPBC REPORTING TOOL	OEH ATLAS RECORDS	BIRDS AUSTRALIA RECORDS	BATHURST REGIONAL COUNCIL	MID-WESTERN REGIONAL COUNCIL*
MAMMALS										
Brush-tailed Phascogale *Phascogale tapoatafa*	V	-	The Brush-tailed Phascogale has a patchy distribution around the coast of Australia. In NSW it is mainly found east of the Great Dividing Range although there are occasional records west of the divide. Prefers dry sclerophyll open forest with sparse groundcover of herbs, grasses, shrubs or leaf litter. Also inhabits heath, swamps, rainforest and wet sclerophyll forest. An agile climber foraging preferentially in rough barked trees of 25 cm DBH or greater. Nest and shelter in tree hollows with entrances 2.5 - 4 cm wide and use many different hollows over a short time span (OEH 2011b).	Potential	x					
Brush-tailed Rock Wallaby *Petrogale penicillata*	E	V	Rocky areas in a variety of habitats, typically north facing sites with numerous ledges, caves and crevices (Strahan 1998).	No					x	

SPECIES	TSC ACT	EPBC ACT	HABITAT REQUIREMENTS	LIKELIHOOD OF OCCURRENCE	REQUIRES SURVEY UNDER BIOBANKING METHODOLOGY	PREDICTED BY EPBC REPORTING TOOL	OEH ATLAS RECORDS	BIRDS AUSTRALIA RECORDS	BATHURST REGIONAL COUNCIL	MID-WESTERN REGIONAL COUNCIL*
Eastern Quoll *Dasyurus viverrinus*	E		No recent sightings of this species in NSW. Presumed extinct. Occurs in dry sclerophyll forest, scrub, heathland and cultivated land. Home ranges vary between sexes. Males may travel over a kilometre in a night, whilst females restrict their movements to a few hundred metres surrounding their dens (OEH 2011b).	Unlikely					x	
Koala *Phascolarctos cinereus*	V		Koalas inhabit eucalypt woodlands and forests. They feed on the foliage of more than 70 eucalypt species and 30 non-eucalypt species, but in any one area will select preferred browse species. They are inactive for most of the day, feeding and moving mostly at night. Home range size varies with quality of habitat, ranging from less than two ha to several hundred hectares in size. Generally solitary, but have complex social hierarchies based on a dominant male with a territory overlapping several females and sub-ordinate males on the periphery (OEH 2011b).	Yes - Recorded during survey			x		x	

SPECIES	TSC ACT	EPBC ACT	HABITAT REQUIREMENTS	LIKELIHOOD OF OCCURRENCE	REQUIRES SURVEY UNDER BIOBANKING METHODOLOGY	PREDICTED BY EPBC REPORTING TOOL	OEH ATLAS RECORDS	BIRDS AUSTRALIA RECORDS	BATHURST REGIONAL COUNCIL	MID-WESTERN REGIONAL COUNCIL*
New Holland Mouse *Pseudomys novaehollandiae*	-	V	Recorded from Queensland to Tasmania, though with a sporadic and patchy distribution. Most records are coastal, though a population has recently been recorded up to 400km inland. The species includes heathlands, woodlands, open forest and paperbark swamps and on sandy, loamy or rocky soils. In coastal populations the species seems to have a preference for sandy substrates, a heathy understorey of legumes less than one metre high and sparse ground litter. Recolonisation of regenerating burnt areas occurs after one or two years and rehabilitated sand-mined areas after four to five years.	Unlikely		x				

SPECIES	TSC ACT	EPBC ACT	HABITAT REQUIREMENTS	LIKELIHOOD OF OCCURRENCE	REQUIRES SURVEY UNDER BIOBANKING METHODOLOGY	PREDICTED BY EPBC REPORTING TOOL	OEH ATLAS RECORDS	BIRDS AUSTRALIA RECORDS	BATHURST REGIONAL COUNCIL	MID-WESTERN REGIONAL COUNCIL*
Spotted-tailed Quoll *Dasyurus maculates maculatus* (EPBC Act lists only the SE Mainland Population) *D. maculatus maculatus*	V	E	The Spotted-tailed Quoll inhabits a range of forest communities including wet and dry sclerophyll forests, coastal heathlands and rainforests, more frequently recorded near the ecotones of closed and open forest. This species requires habitat features such as maternal den sites, an abundance of food (birds and small mammals) and large areas of relatively intact vegetation to forage in (OEH 2011b). Maternal den sites are logs with cryptic entrances; rock outcrops; windrows; burrows (Environment Australia 2000).	Potential		x	x		x	

SPECIES	TSC ACT	EPBC ACT	HABITAT REQUIREMENTS	LIKELIHOOD OF OCCURRENCE	REQUIRES SURVEY UNDER BIOBANKING METHODOLOGY	PREDICTED BY EPBC REPORTING TOOL	OEH ATLAS RECORDS	BIRDS AUSTRALIA RECORDS	BATHURST REGIONAL COUNCIL	MID-WESTERN REGIONAL COUNCIL*
Squirrel Glider *Petaurus norfolcensis*	V		Inhabits mature or old growth Box, Box-Ironbark woodlands and River Red Gum forest west of the Great Dividing Range and Blackbutt-Bloodwood forest with heath understorey in coastal areas. Prefers mixed species stands with a shrub or Acacia midstorey. Live in family groups of a single adult male one or more adult females and offspring. Require abundant tree hollows for refuge and nest sites. Diet varies seasonally and consists of Acacia gum, eucalypt sap, nectar, honeydew and manna, with invertebrates and pollen providing protein (OEH 2011b).	Potential – although no current records, habitat for this species is present at the site.						

SPECIES	TSC ACT	EPBC ACT	HABITAT REQUIREMENTS	LIKELIHOOD OF OCCURRENCE	REQUIRES SURVEY UNDER BIOBANKING METHODOLOGY	PREDICTED BY EPBC REPORTING TOOL	OEH ATLAS RECORDS	BIRDS AUSTRALIA RECORDS	BATHURST REGIONAL COUNCIL	MID-WESTERN REGIONAL COUNCIL*
MAMMALS (BATS)										
Eastern Bentwing-bat *Miniopterus orianae oceanensis*	V	-	Associated with a range of habitats such as rainforest, wet and dry sclerophyll forest, monsoon forest, open woodland, paperbark forests and open grassland (Churchill 1998). It forages above and below the tree canopy on small insects (AMBS 1995, Dwyer 1995, Dwyer 1981). Will utilise caves, old mines, and stormwater channels, under bridges and occasionally buildings for shelter (Environment Australia 2000, Dwyer 1995).	Yes - Recorded during survey			x			
Eastern Cave Bat *Vespadelus troughtoni*	V	-	Inhabit tropical mixed woodland and wet sclerophyll forest on the coast and the dividing range but extend into the drier forest of the western slopes and inland areas. Has been found roosting in sandstone overhand caves, boulder piles, mine tunnels and occasionally in buildings (Churchill 1998).	Yes - Potentially recorded during survey (possible recording)						
Eastern False Pipistrelle *Falsistrellus tasmeniensis*	V	-	Prefers moist habitats with trees taller than 20m. Roosts in tree hollows but has also been found roosting in buildings or under loose bark (OEH 2011b).	Unlikely			x			

SPECIES	TSC ACT	EPBC ACT	HABITAT REQUIREMENTS	LIKELIHOOD OF OCCURRENCE	REQUIRES SURVEY UNDER BIOBANKING METHODOLOGY	PREDICTED BY EPBC REPORTING TOOL	OEH ATLAS RECORDS	BIRDS AUSTRALIA RECORDS	BATHURST REGIONAL COUNCIL	MID-WESTERN REGIONAL COUNCIL*
Greater (Eastern) Long-eared Bat *Nyctophilus corbeni* (syn. *N timoriensis*)	V	V	Preference for semi-arid areas, however, have been recorded in the high rainfall areas of south-western Australia (Churchill 1998). In South Australia this species has been associated with a range of mallee species, and found to the fringes of the treeless Nullarbor Plain (Duncan *et al.* 1999). In northern NSW, this species is thought to prefer structurally complex forest as foraging habitat, and breeding and sheltering is in tree hollows (Environment Australia 2000).	Yes - Potentially recorded during survey (records for *Nyctophilus* sp.)		x				
Grey-headed Flying-Fox *Pteropus poliocephalus*	V	V	Inhabits a wide range of habitats including rainforest, mangroves, paperbark forests, wet and dry sclerophyll forests and cultivated areas (Churchill 1998, Eby 1998). Camps are often located in gullies, typically close to water, in vegetation with a dense canopy (Churchill 1998).	Potential		x			x	
Large-eared Pied Bat *Chalinolobus dwyeri*	V	V	The Large-eared Pied Bat has been recorded in a variety of habitats, including dry sclerophyll forests, woodland, sub-alpine woodland, edges of rainforests and wet sclerophyll forests. This species roosts in caves, rock overhangs and disused mine shafts and as such is usually associated with rock outcrops and cliff faces (Churchill 1998; OEH 2011b).	Yes - Recorded during survey (probable recording)		x				

SPECIES	TSC ACT	EPBC ACT	HABITAT REQUIREMENTS	LIKELIHOOD OF OCCURRENCE	REQUIRES SURVEY UNDER BIOBANKING METHODOLOGY	PREDICTED BY EPBC REPORTING TOOL	OEH ATLAS RECORDS	BIRDS AUSTRALIA RECORDS	BATHURST REGIONAL COUNCIL	MID-WESTERN REGIONAL COUNCIL*
Little Pied Bat *Chalinolobus picatus*	V	-	The Little-Pied Bat is found in inland Queensland and NSW (including Western Plains and slopes) extending slightly into South Australia and Victoria. Occurs in dry open forest, open woodland, mulga woodlands, chenopod shrublands, cypress-pine forest, mallee, Bimbil box. Roosts in caves, rock outcrops, mine shafts, tunnels, tree hollows and buildings. Feeds on moths and possibly other flying invertebrates (OEH 2011b).	Yes - Recorded during survey						
Yellow-bellied Sheathtail-bat *Saccolaimus flaviventris*	V	-	Found in almost all habitats, from wet and dry sclerophyll forest, open woodland (Churchill 1998), open country, mallee, rainforests, heathland and waterbodies. Roosts in tree hollows; may also use caves; has also been recorded in a tree hollow in a paddock (Environment Australia 2000) and in abandoned sugar glider nests (Churchill 1998). The Yellow-bellied Sheathtail-bat is dependent on suitable hollow-bearing trees to provide roost sites, which may be a limiting factor on populations in cleared or fragmented habitats (Environment Australia 2000).	Yes - Potentially recorded during survey (possible recording)						

SPECIES	TSC ACT	EPBC ACT	HABITAT REQUIREMENTS	LIKELIHOOD OF OCCURRENCE	REQUIRES SURVEY UNDER BIOBANKING METHODOLOGY	PREDICTED BY EPBC REPORTING TOOL	OEH ATLAS RECORDS	BIRDS AUSTRALIA RECORDS	BATHURST REGIONAL COUNCIL	MID-WESTERN REGIONAL COUNCIL*
MIGRATORY TERRESTRIAL SPECIES LISTED UNDER EPBC ACT										
White-bellied Sea-Eagle *Haliaeetus leucogaster*	-	M	Forages over large open fresh or saline waterbodies, coastal seas and open terrestrial areas (Simpson and Day 2004). Breeding habitat consists of tall trees, mangroves, cliffs, rocky outcrops, silts, caves and crevices and is located along the coast or major rivers. Breeding habitat is usually in or close to water, but may occur up to a kilometre away (Marchant and Higgins 1993).	Unlikely		x				
White-throated Needletail *Hirundapus caudacutus*	-	M	Forages aerially over a variety of habitats usually over coastal and mountain areas, most likely with a preference for wooded areas (Marchant and Higgins 1993; Simpson and Day 2004). Has been observed roosting in dense foliage of canopy trees, and may seek refuge in tree hollows in inclement weather.	Potential		x		x		

SPECIES	TSC ACT	EPBC ACT	HABITAT REQUIREMENTS	LIKELIHOOD OF OCCURRENCE	REQUIRES SURVEY UNDER BIOBANKING METHODOLOGY	PREDICTED BY EPBC REPORTING TOOL	OEH ATLAS RECORDS	BIRDS AUSTRALIA RECORDS	BATHURST REGIONAL COUNCIL	MID-WESTERN REGIONAL COUNCIL*
Rainbow Bee-eater *Merops ornatus*	-	M	Resident in coastal and subcoastal northern Australia; regular breeding migrant in southern Australia, arriving September to October, departing February to March, some occasionally present April to May. Occurs in open country, chiefly at suitable breeding places in areas of sandy or loamy soil: sand-ridges, riverbanks, road-cuttings, sand-pits, occasionally coastal cliffs. Nest is a chamber at the end of a burrow, up to 1.6 m long, tunnelled in flat or sloping ground, sandy back or cutting (DSEWPAC 2011b).	Yes - Recorded during survey	x	x		x		
Satin Flycatcher *Myiagra cyanoleuca*	-	M	Associated with drier eucalypt forests, absent from rainforests (Blakers *et al.* 1984), open forests, often at height (Simpson and Day 2004).	Potential		x				
Regent Honeyeater *Anthochaera phrygia*	E	E, M	SEE DIURNAL BIRDS ABOVE	Potential		x	x		x	

SPECIES	TSC ACT	EPBC ACT	HABITAT REQUIREMENTS	LIKELIHOOD OF OCCURRENCE	REQUIRES SURVEY UNDER BIOBANKING METHODOLOGY	PREDICTED BY EPBC REPORTING TOOL	OEH ATLAS RECORDS	BIRDS AUSTRALIA RECORDS	BATHURST REGIONAL COUNCIL	MID-WESTERN REGIONAL COUNCIL*
MIGRATORY WETLAND SPECIES LISTED UNDER EPBC ACT										
Great Egret *Ardea alba*	—	M	The Great Egret is common and widespread in Australia. It forages in a wide range of wet and dry habitats including permanent and ephemeral freshwaters, wet pasture and estuarine mangroves and mudflats (McKilligan, 2005).	Potential		x				
Cattle Egret *Ardea ibis*	—	M	Cattle Egrets forage on pasture, marsh, grassy road verges, rain puddles and croplands, but not usually in the open water of streams or lakes and they avoid marine environments. Some individuals stay close to the natal heronry from one nesting season to the next, but the majority leave the district in autumn and return the next spring. Cattle Egrets are likely to spend the winter dispersed along the coastal plain and only a small number have been recovered west of the Great Dividing Range (McKilligan, 2005).	Potential		x				
Latham's Snipe *Gallinago hardwickii*	—	M	A variety of permanent and ephemeral wetlands, preferring open fresh water wetlands with nearby cover (Marchant and Higgins 1993). Occupies a variety of vegetation around wetlands (Marchant and Higgins 1993) including wetland grasses and open wooded swamps (Simpson and Day 2004).	Unlikely		x				

SPECIES	TSC ACT	EPBC ACT	HABITAT REQUIREMENTS	LIKELIHOOD OF OCCURRENCE	REQUIRES SURVEY UNDER BIOBANKING METHODOLOGY	PREDICTED BY EPBC REPORTING TOOL	OEH ATLAS RECORDS	BIRDS AUSTRALIA RECORDS	BATHURST REGIONAL COUNCIL	MID-WESTERN REGIONAL COUNCIL*
Painted Snipe *Rostratula benghalensis* (a.k.a. *R. australis*)	-	M	See: Painted Snipe *Rostratula australis*	Unlikely		x				

* Note that fauna data from Mid-Western Regional Council was not provided

Appendix D: Flora Species List

Revised Biometric Vegetation Type			White Box-Blakelys Red-Gum-Yellow Box grassy woodland, Moderate-Good								White Box-Blakelys Red-Gum-Yellow Box grassy woodland, Low		Broad-leaved Peppermint-Brittle Gum-Red Stringybark dry open forest on the southeastern highlands, Moderate-Good	Wet tussock grasslands of cold air drainage areas of the tablelands, Moderate to Good	Red Stringybark-Scribbly Gum-Red Box-Long-leaved Box shrub-tussock grass open forest, Moderate to Good with Trees															Red Stringybark-Scribbly Gum-Red Box-Long-leaved Box shrub-tussock grass open forest, Moderate to Good without Trees		
Scientific Name	Common Name	Native/ Exotic	WBBRGYBMGT1	WBBRGYBMGT2	WBBRGYBMGT3	WBBRGYBMG1	WBBRGYBMG2	WBBRGYBMG3	WBBRGYBMG4	WBBRGYBMG5	WBBRGYML1	WBBRGYML2	BLPBGRSMG1	WTGMG1	RSSGRBMG1	RSSGRBMG2	RSSGRBMG3	RSSGRBMG4	RSSGRBMGNS1-2	RSSGRBMGNG1-4	RSSGRBMGNG1-5	RSSGRBMGNG2-6	RSSGRBMGNG2-7	RSSGRBMGNG1-8	RSSGRBGNG2-9	RSSGRBMGNG2-10	RSSGRBGNG2-11	RSSGRBMGNG3-1	RSSGRBHGNG3-3	RSSGRBGNG3-12
Acacia dealbata	Silver Wattle	N	x																								x			x
Acacia gunnii		N																													
Acacia obtusifolia		N																					x								
Acaena ovina		N																				x	x					x	x	x	
Acaena spp.		N					x																				x				
Acetosella vulgaris	Sorrel	E			x			x		x			x			x										x		x	x	x	
Aira cupaniana		E																x									x	x	x	x	
Amyema miquelii		N	x																												
Anagallis arvensis	Scarlet/Blue Pimpernel	E																									x		x		
Aphanes australiana		N																							x				x		
Aristida ramosa	Purple Wiregrass	N	x																									x			
Aristida spp.		N		x			x	x	x						x		x														x
Arthropodium minus		N		x																											
Asperula conferta	Common Woodruff	N																							x		x		x		
Austrodanthonia carphoides		N																													
Austrodanthonia		N																													

Revised Biometric Vegetation Type			White Box-Blakelys Red-Gum-Yellow Box grassy woodland, Moderate-Good								White Box-Blakelys Red-Gum-Yellow Box grassy woodland, Low		Broad-leaved Peppermint-Brittle Gum-Red Stringybark dry open forest on the southeastern highlands, Moderate-Good	Wet tussock grasslands of cold air drainage areas of the tablelands, Moderate to Good	Red Stringybark-Scribbly Gum-Red Box-Long-leaved Box shrub-tussock grass open forest, Moderate to Good with Trees														Red Stringybark-Scribbly Gum-Red Box-Long-leaved Box shrub-tussock grass open forest, Moderate to Good without Trees		
eriantha																															
Austradanthoniac aespitosa		N																													
Austrodanthonia racemosa		N																													
Austrostipa scabra	Speargrass	N				x			x	x		x	x				x	x							x			x	x	x
Austrostipa spp.		N					x								x	x															
Bossiaea prostrata		N		x																		x	x								
Bothriochloa decipiens		N				x	x			x	x	x			x	x		x													
Bothriochloa macra	Red Grass	N	x			x		x	x		x																		x		
Bothriochloa spp.		N											x																		X
Brachyscome ciliaris	Variable Daisy	N																							x			x			
Brachyscome stuartii	Stuart's Daisy	N	x			x																									
Brachyscome spp.		N															x														
Briza minor	Shivery Grass	E																										x	x		x
Bromus catharticus	Praire Grass	E			x																										
Bromus diandrus	Great Brome	E																							x	x		x	x	x	
Bromus hordeaceus subsp. *molliformis*	Soft Brome	E																							x	x			x		
Bromus spp.		N			x		x			x	x	x			x			x													
Bursaria spinosa ssp. spinosa	Native Blackthorn	N					x																								
Caladenia carnea		N																													
Carex appressa	Tall Sedge	N							x					x																		
Carex inversa	Knob Sedge	N																							x		x	x	x		
Carthamus lanatus	Saffron Thistle	E						x		x	x	x						x							x						
Cassinia arcuata	Sifton Bush	N		x		x							x				x	x				x	x					x	x	x	
Cassinia quinquefaria		N	x																												

Revised Biometric Vegetation Type			White Box-Blakelys Red-Gum-Yellow Box grassy woodland, Moderate-Good								White Box-Blakelys Red-Gum-Yellow Box grassy woodland, Low		Broad-leaved Peppermint-Brittle Gum-Red Stringybark dry open forest on the southeastern highlands, Moderate-Good	Wet tussock grasslands of cold air drainage areas of the tablelands, Moderate to Good	Red Stringybark-Scribbly Gum-Red Box-Long-leaved Box shrub-tussock grass open forest, Moderate to Good with Trees													Red Stringybark-Scribbly Gum-Red Box-Long-leaved Box shrub-tussock grass open forest, Moderate to Good without Trees		
Centaurium erythraea	Common Centaury	E																											x		
Centaurium spp.		E	x	x		x	x	x			x		x			x	x														x
Cerastium glomeratum	Mouse-ear Chickweed	E																									x			x	x
Cheilanthes sieberi subsp. Sieberi		N	x	x			x	x								x	x					x					x			x	x
Cheilanthes austrotenuifolia		N																											x		
Cheiranthera linearis	Finger Flower	N																	x	x	x	x		x		x		x			
Chenopodium pumilio	Small Crumbweed	E			x																										
Chloris truncata	Windmill Grass	N				x			x																						
Chondrilla juncea		E										x	x																		
Crataegus monogyna	Common Hawthorn	E		x																											
Cichorium intybus	Chicory	E					x																								
Cirsium vulgare	Spear Thistle	E			x						x			x				x				x			x	x	x	x	x		
Convolvulus graminetinus		N										x																		x	
Conyza bonariensis	Flaxleaf Fleabane	E	x					x	x	x	x	x	x		x		x	x													
Conyza sp		E					x																								
Cotula australis	Common Cotula	N																									x				
Crassula sieberiana	Australian Stonecrop	N																												x	
Cymbonotus lawsonianus	Bear's Ear	N	x					x					x		x		x												x		x	x
Cymbonotus sp.		N																					x		x			x			

Revised Biometric Vegetation Type			White Box-Blakelys Red-Gum-Yellow Box grassy woodland, Moderate-Good								White Box-Blakelys Red-Gum-Yellow Box grassy woodland, Low		Broad-leaved Peppermint-Brittle Gum-Red Stringybark dry open forest on the southeastern highlands, Moderate-Good	Wet tussock grasslands of cold air drainage areas of the tablelands, Moderate to Good	Red Stringybark-Scribbly Gum-Red Box-Long-leaved Box shrub-tussock grass open forest, Moderate to Good with Trees												Red Stringybark-Scribbly Gum-Red Box-Long-leaved Box shrub-tussock grass open forest, Moderate to Good without Trees		
Cynosurus echinatus	Rough Dog's Tail	E																						x						
Dactylis glomerata	Cocksfoot	E									x												x							
Daucus glochidiatus	Native Carrot	N																				x								x
Desmodium gunnii	Slender tick trefoil	N																			x									
Desmodium varians	Slender Tick-trefoil	N		x			x	x		x												x				x		x		
Dichelachne micrantha	Shorthair Plumegrass	N	x	x				x					x							x		x					x		x	
Dichondra repens	Kidney Weed	N																										x		
Dichondra sp. A		N															x													
Digitaria sanguinalis	Summer Grass	E									x																			
Digitaria spp.																														
Discaria pubescens	**Australian Anchor Plant**	N																												
Diuris chryseopsis		N																												
Diuris goonooensis		N																		x										
Dillwynia phylicoides		N																					x							
Dillwynia sericea	Showy Parrot-pea	N																				x								
Echinochloa crusgalli	Barnyard Grass	E																												
Echium plantagineum	Purple Viper's Bugloss	E									x																			
Einadia nutans	Climbing Saltbush	N																							x	x				
Einadia trigonos	Fishweed	N	x									x																		
Eleusine tristachya	Goose Grass	E			x				x	x	x					x														
Elymus scaber		N			x									x				x												

Revised Biometric Vegetation Type			White Box-Blakelys Red-Gum-Yellow Box grassy woodland, Moderate-Good								White Box-Blakelys Red-Gum-Yellow Box grassy woodland, Low		Broad-leaved Peppermint-Brittle Gum-Red Stringybark dry open forest on the southeastern highlands, Moderate-Good	Wet tussock grasslands of cold air drainage areas of the tablelands, Moderate to Good	Red Stringybark-Scribbly Gum-Red Box-Long-leaved Box shrub-tussock grass open forest, Moderate to Good with Trees														Red Stringybark-Scribbly Gum-Red Box-Long-leaved Box shrub-tussock grass open forest, Moderate to Good without Trees		
Epilobium billardierianum ssp. cinereum	Variable Willow-herb	N					x																								
Eragrostis alveiformis		N				x				x																					
Eragrostis leptostachya	Paddock Lovegrass	N							x							x															
Eragrostis parviflora		N			x						x	x		x																	
Eragrostis spp.		N						x	x	x			x			x		x			x								x		
Eriochilus sp aff. petricola		N		x																											
Erodium cicutarium	Common Storksbill	E																												x	
Eryngium prostratum		N																													
Eucalyptus blakelyi	Blakely's Red Gum	N		x	x																x										
Eucalyptus goniocalyx	Long-leaved Box	N																	x	x	x	x	x	x	x		x				
Eucalyptus macrorhyncha	Red Stringybark	N																	x		x	x	x	x		x	x				
Eucalyptus mannifera	Brittle Gum	N																					x		x						
Eucalyptus melliodora	Yellow Box	N	x	x	x																										
Eucalyptus nortonii	Bundy	N																													
Eucalyptus polyanthemos	Red Box	N	x																x		x	x	x			x	x				
Eucalyptus rossii	Inland Scribbly Gum	N																		x	x			x							
Euchiton gymnocephalus		N																											x		
Euchiton sphaericus		N		x		x	x	x	x				x	x	x	x	x										x			x	

Revised Biometric Vegetation Type			White Box-Blakelys Red-Gum-Yellow Box grassy woodland, Moderate-Good								White Box-Blakelys Red-Gum-Yellow Box grassy woodland, Low		Broad-leaved Peppermint-Brittle Gum-Red Stringybark dry open forest on the southeastern highlands, Moderate-Good	Wet tussock grasslands of cold air drainage areas of the tablelands, Moderate to Good	Red Stringybark-Scribbly Gum-Red Box-Long-leaved Box shrub-tussock grass open forest, Moderate to Good with Trees														Red Stringybark-Scribbly Gum-Red Box-Long-leaved Box shrub-tussock grass open forest, Moderate to Good without Trees		
Euchiton sp		N	x							x											x								x	
Euchiton involucratus	Star Cudweed	N																											x	
Festuca arundinacea	Tall Fescue	E									x																			
Galium binifolium		N																					x							
Galium murale	Small Bedstraw	E																						x						
Galium propinquum	Maori Bedstraw	N																							X					
Gamochaeta sp		E				x									x		x													
Geranium molle		E			x																									
Geranium solanderi	Native Geranium	N																				x	x		x	x	x	x	x	
Geranium sp		N			x		x			x			x																	
Glycine clandestina		N																				x	x							
Glycine tabacina	Glycine	N					x																							
Gonocarpus micranthus		N	x														x													
Gonocarpus tetragynus		N		x															x	x	x	x	x				x	x		x
Goodenia hederacea subsp. hederacea	Ivy Goodenia	N	x	x			x										x					x					x			x
Goodenia paniculata		N																	x		x									
Goodenia sp.																				x	x			x						
Haloragis heterophylla		N	x											x		x														x
Hibbertia obtusifolia	Hoary guinea flower	N						x									x		x	x		x	x				x			x
Holcus lanatus		E												x													x	x		
Hordeum leporinum	Barley Grass	E																						x						
Hordeum spp.		E																							x		x	x		
Hovea heterophylla		N																		x										
Hydrocotyle laxiflora	Stinking Pennywort	N		x																	x	x	x			x			x	x

Revised Biometric Vegetation Type			White Box-Blakelys Red-Gum-Yellow Box grassy woodland, Moderate-Good								White Box-Blakelys Red-Gum-Yellow Box grassy woodland, Low		Broad-leaved Peppermint-Brittle Gum-Red Stringybark dry open forest on the southeastern highlands, Moderate-Good	Wet tussock grasslands of cold air drainage areas of the tablelands, Moderate to Good	Red Stringybark-Scribbly Gum-Red Box-Long-leaved Box shrub-tussock grass open forest, Moderate to Good with Trees													Red Stringybark-Scribbly Gum-Red Box-Long-leaved Box shrub-tussock grass open forest, Moderate to Good without Trees		
Hydrocotyle peduncularis		N													x															
Hydrocotyle spp.		N																								x		x			
Hypericum gramineum	Small St John's Wort	N	x	x		x	x	x					x		x	x	x					x	x							x
Hypericum perforatum	St. Johns Wort	E					x	x																				x			x
Hypericum japonicum		N																										x			x
Hypochaeris glabra	Smooth Catsear	E				x		x						x																	
Hypochaeris radicata	Catsear	E	x		x	x	x	x	x	x		x	x		x	x	x	x				x	x			x	x	x	x		
Indigofera australis	Australian Indigo	N																										x			
Joycea pallida	Silvertop Wallaby Grass	N	x																										x		
Juncus bufonius	Toad Rush	E																x													
Juncus homalocaulis		N																												x	x
Juncus spp.		N												x								x		x							x
Juncus usitatus		N	x										x		x	x		x											x		
Lagenophora spp.		N															x														
Lagenophora gracilis		N				x			x				x																		
Lagenophora stipitata	Blue Bottle-daisy	N																				x	x								x
Lepidium africanum		E			x																										
Lepidosperma laterale		N																				x									
Leptorhynchos squamatus subsp. squamatus		N		x																											
Leptospermum multicaule		N																													
Linum trigynum		N/E											x																		
Lissanthe strigosa	Peach Heath	N	x	x			x	x										x				x	x		x			x			

Revised Biometric Vegetation Type			White Box-Blakelys Red-Gum-Yellow Box grassy woodland, Moderate-Good								White Box-Blakelys Red-Gum-Yellow Box grassy woodland, Low		Broad-leaved Peppermint-Brittle Gum-Red Stringybark dry open forest on the southeastern highlands, Moderate-Good	Wet tussock grasslands of cold air drainage areas of the tablelands, Moderate to Good	Red Stringybark-Scribbly Gum-Red Box-Long-leaved Box shrub-tussock grass open forest, Moderate to Good with Trees												Red Stringybark-Scribbly Gum-Red Box-Long-leaved Box shrub-tussock grass open forest, Moderate to Good without Trees		
Lolium perenne	Perennial Ryegrass	E																					x	x				
Lomandra filiformis subsp. *coriacea*		N																	x			x	x		x			
Lomandra filiformis subsp. *filiformis*		N																	x	x		x	x	x		x		
Lomandra filiformis	Wattle Matt-rush	N	x	x																	x						x		
Lomandra multiflora subsp. *multiflora*	Many-flowered Mat-rush	N																		x	x	x					x		
Lomandra spp.		N									x											x							
Lythrum hyssopifolia		N														x													
Malva parviflora	Small-flowered Mallow	E																											
Marrubium vulgare	Horehound	E			x																				x				
Medicago spp.		E										x	x					x							x		x		
Melichrus erubescens	Ruby Urn Heath	N																					x						
Melichrus urceolatus	Urn Heath	N		x																		x		x					
Microlaena stipoides		N				x	x				x	x	x	x	x	x	x	x			x	x	x		x		x	x	x	
Microtis unifolia	Common Onion Orchid	N	x																										x
Microtis spp.		N		x																							x		
Modiola caroliniana	Red-flowered Mallow	E								x																			
Nassella trichotoma	Serrated Tussock	E																										x	
Onopordum acanthium	Scotch Thistle	E																							x				
Opercularia diphylla		N		x																									
Oxalis exilis		N																				x	x						
Oxalis perennans		N																			x					x	x	x	x	x

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Oxalis sp		N				x		x				x	x													x					
Panicum effusum	Poison or Hairy Panic	N																											x		
Panicum spp.		N	x					x			x		x	x		x	x	x									x	x		
Paronychia brasiliana	Chilean Whitlow Wort	E			x				x	x	x	x	x		x	x										x	x	x	x	x	
Paronychia sp		E					x																								
Paspalidium sp		N									x																				
Paspalum dilatatum	Paspalum	E								x	x																				
Petrorhagia nanteuilii		E		x																											
Petrorhagia sp		E					x																			x		x	x		
Phalaris aquatica	Phalaris	E			x					x				x																	
Phalaris sp		E																								x					
Phytolacca octandra	Inkweed	E																									x	x			
Plantago debilis		N																										x		x	
Plantago lanceolata	Lamb's Tongues	E						x			x																				
Plantago sp.		E																							x						
Plantago varia		N																					x			x					
Poa labillardierei	Tussock Grass	N												x																	
Poa meionectes		N																	x	x			x								
Poa sieberiana var sieberiana		N		x				x													x	x					x	x			
Poa spp.		N																				x		x	x				x		
Polygonum aviculare	Wireweed	E			x																										
Polygonum spp.		N																													
Poranthera microphylla		N																				x	x					x			
Pterostylis bicolor		N																													

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Pultenaea microphylla		N	x	x																		x					x			
Pultenaea procumbens	Heathy Bush-pea	N																												x
Pultenaea sp		N	x																											
Rapistrum rugosum		E										x																		
Richardia stellaris		E																				x								
Rosa rubiginosa	Sweet Briar	E																				x								
Rubus fruticosus sp. agg.	Blackberry complex	E	x																						x					
Rumex brownii	Swamp Dock	N			x					x	x	x							x					x		x			x
Rumex spp.		E																										x		
Saponaria officinalis	Soapwort	E																								x				
Salix sp	Willow	E																												
Schoenus apogon	Fluke Bogrush	N	x	x		x										x		x												
Senecio bipinatisectus		N																												
Senecio hispidulus	Hill Fireweed	N																									x			
Senecio jacobaea	Ragwory	E																							x					
Senecio prenanthoides		N																					x							
Senecio quadridentatus	Cotton Fireweed	N											x									x					x			
Senecio spp.		N									x																			
Setaria parviflora		E														x														
Sisymbrium offcinale		E										x																		
Solanum cinereum	Narrawa Burr	N																							x					
Solanum elegans		N																												
Solanum nigrum	Black-berry Nightshade	E	x		x																				x					
Solanum prinophyllum	Forest Nightshade	N																												

Revised Biometric Vegetation Type			White Box-Blakelys Red-Gum-Yellow Box grassy woodland, Moderate-Good								White Box-Blakelys Red-Gum-Yellow Box grassy woodland, Low		Broad-leaved Peppermint-Brittle Gum-Red Stringybark dry open forest on the southeastern highlands, Moderate-Good	Wet tussock grasslands of cold air drainage areas of the tablelands, Moderate to Good	Red Stringybark-Scribbly Gum-Red Box-Long-leaved Box shrub-tussock grass open forest, Moderate to Good with Trees														Red Stringybark-Scribbly Gum-Red Box-Long-leaved Box shrub-tussock grass open forest, Moderate to Good without Trees		
Solenogyne bellioides		N																				x									
Sonchus oleraceus	Common Sowthistle	E																						x							
Sporobolus creber	Slender Rat's Tail Grass	N				x		x	x	x	x	x	x					x													
Stellaria flaccida		N																						x							
Swainsona galegifolia	Smooth Darling Pea	N																				x									
Swainsona monticola	Notched Swainson-pea	N																													
Swainsona recta	Mountain Swainson-pea	N																													
Taraxacum officinale	Dandelion	E																						x							
Themeda australis	Kangaroo Grass	N	x	x			x	x	x							x												x		x	
Thesium australe	Austral Toadflax	N																													
Thysanotis patersonii		N																													
Tolpis umbellata	Yellow Hawkweed	E	x										x			x	x														
Tolpis barbarta	Yellow Hawkeweed	E																										x	x		x
Trifolium arvense	Haresfoot Clover	E											x														x	x	x	x	x
Trifolium campestre	Hop Clover	E																										x			
Trifolium dubium		E					x			x		x	x					x											x		
Trifolium glomeratum	Clustered Clover	E																											x		x
Trifolium hirtum	Rose Clover	E																											x		
Trifolium repens	White Clover	E																										x			
Trifolium striatum	Knoted Clover	E																												x	
Trifolium subterraneum	Subterraneum Clover	E																												x	

Revised Biometric Vegetation Type			White Box-Blakelys Red-Gum-Yellow Box grassy woodland, Moderate-Good								White Box-Blakelys Red-Gum-Yellow Box grassy woodland, Low		Broad-leaved Peppermint-Brittle Gum-Red Stringybark dry open forest on the southeastern highlands, Moderate-Good	Wet tussock grasslands of cold air drainage areas of the tablelands, Moderate to Good	Red Stringybark-Scribbly Gum-Red Box-Long-leaved Box shrub-tussock grass open forest, Moderate to Good with Trees													Red Stringybark-Scribbly Gum-Red Box-Long-leaved Box shrub-tussock grass open forest, Moderate to Good without Trees		
Trifolium spp.		E			x				x						x	x									x		x			
Triptilodiscus pymaeus	Common sunray	N																												
Urtica urens	Small Nettle	E																							x				x	
Verbena spp.		E																												
Veronica calycina	Hairy Speedwell	N															x													
Veronica plebeia	Trailing Speedwell	N																		x	x	x			x	x				
Viola betonicifolia	Native Violet	N																				x								
Vittadinia spp.		N					x																							
Vulpia bromoides	Squirrel Tail Fescue	E																	x		x				x		x			
Vulpia myuros	Rat's Tail Fescue	E																				x					x			
Vulpia spp.		E		x																					x				x	
Wahlenbergia communis	Tufted Bluebell	N											x																	
Wahlenbergia gracilis	Sprawling Bluebell	N								x																				
Wahlenbergia spp.		N	x	x			x		x						x		x	x				x	x				x		x	x

Appendix E: Fauna Species List

Appendix F: Bat Collision Matrix

SCIENTIFIC NAME	COMMON NAME	CONSERVATION STATUS (TSC & / or EPBC Act)	SEASONAL RISKS (EG. MIGRATION)	FLIGHT CHARACTER	ROOSTING	FORAGING	BREEDING SEASON	LIKELIHOOD OF SPECIES BEHAVIOUR RESULTING IN COLLISIONS	COLLISION DUE TO TURBINES IN PROXIMITY TO ROOSTING HABITAT	LIKELIHOOD OF COLLISION WITH OVERHEAD CABLING	OVERALL RISK	MITIGATION
*Chalinolobus dwyeri***	Large-eared Pied Bat	V	No	Relatively slowly with rapid but shallow wing beats. Direct and moderately manoeuvrable, from just above creek bed to mid canopy 6-10 metres off the ground.	Caves, crevices, cliffs, old mines, disused Fairy Martin nests.	Probably forages for small, flying insects below the canopy.	Raising young from November to January in maternity roosts in caves.	Low	Low	Low	**Low**	
Chalinolobus gouldii	Gould's Wattled Bat	No	No	Within canopy and sub canopy, selecting for gaps in the canopy.	Tree hollows, buildings.	Forages 5-10 km and up to 15 km from roost sites. Will pass through open paddocks. Agile and fast flight (up to 36km/h), tending to be on a fixed horizontal plane with abrupt zigzag changes of course. May also be attracted to turbine lighting as the species is known to feed around floodlights.	Mating in late autumn / winter. Juveniles fly December or January.	High	Moderate	Low	**Moderate**	Turbines located at least 30 m from hollow-bearing trees Turbine lighting should be a form that minimises attraction of insects.

SCIENTIFIC NAME	COMMON NAME	CONSERVATION STATUS (TSC & / or EPBC Act)	SEASONAL RISKS (EG. MIGRATION)	FLIGHT CHARACTER	ROOSTING	FORAGING	BREEDING SEASON	LIKELIHOOD OF SPECIES BEHAVIOUR RESULTING IN COLLISIONS	COLLISION DUE TO TURBINES IN PROXIMITY TO ROOSTING HABITAT	LIKELIHOOD OF COLLISION WITH OVERHEAD CABLING	OVERALL RISK	MITIGATION
Chalinolobus morio	Chocolate Wattled Bat	No	No - individuals in southern Australia do not migrate.	Open zone between the top of the understorey and the canopy.	Tree hollows, buildings and caves.	Forage up to 5km from their roost sites. Range of habitats including treeless regions. A fast, direct and agile hunter with rapid wing beats, recorded flying at speeds of 28km/h.	Mating in autumn and winter. Birth in late spring or early summer.	Moderate	Low - Moderate	Low	**Moderate**	
Chalinolobus picatus	Little Pied Bat	V	No	Within the canopy	Mainly tree hollows, but also disused buildings and caves.	Agile and manoeuvrable with fast, darting flight. Have been found to make nightly return trips of 14-34km.	Pregnancy from mid-September. Birth in late spring (November), with young leaving maternity roosts in early March.	High	Moderate	Low	**Moderate**	Turbines located at least 30 m from hollow-bearing trees
Miniopterus orianae oceanensis	Eastern Bentwing Bat	V	Yes – travel up to several hundred kilometres to over-wintering roosts	High, from just above to many times above the canopy and in open areas.	Caves, disused mines.	Fast flight and typically level with swift shallow dives. Can travel up to 65km in one night. Forested areas opens areas, waterways, street lights and tracks.	Mating in early winter. Birth in spring /. Summer. Juveniles leave cave in March.	High	Low	Low	**Moderate – may also be attracted to turbine lighting**	Turbine lighting should be a form that minimises attraction of insects.
Mormopterus sp.*3* *	Inland Freetail Bat	No	No	Fast above the canopy, 3 – 5 metres above water, along tree-lined creeks. Not very manoeuvrable in flight.	Small roost sites such as cracks and fissures in trees and posts, under corrugated iron roofs and water pipes.	Tend to forage in open unobstructed areas, flying fast above canopy and water. They will sometimes land and crawl rapidly over the ground and on tree trunks to chase and eat prey.	Birth in late November and December. Flying young have been caught in December.	High	Moderate	Low	**Moderate**	

SCIENTIFIC NAME	COMMON NAME	CONSERVATION STATUS (TSC & / or EPBC Act)	SEASONAL RISKS (EG. MIGRATION)	FLIGHT CHARACTER	ROOSTING	FORAGING	BREEDING SEASON	LIKELIHOOD OF SPECIES BEHAVIOUR RESULTING IN COLLISIONS	COLLISION DUE TO TURBINES IN PROXIMITY TO ROOSTING HABITAT	LIKELIHOOD OF COLLISION WITH OVERHEAD CABLING	OVERALL RISK	MITIGATION
Mormopterus sp.*4*	Southern Freetail Bat	No	No	Above the canopy, in the spaces between trees. Also along roadways, at the outer edge of remnant vegetation, and on the ground.	Tree hollows and in the roofs of houses.	Can forage up to 12 km from roosts. Agile flier, although they have difficulty taking off from the ground and will climb 1-2m from the ground before launching.	Young born in December or January. Young are flying by March.	High	Moderate	Low	**High**	Turbines located at least 30 m from hollow-bearing trees
Nyctophilus geoffroyi	Lesser Long-eared Bat	No	No	Below canopy and often flies close to the ground. When commuting their flight is rapid and direct.	Dead trees, under exfoliating bark, in hollows or buildings.	Forages with slow, manoeuvrable, undulating flight pattern. Adapted to both urban and rural environments. Individuals move every day or two between a number of roost sites within a defined roosting area. Individuals capable of foraging up to 12 km from their roost site. In farmland areas they can fly across open paddocks but most foraging is concentrated around remnant vegetation.	Mating in autumn. Twin young born in October or November. Young commence flying in December or January.	Moderate – when commuting	Moderate	Low	**Low**	

SCIENTIFIC NAME	COMMON NAME	CONSERVATION STATUS (TSC & / or EPBC Act)	SEASONAL RISKS (EG. MIGRATION)	FLIGHT CHARACTER	ROOSTING	FORAGING	BREEDING SEASON	LIKELIHOOD OF SPECIES BEHAVIOUR RESULTING IN COLLISIONS	COLLISION DUE TO TURBINES IN PROXIMITY TO ROOSTING HABITAT	LIKELIHOOD OF COLLISION WITH OVERHEAD CABLING	OVERALL RISK	MITIGATION
Nyctophilus gouldi ***	Gould's Long-eared Bat	No	No	Typically fly slowly in large circles approximately 2 – 5 m above the ground and below the canopy of forest trees. Echolocation is not used for orientation except in unfamiliar environments, nor is it used when they approach prey as they rely on listening.	Rooftops, tree hollows and under peeling bark. Maternity roosts are located preferentially in hollows of large trees, usually in gullies.	Slow, manoeuvrable, flight for foraging in dense vegetation. Capable of foraging in open situations also. May sit and wait before dropping on its prey in the forest litter.	First young fly in January.	Low	Moderate	Low	**Low**	
Nyctophilus corbeni (syn N. *timoriensis*) ***	Greater (eastern) Long-eared Bat	V	No	Highly manoeuvrable, very close to vegetation and in gaps.	Fissures in branches and under dried sheets of bark still attached to ring-barked trees.	At least 3 km from the roost. Catching insects by flying high and swooping almost to ground level.	October to April.	Low	Moderate	Low	**Low**	
Saccolaimus flaviventris *	Yellow-bellied Sheathtail-bat	V	Migrate to southern Australia between January and April during the summer	Above canopy but lower in open areas and at forest edges.	Tree hollows and buildings.	Fast and straight flight, capable of tight lateral turns.	December to mid-March.	High	Moderate	Low	**High**	Turbines located at least 30 m from hollow-bearing trees
Scotorepens balstoni	Inland Broad-nosed Bat	No	No	Among and below canopy, within 15m of the ground although may also forage on ground.	Tree hollows and roofs.	Fast, flickering wing beats. Flight is continuous with sudden rapid diversions in pursuit of prey. Flight speeds have been recorded from 12-21km/h.	Birth in November. Young fly during their second month of life.	Low	Low - Moderate	Low	**Low**	

SCIENTIFIC NAME	COMMON NAME	CONSERVATION STATUS (TSC & / or EPBC Act)	SEASONAL RISKS (EG. MIGRATION)	FLIGHT CHARACTER	ROOSTING	FORAGING	BREEDING SEASON	LIKELIHOOD OF SPECIES BEHAVIOUR RESULTING IN COLLISIONS	COLLISION DUE TO TURBINES IN PROXIMITY TO ROOSTING HABITAT	LIKELIHOOD OF COLLISION WITH OVERHEAD CABLING	OVERALL RISK	MITIGATION
*Scotorepens greyii***	Little broad-nosed bat	No	No	Moderately fast and agile in flight characterised by abrupt horizontal turns where the bat rolls to near vertical bank angles.	Hollows mostly in trees but also fence posts and disused buildings.	Continuous flight foragers close to but not above tree tops, open spaces along the contour of vegetation within 2 metres of the foliage.	Pregnancy from August to early November, birth in October and November. Young fly with females in December.	Moderate	Moderate	Low	**Moderate**	Turbines located at least 30 m from hollow-bearing trees
Tadarida australis	White-striped Freetail Bat	No	Yes – migrate to northern regions during winter (non-hibernating species)	Above canopy.	Large eucalypts (often in their hollows). Roosts in trees in a range of habitats from forest to open parklands.	Fast and direct path. High altitude feeding. Can commute 50 km between roost and feeding.	Birth mid-December to end of January. Juveniles weaned by mid-February.	High	Moderate	Low	**High**	Turbines located at least 30 m from hollow-bearing trees Turbines located in north south rather than east west direction to minimise impacts on northern migration

SCIENTIFIC NAME	COMMON NAME	CONSERVATION STATUS (TSC & / or EPBC Act)	SEASONAL RISKS (EG. MIGRATION)	FLIGHT CHARACTER	ROOSTING	FORAGING	BREEDING SEASON	LIKELIHOOD OF SPECIES BEHAVIOUR RESULTING IN COLLISIONS	COLLISION DUE TO TURBINES IN PROXIMITY TO ROOSTING HABITAT	LIKELIHOOD OF COLLISION WITH OVERHEAD CABLING	OVERALL RISK	MITIGATION
Vespadelus darlingtoni	Large Forest Bat	No	No	Below canopy, within canopy and forest floor.	Tree hollows and also buildings.	Less manoeuvrable than most *Vespadelus.* Flight characterised by rapid wing beats that are interrupted by gliding changes of direction. Foraging areas range from 10ha to over 300ha. Individuals can forage for up to 6km. Cluttered vegetation avoided. Foraging and commuting focused along trails and streams.	Birth November – December. Juveniles fly from mid-January.	Low	Moderate	Low	**Low**	
Vespadelus regulus	Southern Forest Bat	No	No	Below canopy and within canopy.	Tree hollows and roof cavities.	Highly manoeuvrable, moderately fast flight with flight speeds of 5-25km/h. Small foraging range of less than 10ha.	Birth early summer.	Low	Moderate	Low	**Low**	
Vespadelus troughtoni *	Eastern Cave Bat	V	No	Air space above creeks and in spaces between trees, interspersed with occasional rapid flights across paddocks.	Well-lit areas in overhangs and caves, mine tunnels, road culverts, occasionally in buildings and Fairy Martin nests.	Forage over a small area around 30 ha.	In NSW, maternity colonies of up to 500 females congregate during November.	Low	Low	Low	**Low**	
Vespadelus vulturnus	Little Forest Bat	No	No	Below canopy.	Roof cavities and hollows in dead timber.	Very agile, with fluttery flight, feeding at the top of the shrub	Birth early summer.	Low	Moderate	Low	**Low**	

SCIENTIFIC NAME	COMMON NAME	CONSERVATION STATUS (TSC & / or EPBC Act)	SEASONAL RISKS (EG. MIGRATION)	FLIGHT CHARACTER	ROOSTING	FORAGING	BREEDING SEASON	LIKELIHOOD OF SPECIES BEHAVIOUR RESULTING IN COLLISIONS	COLLISION DUE TO TURBINES IN PROXIMITY TO ROOSTING HABITAT	LIKELIHOOD OF COLLISION WITH OVERHEAD CABLING	OVERALL RISK	MITIGATION
						layer. Forage up to 1.5km from roost sites.						

Note:

Flight characteristics sourced from Strahan (2008) or DECCW (2011)

*** = possible recording in Anabats only**

**** = probable recording in Anabats only**

***** = not recorded within the study area but predicted to occur**

Appendix G: Bird Collision Matrix

SCIENTIFIC NAME	COMMON NAME	CONSERVATION STATUS	NUMBER OF RECORDS ON SITE	FLIGHT CHARACTERISTICS	MIGRATORY	DISTRIBUTION ACROSS SITE	RISK OF COLLISION WITH TURBINES	RISK OF COLLISION WITH OVERHEAD POWERLINES
Threatened species								
Climacteris picumnus victoriae	Brown Treecreeper	V	3	Moderate to low flight	No	Woodlands and grasslands	Low	Low
Melanodryas cucullata cucullata	Hooded Robin	V	5	Moderate to low flight	No	Woodlands and grasslands	Low	Low
Stagonopleura guttata	Diamond Firetail	V	10	Moderate to low flight	No	Woodlands and grasslands	Low	Low
Glossopsitta pusilla	Little Lorikeet	V	1	Fast, high - low flight depending on activity	No evidence of regular migration but the species is considered to be nomadic	Woodlands & grassland	Moderate	Low
Petroica boodang	Scarlet Robin	V	3	Moderate to low flight	Makes some local movements during winter (altitudinal migrant)	Woodlands and grasslands	Moderate – migratory species	Low

SCIENTIFIC NAME	COMMON NAME	CONSERVATION STATUS	NUMBER OF RECORDS ON SITE	FLIGHT CHARACTERISTICS	MIGRATORY	DISTRIBUTION ACROSS SITE	RISK OF COLLISION WITH TURBINES	RISK OF COLLISION WITH OVERHEAD POWERLINES
Pyrrholaemus sagittatus	Speckled Warbler	V	3	Moderate to low flight	No	Woodlands	Low	Low
Migratory Species								
Anthochaera phrygia	Regent Honeyeater^	M,.E	Not recorded	Within canopy during foraging and between 5 m and 50 m above canopy when moving between areas	Disperses from breeding sites, including in the Capertee Valley, outside of the breeding season.	Woodlands	Moderate - High	Low
Hirundapus caudacutus	White-throated Needletail	M	Not recorded	High, soaring, flies on updraughts	Migratory species, travelling to Asia for breeding in mid-May.	Woodlands and grasslands	Moderate - High	Moderate
Merops ornatus	Rainbow Bee-eater	M	Not recorded	Moderate flight except when migrating	Migratory species, travelling north during winter	Woodlands and grasslands	Moderate	Low
Commonly recorded species								
Corvus coronoides	Australian Raven	-	Not recorded	Moderate to low flight	No	Woodlands and grasslands	Low	Low
Gymnorhina tibicen	Australian Magpie	-	Not recorded	Moderate to low flight	No	Woodlands and grasslands	Low	Low

SCIENTIFIC NAME	COMMON NAME	CONSERVATION STATUS	NUMBER OF RECORDS ON SITE	FLIGHT CHARACTERISTICS	MIGRATORY	DISTRIBUTION ACROSS SITE	RISK OF COLLISION WITH TURBINES	RISK OF COLLISION WITH OVERHEAD POWERLINES
Coracina novaehollandiae	Black-faced Cuckoo-shrike	-	Not recorded	Moderate to low flight	Partly nomadic, with northwards migrations	Woodlands and grasslands	Moderate – migratory species	Low
Platycercus elegans	Crimson Rosella	-	Not recorded	Fast, high - low flight depending on activity	No	Woodlands and grasslands	Moderate	Low
Platycercus adscitus eximius	Eastern Rosella	-	Not recorded	Fast, high - low flight depending on activity	No	Woodlands and grasslands	Moderate	Low
Rhipidura albiscapa	Grey Fantail	-	Not recorded	Moderate to low flight	Appears to undergo a partial northern migration during winter	Woodlands	Moderate – migratory species	Low
Dacelo novaeguineae	Laughing Kookaburra	-	Not recorded	Moderate to low flight	No	Woodlands and grasslands	Low	Low
Philemon corniculatus	Noisy Friarbird	-	Not recorded	Moderate to low flight	Partly migratory in the south of its range, moving north in autumn and south in late winter	Woodlands and grasslands	Moderate – migratory species	Low
Strepera graculina	Pied Currawong	-	Not recorded	Moderate to low flight	Mostly sedentary	Woodlands and grasslands	Low	Low
Anthochaera carunculata	Red Wattlebird	-	Not recorded	Moderate to low flight	No	Woodlands and grasslands	Low	Low

SCIENTIFIC NAME	COMMON NAME	CONSERVATION STATUS	NUMBER OF RECORDS ON SITE	FLIGHT CHARACTERISTICS	MIGRATORY	DISTRIBUTION ACROSS SITE	RISK OF COLLISION WITH TURBINES	RISK OF COLLISION WITH OVERHEAD POWERLINES
Pardalotus punctatus	Spotted Pardalote	-	Not recorded	Moderate to low flight	Largely sedentary	Woodlands	Low	Low
Cormobates leucophaeus	White-throated Treecreeper	-	Not recorded	Moderate to low flight	No	Woodlands	Low	Low
Rhipidura leucophrys	Willy Wagtail	-	Not recorded	Moderate to low flight	No	Woodlands and grasslands	Low	Low
Lichenostomus chrysops	Yellow-faced Honeyeater	-	Not recorded	Moderate to low flight	Partly migratory, moving north in autumn and south in spring in south eastern Australia	Woodlands and grasslands	Moderate – migratory species	Low
Acanthiza chrysorrhoa	Yellow-rumped Thornbill	-	Not recorded	Moderate to low flight	No	Woodlands	Low	Low
Birds of Prey								
Falco cenchroides	Nankeen Kestrel	-	Not recorded	High	Partially	Grassland	Moderate	Low
Aquila audax	Wedge-tailed Eagle	-	Not recorded	High, soaring	No	Grassland	Moderate	Low

SCIENTIFIC NAME	COMMON NAME	CONSERVATION STATUS	NUMBER OF RECORDS ON SITE	FLIGHT CHARACTERISTICS	MIGRATORY	DISTRIBUTION ACROSS SITE	RISK OF COLLISION WITH TURBINES	RISK OF COLLISION WITH OVERHEAD POWERLINES
Elanus axillaris	Black-shouldered Kite	-	Not recorded	High	Nomadic; populations may irrupt in response to mouse plagues in particular areas.	Woodlands and grasslands	Moderate	Low
Falco berigora	Brown Falcon	-	Not recorded	High, soaring	May move around locally in response to changes in condition	Grassland	Moderate	Low

High flight = species soars, hovers or flies well above the canopy

Medium flight species flies within or just above the canopy

Low flight = flies below the canopy

^ species not recorded within the study area although included as a precaution give proximity of site to breeding site in Capertee Valley

E = Endangered, V = Vulnerable, M = Migratory

Appendix H: Part 3A Impact Assessment Criteria

ENDANGERED ECOLOGICAL COMMUNITIES

The following communities have been recorded throughout the study area:

- White Box - Yellow Box - Blakely's Red Gum Woodland (EEC)

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The following species have the potential to occur in the study area:

- *Eucalyptus cannonii* (Capertee Stringybark);
- *Eucalyptus robertsonii* subsp*. hemisphaerica* (Robertson's Peppermint);
- *Swainsona recta* (Mountain Swainson-pea)*;*
- *Swainsona sericea* (Silky Swainson-pea)*;* and
- *Thesium australe* (Austral Toadflax).

FAUNA

The following species have been recorded across the project site:

- *Climacteris picumnus victoriae* (Brown Treecreeper);
- *Glossopsitta pusilla* (Little Lorikeet);
- *Melanodryas cucullata cucullata* (Hooded Robin);
- *Petroica boodang* (Scarlet Robin);
- *Pyrrholaemus saggitatus* (Speckled Warbler);
- *Stagonopleura guttata* (Diamond Firetail);
- *Phascolarctos cinereus* (Koala);
- *Chalinolobus dwyeri* (Large-eared Pied Bat) ("probable" anabat recording);
- *Chalinolobus picatus* (Little Pied Bat) ("definite" anabat recording);
- *Miniopterus orianae oceanensis* (Eastern Bentwing-bat) ("definite" anabat recording);

- *Nyctophilus corbeni (*syn. *N. timoriensis)* (Greater (Eastern) Long-eared Bat) ("definite" anabat recording for *Nyctophilus* spp.);
- *Saccolaimus flaviventris* (Yellow-bellied Sheathtail Bat) ("possible" anabat recording); and
- *Vespadelus troughtoni* (Eastern Cave Bat) ("possible" anabat recording).

The following species have the potential to occur:

- *Anthochaera phrygia* (Regent Honeyeater);
- *Burhinus grallarius* (Bush Stone-curlew);
- *Callocephalon fimbriatum* (Gang Gang Cockatoo);
- *Circus assimilis* (Spotted Harrier);
- *Daphoenositta chrysoptera* (Varied Sittella);
- *Hieraaetus morphnoides* (Little Eagle);
- *Lathamus discolor* (Swift Parrot);
- *Melithreptus gularis gularis* (Black-chinned Honeyeater (eastern subspecies));
- *Ninox connivens* (Barking Owl);
- *Ninox strenua* (Powerful Owl);
- *Petroica phoenicea* (Flame Robin);
- *Polytelis swainsonii* (Superb Parrot);
- *Dasyurus maculatus* (Spotted-tailed Quoll);
- *Petaurus norfolcensis* (Squirrel Glider);
- *Phascogale tapoatafa* (Brush-tailed Phascogale);
- *Pteropus poliocephalus* (Grey-headed Flying-fox); and
- *Aprasia parapulchella* (Pink-tailed Legless Lizard).

ENDANGERED ECOLOGICAL COMMUNITIES

White Box Yellow Box Blakely's Red Gum Woodland (BGW)

White Box Yellow Box Blakely's Red Gum Woodland (commonly referred to as Box-Gum Woodland; BGW) is listed as an Endangered Ecological Community under the TSC Act (OEH 2011b).

BGW is found from the Queensland border in the north, to the Victorian border in the south. It occurs in the tablelands and western slopes of NSW. Remnants generally occur on fertile lower parts of the landscape where resources such as water and nutrients are abundant (OEH 2011b).

BGW is an open woodland community (sometimes occurring as a forest formation), in which the most obvious species are one or more of the following: *Eucalyptus albens* (White Box), *E. melliodora* (Yellow Box) and *E. blakelyi* (Blakely's Red Gum). Intact sites contain a high diversity of plant species, including the main tree species, additional tree species, some shrub species, several climbing plant species, many grasses and a very high diversity of herbs. The community also includes a range of mammal, bird, reptile, frog and invertebrate fauna species (OEH 2011b).

Intact stands that contain diverse upper and mid-storeys and ground layers are rare. Disturbed remnants are considered to form part of the community, including where the vegetation would respond to assisted natural regeneration (OEH 2011b).

Retention of remnants is important as they contribute to productive farming systems (stock shelter, seed sources, sustainable grazing and water-table and salinity control). The fauna of remnants (insectivorous birds, bats etc) can contribute to insect control on grazing properties. Some of the component species (e.g. wattles, she-oaks, native legumes) fix nitrogen that is made available to other species in the community, while fallen timber and leaves recycle their nutrients (OEH 2011b).

Flora surveys and vegetation community validation were conducted across the proposed study area and project site during October and November 2008, January 2009, and March and April 2011. BGW was recorded in lower lying, gently sloping and undulating land below 900 m elevation. It occurred in both the Sallys Flat and Pyramul Clusters, but was present mostly in the eastern arm of the study area where the external overhead lines are proposed, mainly on clastic (siltstone), volcanoclastic, and felsic rock (rhyolite), but also to a lesser extent on metamorphic rock (siltstone). The structure of the community was open grassy woodland and grassland.

How is the proposal likely to affect the lifecycle of a threatened species and/or population?

Not applicable - BGW is not a threatened species or population.

How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

The proposal will result in the permanent removal of up to 5.38 ha of BGW. This includes the permanent removal 4.42 ha of BGW (tree cover only) for the installation of the external overhead line. An additional 0.11 ha of temporary clearance is proposed for cut and fill, and rock crushing / batching plants. In total, permanent and temporary clearance will amount to 5.38 ha of BGW, representing 2.17 % of the BGW present within the study area, and 0.83 % of the BGW present within the project site.

Despite the clearance of BGW, extensive areas of BGW will remain within the study area (242.96 ha) and project site (644.63 ha) and offsets will be provided for all BGW clearance. The vegetation

clearance will take place as small fragments across a large area, mostly on the edges of the community. However, a small section within a woodland remnant of BGW will be cleared in the eastern part of the study area for the external overhead lines.

During the construction phase of the project, there is potential that BGW habitat will be indirectly impacted by erosion and/or increased sediment. During the operation phase of the project, there is potential that BGW habitat will be impacted by weeds. Management measures including a Construction Environmental Management Plan, Soil and Water Management Plan, and Weed Management Plan will be implemented to prevent degradation of adjacent remaining areas of BGW due to sedimentation, edge effects and weed invasion.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

BGW is not a threatened species or population. However, BGW is found from the Queensland border in the north, to the Victorian border in the south, occurring in the tablelands and western slopes of NSW (OEH 2011b). Thus, BGW is not at the limit of its known distribution at Crudine Ridge.

How is the proposal likely to affect current disturbance regimes?

Current disturbances at the site include sheep and cattle grazing, soil disturbance and grazing by feral animals including the European Rabbit and Goat, and periods of drought and rainfall consistent with the southern oscillation index and resultant cycles of drought (El Niño) and wetter periods (La Niña). There have been no major fire events on the site in the last decade.

The proposal is unlikely to exacerbate grazing impacts at the site. In fact, it may contribute to a more sustainable grazing regime through the mitigation measures proposed in some parts of the site. In the absence of fire, grazing can be an important form of disturbance to prevent the accumulation of biomass that may not be favourable to some native flora species. Rotational periods of grazing and spelling help to foster healthy native pastures in the absence of fire.

Similarly, the proposal is unlikely to contribute to increasing feral animal activity across the project site and instead is likely to assist with the management of these species through the proposed mitigation measures to be implemented within the study area and on the proposed offset sites.

The proposal is also unlikely to alter the current fire regime at the study area. The risk of fire with wind farms is inherently low (CFA 2007). A low risk is associated with malfunctioning turbine bearings, inadequate crankcase lubrication, cable damage during rotation, electrical shorting or arcing occurring in transmission and distribution facilities (CFA 2007). The location of wind turbines primarily in grassy breaks away from / between tall vegetation in the study area minimises the risk of fire. It is unlikely that the proposal will significantly affect the fire regime and given the range of fire mitigation measures to be put in place during and post construction, it is unlikely that the proposal would result in a high intensity fire that would have a detrimental impact on the BGW. The proposed access roads will increase the accessibility across the site should a fire occur.

The proposal has the potential to increase erosion, sedimentation and runoff through the clearing of vegetation and the construction of roads, and produce conditions favourable to weed invasion. However, any increases in run-off in areas where the ground within the construction area will be compacted, gravelled or concreted will be small and localised. The proposal will not affect flooding or flow regimes for the study area. Soil erosion and run-off control measures and weed control will be implemented as part of the mitigation measures undertaken for the proposal.

How is the proposal likely to affect habitat connectivity?

The proposal will result in minimal fragmentation of BGW given that that majority of the proposed clearance is to take place in pasture areas with scattered trees. Minor fragmentation will occur in the east of the study area where the powerline passes through a remnant of BGW. However, this will include tree removal only, with all vegetation < 3m remaining . Routes for access roads and turbine locations have been selected such that tree clearance is avoided wherever possible.

Where clearing within the community will occur, for example in the area where the external overhead lines will be located, gaps in the canopy will result. However, the structure of BGW across the site is open woodland and canopy gaps are common. Although the proposed infrastructure will create some fragmentation, principally of the ground later, this is considered to be minor and will not prevent seed dispersal mechanisms within and between stands of vegetation.

Furthermore, only 2.17% of the BGW in the study area and 0.83% of the project site will be cleared for the proposal.

Some existing vegetation corridors will be subject to disturbance within the study area; however, this is likely to consist of turbine nodes (25 m radius) and 6 m access road joining these nodes. The corridors are already subject to some fragmentation from historic land uses (agriculture) and the proposed footprint has avoided the most intact sections of these vegetation corridors throughout the project site.

How is the proposal likely to affect critical habitat?

Not applicable - critical habitat has not been declared for this community.

FLORA

***Eucalyptus cannonii* (Capertee Stringybark)**

Eucalyptus cannonii is listed as a vulnerable species under both the TSC Act and the EPBC Act. The species is restricted to an area of about 100 x 60 km in the central tablelands of NSW. The western border is approximately marked by a line between Bathurst and Mudgee, while the eastern locations occur approximately on a line between Lithgow and the town of Bylong. Within this area the species is often locally frequent (OEH 2011b).

The species has been recorded from Tablelands Grassy Woodland Complex communities and Talus Slope Woodland. In Winburndale Nature Reserve, it has been recorded within woodland dominated by *Eucalyptus macrorhyncha* (Red Stringybark) and *E. goniocalyx* (Long-leaved Box). Other associated species are *E. viminalis*, *E. mannifera*, *E. polyanthemos*, *E. rossii*, *E. blakelyi*, *E. oblonga*, *E. sparsifolia*, *E. bridgesiana*, *E. dalrympleana*, *E. melliodora*, *E. dives* and *Angophora floribunda*. The altitude range of *Eucalyptus cannonii* is from about 460 m to 1040 m. Within the range, the species appears to tolerate most situations except the valley floors (OEH 2011b).

Some populations of *E. cannonii* are quite large. The population in Winburndale Nature Reserve is estimated to be at a minimum, 6000 individuals with the total closer to 10,000 individuals. There are 67 different locations recorded in the NPWS database for the species. It is probable that populations of *Eucalyptus cannonii* are discontinuous (OEH 2011b).

Eucalyptus cannonii produces white flowers from January to April. The seed is spread by wind or gravity, generally in proximity (within 30 m) to the parent plant. The species has no dormancy mechanism (OEH 2011b).

Hybrids with *E. macrorrhyncha*, *E. sparsifolia* / *E. tenella* have been collected. At some locations where *E. cannonii* and *E. macrorrhyncha* occur together, no intermediates are found while at other locations, hybrid swarms are evident (OEH 2011b).

Mature trees survive hot fires, re-sprouting from epicormic buds. However, frequent fires may kill seedlings and weaken mature trees (OEH 2011b).

Flora surveys and vegetation community validation were conducted across the proposed study area and project site during October and November 2008, January 2009, and March, April, September and October 2011. *Eucalyptus cannonii* was not recorded during field survey, but has been previously recorded in the locality, mostly to the east of the study area, with the closest record located off the Castlereagh Highway, approximately 1.7 km away. Other records of the species include north toward Lake Windamere (2 records), and south east in the Ilford area (3 records), and east around the Clandulla area (2 records in Clandulla State Forest and 1 record at Charbon Colliery) (OEH 2011a, RBG 2011).

How is the proposal likely to affect the lifecycle of a threatened species and/or population?

The proposal may impact on the life cycle of *E. cannonii* by reducing the amount of potential habitat available to the species, degrading *E. cannonii* habitat (eg. through fragmentation), or changing the fire or grazing regime of the area. However, no individuals of this conspicuous species were identified during field surveys.

Potential habitat for *E. cannonii* within the study area exists in areas of BPBGRS, RSSGRBLLB, and WBBRGYB (wooded areas and pasture). The proposal will permanently remove 66.25 ha and

temporarily remove 31.45 ha of potential habitat within the study area.

However, the amount of clearance is small with respect to the amount of potential habitat present for this species within the study area. Only 7.61 % of habitat in the study area (1,283.29 ha) and 2.99 % of the project site (3,262.80 ha) will be removed in a primarily linear manner, rather than one consolidated block. The proposal will not significantly fragment the habitat of the species. The seeds of the species disperse by wind and gravity, close to parent plants (OEH 2011b). The proposal will not obstruct the dispersal of seeds, should the species be present.

During the operational phase of the wind farm, there is a risk that the species will be impacted by changed fire regimes. However, the risk of fire with wind farms is inherently low (CFA 2007). A low risk is associated with malfunctioning turbine bearings, inadequate crankcase lubrication, cable damage during rotation, electrical shorting or arcing occurring in transmission and distribution facilities (CFA 2007). The location of wind turbines away from tall vegetation in the study area minimises the risk of fire. It is unlikely that the proposal will significantly affect the fire regime such that high intensity fire would have a detrimental impact on *E. cannonii* habitat. The proposed access roads will increase the accessibility across the site should a fire occur.

The life cycle may also be impacted by changed grazing regimes. The species is threatened by grazing as it prevents recruitment or regeneration of the species (OEH 2011b). However, the proposal is unlikely to exacerbate over-grazing at the site. It may, in fact, contribute to a more sustainable grazing regime through the mitigation measures proposed in some parts of the site. A spell in grazing may result in the increased regeneration of the species.

Given the species was not recorded during field surveys, the narrow linear nature of the proposal, the small amount of potential habitat that will be removed, and the low risk of frequent fire or overgrazing due to the proposal, detrimental impacts on the lifecycle of *E. cannonii* are not anticipated.

How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

Vegetation representing potential habitat for *E. cannonii* will be removed in primarily linear strips (for turbines, access tracks and the associated ancillary structures required for the running of the wind farm). As a worst case scenario, the area of habitat to be cleared consists of a permanent loss of 66.25 ha and a temporary impact to 31.45 ha of potential habitat, totalling 97.70 ha.

The amount of potential habitat proposed to be impacted represents 7.61 % of the potential habitat mapped within the study area, but only 2.99 % of potential habitat mapped within the project site. Thus, the proposal is unlikely to substantially reduce the amount of potential habitat for this species present in the project site.

The proposal may increase erosion, sedimentation and runoff through the clearing of vegetation and the construction of roads, and produce conditions favourable to weed invasion impacting on the species' habitat. However, any increases in run-off in areas where the ground within the construction area will be compacted, gravelled or concreted will be small and localised. The proposal will not affect flooding or flow regimes for the study area. Soil erosion and run-off control measures and weed control (over a 3-year period) will be implemented as part of the mitigation measures undertaken for the proposal, thereby reducing potential impacts of the proposal to potential habitat for this species.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

Eucalyptus cannonii is restricted to an area of about 100 x 60 km in the central tablelands of NSW. The western border is approximately marked by a line between Bathurst and Mudgee, while the eastern locations occur approximately on a line between Lithgow and the town of Bylong (OEH 2011b). Given Crudine Ridge is located on the western border, the study area is at the western limit of the species' distribution (OEH 2011b).

How is the proposal likely to affect current disturbance regimes?

Current disturbances at the site include cattle and sheep grazing, grazing by feral animals including the European Rabbit and Goat, and periods of drought and rainfall consistent with the southern oscillation index and resultant cycles of drought (El Niño) and wetter periods (La Niña). There has been no major fire event in the last decade.

The proposal is unlikely to exacerbate grazing at the site, but may, in fact, contribute to a more sustainable grazing regime through the mitigation measures proposed in some parts of the site. In the absence of fire, grazing can be an important form of disturbance to prevent the accumulation of biomass that may not be favourable to some native flora species. Rotational periods of grazing and spelling help to foster healthy native pastures in the absence of fire.

Feral animals can have a detrimental impact on threatened species and their habitat. In the case of threatened flora, grazing by feral animals such as the European Rabbit and Goat can result in the species being precluded from a site (recruitment and regeneration are prevented). The proposal is unlikely to contribute to increasing feral animal activity across the project site and instead is likely to assist with the management of these species through the proposed mitigation measures to be implemented within the study area and on the proposed offset sites.

The proposal is also unlikely to alter the current fire regime at the study area. The risk of fire with wind farms is inherently low (CFA 2007). A low risk is associated with malfunctioning turbine bearings, inadequate crankcase lubrication, cable damage during rotation, electrical shorting or arcing occurring in transmission and distribution facilities (CFA 2007). The location of wind turbines away from tall vegetation in the study area minimises the risk of fire. It is unlikely that the proposal will significantly affect the fire regime such that it would have a detrimental impact on *E. cannonii*.

The proposal has the potential to increase erosion, sedimentation and runoff through the clearing of vegetation and the construction of roads, and produce conditions favourable to weed invasion. However, any increases in run-off in areas where the ground within the construction area will be compacted, gravelled or concreted will be small and localised. The proposal will not affect flooding or flow regimes for the study area. Soil erosion and run-off control measures and weed control will be implemented as part of the mitigation measures undertaken for the proposal.

How is the proposal likely to affect habitat connectivity?

The proposal is unlikely to impact upon habitat connectivity for *E. cannonii* due to the availability of at least 1,283.29 ha of potential habitat within the study area, and 3,262.8 ha of potential habitat mapped within the project site that will not be cleared. Some existing vegetation corridors will be subject to disturbance within the study area; however, this is likely to consist of turbine nodes (25 m radius), with a 6 m access road joining these nodes. The corridors are already subject to some fragmentation from historic land uses (agriculture) and the proposed footprint has avoided the most intact sections of these vegetation corridors throughout the project site (the main habitat corridor through the project site along

the eastern slopes of Crudine Ridge will be largely retained).

How is the proposal likely to affect critical habitat?

Not applicable - critical habitat cannot be declared for vulnerable species.

***Eucalyptus robertsonii* subsp. *hemisphaerica* (Robertson's Peppermint)**

E. robertsonii subsp. *hemisphaerica* is listed as a vulnerable species under both the TSC Act and the EPBC Act. The species is found only in the central tablelands of NSW, from sites to the east and south east of Bathurst and Orange. Specimen localities include Glengowan (Upper Meroo), Burraga, Mullion Creek area, west of Bocoble Mountain and Isobella River (OEH 2011b).

E. robertsonii subsp. *hemisphaerica* is locally frequent in grassy or dry sclerophyll woodland or forest, on lighter soils and often on granite. It is usually found in closed grassy woodlands in locally sheltered sites. Habitats include quartzite ridges, upper slopes and a slight rise of shallow clay over volcanics. Associated vegetation includes variously mixed woodlands of *Eucalyptus piperita*, *E. goniocalyx*, *E. dalrympleana*, *E. dives*, *E. mannifera* and *E. rossii.* Populations are usually highly localised, with trees recorded as frequent in populations (OEH 2011b).

The species' flowering period is from February to March. Seed is dispersed locally by wind or gravity, and there is no dormancy mechanism. Plants re-sprout from epicormic buds after fire. A specimen from the Mullion Creek locality was observed to be suckering freely from base to crown after fire (OEH 2011b).

Flora surveys and vegetation community validation were conducted across the proposed study area and project site during October and November 2008, January 2009, and March, April, September and October 2011. *E. robertsonii* subsp. *hemisphaerica* was not recorded during field survey, but has been previously recorded in the locality to the north of the study area in the Calcagong area (OEH 2011a).

How is the proposal likely to affect the lifecycle of a threatened species and/or population?

The proposal could impact on the life cycle of *E. robertsonii* subsp. *hemisphaerica* by reducing the amount of potential habitat available to the species, degrading *E. robertsonii* subsp. *hemisphaerica* habitat (eg. through fragmentation), or changing the fire or grazing regime of the area. However, no individuals of this conspicuous species were identified during field surveys.

Potential habitat for *E. robertsonii* subsp. *hemisphaerica* within the study area exists in areas of Broad-leaved Peppermint – Brittle Gum – Red Stringybark dry open forest on the south eastern highlands. The proposal will permanently remove 0.81 ha and temporarily remove 0.40 ha of potential habitat within the study area.

However, the amount of clearance will be minimal with respect to the amount of potential habitat present for this species within the study area. Only 7.79 % of habitat in the study area (15.53 ha) and 3.01 % of the project site (40.24 ha) will be removed in a linear manner, rather than one consolidated block. The proposal will not significantly fragment the habitat of the species. The seeds of the species disperse by wind and gravity (OEH 2011b). The proposal will not obstruct the dispersal of seeds, should the species be present.

During the operational phase of the wind farm, there is a risk that the species will be impacted by changed fire regimes. However, the risk of fire with wind farms is inherently low (CFA 2007). A low risk is associated with malfunctioning turbine bearings, inadequate crankcase lubrication, cable damage during rotation, electrical shorting or arcing occurring in transmission and distribution facilities (CFA 2007). The location of wind turbines away from tall vegetation in the study area minimises the risk of fire. It is unlikely that the proposal will significantly affect the fire regime such that high intensity fire would have a detrimental impact on *E. robertsonii* subsp. *hemisphaerica* habitat. The proposed access roads will increase the accessibility across the site should a fire occur.

The life cycle may also be impacted by changed grazing regimes. The species may be threatened by grazing as it prevents recruitment or regeneration of the species (OEH 2011b). However, the proposal is unlikely to exacerbate over-grazing at the site. It may, in fact, contribute to a more sustainable grazing regime through the mitigation measures proposed in some parts of the site. A spell in grazing may result in the increased regeneration of the species.

Given the species was not recorded during field surveys, the narrow linear nature of the proposal, the small amount of potential habitat that will be removed, and the low risk of frequent fire or overgrazing due to the proposal, detrimental impacts on the lifecycle of *E. robertsonii* subsp. *hemisphaerica* are not anticipated.

How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

Vegetation representing potential habitat for *E. robertsonii* subsp. *hemisphaerica* will be removed in linear strips (for turbines, access tracks and the associated ancillary structures required for the running of the wind farm). As a worst case scenario, the area of habitat to be cleared consists of a permanent loss of 0.81 ha and a temporary impact to 0.40 ha of potential habitat, totalling 1.21 ha.

The amount of potential habitat proposed to be impacted represents 7.79 % of the potential habitat mapped within the study area, but only 3.01 % of potential habitat mapped within the project site. Thus, the proposal is unlikely to substantially reduce the amount of potential habitat for this species present in the project site.

The proposal may increase erosion, sedimentation and runoff through the clearing of vegetation and the construction of roads, and produce conditions favourable to weed invasion impacting on the species' habitat. However, any increases in run-off in areas where the ground within the construction area will be compacted, gravelled or concreted will be small and localised. The proposal will not affect flooding or flow regimes for the study area. Soil erosion and run-off control measures and weed control (over a 3-year period) will be implemented as part of the mitigation measures undertaken for the proposal, thereby reducing potential impacts of the proposal to potential habitat for this species.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

Eucalyptus robertsonii subsp. *hemisphaerica* is found only in the central tablelands of NSW, from sites to the east and south east of Bathurst and Orange. Specimen localities include Glengowan (Upper Meroo), Burraga, Mullion Creek area, west of Bocoble Mountain and Isobella River (OEH 2011b). Given Crudine Ridge lies between sites where the species has been recorded, the species is not at the limit of the species' distribution (OEH 2011b).

How is the proposal likely to affect current disturbance regimes?

Current disturbances at the site include cattle and sheep grazing, grazing by feral animals including the European Rabbit and Goat, and periods of drought and rainfall consistent with the southern oscillation index and resultant cycles of drought (El Niño) and wetter periods (La Niña). There has been no major fire event in the last decade.

The proposal is unlikely to exacerbate grazing at the site, but may, in fact, contribute to a more sustainable grazing regime through the mitigation measures proposed in some parts of the site. In the absence of fire, grazing can be an important form of disturbance to prevent the accumulation of biomass that may not be favourable to some native flora species. Rotational periods of grazing and spelling help

to foster healthy native pastures in the absence of fire.

Feral animals can have a detrimental impact on threatened species and their habitat. In the case of threatened flora, grazing by feral animals such as the European Rabbit and Goat can result in the species being precluded from a site (recruitment and regeneration are prevented). The proposal is unlikely to contribute to increasing feral animal activity across the project site and instead is likely to assist with the management of these species through the proposed mitigation measures to be implemented within the study area and on the proposed offset sites.

The proposal is also unlikely to alter the current fire regime at the study area. The risk of fire with wind farms is inherently low (CFA 2007). A low risk is associated with malfunctioning turbine bearings, inadequate crankcase lubrication, cable damage during rotation, electrical shorting or arcing occurring in transmission and distribution facilities (CFA 2007). The location of wind turbines away from tall vegetation in the study area minimises the risk of fire. It is unlikely that the proposal will significantly affect the fire regime such that it would have a detrimental impact on *E. robertsonii* subsp. *hemisphaerica*.

The proposal has the potential to increase erosion, sedimentation and runoff through the clearing of vegetation and the construction of roads, and produce conditions favourable to weed invasion. However, any increases in run-off in areas where the ground within the construction area will be compacted, gravelled or concreted will be small and localised. The proposal will not affect flooding or flow regimes for the study area. Soil erosion and run-off control measures and weed control will be implemented as part of the mitigation measures undertaken for the proposal.

How is the proposal likely to affect habitat connectivity?

The proposal is unlikely to impact upon habitat connectivity for *E. robertsonii* subsp. *hemisphaerica* due to the availability of at least 15.53 ha of potential habitat within the study area, and 40.24 ha of potential habitat mapped within the project site the majority of which will not be cleared. Some existing vegetation corridors will be subject to disturbance within the study area; however, this is likely to consist of turbine nodes (25 m radius), 6 m access road joining these nodes. The corridors are already subject to some fragmentation from historic land uses (agriculture) and the proposed footprint has avoided the most intact sections of these vegetation corridors throughout the project site (the main habitat corridor through the project site along the eastern slopes of Crudine Ridge will be largely retained).

How is the proposal likely to affect critical habitat?

Not applicable - critical habitat cannot be declared for vulnerable species.

***Swainsona recta* (Small Purple-pea)**

Swainsona recta is listed as an endangered species under both the TSC and the EPBC Acts. *Swainsona recta* is a slender, erect perennial herb growing to 30 cm tall. It was recorded historically from places such as Carcoar, Culcairn and Wagga Wagga where it is probably now extinct. Populations still exist in the Queanbeyan and Wellington-Mudgee areas. Over 80% of the southern population grows on a railway easement. It is also known from the ACT and a single population of four plants near Chiltern in Victoria (OEH 2011b).

Prior to European settlement, *Swainsona recta* was associated with the grassy understorey of woodlands and open-forests dominated by *Eucalyptus blakelyi* (Blakely's Red Gum), *E. melliodora* (Yellow Box), *E. rubida* (Candlebark Gum) and *E. goniocalyx* (Long-leaf Box) (OEH 2011b). The species now occurs in open woodland dominated by one or more of the following: *Callitris endichleri*, *C. glaucophylla*, *Eucalyptus blakelyi*, *E. bridgesiana*, *E. dives*, *E. melliodora*, *E. microcarpa*, *E. nortonii* and *E. polyanthemos*, with grassy understorey dominated by *Themeda triandra (syn. Themeda australis*), *Poa sieberiana* var. *sieberiana* or *Austrostipa* spp. (ACT Government 1997).

Plants die back in summer, surviving as rootstocks until they shoot again in autumn. The species flowers throughout spring, with a peak in October, and seeds ripen at the end of the year. Individual plants have been known to live for up to 20 years. The species is generally tolerant of fire, which also enhances germination by breaking the seed coat and reduces competition from other species (OEH 2011b).

The species was recorded during September and October 2011 but was not recorded during field surveys conducted during October and November 2008, January 2009, and March, April 2011. It has not been previously recorded in the locality, but was predicted to occur by the Biobanking tool.

All individuals recorded during September and October 2011 were recorded within WBBRGYB (wooded areas) along the proposed external overhead line, although there is also the potential for this species to inhabit the pasture areas of this community and also areas of RSSGRBLLB in other parts of the study area and project site.

Thirty six individuals were recorded across five locations within or near the proposed external powerline easement. It is possible that more individuals are present in this area but may not have been detected as not all recorded individuals were in flower and detection of non-flowering individuals is often difficult. The numbers of individuals are outlined below according to the five locations where the species was recorded:

- 24 individuals on the lower slope east of the current access track
- 7 individuals near an existing powerpole and within the proposed powerline easement east of the current access track
- 2 individuals in a small area on the western west side of road, small area
- 2 individuals in a small area on the western west side of road, small area
- 1 individual on the western west side of road, small area

How is the proposal likely to affect the lifecycle of a threatened species and/or population?

No direct impacts on any *Swainsona recta* individuals recorded during field surveys in September and October 2011 is proposed. The current access track will not be widened thereby avoiding impacts on

those individuals directly adjacent to the track. Furthermore, where necessary, poles will be aligned to ensure there no impacts on the other individuals recorded. In areas between poles, removal of trees is the only anticipated impact. Given that most of the individuals identified were in the current easement, the majority of tree clearance has already been undertaken in these areas and, therefore,, any future disturbance due to the need to remove trees is likely to be minimal. In order, to ensure no individuals are accidently trampled during construction, known individuals will be fenced off prior to construction qd will remain fenced until the completion of construction.

Realignment of the powerline corridor further east or west was considered although this was likely to result in more vegetation clearance and greater impacts on potential habitat for this species as additional clearance areas would be needed to provide access for construction and maintenance. In the current location, the external overhead line runs along an existing easement and access road and, therefore, impacts to native vegetation have been minimised. Furthermore, provided stringent mitigation measures are implemented during construction, it is unlikely that the proposal would have a detrimental impact on the population with many of the recorded individuals present in a current powerline easement. These include:

- Fencing around the individuals incorporating a 5 m buffer from the outer most plants when erecting the fencing;
- Implementation of sediment and erosion control measures; and
- Ongoing weed management.

Potential habitat for *Swainsona recta* within the study area exists in areas of WBBRGYB, and RSSGRBLLB, and WBBRGYB (wooded areas and pasture). The proposal will permanently remove 69.68 ha and temporarily remove 31.16 ha of potential habitat within the study area.

However, the amount of potential habitat impacted is minimal with respect to the amount of potential habitat present for this species within the project site. Only 6.37 % of the habitat within the project site will be removed in a linear and dispersed manner, rather than one consolidated block and no individuals will be directly impacted. While a greater proportion of potential habitat within the study area will be removed (25.49 %), the majority of habitat in the study area will remain, including known habitat. Areas of temporary vegetation removal will be allowed to regenerate. The species is pollinated by insects (it is also self-compatible), and these insects and their movements would not be impacted by the proposal. Mitigation measures to minimise erosion and control soil movement and weed spread will be implemented during construction and post to limit potential for indirect impacts from the proposal on potential habitat.

During the operational phase of the wind farm, there is a risk that the species will be impacted by changed fire regimes. However, the risk of fire with wind farms is inherently low (CFA 2007). A low risk is associated with malfunctioning turbine bearings, inadequate crankcase lubrication, cable damage during rotation, electrical shorting or arcing occurring in transmission and distribution facilities (CFA 2007). The location of wind turbines away from tall vegetation in the study area minimises the risk of fire. It is unlikely that the proposal will significantly affect the fire regime such that high intensity fire would have a detrimental impact on *Swainsona recta* habitat. The proposed access roads will increase the accessibility across the site should a fire occur.

The proposal is unlikely to exacerbate over-grazing at the site. It may, in fact, contribute to a more sustainable grazing regime through the mitigation measures proposed in some parts of the site. A spell

in grazing may result in the increased regeneration of the species.

How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

Vegetation representing potential habitat for *Swainsona recta* will be removed to install poles for overhead lines and in linear strips (for turbines, access tracks and the associated ancillary structures required for the running of the wind farm). As a worst case scenario, the area of habitat to be cleared consists of a permanent loss of 69.68 ha and a temporary impact to 31.16 ha of potential habitat, totalling 100.84 ha.

The amount of potential habitat proposed to be impacted represents 25.49 % of the potential habitat mapped within the study area, but only 6.37 % of potential habitat mapped within the project site. Thus, the proposal is unlikely to substantially reduce the amount of potential habitat for this species present within the project site.

The proposal may increase erosion, sedimentation and runoff through the clearing of vegetation and the construction of roads, and produce conditions favourable to weed invasion impacting on the species' habitat. However, any increases in run-off in areas where the ground within the construction area will be compacted, gravelled or concreted will be small and localised. The proposal will not affect flooding or flow regimes for the study area. Soil erosion and run-off control measures and weed control (over a 3-year period) will be implemented as part of the mitigation measures undertaken for the proposal, thereby reducing potential impacts of the proposal to potential habitat for this species.

In the area where *Swainsona recta* has been recorded, mitigation measures will include:

- Fencing around the individuals incorporating a 5 m buffer from the outer most plants when erecting the fencing;
- Implementation of sediment and erosion control measures; and
- Ongoing weed management.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

Swainsona recta currently exists in the Queanbeyan and Wellington-Mudgee areas. It is also known from the ACT and a single population of four plants near Chiltern in Victoria (OEH 2011b). Crudine Ridge is located in Wellington-Mudgee area, the northern-most part of the species' distribution. As such, the study area is close to the limit of the species' distribution.

How is the proposal likely to affect current disturbance regimes?

Current disturbances at the site include cattle and sheep grazing, grazing by feral animals including the European Rabbit and Goat, and periods of drought and rainfall consistent with the southern oscillation index and resultant cycles of drought (El Niño) and wetter periods (La Niña). There has been no major fire event in the last decade.

The proposal is unlikely to exacerbate grazing at the site, but may, in fact, contribute to a more

sustainable grazing regime through the mitigation measures proposed in some parts of the site. In the absence of fire, grazing can be an important form of disturbance to prevent the accumulation of biomass that may not be favourable to some native flora species. Rotational periods of grazing and spelling help to foster healthy native pastures in the absence of fire.

Feral animals can have a detrimental impact on threatened species and their habitat. In the case of threatened flora, grazing by feral animals such as the European Rabbit and Goat can result in the species being precluded from a site (recruitment and regeneration are prevented). The proposal is unlikely to contribute to increasing feral animal activity across the project site and instead is likely to assist with the management of these species through the proposed mitigation measures to be implemented within the study area and on the proposed offset sites.

The proposal is also unlikely to alter the current fire regime at the study area. The risk of fire with wind farms is inherently low (CFA 2007). A low risk is associated with malfunctioning turbine bearings, inadequate crankcase lubrication, cable damage during rotation, electrical shorting or arcing occurring in transmission and distribution facilities (CFA 2007). The location of wind turbines away from tall vegetation in the study area minimises the risk of fire. It is unlikely that the proposal will significantly affect the fire regime such that it would have a detrimental impact on *Swainsona recta*.

The proposal has the potential to increase erosion, sedimentation and runoff through the clearing of vegetation and the construction of roads, and produce conditions favourable to weed invasion. However, any increases in run-off in areas where the ground within the construction area will be compacted, gravelled or concreted will be small and localised. The proposal will not affect flooding or flow regimes for the study area. Soil erosion and run-off control measures and weed control will be implemented as part of the mitigation measures undertaken for the proposal.

How is the proposal likely to affect habitat connectivity?

The proposal is unlikely to impact upon habitat connectivity for *Swainsona recta.* Some existing vegetation corridors will be subject to disturbance within the study area; however, this is likely to consist of turbine nodes (25 m radius), with a 6 m access road joining these nodes. The corridors are already subject to some fragmentation from historic land uses (agriculture), and the proposed footprint has avoided the most intact sections of these vegetation corridors throughout the project site (the main habitat corridor through the project site along the eastern slopes of Crudine Ridge will be largely retained).

How is the proposal likely to affect critical habitat?

Not applicable. Critical habitat has not been declared for this species.

***Swainsona sericea* (Silky Swainson-pea)**

Swainsona sericea is listed as a vulnerable species under the TSC Act. *Swainsona sericea* is a prostrate or erect perennial, growing to 10 cm tall. The stems and leaves are densely hairy. It has been recorded from the Northern Tablelands to the Southern Tablelands and further inland on the slopes and plains. There is one isolated record from the far north-west of NSW. Its stronghold is on the Monaro. It is also found in South Australia, Victoria and Queensland (OEH 2011b). At least 80 geographically distinct populations are represented in NSW, with the actual number likely to be in the vicinity of 100 or more (NSW Scientific Committee 2008).

Swainsona sericea grows in grassland and eucalypt woodland communities in a variety of habitats including riverine plains, sandhills and rocky outcrops. It is found in Natural Temperate Grassland and *Eucalyptus pauciflora* (Snow Gum) Woodland on the Monaro, and in Box-Gum Woodland in the Southern Tablelands and South West Slopes. Populations from the Central Western Slopes have been found growing on gentle slopes in White Box grassy woodlands and on a flat granite hillcrest with White Box, White Cypress Pine and Dwyer's Red Gum. Sometimes the species is found in association with *Callitris* spp. (Cypress Pines). Its habitat on the plains is unknown (NSW Scientific Committee 2008).

Swainsona sericea flowers from September to November, with the species making most of its growth in the cooler months. *Swainsona* species are largely renascent perennials, resprouting in suitable conditions from a persistent rootstock. Vegetative reproduction appears to be the most common method of reproduction in *Swainsona sericea*, at least in mallee populations in Victoria (Earl *et al.* 2003). Copious flowers and abundant quantities of seed can be also produced under favourable conditions (NSW Scientific Committee 2008).

Little is known of its reproductive biology; however, the species is believed to regenerate from seed after fire. Fire is likely to play an essential role in seedling regeneration by breaking the dormancy of the hard-coated seed. Light grazing may also reduce grass cover, maintaining an open sward as it does for *S. plagiotropis*, allowing sufficient inter-tussock space for germination and establishment (NSW Scientific Committee 2008).

The species was not recorded during field surveys conducted during October and November 2008, January 2009, and March, April, September and October 2011 surveys. It has not been previously recorded in the locality, but was predicted to occur by the Biobanking tool.

How is the proposal likely to affect the lifecycle of a threatened species and/or population?

No individuals of this species were identified during field surveys. The proposal could impact on the life cycle of *Swainsona sericea* by reducing the amount of potential habitat available to the species, degrading *Swainsona sericea* habitat (eg. through fragmentation or weed invasion), or changing the fire or grazing regime of the area.

There is potential for *Swainsona sericea* to occur within areas of WBBRGYB (wooded areas and pasture). The proposal will permanently remove 4.90 ha and temporarily remove 0.11 ha of potential habitat within the study area.

However, the amount of clearance of potential habitat is minimal with respect to the amount of potential habitat present for this species within the project site. Only 0.91 % of the habitat within the project site will be removed in a linear and dispersed manner, rather than one consolidated block and no individuals will be directly impacted. While a greater proportion of potential habitat within the study area will be removed (2.56 %), the majority of habitat in the study area will remain. Areas of temporary vegetation removal will be a allowed to regenerate. Mitigation measures to minimise erosion and control soil

movement and weed spread will be implemented during construction works to limit potential impacts from the proposal on potential habitat.

Little is known of the reproductive biology of *Swainsona sericea.* However, *Swainsona* species are largely renascent perennials, resprouting in suitable conditions from a persistent rootstock. Vegetative reproduction appears to be the most common method of reproduction in *Swainsona sericea*, at least in mallee populations in Victoria (Earl *et al.* 2003), although copious flowers and abundant quantities of seed can also be produced under favourable conditions (NSW Scientific Committee 2008).

During the operational phase of the wind farm, there is a risk that the species will be impacted by changed fire regimes. Fire is likely to play an essential role in seedling regeneration by breaking the dormancy of the hard-coated seed (OEH 2011b). However, the risk of fire with wind farms is inherently low (CFA 2007). A low risk is associated with malfunctioning turbine bearings, inadequate crankcase lubrication, cable damage during rotation, electrical shorting or arcing occurring in transmission and distribution facilities (CFA 2007). The location of wind turbines away from tall vegetation in the study area minimises the risk of fire. It is unlikely that the proposal will significantly affect the fire regime such that high intensity fire would have a detrimental impact on *Swainsona sericea* habitat. The proposed access roads will increase the accessibility across the site should a fire occur.

The life cycle may also be impacted by changed grazing regimes. The species is threatened by grazing as it prevents recruitment or regeneration of the species (OEH 2011b). However, the proposal is unlikely to exacerbate over-grazing at the site. It may, in fact contribute to a more sustainable grazing regime through the mitigation measures proposed in some parts of the site. A spell in grazing may result in the increased regeneration of the species. It has been suggested that light grazing provides favourable conditions for the species through reducing grass cover.

Given the species was not recorded during field surveys and the narrow linear nature of the proposal, the dispersal of seeds of this species is unlikely to be impeded by the proposal. Detrimental impacts on the lifecycle of *Swainsona sericea* are not anticipated.

How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

Vegetation representing potential habitat for *Swainsona sericea* will be removed in linear strips (for turbines, access tracks and the associated ancillary structures required for the running of the wind farm). As a worst case scenario, the area of vegetation to be cleared consists of a permanent loss of 4.90 ha and a temporary impact to 0.11 ha of potential habitat, totalling 5.01 ha.

The amount of potential habitat proposed to be impacted represents 2.56 % of the potential habitat mapped within the study area, but only 0.91 % of potential habitat mapped within the project site. Thus, the proposal is unlikely to substantially reduce the amount of potential habitat for this species present in the project site.

The proposal may increase erosion, sedimentation and runoff through the clearing of vegetation and the construction of roads, and produce conditions favourable to weed invasion impacting on the species' habitat. However, any increases in run-off in areas where the ground within the construction area will be compacted, gravelled or concreted will be small and localised. The proposal will not affect flooding or flow regimes for the study area. Soil erosion and run-off control measures and weed control (over a 3-year period) will be implemented as part of the mitigation measures undertaken for the proposal, thereby reducing potential impacts of the proposal to potential habitat for this species.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

Swainsona sericea has been recorded from the Northern Tablelands to the Southern Tablelands and further inland on the slopes and plains. There is one isolated record from the far north-west of NSW. Its stronghold is on the Monaro. It is also found in South Australia, Victoria and Queensland. Given it has been recorded from the Northern Tablelands to the Southern Tablelands, the study area is not at the limit of the species' distribution.

How is the proposal likely to affect current disturbance regimes?

Current disturbances at the site include cattle and sheep grazing, grazing by feral animals including the European Rabbit and Goat, and periods of drought and rainfall consistent with the southern oscillation index and resultant cycles of drought (El Niño) and wetter periods (La Niña). There has been no major fire event in the last decade.

The proposal is unlikely to exacerbate grazing at the site, but may, in fact, contribute to a more sustainable grazing regime through the mitigation measures proposed in some parts of the site. In the absence of fire, grazing can be an important form of disturbance to prevent the accumulation of biomass that may not be favourable to some native flora species. Rotational periods of grazing and spelling help to foster healthy native pastures in the absence of fire.

Feral animals can have a detrimental impact on threatened species and their habitat. In the case of threatened flora, grazing by feral animals such as the European Rabbit and Goat can result in the species being precluded from a site (recruitment and regeneration are prevented). The proposal is unlikely to contribute to increasing feral animal activity across the project site and instead is likely to assist with the management of these species through the proposed mitigation measures to be implemented within the study area and on the proposed offset sites.

The proposal is also unlikely to alter the current fire regime at the study area. The risk of fire with wind farms is inherently low (CFA 2007). A low risk is associated with malfunctioning turbine bearings, inadequate crankcase lubrication, cable damage during rotation, electrical shorting or arcing occurring in transmission and distribution facilities (CFA 2007). The location of wind turbines away from tall vegetation in the study area minimises the risk of fire. It is unlikely that the proposal will significantly affect the fire regime such that it would have a detrimental impact on *Swainsona sericea.*

The proposal has the potential to increase erosion, sedimentation and runoff through the clearing of vegetation and the construction of roads, and produce conditions favourable to weed invasion. However, any increases in run-off in areas where the ground within the construction area will be compacted, gravelled or concreted will be small and localised. The proposal will not affect flooding or flow regimes for the study area. Soil erosion and run-off control measures and weed control will be implemented as part of the mitigation measures undertaken for the proposal.

How is the proposal likely to affect habitat connectivity?

The proposal is unlikely to impact upon habitat connectivity for *Swainsona sericea.* Some existing vegetation corridors will be subject to disturbance within the study area; however, this is likely to consist of turbine nodes (25 m radius), with a 6 m access road joining these nodes. The corridors are already subject to some fragmentation from historic land uses (agriculture), and the proposed footprint has avoided the most intact sections of these vegetation corridors throughout the project site (the main habitat corridor through the project site along the eastern slopes of Crudine Ridge will be largely retained).

How is the proposal likely to affect critical habitat?

Not applicable - critical habitat cannot be declared for vulnerable species.

***Thesium australe* (Austral Toadflax)**

Thesium australe is a small, straggling herb to 40 cm tall which is listed as a vulnerable species under the TSC Act and EPBC Act. *Thesium australe* is found in very small populations scattered across eastern NSW, along the coast, and from the Northern to Southern Tablelands. It is also found in Tasmania and Queensland and in eastern Asia (OEH 2011b).

Thesium australe occurs in grassland or grassy woodland, often in damp sites. It is a root parasite, taking water and some nutrients from other plants, and often grows in association with Kangaroo Grass (*Themeda australis*) (OEH 2011b).

Flora surveys and vegetation community validation were conducted across the proposed study area and project site during October and November 2008, January 2009, and March, April, September and October 2011. *Thesium australe* was not recorded during field survey and there are no records for the species in the locality. The species was predicted to occur by the Protected Matters search tool (DSEWPAC 2011a).

How is the proposal likely to affect the lifecycle of a threatened species and/or population?

No individuals of this species were identified during field surveys. The proposal could impact on the life cycle of *Thesium australe* by reducing the amount of potential habitat available to the species, degrading *Thesium australe* habitat (eg. through fragmentation), or changing the fire or grazing regime of the area.

There is potential for *Thesium australe* to occur within areas of woodland (RSSGRBLLB, WBBRGYB), BPBGRS on the southeastern highlands and derived grassland. The proposal will permanently remove 71.52 ha and temporarily remove 31.56 ha of potential habitat within the study area.

However, the amount of clearance will be minimal with respect to the amount of potential habitat present for this species within the study area. Only 6.73 % of habitat in the study area (1,531.63 ha) and 2.63 % of the project site (3,912.81 ha) will be removed in a linear manner, rather than one consolidated block.

Little is known of dormancy, the persistence of seedbanks, associated pollinators, or germination and dispersal mechanisms for this species. *Thesium australe* is to be a biennial species, however, glasshouse studies suggest plants could live up to three years from germination (DSE 2003). It is generally observed in association with *Themeda* sp. (Kangaroo Grass), species upon which it is hemiparasitic (DSE 2003). *Thesium australe* has been observed to germinate well post-fire, however, adequate regeneration can be expected without fire, as least where the grassland is lightly grazed (DSE 2003).

During the operational phase of the wind farm, there is a risk that the species will be impacted by changed fire regimes. However, the risk of fire with wind farms is inherently low (CFA 2007). A low risk is associated with malfunctioning turbine bearings, inadequate crankcase lubrication, cable damage during rotation, electrical shorting or arcing occurring in transmission and distribution facilities (CFA 2007). The location of wind turbines away from tall vegetation in the study area minimises the risk of fire. It is unlikely that the proposal will significantly affect the fire regime such that high intensity fire would have a detrimental impact on *Thesium australe* habitat. The proposed access roads will increase the accessibility across the site should a fire occur.

The life cycle may also be impacted by changed grazing regimes. The species is threatened by grazing as it prevents recruitment or regeneration of the species (OEH 2011b). However, the proposal is unlikely to exacerbate over-grazing at the site. It may, in fact, contribute to a more sustainable grazing

regime through the mitigation measures proposed in some parts of the site. A spell in grazing may result in the increased regeneration of the species.

Given the species was not recorded during field surveys and the narrow linear nature of the proposal, the dispersal of seeds of this species is unlikely to be impeded by the proposal. Detrimental impacts on the lifecycle of *Thesium australe* are not anticipated.

How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

Vegetation representing potential habitat for *Thesium australe* will be removed in linear strips (for turbines, access tracks and the associated ancillary structures required for the running of the wind farm). As a worst case scenario, the area of vegetation to be cleared consists of a permanent loss of 71.52 ha and a temporary impact to 31.56 ha of potential habitat, totalling 103.08 ha.

The amount of potential habitat proposed to be impacted represents 6.73 % of the potential habitat mapped within the study area, but only 2.63 % of potential habitat mapped within the project site. Thus, the proposal is unlikely to substantially reduce the amount of potential habitat for this species present in the project site.

The proposal may increase erosion, sedimentation and runoff through the clearing of vegetation and the construction of roads, and produce conditions favourable to weed invasion impacting on the species' habitat. However, any increases in run-off in areas where the ground within the construction area will be compacted, gravelled or concreted will be small and localised. The proposal will not affect flooding or flow regimes for the study area. Soil erosion and run-off control measures and weed control (over a 3-year period) will be implemented as part of the mitigation measures undertaken for the proposal, thereby reducing potential impacts of the proposal to potential habitat for this species.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

The known distribution of the *Thesium australe* extends to eastern Victoria and south-eastern Queensland and, therefore, the study area does not constitute the limit of its distribution (OEH 2011b).

How is the proposal likely to affect current disturbance regimes?

Current disturbances at the site include cattle and sheep grazing, grazing by feral animals including the European Rabbit and Goat, and periods of drought and rainfall consistent with the southern oscillation index and resultant cycles of drought (El Niño) and wetter periods (La Niña). There has been no major fire event in the last decade.

The proposal is unlikely to exacerbate grazing at the site, but may, in fact, contribute to a more sustainable grazing regime through the mitigation measures proposed in some parts of the site. In the absence of fire, grazing can be an important form of disturbance to prevent the accumulation of biomass that may not be favourable to some native flora species. Rotational periods of grazing and spelling help to foster healthy native pastures in the absence of fire.

Feral animals can have a detrimental impact on threatened species and their habitat. In the case of threatened flora, grazing by feral animals such as the European Rabbit and Goat can result in the species being precluded from a site. The proposal is unlikely to contribute to increasing feral animal activity across the project site and instead is likely to assist with the management of these species through the proposed mitigation measures to be implemented within the study area and on the proposed

offset sites.

The proposal is also unlikely to alter the current fire regime at the study area. The risk of fire with wind farms is inherently low (CFA 2007). A low risk is associated with malfunctioning turbine bearings, inadequate crankcase lubrication, cable damage during rotation, electrical shorting or arcing occurring in transmission and distribution facilities (CFA 2007). The location of wind turbines away from tall vegetation in the study area minimises the risk of fire. It is unlikely that the proposal will significantly affect the fire regime such that it would have a detrimental impact on *Thesium australe*.

The proposal has the potential to increase erosion, sedimentation and runoff through the clearing of vegetation and the construction of roads, and produce conditions favourable to weed invasion. However, any increases in run-off in areas where the ground within the construction area will be compacted, gravelled or concreted will be small and localised. The proposal will not affect flooding or flow regimes for the study area. Soil erosion and run-off control measures and weed control will be implemented as part of the mitigation measures undertaken for the proposal.

How is the proposal likely to affect habitat connectivity?

The proposal is unlikely to impact upon habitat connectivity for *Thesium australe* due to the availability of at least 1,531.63 ha of potential habitat within the study area, and 3,912.81 ha of potential habitat mapped within the project site that will not be cleared. Some existing vegetation corridors will be subject to disturbance within the study area; however, this is likely to consist of turbine nodes (25 m radius), with a 6 m access road joining these nodes. The corridors are already subject to some fragmentation from historic land uses (agriculture) and the development footprint has avoided the most intact sections of these vegetation corridors throughout the project site (the main habitat corridor through the project site along the eastern slopes of Crudine Ridge will be largely retained).

How is the proposal likely to affect critical habitat?

Not applicable - critical habitat cannot be declared for vulnerable species.

FAUNA

Birds – identified within study area

***Climacteris picumnus victoriae* (Brown Treecreeper)**

The eastern subspecies of Brown Treecreeper is listed as a vulnerable species under the TSC Act. It lives in eastern NSW in dry eucalypt woodlands and forests through the western slopes of NSW and in coastal areas with drier open woodlands such as the Snowy River Valley, Cumberland Plain, Hunter Valley and parts of the Richmond and Clarence Valleys (OEH 2011b).

The species inhabits woodlands dominated by stringybarks or other rough-barked eucalypts, usually with an open grassy understorey. They nest in hollows in standing dead or live trees and tree stumps. Fallen timber is an important habitat component for this species (OEH 2011b).

It is considered a sedentary species, with territories ranging between approximately 1 ha to 11 ha (average 4.4 ha), though some birds may disperse locally after breeding. Populations consist of pairs to groups of three to six. They prefer open woodlands with much open ground and fallen timber, thus benefiting from vegetation clearing by man. The species spends much more time foraging on the ground and fallen logs than other treecreepers (OEH 2011b).

Diurnal bird surveys and opportunistic surveys were conducted in areas of suitable habitat across the proposed study area and project site during October and November 2008, and January 2009. The species was recorded three times during field surveys: once in the study area within the Sallys Flat Cluster, and twice in the project site (within both the Sallys Flat and Pyramul Clusters) within RSSGRBLLB.

The Brown Treecreeper has been recorded on ten occasions in the locality: twice in the Lower Pyramul area off Doughertys Junction Road and Sallys Flat Road to west of the study area (Birds Australia 2011a), seven times to the south of the study area, south of Crudine (5 records) and north of Sofala (2 records) along Turondale Road and Sofala Road, respectively (Birds Australia 2011a, BRC 2011, OEH 2011a), and once near Charbon to the east of the study area (OEH 2011a).

How is the proposal likely to affect the lifecycle of a threatened species and/or population?

The proposal is unlikely to impact on the life cycle of Brown Treecreeper despite a small reduction in the amount of foraging, sheltering and breeding habitat available to the species, habitat degradation (eg. through fragmentation), or an increase in the species' mortality rates via collisions with turbines.

Habitat for the Brown Treecreeper within the study area exists in areas of BPBGRS (wooded areas and pasture), RSSGRBLLB (wooded areas and pasture) and WBBRGYB (wooded areas and pasture). The proposal will require 71.63 ha of permanent habitat loss and 31.56 ha of temporary loss within these vegetation communities.

While the proposal will remove habitat for the Brown Treecreeper, tree clearance for the proposal and hollow-bearing trees will be avoided, wherever possible and the amount of trees being removed will be minimal with respect to the amount of potential habitat present for this species within the study area. Only 6.74 % of habitat in the study area (1,531.63 ha) and 2.64 % of the project site (3,912.81 ha) will be removed. The proposal will not significantly fragment the habitat of the species or significantly reduce the area of woodland remnants remaining in the project site to a size that could not be used by the species (the Brown Treecreeper appears unable to maintain viable populations in remnants less than 200 ha; Scientific Committee Final Determinations 2011). The territorial range of the Brown

Treecreeper ranges between 1 and 11 ha, and although the proposal will result in the loss of up to 103.19 ha of potential habitat within the study area, impacts will be distributed throughout the linear development footprint, and not one consolidated area of vegetation. Thus, the removal of any areas of potential habitat may result in the reduction of a territorial range but is unlikely to affect the entire territory. Also, given habitat is widely spread across the project site, it is unlikely that the proposed wind farm would lead to the displacement of any individuals. Where the removal of habitat trees is required, a pre-clearance protocol will be developed and implemented to determine if any individuals are present in any trees proposed for clearing. An ecologist will be present during clearing to capture and re-release individuals (where appropriate).

Given the Brown Treecreeper forages in terrestrial and arboreal habitats in equal measures, on a diet of ants and other invertebrates, with its preference for foraging within vegetated areas or close to the ground, the risk of the Brown Treecreeper colliding with turbines is considered low (OEH 2011b). Therefore, the proposal is unlikely to affect the lifecycle of this species.

How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

Vegetation representing habitat for the Brown Treecreeper will be removed in linear strips (for turbines, access tracks and the associated ancillary structures required for the running of the wind farm), rather than one consolidated stand. As a worst case scenario, the area of vegetation to be cleared consists of a permanent loss of 71.63 ha and a temporary impact to 31.56 ha of potential habitat, totalling 103.19 ha.

However, the vegetation communities and habitat that will be lost represents 6.74 % of the potential habitat mapped within the study area, and 2.64 % of potential habitat mapped within the project site. Wooded areas larger than 200 ha, required by the species, would remain in the project site. It is unlikely that the proposed vegetation clearance would impact on this species such that foraging and nesting resources would become limited within the study area. Thus, the proposal is unlikely to substantially reduce the amount of potential habitat for this species present within the project site.

The removal of habitat trees, including trees with hollows, will be avoided, where possible. However, where the removal of habitat trees is required, a pre-clearance protocol will be developed and implemented to determine if nests are present in any trees proposed for clearing. An ecologist will be present during clearing to capture and re-release individuals (where appropriate).

The proposal may increase erosion, sedimentation and runoff through the clearing of vegetation and the construction of roads, and produce conditions favourable to weed invasion impacting on the species' habitat. However, any increases in run-off in areas where the ground within the construction area will be compacted, gravelled or concreted will be small and localised. The proposal will not affect flooding or flow regimes for the study area. Soil erosion and run-off control measures and weed control (over a 3-year period) will be implemented as part of the mitigation measures undertaken for the proposal, thereby reducing potential impacts of the proposal to potential habitat for this species.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

The Brown Treecreeper is endemic to eastern Australia and occurs in eucalypt forests and woodlands of inland plains and slopes of the Great Dividing Range. The western boundary of the range of the threatened Brown Treecreeper subspecies runs approximately through Corowa, Wagga Wagga, Temora, Forbes, Dubbo and Inverell, and along this line, the subspecies intergrades with the arid zone

subspecies of Brown Treecreeper (*Climacteris picumnus picumnus*) which then occupies the remaining parts of the state. Given the range of the Brown Treecreeper across NSW and eastern Australia, the species is not at the limit of its distribution at Crudine Ridge.

How is the proposal likely to affect current disturbance regimes?

Current disturbances at the site include cattle and sheep grazing, grazing by feral animals including the European Rabbit and Goat, and periods of drought and rainfall consistent with the southern oscillation index and resultant cycles of drought (El Niño) and wetter periods (La Niña). There has been no major fire event in the last decade.

The fire regime of the study area is not expected to change as a result of the proposal, as the risk of fire with wind farms is inherently low (CFA 2007). A low risk is associated with malfunctioning turbine bearings, inadequate crankcase lubrication, cable damage during rotation, electrical shorting or arcing occurring in transmission and distribution facilities (CFA 2007). Furthermore, a number of mitigation measures will be implemented during construction to prevent accidental fires.

The proposal is also unlikely to exacerbate grazing in the study area and project site, which may reduce the availability of invertebrate taxa, a food source for Brown Treecreeper. It may, in fact, contribute to a more sustainable grazing regime through the mitigation and offset measures proposed in some parts of the site. In the absence of fire, grazing can be an important form of disturbance to prevent the accumulation of biomass that may not be favourable to some native flora species. Rotational periods of grazing and spelling help to foster healthy native pastures in the absence of fire.

Feral animals can also have a detrimental impact on Brown Treecreeper through predation by species such as feral cats and the European Red Fox. The proposal is unlikely to contribute to increasing feral animal activity across the project site and instead is likely to assist with the management of these species through the proposed mitigation measures to be implemented within the study area and on the proposed offset sites.

The proposal has the potential to increase erosion, sedimentation and runoff through the clearing of vegetation and the construction of roads, and produce conditions favourable to weed invasion. However, any increases in run-off in areas where the ground within the construction area will be compacted, gravelled or concreted will be small and localised. The proposal will not affect flooding or flow regimes for the study area. Soil erosion and run-off control measures and weed control will be implemented as part of the mitigation measures undertaken for the proposal.

How is the proposal likely to affect habitat connectivity?

The woodland and open forest areas of the study area have naturally large canopy gaps and a very open understorey. Given the linear nature of the proposal, the mobile nature of the species, and that tree clearance has been minimised, it is unlikely that the proposal would create barriers to movement of this species throughout the project site. The main habitat corridor through the project site along the eastern slopes of Crudine Ridge will be largely retained. Furthermore, given the flight characteristics of this species, it is unlikely that they would collide with turbines and hence turbines are unlikely to restrict movement across the project site.

How is the proposal likely to affect critical habitat?

Not applicable - critical habitat cannot be declared for vulnerable species.

***Glossopsitta pusilla* (Little Lorikeet)**

The Little Lorikeet is a threatened species, listed as vulnerable under the TSC Act. In NSW, the range of the Little Lorikeet extends from the coast to the western slopes of the Great Dividing Range, along the full length of the eastern seaboard. NSW provides a large portion of the species' core habitat, with lorikeets found westward as far as Dubbo and Albury. Nomadic movements are common, influenced by season and food availability, although some areas retain residents for much of the year and 'locally nomadic' movements are suspected of breeding pairs (OEH 2011b).

The species feeds mostly on nectar and pollen and forage primarily on Eucalypts in open woodland but also utilise other trees such as *Angophora* and *Melaleuca*. Riparian habitats are particularly used, due to higher soil fertility and hence greater productivity. Isolated flowering trees in open country, for example, paddocks, roadside remnants and urban trees also help sustain viable populations of the species.

The species is gregarious, travelling and feeding in small flocks (<10), though often with other lorikeets. Flocks numbering hundreds are still occasionally observed and may have been the norm in past centuries. The species roosts in treetops, most typically selecting hollows in the limb or trunk of smooth-barked Eucalypts. The entrance to hollows is small (3 cm) and usually high above the ground (2–15 m). These nest sites are often used repeatedly for decades, suggesting that preferred sites are limited. Riparian trees often chosen including species like *Allocasuarina*.

Nesting season extends from May to September. In years when flowering is prolific, Little Lorikeet pairs can breed twice, producing 3-4 young per attempt. However, the survival rate of fledglings is unknown (OEH 2011b).

Diurnal bird surveys and opportunistic surveys were conducted in areas of suitable habitat across the proposed study area and project site during October and November 2008, and January 2009. The species was recorded just outside a wooded area in the Sallys Flat Cluster during field surveys, outside of the study area but in the project site within RSSGRBLLB. No records have been made for the Little Lorikeet in the locality which have been submitted to Birds Australia or the OEH or recorded by Bathurst Regional Council.

How is the proposal likely to affect the lifecycle of a threatened species and/or population?

The proposal could impact on the life cycle of Little Lorikeet by reducing the amount of foraging, sheltering and breeding habitat available to the species, degrading their habitat (eg. through fragmentation), or increasing the species' mortality rates via collisions with turbines.

Potential habitat for Little Lorikeet is present within areas of BPBGRS (wooded areas and within pasture), RSSGRBLLB (wooded areas and within pasture), and WBBRGYB (wooded areas and trees within pasture). The proposal will require 11.19 ha of permanent potential habitat loss and 3.15 ha of temporary loss within these communities.

While the proposal will remove habitat for the Little Lorikeet, tree clearance for the proposal will be avoided, wherever possible, and the amount of trees being removed will be minimal with respect to the amount of potential habitat present for this species within the study area. Further, vegetation clearance is linear in nature and, therefore, will not result in large consolidated patches of vegetation clearance. Only 4.96 % of habitat in the study area (288.65 ha) and 1.14 % of the project site (1,261.66 ha) will be removed. The proposal will not significantly fragment the habitat of the species. Also, given habitat is widely spread across the project site, it is unlikely that the proposed wind farm would lead to the displacement of any individuals. Where the removal of habitat trees is required, a pre-clearance

protocol will be developed and implemented to determine if individuals are present in any trees proposed for clearing. An ecologist will be present during clearing to capture and re-release individuals (where appropriate).

A risk matrix anticipating the likelihood of collision with turbines and risk of collision with overhead powerlines has been prepared for those species most commonly recorded within the study area and threatened species including the Little Lorikeet. The Little Lorikeet was found to have a moderate risk of collision with turbines and a low risk of collision with overhead powerlines given its fast, high-low flight (depending on activity). Wind turbines are solid structures and the risks posed by moving rotors are generally within the height range of between 30 and 120 metres above the ground. It is considered that the types of collision situations that the Little Lorikeet could encounter would be from moving about a location in the course of routine foraging, which they generally do within the height of the trees in which they feed.

Nevertheless, the proposal is unlikely to have a negative impact on the lifecycle of the Little Lorikeet.

How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

Vegetation representing habitat for Little Lorikeets will be removed in linear strips (for turbines, access tracks and the associated ancillary structures required for the running of the wind farm), rather than one consolidated stand. As a worst case scenario, the area of vegetation to be cleared consists of a permanent loss of 11.19 ha and a temporary impact to 3.15 ha of potential habitat, totalling 14.33 ha.

However, the vegetation communities and habitat that will be lost represents 4.96 % of the potential habitat mapped within the study area, and 1.14 % of potential habitat mapped within the project site. It is unlikely that the proposed vegetation clearance would impact on this species such that foraging and sheltering resources (mostly tree canopies) would become limited within the study area.

The study area supports a large proportion of hollow-bearing trees which are common throughout woodland and as scattered trees and would provide potential nesting habitat for this species. Little Lorikeets typically nest in limbs or trunks of smooth-barked eucalypts and riparian trees such as *Allocasuarina* species. Nest sites are often used repeatedly for decades suggesting that preferred sites are limited. However, the removal of potential nesting trees (and other habitat trees) will be avoided where possible. Following construction, all turbines will be situated at least 30 m from hollow-bearing trees. Removal of habitat trees will be further minimised during the detailed design phase. Where the removal of habitat trees is required, a pre-clearance protocol will be developed and implemented to survey for hollow-bearing fauna and determine if nests are present in any trees proposed for clearing. An ecologist will be present during clearing to capture and re-release individuals (where appropriate).

The proposal may increase erosion, sedimentation and runoff through the clearing of vegetation and the construction of roads, and produce conditions favourable to weed invasion impacting on the species' habitat. However, any increases in run-off in areas where the ground within the construction area will be compacted, gravelled or concreted will be small and localised. The proposal will not affect flooding or flow regimes for the study area. Soil erosion and run-off control measures and weed control (over a 3-year period) will be implemented as part of the mitigation measures undertaken for the proposal, thereby reducing potential impacts of the proposal to potential habitat for this species.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

The Little Lorikeet is distributed widely across the coastal and Great Divide regions of eastern Australia from Cape York to South Australia. NSW provides a large portion of the species' core habitat, with lorikeets found westward as far as Dubbo and Albury (OEH 2011b). Given the range of the Little Lorikeet across NSW and eastern Australia, the species is not at the limit of its distribution at Crudine Ridge.

How is the proposal likely to affect current disturbance regimes?

Current disturbances at the site include cattle and sheep grazing, soil disturbance and grazing by feral animals including the European Rabbit and Goat, and periods of drought and rainfall consistent with the southern oscillation index and resultant cycles of drought (El Niño) and wetter periods (La Niña). There have been no major fire events on the site in the last decade.

Fire regimes that impact foraging habitat are of most relevance to the Little Lorikeet. However, the proposal is unlikely to alter the current fire regime at the study area. The risk of fire with wind farms is inherently low (CFA 2007). The location of wind turbines away from tall vegetation in the study area minimises the risk of fire. It is unlikely that the proposal will significantly affect the fire regime such that high intensity fire would have a detrimental impact on Little Lorikeet foraging habitat. The proposed access roads will increase the accessibility across the site should a fire occur.

The proposal has the potential to increase erosion, sedimentation and runoff through the clearing of vegetation and the construction of roads, and produce conditions favourable to weed invasion. However, any increases in run-off in areas where the ground within the construction area will be compacted, gravelled or concreted will be small and localised. The proposal will not affect flooding or flow regimes for the study area. Soil erosion and run-off control measures and weed control will be implemented as part of the mitigation measures undertaken for the proposal.

How is the proposal likely to affect habitat connectivity?

The landscape within the study area is one of open woodland, and turbine corridors have been deliberately focussed in areas of vegetation that have already undergone some historical clearing (for agricultural uses). Therefore, the narrow and linear nature of the proposal is unlikely to result in fragmentation of habitat or create barriers to movement for this highly mobile species. The main habitat corridor through the project site along the eastern slopes of Crudine Ridge will be largely retained.

During the operational phase of the wind farm, there is a risk that Little Lorikeet will accidentally collide with the moving turbines, affecting habitat connectivity. Much literature has been produced regarding potential impacts of wind farms on birds although most of the studies have been undertaken overseas. The impacts appear to be dependent on a number of factors including proximity to wetlands, migratory pathways, proximity to bird concentrations and forested areas. These issues have been addressed in the layout design to minimise the risk of bird strike where possible. Bird strike will be monitored during the operation of the wind farm and an adaptive management approach implemented whereby additional measures are investigated should significant bird (and bat) strike at certain turbines be recorded.

However, given the species generally moves within the height of the trees in which they feed, the likelihood of collisions with moving turbines is minimised and habitat fragmentation in terms of use by this species is unlikely.

How is the proposal likely to affect critical habitat?

Not applicable - critical habitat cannot be declared for vulnerable species.

***Melanodryas cucullata cucullata* (Hooded Robin)**

The south-eastern form of the Hooded Robin is listed as vulnerable under the TSC Act. It is common in few places, and rarely found on the coast. It is considered a sedentary species, but local seasonal movements are possible. The south-eastern form is found from Brisbane to Adelaide throughout much of inland NSW, with the exception of the north-west. The species is widespread, found across Australia, except for the driest deserts and the wetter coastal areas - northern and eastern coastal Queensland and Tasmania (OEH 2011b).

The Hooded Robin prefers lightly wooded country, usually open eucalypt woodland, acacia scrub and mallee, often in or near clearings or open areas. The Hooded Robin requires structurally diverse habitats featuring mature eucalypts, saplings, some small shrubs and a ground layer of moderately tall native grasses. Territories range from around 10 ha during the breeding season, to 30 ha in the non-breeding season. The nest is a small, neat cup of bark and grasses bound with webs, in a tree fork or crevice, from less than 1 m to 5 m above the ground. The nest is defended by both sexes with displays of injury-feigning, tumbling across the ground. A clutch of two to three is laid and incubated for fourteen days by the female (OEH 2011b).

Diurnal bird surveys and opportunistic surveys were conducted in areas of suitable habitat across the proposed study area and project site during October and November 2008, and January 2009. The species was recorded on five occasions during field surveys: once in the study area within the Sallys Flat Cluster, and four times in the project site (once in the area between the Sallys Flat and Pyramul Clusters, and three times in the Pyramul Cluster). The species was recorded within RSSGRBLLB, and WBBRGYB.

The Hooded Robin has been recorded on six occasions in the locality: twice in the Lower Pyramul area off Doughertys Junction Road to west of the study area (1999; Birds Australia 2011a), once in the Crudine area on Crudine Road approximately 6 km north from the intersection with Hill End Road (2002; BRC 2011, OEH 2011a), once on Turondale Road approximately 2.5 km south of the intersection with Hill End Road (2008; BRC 2011), and twice approximately 2.5 km to the west of Turondale Road, approximately 4 km south of the intersection with Hill End Road (1978 and 1980; BRC 2011).

How is the proposal likely to affect the lifecycle of a threatened species and/or population?

The proposal could impact on the life cycle of Hooded Robin by reducing the amount of foraging, sheltering and breeding habitat available to the species, degrading their habitat (e.g. through fragmentation), or increasing the species' mortality rates via collisions with turbines.

Habitat for the Hooded Robin within the study area exists in areas of BPBGRS (wooded areas and within pasture), RSSGRBLLB (wooded areas and within pasture) and WBBRGYB (wooded areas and within pasture). The proposal will require 71.63 ha of permanent habitat loss and 31.56 ha of temporary loss within these vegetation communities.

While the proposal will remove habitat for the Hooded Robin, tree clearance for the proposal will be avoided, wherever possible, limiting clearance to small sections of grassy understorey, and the amount of trees being removed will be minimal with respect to the amount of potential habitat present for this species within the study area. Only 6.74 % of habitat in the study area (1,531.63 ha) and 2.64 % of the project site (3,912.81 ha) will be removed. The proposal will not significantly fragment the habitat of the species or significantly reduce the area of woodland remnants remaining in the project site to a size that could not be used by the species (the Hooded Robin appears unable to survive in remnants smaller than 100 - 200 ha; Scientific Committee Final Determinations 2011). The territorial range of Hooded

Robin increases from 10 ha during the breeding season to 30 ha in the non-breeding season, and although the proposal will result in the loss of up to 103.19 ha of potential habitat, impacts will be distributed throughout the linear development footprint, and not one consolidated area of vegetation. Thus, the removal of any areas of potential habitat may result in the reduction of a territorial range but is unlikely to affect the entire territory. Also, given habitat is wide spread across the project site, it is unlikely that the proposed wind farm would lead to the displacement of any individuals. Where the removal of habitat trees is required, a pre-clearance protocol will be developed and implemented to determine if nests are present in any trees proposed for clearing. An ecologist will be present during clearing to capture and re-release individuals (where appropriate).

The Hooded Robin is unlikely to fly at height that puts it at risk collisions with turbines as it is a woodland foraging species that nests below 6 m high, and, therefore, turbine strike where turbines occur throughout open parts of woodland is unlikely. Although flight heights may increase between woodland patches, given the home range of this species, and the size of the most consolidated patches of structurally-diverse woodland (large enough to cover the home range for this species) that will be retained, the potential for this species being struck by turbines due to movement between woodland patches is considered low. Therefore the proposal is unlikely to affect the lifecycle of this species.

How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

Vegetation representing habitat for Hooded Robin will be removed in linear strips (for turbines, access tracks and the associated ancillary structures required for the running of the wind farm), rather than one consolidated stand. As a worst case scenario, the area of vegetation to be cleared consists of a permanent loss of 71.63 ha and a temporary impact to 31.56 ha of potential habitat, totalling 103.19 ha.

However, the vegetation communities and habitat that will be lost represents 6.74 % of the potential habitat mapped within the study area, and 2.64 % of potential habitat mapped within the project site. Wooded areas larger than 200 ha, required by the species, would remain in the project site. It is unlikely that the proposed vegetation clearance would impact on this species such that foraging and nesting resources would become limited within the study area. Thus, the proposal is unlikely to substantially reduce the amount of potential habitat for this species present within the project site.

Where the removal of habitat trees is required, a pre-clearance protocol will be developed and implemented to determine if nests are present in any trees proposed for clearing. An ecologist will be present during clearing to capture and re-release individuals (where appropriate).

The proposal may increase erosion, sedimentation and runoff through the clearing of vegetation and the construction of roads, and produce conditions favourable to weed invasion impacting on the species' habitat. However, any increases in run-off in areas where the ground within the construction area will be compacted, gravelled or concreted will be small and localised. The proposal will not affect flooding or flow regimes for the study area. Soil erosion and run-off control measures and weed control (over a 3-year period) will be implemented as part of the mitigation measures undertaken for the proposal, thereby reducing potential impacts of the proposal to potential habitat for this species.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

The Hooded Robin is widespread, found across Australia, except for the driest deserts and the wetter coastal areas - northern and eastern coastal Queensland and Tasmania (OEH 2011b). Given the range of the Hooded Robin, the species is not at the limit of its distribution within the project site.

How is the proposal likely to affect current disturbance regimes?

Current disturbances at the site include cattle and sheep grazing, grazing by feral animals including the European Rabbit and Goat, and periods of drought and rainfall consistent with the southern oscillation index and resultant cycles of drought (El Niño) and wetter periods (La Niña). There has been no major fire event in the last decade.

The fire regime of the study area is not expected to change as a result of the proposal, as the risk of fire with wind farms is inherently low (CFA 2007). A low risk is associated with malfunctioning turbine bearings, inadequate crankcase lubrication, cable damage during rotation, electrical shorting or arcing occurring in transmission and distribution facilities (CFA 2007). Furthermore, a number of mitigation measures will be implemented during construction to prevent accidental fires.

The proposal is also unlikely to exacerbate grazing at the site, which may reduce the availability of invertebrate taxa, a food source for Hooded Robin. In fact, it may contribute to a more sustainable grazing regime through the mitigation and offset measures proposed in some parts of the site. In the absence of fire, grazing can be an important form of disturbance to prevent the accumulation of biomass that may not be favourable to some native flora species. Rotational periods of grazing and spelling help to foster healthy native pastures in the absence of fire.

Feral animals can have a detrimental impact on Hooded Robin habitat. In the case of grasslands and grassy woodlands, grazing by feral animals such as the European Rabbit and Goat can result in loss of species diversity and tussock structure which in turn impacts the presence of insects as a food source for Hooded Robin. Feral animals can also have a detrimental impact on Hooded Robin through predation by species such as feral Cats and the European Red Fox. However, the proposal is unlikely to contribute to increasing feral animal activity across the project site and instead is likely to assist with the management of these species through the proposed mitigation measures to be implemented within the study area and on the proposed offset sites.

The proposal has the potential to increase erosion, sedimentation and runoff through the clearing of vegetation and the construction of roads, and produce conditions favourable to weed invasion. However, any increases in run-off in areas where the ground within the construction area will be compacted, gravelled or concreted will be small and localised. The proposal will not affect flooding or flow regimes for the study area. Soil erosion and run-off control measures and weed control will be implemented as part of the mitigation measures undertaken for the proposal.

How is the proposal likely to affect habitat connectivity?

The woodland and open forest areas of the study area have naturally large canopy gaps and a very open understorey; however, the Hooded Robin has a preference for foraging and nesting within the most structurally diverse areas of woodlands. Given the narrow linear nature of the proposal, sited on mostly cleared areas, it is unlikely that the proposal would create barriers to movement of Hooded Robin throughout the project site. The main habitat corridor through the project site along the eastern slopes of Crudine Ridge will be largely retained. Furthermore, given the ground-foraging habit of this species, it is unlikely that they would collide with turbines and hence turbines are unlikely to restrict movement across the project site.

How is the proposal likely to affect critical habitat?

Not applicable - critical habitat cannot be declared for vulnerable species.

***Petroica boodang* (Scarlet Robin)**

The Scarlet Robin is listed as vulnerable under the TSC Act and is found from south east Queensland to south east South Australia and also in Tasmania and south west Western Australia. In NSW, it occurs from the coast to the inland slopes. After breeding, some Scarlet Robins disperse to the lower valleys and plains of the tablelands and slopes. Some birds may appear as far west as the eastern edges of the inland plains in autumn and winter (OEH 2011b).

The Scarlet Robin lives in dry eucalypt forests and woodlands. The understorey is usually open and grassy with few scattered shrubs. This species lives in both mature and regrowth vegetation. It occasionally occurs in mallee or wet forest communities, or in wetlands and tea-tree swamps. Scarlet Robin habitat usually contains abundant logs and fallen timber: these are important components of its habitat (OEH 2011b).

The Scarlet Robin breeds on ridges, hills and foothills of the western slopes, the Great Dividing Range and eastern coastal regions; this species is occasionally found up to 1000 metres in altitude. The Scarlet Robin is primarily a resident in forests and woodlands, but some adults and young birds disperse to more open habitats after breeding. In autumn and winter many Scarlet Robins live in open grassy woodlands, and grasslands or grazed paddocks with scattered trees (OEH 2011b).

Scarlet Robin pairs defend a breeding territory and mainly breed between the months of July and January; they may raise two or three broods in each season. This species' nest is an open cup made of plant fibres and cobwebs and is built in the fork of tree usually more than two metres above the ground; nests are often found in a dead branch in a live tree, or in a dead tree or shrub. The Scarlet Robin is a quiet and unobtrusive species which is often quite tame and easily approached (OEH 2011b).

Diurnal bird surveys and opportunistic surveys were conducted in areas of suitable habitat across the proposed study area and project site during October and November 2008, and January 2009. The species was recorded on three occasions outside of the study area but within the project site during field surveys. The records were all within RSSGRBLLB in the Pyramul Cluster.

The Scarlet Robin has been recorded on numerous occasions in the locality, with 25 records for the species on the "Wiruna" property on Old Ilford Road, near Razorback (south east of the study area; Birds Australia 2011a), one record in the Lower Pyramul area off Doughertys Junction Road (west of the study area; Birds Australia 2011a), and one record from Charbon Colliery (to the east of the study area) (Birds Australia 2011a).

How is the proposal likely to affect the lifecycle of a threatened species and/or population?

The proposal could impact on the life cycle of the Scarlet Robin by reducing the amount of foraging, sheltering and breeding habitat available to the species, degrading their habitat (eg. through fragmentation), or increasing the species' mortality rates via collisions with turbines.

Habitat for the Scarlet Robin within the study area exists in areas of BPBGRS, RSSGRBLLB and WBBRGYB (wooded areas and pasture). The proposal will require 71.63 ha of permanent habitat loss and 31.56 ha of temporary loss within these vegetation communities.

While the proposal will remove habitat for the Scarlet Robin, tree clearance for the proposal will be avoided wherever possible, limiting clearance to small sections of grassy understorey, and the amount of trees being removed will be minimal with respect to the amount of potential habitat present for this species within the study area. Vegetation clearance is linear in nature and, therefore, will not result in large consolidated patches of vegetation clearance (the removal of any areas of potential habitat may

result in the reduction of a territorial range but is unlikely to affect the entire territory). Only 6.74 % of habitat in the study area (1,531.63 ha) and 2.64 % of the project site (3,912.81 ha) will be removed. The proposal will not significantly fragment the habitat of the species, which also occurs in open grassy woodlands, and grasslands or grazed paddocks with scattered trees, or significantly reduce the area of woodland remnants (the Scarlet Robin declines in small patches of habitat <30 ha; Scientific Committee Final Determinations 2011). Also, given habitat is widely spread across the project site, it is unlikely that the proposed wind farm would lead to the displacement of any individuals. Where the removal of habitat trees is required, a pre-clearance protocol will be developed and implemented to determine if nests are present in any trees proposed for clearing. An ecologist will be present during clearing to capture and re-release individuals (where appropriate).

The Scarlet Robin is unlikely to fly at height that puts it at risk collisions with turbines as it is a woodland species that usually forages from low perches, fence-posts or on the ground (OEH 2011b). Therefore, turbine strike where turbines occur throughout open parts of woodland is unlikely. Given the flight habits of this species, the potential for this species being struck by turbines due to movement between woodland patches is considered low. Therefore the proposal is unlikely to affect the lifecycle of this species.

How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

Vegetation representing habitat for Scarlet Robin will be removed in linear strips (for turbines, access tracks and the associated ancillary structures required for the running of the wind farm), rather than one consolidated stand. As a worst case scenario, the area of vegetation to be cleared consists of a permanent loss of 71.63 ha and a temporary impact to 31.56 ha of potential habitat, totalling 103.19 ha.

However, the vegetation communities and habitat that will be lost represents 6.74 % of the potential habitat mapped within the study area, and 2.64% of potential habitat mapped within the project site. Contiguous wooded areas larger than 30 ha, required by the species, would remain in the project site. It is unlikely that the proposed vegetation clearance would impact on this species such that foraging and nesting resources would become limited within the study area. Thus, the proposal is unlikely to substantially reduce the amount of potential habitat for this species present within the project site.

Where the removal of habitat trees is required, a pre-clearance protocol will be developed and implemented to determine if nests are present in any trees proposed for clearing. An ecologist will be present during clearing to capture and re-release individuals (where appropriate).

The proposal may increase erosion, sedimentation and runoff through the clearing of vegetation and the construction of roads, and produce conditions favourable to weed invasion impacting on the species' habitat. However, any increases in run-off in areas where the ground within the construction area will be compacted, gravelled or concreted will be small and localised. The proposal will not affect flooding or flow regimes for the study area. Soil erosion and run-off control measures and weed control (over a 3-year period) will be implemented as part of the mitigation measures undertaken for the proposal, thereby reducing potential impacts of the proposal to potential habitat for this species.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

The Scarlet Robin is found from south east Queensland to south east South Australia and also in Tasmania and south west Western Australia. In NSW, it occurs from the coast to the inland slopes (OEH 2011b). Thus, this species is not at the limit of its known distribution in the study area.

How is the proposal likely to affect current disturbance regimes?

Current disturbances at the site include cattle and sheep grazing, grazing by feral animals including the European Rabbit and Goat, and periods of drought and rainfall consistent with the southern oscillation index and resultant cycles of drought (El Niño) and wetter periods (La Niña). There has been no major fire event in the last decade.

The fire regime of the study area is not expected to change as a result of the proposal, as the risk of fire with wind farms is inherently low (CFA 2007). A low risk is associated with malfunctioning turbine bearings, inadequate crankcase lubrication, cable damage during rotation, electrical shorting or arcing occurring in transmission and distribution facilities (CFA 2007). Furthermore, a number of mitigation measures will be implemented during construction to prevent accidental fires.

The proposal is also unlikely to exacerbate over-grazing at the site, but may, in fact, contribute to a more sustainable grazing regime through the mitigation and offset measures proposed in some parts of the site. In the absence of fire, grazing can be an important form of disturbance to prevent the accumulation of biomass that may not be favourable to some native flora species. Rotational periods of grazing and spelling help to foster healthy native pastures in the absence of fire.

Feral animals can have a detrimental impact on Scarlet Robin habitat. In the case of grasslands and grassy woodlands, grazing by feral animals such as the European Rabbit can result in loss of species diversity and tussock structure which in turn impacts the presence of insects as a food source for Scarlet Robin. Feral animals can also have a detrimental impact on Scarlet Robin through predation by species such as feral Cats and the European Red Fox. However, the proposal is unlikely to contribute to increasing feral animal activity across the project site and instead is likely to assist with the management of these species through the proposed mitigation measures to be implemented within the study area and on the proposed offset sites.

The proposal has the potential to increase erosion, sedimentation and runoff through the clearing of vegetation and the construction of roads, and produce conditions favourable to weed invasion. However, any increases in run-off in areas where the ground within the construction area will be compacted, gravelled or concreted will be small and localised. The proposal will not affect flooding or flow regimes for the study area. Soil erosion and run-off control measures and weed control will be implemented as part of the mitigation measures undertaken for the proposal.

How is the proposal likely to affect habitat connectivity?

The woodland and open forest areas of the project site naturally have large canopy gaps and a very open and more often absent understorey. Given the narrow linear nature of the proposal, sited on mostly cleared areas, it is unlikely that the proposal would create barriers to movement of Scarlet Robin throughout the project site, particularly since the species is known to forage in open grassy woodlands, and grasslands or grazed paddocks with scattered trees. The main habitat corridor through the project site along the eastern slopes of Crudine Ridge will be largely retained. Furthermore, given the ground-foraging habit of this species, it is unlikely that they would collide with turbines and hence turbines are unlikely to restrict movement across the project site.

How is the proposal likely to affect critical habitat?

Not applicable – critical habitat cannot be declared for vulnerable species.

***Pyrrholaemus sagittatus* (Speckled Warbler)**

Speckled Warbler is listed as vulnerable under the TSC Act. It has a patchy distribution throughout south-eastern Queensland, the eastern half of NSW and into Victoria, as far west as the Grampians. The species is most frequently reported from the hills and tablelands of the Great Dividing Range, and rarely from the coast. The Speckled Warbler inhabits a wide range of eucalypt dominated communities that have a grassy understorey, often on rocky ridges or in gullies. A typical habitat would include scattered native tussock grasses, a sparse shrub layer, some eucalypt regrowth and an open canopy (OEH 2011b).

Large, relatively undisturbed remnants are required for the species to persist in an area. The diet of this species consists of seeds and insects, with most foraging taking place on the ground around tussocks and under bushes and trees. Speckled Warblers often join mixed species' feeding flocks in winter, with other species such as the Yellow-rumped, Buff-rumped, Brown and Striated Thornbills (OEH 2011b).

Pairs are sedentary and occupy a breeding territory of about 10 ha, with a slightly larger home-range when not breeding. The species builds a rounded, domed, roughly built nest of dry grass and strips of bark which is located in a slight hollow in the ground or the base of a low dense plant, often among fallen branches and other litter. A side entrance allows the bird to walk directly inside. A clutch of 3-4 eggs is laid, between August and January, and both parents feed the nestlings. Some cooperative breeding occurs. The species may act as host to the Black-eared Cuckoo (OEH 2011b).

Diurnal bird surveys and opportunistic surveys were conducted in areas of suitable habitat across the proposed study area and project site during October and November 2008, and January 2009. The species was recorded on three occasions: twice in the study area and once in the project site within the Pyramul Cluster. The species was recorded within RSSGRBLLB.

The Speckled Warbler has been recorded on four occasions in the locality, in three areas. In one of the areas, south of Crudine on Turondale Road approximately 2.5 km south of the intersection with Hill End Road, the species has been recorded twice (1992 and 2008; BRC 2011). In the Sofala / Upper Turon area to the south of the study area (on Sofala Road approximately 3 km south of the intersection with Hill End Road and Upper Turon Road approximately 5 km east of the intersection with Hill End Road), the species has been recorded once each (in 2000 and 2006; Birds Australia 2011a).

How is the proposal likely to affect the lifecycle of a threatened species and/or population?

The proposal could impact on the life cycle of Speckled Warbler by reducing the amount of foraging, sheltering and breeding habitat available to the species, degrading their habitat (eg. through fragmentation), or increasing the species' mortality rates via collisions with turbines.

Habitat for the Speckled Warbler within the study area exists in areas of BPBGRS, RSSGRBLLB, and WBBRGYB (wooded areas only). The proposal will require 7.98 ha of permanent habitat loss and 1.65 ha of temporary loss within these vegetation communities.

While the proposal will remove habitat for the Speckled Warbler, tree clearance for the proposal will be avoided, wherever possible, and the amount of trees and potential breeding habitat (ground cover under tussocks, shrubs and trees) being removed will be minimal with respect to the amount of potential habitat present for this species within the study area. Only 4.33 % of habitat in the study area (222.17 ha) and 0.86 % of the project site (1,121.32 ha) will be removed. The proposal will not significantly fragment the habitat of the species, which would decrease the area of woodland remnants remaining in the project site to a size that could not be used by the species (the Speckled Warbler requires undisturbed remnants larger than 100 ha in size to persist in an area; Scientific Committee Final

Determinations 2011). The main wooded corridor through the project site on the eastern slopes of Crudine Ridge will be retained. The territorial range of Speckled Warbler ranges from 6 to 12 ha (usually around 10 ha; OEH 2011b), and although the proposal will result in the loss of up to 9.63 ha of potential habitat, impacts will be distributed throughout the linear development footprint, and not one consolidated area of vegetation. Thus, the removal of any areas of potential habitat may result in the reduction of a territorial range but is unlikely to affect the entire territory. Also, given habitat is widely spread across the project site, it is unlikely that the proposed wind farm would lead to the displacement of any individuals.

The Speckled Warbler is unlikely to fly at height that puts it at risk collisions with turbines as it is a woodland foraging species, with most foraging taking place on the ground around tussocks and under bushes and trees (OEH 2011b). Therefore, turbine strike where turbines occur throughout open parts of woodland is unlikely. Given the flight habits of this species, the potential for this species being struck by turbines due to movement between woodland patches is considered low. Therefore the proposal is unlikely to affect the lifecycle of this species.

How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

Vegetation representing habitat for Speckled Warbler will be removed in linear strips (for turbines, access tracks and the associated ancillary structures required for the running of the wind farm), rather than one consolidated stand. As a worst case scenario, the area of vegetation to be cleared consists of a permanent loss of 7.98 ha and a temporary impact to 1.65 ha of potential habitat, totalling 9.63 ha.

However, the vegetation communities and habitat that will be lost represents 4.33 % of the potential habitat mapped within the study area, and 0.86 % of potential habitat mapped within the project site. Wooded areas larger than 100 ha, required by the species, would remain in the project site. It is unlikely that the proposed vegetation clearance would impact on this species such that foraging and nesting resources would become limited within the study area; the majority of clearing would be in pasture rather than wooded areas with habitat elements such as a shrub layer, fallen logs and leaf litter, required by the species. Thus, the proposal is unlikely to substantially reduce the amount of potential habitat for this species present within the project site.

The proposal may increase erosion, sedimentation and runoff through the clearing of vegetation and the construction of roads, and produce conditions favourable to weed invasion impacting on the species' habitat. However, any increases in run-off in areas where the ground within the construction area will be compacted, gravelled or concreted will be small and localised. The proposal will not affect flooding or flow regimes for the study area. Soil erosion and run-off control measures and weed control (over a 3-year period) will be implemented as part of the mitigation measures undertaken for the proposal, thereby reducing potential impacts of the proposal to potential habitat for this species.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

The Speckled Warbler has a patchy distribution throughout south-eastern Queensland, the eastern half of NSW and into Victoria, as far west as the Grampians. The species is most frequently reported from the hills and tablelands of the Great Dividing Range, and rarely from the coast (OEH 2011b). Thus, the project site does not lie at limit of this species' distribution.

How is the proposal likely to affect current disturbance regimes?

Current disturbances at the site include sheep grazing, with some cattle grazing also occurring,

predation by feral animals, and periods of drought and rainfall consistent with the southern oscillation index and resultant cycles of drought (El Niño) and wetter periods (La Niña). There have been no major fire events on the site in the last decade.

A high intensity fire would result in a temporary loss of foraging habitat for the Speckled Warbler and place the species at greater risk from predation by raptors during breeding. However, the fire regime of the study area is not expected to change as a result of the proposal; the risk of fire with wind farms is inherently low (CFA 2007). The location of wind turbines away from tall vegetation in the study area minimises the risk of fire. It is unlikely that the proposal will significantly affect the fire regime such that high intensity fire would have a detrimental impact on Speckled Warbler habitat. The proposed access roads will increase the accessibility across the site should a fire occur.

As the Speckled Warbler builds nests on or close to the ground, it is at high risk of predation by feral animals such as feral cats and the European Red Fox. The proposal is unlikely to contribute to increasing feral animal activity across the project site and instead is likely to assist with the management of these species through the proposed mitigation measures to be implemented within the study area and on the proposed offset sites.

The proposal is unlikely to exacerbate over-grazing at the site, but may, in fact, contribute to a more sustainable grazing regime through the mitigation and offset measures proposed in some parts of the site. In the absence of fire, grazing can be an important form of disturbance to prevent the accumulation of biomass that may not be favourable to some native flora species. Rotational periods of grazing and spelling help to foster healthy native pastures in the absence of fire.

The proposal has the potential to increase erosion, sedimentation and runoff through the clearing of vegetation and the construction of roads, and produce conditions favourable to weed invasion. However, any increases in run-off in areas where the ground within the construction area will be compacted, gravelled or concreted will be small and localised. The proposal will not affect flooding or flow regimes for the study area. Soil erosion and run-off control measures and weed control will be implemented as part of the mitigation measures undertaken for the proposal.

How is the proposal likely to affect habitat connectivity?

The woodland and open forest areas of the study area have naturally large canopy gaps and a very open understorey. Given the linear nature of the proposal, sited on mostly cleared areas, it is unlikely that the proposal would create barriers to movement of Speckled Warblers throughout the project site. The main habitat corridor through the project site along the eastern slopes of Crudine Ridge will be largely retained. Furthermore, given the ground-foraging habit of this species, it is unlikely that they would collide with turbines and hence turbines are unlikely to restrict movement across the project site.

How is the proposal likely to affect critical habitat?

Not applicable - critical habitat cannot be declared for vulnerable species.

***Stagonopleura guttata* (Diamond Firetail)**

The Diamond Firetail is listed as vulnerable under the TSC Act and is endemic to south-eastern Australia, extending from central Queensland to the Eyre Peninsula in South Australia. It is widely distributed in NSW, with a concentration of records from the Northern, Central and Southern Tablelands, the Northern, Central and South Western Slopes and the North West Plains and Riverina (OEH 2011b).

The Diamond Firetail can be found in grassy eucalypt woodlands, including Box-Gum Woodlands and Snow Gum Woodlands, and in derived grassland derived from other communities. This species can also be found in open forest, mallee, riparian vegetation, grasslands, and lightly wooded farmland. This species is usually seen in flocks of between five to forty birds. This species is a ground feeder, feeding on ripe and partly-ripe grass, herb seeds, green leaves, and on insects (OEH 2011b).

Nests are globular structures built either in the shrubby understorey, or higher up, especially under hawk's or raven's nests. Birds roost in dense shrubs or in smaller nests built especially for roosting. The species appears to be sedentary, though some populations move locally, especially those in the south (OEH 2011b).

Diurnal bird surveys and opportunistic surveys were conducted in areas of suitable habitat across the proposed study area and project site during October and November 2008, and January 2009. The species was recorded on10 occasions during field survey, twice in the study area within the Sallys Flat Cluster, 7 times in the project site (3 in the Pyramul Cluster, and 4 in the Sallys Flat Cluster) and once just outside the project site on Crudine Road, approximately 300m from where it intersects with Hill End Road. The records for the species were made within RSSGRBLLB, and WBBRGYB.

The Diamond Firetail has been recorded on numerous occasions to the west of the study area in the Lower Pyramul area off Doughertys Junction Road and at the junction of Doughertys Junction Road and Sallys Flat Road (10 records in 1998, 1999, 2000 and 2001; Birds Australia 2011a), and to the south east of the study area on the “Wiruna” property on Old Ilford Road, near Razorback (5 records in 2006, 2008, 2009 and 2010; Birds Australia 2011a). It has also been recorded on six occasions to the south of the study area: twice in the Sofala area (2005 and 2006; Birds Australia 2011a), as well as four times (3 locations) in the Crudine area on and off Turondale Road (1979, 1978, 1992, 1995; BRC 2011).

How is the proposal likely to affect the lifecycle of a threatened species and/or population?

The proposal could impact on the life cycle of the Diamond Firetail by reducing the amount of foraging, sheltering and breeding habitat available to the species, degrading their habitat (eg. through fragmentation), or increasing the species’ mortality rates via collisions with turbines.

Habitat for the Diamond Firetail within the study area exists in areas of BPBGRS, RSSGRBLLB, and WBBRGYB (wooded areas and pasture). The proposal will require 71.63 ha of permanent habitat loss and 31.56 ha of temporary loss within these vegetation communities.

While the proposal will remove habitat for the Diamond Firetail, the amount of habitat being removed will be minimal with respect to the amount of potential habitat present for this species within the study area. Vegetation clearance is linear in nature and, therefore, will not result in large consolidated patches of vegetation clearance. The removal of any areas of potential habitat may result in the reduction of a territorial range but is unlikely to affect the entire territory. Only 6.74% of habitat in the study area (1,531.63 ha) and 2.64 % of the project site (3,912.81 ha) will be removed. The proposal will not significantly fragment the habitat of the species, which also occurs in grasslands, and lightly wooded farmland, or significantly reduce the area of woodland remnants remaining in the project site to a size

that could not be used by the species (the Diamond Firetail is unable to persist in areas which lack remnants larger than 200 ha; Scientific Committee Final Determinations 2011). Also, given habitat is widely spread across the project site, it is unlikely that the proposed wind farm would lead to the displacement of any individuals. Where the removal of habitat trees is required, a pre-clearance protocol will be developed and implemented to determine if nests are present in any trees proposed for clearing. An ecologist will be present during clearing to capture and re-release individuals (where appropriate).

The Diamond Firetail is unlikely to fly at height that puts it at risk collisions with as it is a woodland species that usually forages on the ground, feeding on ripe and partly-ripe grass, herb seeds, green leaves, and on insects (OEH 2011b). Therefore, turbine strike where turbines occur throughout open parts of woodland is unlikely. Given the flight habits of this species, the potential for this species being struck by turbines due to movement between woodland patches is considered low. Therefore the proposal is unlikely to affect the lifecycle of this species.

How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

Vegetation representing habitat for Diamond Firetail will be removed in linear strips (for turbines, access tracks and the associated ancillary structures required for the running of the wind farm), rather than one consolidated stand. As a worst case scenario, the area of vegetation to be cleared consists of a permanent loss of 71.63 ha and a temporary impact to 31.56 ha of potential habitat, totalling 103.19 ha.

However, the vegetation communities and habitat that will be lost represents 6.74 % of the potential habitat mapped within the study area, and 2.64 % of potential habitat mapped within the project site. Wooded areas larger than 200 ha, required by the species, would remain in the project site. It is unlikely that the proposed vegetation clearance would impact on this species such that foraging and nesting resources would become limited within the study area. Thus, the proposal is unlikely to substantially reduce the amount of potential habitat for this species present within the project site.

Where the removal of habitat trees is required, a pre-clearance protocol will be developed and implemented to determine if nests are present in any trees proposed for clearing. An ecologist will be present during clearing to capture and re-release individuals (where appropriate).

The proposal may increase erosion, sedimentation and runoff through the clearing of vegetation and the construction of roads, and produce conditions favourable to weed invasion impacting on the species' habitat. However, any increases in run-off in areas where the ground within the construction area will be compacted, gravelled or concreted will be small and localised. The proposal will not affect flooding or flow regimes for the study area. Soil erosion and run-off control measures and weed control (over a 3-year period) will be implemented as part of the mitigation measures undertaken for the proposal, thereby reducing potential impacts of the proposal to potential habitat for this species.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

The Diamond Firetail is widely distributed in NSW, with a concentration of records from the Northern, Central and Southern Tablelands, the Northern, Central and South Western Slopes and the North West Plains and Riverina. This species is not commonly found in coastal districts, though there are records from near Sydney, the Hunter Valley and the Bega Valley. This species has a scattered distribution over the rest of NSW and is also found in the Australian Capital Territory, Queensland, Victoria and South Australia (OEH 2011b). The project site does not lay at the limit of the species' known

distribution.

How is the proposal likely to affect current disturbance regimes?

Current disturbances at the site include cattle and sheep grazing, grazing by feral animals including the European Rabbit and Goat, and periods of drought and rainfall consistent with the southern oscillation index and resultant cycles of drought (El Niño) and wetter periods (La Niña). There has been no major fire event in the last decade.

The fire regime of the study area is not expected to change as a result of the proposal. The risk of fire with wind farms is inherently low (CFA 2007). A low risk is associated with malfunctioning turbine bearings, inadequate crankcase lubrication, cable damage during rotation, electrical shorting or arcing occurring in transmission and distribution facilities (CFA 2007). A large portion of the study area is grassland and turbines in woodland areas have been located at least 30 m from trees wherever possible, therefore it unlikely that the proposal will dramatically alter fire patterns across the study area. Furthermore, a number of mitigation measures will be implemented during construction to prevent accidental fires.

The proposal is unlikely to exacerbate over-grazing at the site. It may, in fact, contribute to a more sustainable grazing regime through the mitigation and offset measures proposed in some parts of the site. In the absence of fire, grazing can be an important form of disturbance to prevent the accumulation of biomass that may not be favourable to some native flora species. Rotational periods of grazing and spelling help to foster healthy native pastures in the absence of fire providing a food source to the Diamond Firetail.

Feral animals can have a detrimental impact on threatened species and their habitat. In the case of grasslands and grassy woodlands, grazing by feral animals such as the European Rabbit impact on species diversity, seed availability and tussock structure which in turn impacts of potential prey / foraging resources for this species. Feral animals can also have a detrimental impact on threatened fauna through predation by species such as feral cats and the European Red Fox. However, the proposal is unlikely to contribute to increasing feral animal activity across the project site and instead is likely to assist with the management of these species through the proposed mitigation measures to be implemented within the study area and on the proposed offset sites.

The proposal has the potential to increase erosion, sedimentation and runoff through the clearing of vegetation and the construction of roads, and produce conditions favourable to weed invasion. However, any increases in run-off in areas where the ground within the construction area will be compacted, gravelled or concreted will be small and localised. The proposal will not affect flooding or flow regimes for the study area. Soil erosion and run-off control measures and weed control will be implemented as part of the mitigation measures undertaken for the proposal.

How is the proposal likely to affect habitat connectivity?

The woodland and open forest areas of the project site naturally have large canopy gaps and a very open and more often absent understorey. Given the narrow linear nature of the proposal, sited on mostly cleared areas, it is unlikely that the proposal would create barriers to movement of Diamond Firetail throughout the project site, particularly since the species is known to forage in grasslands, and lightly wooded farmland. The main habitat corridor through the project site along the eastern slopes of Crudine Ridge will be largely retained. Furthermore, given the ground-foraging habit of this species, it is unlikely that they would collide with turbines and hence turbines are unlikely to restrict movement across the project site.

How is the proposal likely to affect critical habitat?

Not applicable - critical habitat cannot be declared for vulnerable species.

Mammals– identified within study area

***Phascolarctos cinereus* (Koala)**

The Koala is listed as a vulnerable species under the TSC Act. It has a fragmented distribution throughout eastern Australia from north-east Queensland to the Eyre Peninsula in South Australia. In NSW, it mainly occurs on the central and north coasts with some populations in the west of the Great Dividing Range. It was briefly historically abundant in the 1890s in the Bega District on the south coast of NSW, although not elsewhere, but it now occurs in sparse and possibly disjunct populations. Koalas are also known from several sites on the southern tablelands (OEH 2011b).

The Koala inhabits eucalypt woodlands and forests. It feeds on the foliage of more than 70 eucalypt species and 30 non-eucalypt species, but in any one area will select preferred browse species. The Koala is inactive for most of the day, feeding and moving mostly at night (OEH 2011b).

Individuals spend most of their time in trees, but will descend and traverse open ground to move between trees. Home range size varies with quality of habitat, ranging from less than 2 ha to several hundred hectares in size. The species is generally solitary, but have complex social hierarchies based on a dominant male with a territory overlapping several females and sub-ordinate males on the periphery. Females breed at two years of age and produce one young per year (OEH 2011b).

Surveys for signs of koalas were made across the proposed study area and project site during November 2008 and December 2008, January and February 2009, and March 2011, via scat searches, call playback, spotlighting, and remote camera. Koalas and evidence of Koalas (calls, scats, scratches, skulls) were recorded 18 times during field survey, with 2 records made inside the study area, 14 records made inside the project site (outside of the study area), and 2 records made outside of the project site. In terms of locations within the turbine clusters for those records within the study area or project site, most of the records were made within the Sallys Flat Cluster (1 within the study area and 5 within the project site), with only a few records made within the Pyramul Cluster (1 within the study area and 2 within the project site). Seven records were made in the project site between the Sallys Flat and Pyramul Clusters. The Koala was recorded within RSSGRBLLB, using all of the *Eucalyptus* species in this community.

How is the proposal likely to affect the lifecycle of a threatened species and/or population?

The proposal could impact on the life cycle of the Koala by reducing the amount of foraging, sheltering and breeding habitat available to the species, degrading their habitat (eg. through fragmentation or disturbance), or changing foraging behaviour (through the removal of foraging habitat). The proposal would be unlikely to impact on the species during the operation of the wind farm.

Foraging, sheltering and breeding habitat for the Koala is present within areas of BPBGRS, RSSGRBLLB, and WBBRGYB (wooded areas and pasture). The proposal will permanently remove 11.19 ha and temporarily remove 3.15 ha of foraging/sheltering/breeding habitat within the study area.

However, tree clearance for the proposal will be avoided, wherever possible, and the amount of trees being removed will be minimal with respect to the amount of potential habitat present for this species within the study area. Vegetation clearance is linear in nature and, therefore, will not result in large consolidated patches of vegetation clearance (the removal of any areas of potential habitat may result in the reduction of a territorial range but is unlikely to affect the entire territory). Only 4.96 % of habitat in the study area (288.65 ha) and 1.14 % of the project site (1,261.66 ha) will be removed representing a small amount of an individual's territory. The proposal will not significantly fragment the foraging/sheltering/breeding habitat of the species which will traverse open ground to move between

trees (OEH 2011b). Also, given habitat is widely spread across the project site, it is unlikely that the proposed wind farm would lead to the displacement of any individuals.

How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

The proposal will result in the permanent removal of 11.19 ha of woodland and the temporary loss of 3.15 ha of woodland representing foraging, sheltering and breeding habitat for the Koala, totalling 14.34 ha. However, it is unlikely that the proposed vegetation clearance would impact on this species such that foraging, sheltering and breeding resources would become limited within the study area given that:

- Vegetation representing habitat for the Koala will be removed in linear strips (for turbines, access tracks and the associated ancillary structures required for the running of the wind farm), rather than one consolidated stand;
- The habitat that will be lost represents a small area (4.96 % of the potential habitat mapped within the study area, and 1.14 % of potential habitat mapped within the project site). Large wooded areas would remain in the project site; and
- Trees will be avoided, where possible, with the siting of wind turbines occurring within previously cleared areas where possible.

The proposal may increase erosion, sedimentation and runoff through the clearing of vegetation and the construction of roads, and produce conditions favourable to weed invasion impacting on the species' habitat. However, any increases in run-off in areas where the ground within the construction area will be compacted, gravelled or concreted will be small and localised. The proposal will not affect flooding or flow regimes for the study area. Soil erosion and run-off control measures and weed control (over a 3-year period) will be implemented as part of the mitigation measures undertaken for the proposal, thereby reducing potential impacts of the proposal to potential habitat for this species.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

The species is widely, though sparsely, distributed in eastern Australia, from north-east Queensland to the Eyre Peninsula in South Australia. In NSW, it mainly occurs on the central and north coasts with some populations in the west of the Great Dividing Range in the northern tablelands, central and southern tablelands, and western slopes and plains (DECC 2008b, OEH 2011b). Thus, Crudine Ridge is not at the limit of the known distribution for the species.

How is the proposal likely to affect current disturbance regimes?

Current disturbances at the site include cattle and sheep grazing, grazing by feral animals including the European Rabbit and Goat, and periods of drought and rainfall consistent with the southern oscillation index and resultant cycles of drought (El Niño) and wetter periods (La Niña). There has been no major fire event in the last decade.

The proposal is unlikely to alter the current fire regime at the study area. The risk of fire with wind farms is inherently low (CFA 2007). The location of wind turbines away from tall vegetation in the study area minimises the risk of fire. It is unlikely that the proposal will significantly affect the fire regime such that

high intensity fire would have a detrimental impact on Koala habitat. The proposed access roads will increase the accessibility across the site should a fire occur.

The proposal is also unlikely to exacerbate over-grazing at the site. It may, in fact, contribute to a more sustainable grazing regime through the mitigation measures proposed in some parts of the site. In the absence of fire, grazing can be an important form of disturbance to prevent the accumulation of biomass that may not be favourable to some native flora species. Rotational periods of grazing and spelling help to foster healthy native pastures and recruitment of eucalypts in the absence of fire.

Feral animals can have a detrimental impact on threatened fauna through predation by species (feral dogs for the Koala). The proposal is unlikely to contribute to increasing feral animal activity across the project site and instead is likely to assist with the management of these species through the proposed mitigation measures to be implemented within the study area and on the proposed offset sites. No adverse impacts to potential Koala habitat is expected to result from a reduction in grazing pressure from livestock and feral animals.

The proposal will increase the number of roads in the study area which may lead to an increase in Koala mortality through collisions with vehicles. However, the number of vehicles in the study area will be low and unlikely to significantly increase Koala mortality through road kills.

The proposal has the potential to increase erosion, sedimentation and runoff through the clearing of vegetation and the construction of roads, and produce conditions favourable to weed invasion. However, any increases in run-off in areas where the ground within the construction area will be compacted, gravelled or concreted will be small and localised. The proposal will not affect flooding or flow regimes for the study area. Soil erosion and run-off control measures and weed control will be implemented as part of the mitigation measures undertaken for the proposal.

How is the proposal likely to affect habitat connectivity?

The woodland and open forest areas of the project site naturally have large canopy gaps and a very open and more often absent understorey. Given the narrow linear nature of the proposal, sited on mostly cleared areas, it is unlikely that the proposal would create barriers to movement of Koala throughout the project site, which is a mobile species and able to cross the road corridors to be installed within the study area. The main habitat corridor through the project site along the eastern slopes of Crudine Ridge will be largely retained. It is unlikely that the proposal would have an impact on Koala movements during the operation phase.

How is the proposal likely to affect critical habitat?

Not applicable - critical habitat cannot be declared for vulnerable species.

***Chalinolobus dwyeri* (Large-eared Pied Bat)**

The Large-eared Pied Bat is listed as a vulnerable species under both the TSC Act and EPBC Act. It is found mainly in areas with extensive cliffs and caves, from Rockhampton in Queensland south to Bungonia in the NSW Southern Highlands. It is generally rare with a very patchy distribution in NSW. There are scattered records from the New England Tablelands and North West Slopes (OEH 2011b).

The Large-eared Pied Bat is found in well-timbered areas containing gullies. It frequents low to mid-elevation dry open forest and woodland close to caves, crevices in cliffs, old mine workings and disused mud nests of Fairy Martin. The relatively short, broad wing combined with the low weight per unit area of wing indicates manoeuvrable flight. This species probably forages for small, flying insects below the forest canopy (OEH 2011b).

The Large-eared Pied Bat roosts in caves (near their entrances), crevices in cliffs, old mine workings and in the disused, bottle-shaped mud nests of the Fairy Martin (*Hirundo ariel*). It is possible that the species also roosts in trees hollows (DSEWPAC 2011b). They are likely to hibernate during the cooler months of the year. Females have been recorded raising young in maternity roosts (c. 20-40 females) from November through to January in roof domes in sandstone caves. They remain loyal to the same cave over many years (OEH 2011b).

Harp trapping and anabat surveys were conducted in areas of suitable habitat across the proposed study area and project site mainly during November 2008 and January 2009, with some additional surveys conducted in March 2011. The Large-eared Pied Bat was detected with a high level of certainty in anabat analyses (a probable detection, where detections have a low probability of confusion with species of similar calls) from a single call. The species was recorded in the project site, just outside of the study area, in the Sallys Flat Cluster within RSSCGRBLLB. The species is also known in nearby conservation reserves in the Mid-Western Regional and Bathurst Regional LGAs: Munghorn Gap Nature Reserve, Goulburn River National Park, and Wollemi National Park, and crown land near Ulan (DSEWPAC 2011b).

How is the proposal likely to affect the lifecycle of a threatened species and/or population?

The proposal could impact on the life cycle of the Large-eared Pied Bat by reducing the amount of foraging habitat available to the species, reducing the amount of roosting habitat (disused mud nests of Fairy Martin) available to the species, degrading their habitat (eg. through fragmentation), or increasing the species' mortality rates via collisions with turbines or through barotrauma. The proposal would not impact on the breeding habitat of Large-eared Pied Bat given the species breeds in maternity caves away from the study area.

Habitat for the Large-eared Pied Bat within the study area exists in areas of

BPBGRS, RSSGRBLLB and WBBRGYB (mostly wooded areas). The proposal will require 7.98 ha of permanent habitat loss and 1.65 ha of temporary loss within these vegetation communities.

While the proposal will remove habitat for the Large-eared Pied Bat, tree clearance for the proposal will be avoided, wherever possible, and the amount of trees being removed will be minimal with respect to the amount of potential habitat present for this species within the study area. Vegetation clearance is linear in nature and, therefore, will not result in large consolidated patches of vegetation clearance. The removal of any areas of potential habitat may result in the reduction of a territorial range but is unlikely to affect the entire territory. Only 4.33 % of habitat in the study area (222.17 ha) and 0.86 % of the project site (1,121.32 ha) will be removed. The proposal will not significantly fragment the habitat of the species, which is highly mobile. Also, given habitat is widely spread across the project site, it is unlikely

that the proposed wind farm would lead to the displacement of any individuals. Where the removal of habitat trees is required, a pre-clearance protocol will be developed and implemented to determine if roosts (disused Fairy Martin nests) are present in any trees proposed for clearing. An ecologist will be present during clearing to capture and re-release individuals (where appropriate).

There is a risk that Large-eared Pied Bats will accidentally collide with the moving turbines or be impacted by barotrauma during the operational phase of the wind farm. However, the Large-eared Pied Bat is thought to forage for small, flying insects below the forest canopy (OEH 2011b). Churchill (2008) has also observed the species flying at the mid-canopy level approximately 6-10 m above the ground. As such, the risk matrix included in Appendix F considered the collision potential for this species to be low. Barotrauma is also likely to be low given that individuals would not be in the vicinity of turbine blades.

Should the turbines require lighting, selection of lighting that minimises the likelihood of attracting insects and foraging bats should be used to reduce the risk of bat strike. Monitoring bat strike will be undertaken, and an adaptive management approach implemented whereby additional measures are investigated should significant bat strike at certain turbines be recorded.

How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

Vegetation representing foraging and roosting habitat for the Large-eared Pied Bat will be removed in linear strips (for turbines, access tracks and the associated ancillary structures required for the running of the wind farm), rather than one consolidated stand. As a worst case scenario, the area of vegetation to be cleared consists of a permanent loss of 7.98 ha and a temporary impact to 1.65 ha of potential habitat, totalling 9.63 ha.

However, the vegetation communities and habitat that will be lost represents 4.33 % of the potential habitat mapped within the study area, and 0.86 % of potential habitat mapped within the project site. Large wooded areas would remain in the project site. It is unlikely that the proposed vegetation clearance would impact on this species such that foraging and roosting resources would become limited within the study area. The removal of habitat trees, including trees with hollows, will be avoided where possible. However, where the removal of habitat trees is required, a pre-clearance protocol will be developed and implemented to determine if roosts are present in disused Fairy Martin nests and tree hollows in any trees proposed for clearing. An ecologist will be present during clearing to capture and re-release individuals (where appropriate). The Large-eared Pied Bat is also highly mobile and would be able to access foraging resources in the locality. Thus, the proposal is unlikely to substantially reduce the amount of potential habitat for this species present within the project site. No breeding habitat (maternity roosts) would be impacted by the proposal.

The proposal may increase erosion, sedimentation and runoff through the clearing of vegetation and the construction of roads, and produce conditions favourable to weed invasion impacting on the species' habitat. However, any increases in run-off in areas where the ground within the construction area will be compacted, gravelled or concreted will be small and localised. The proposal will not affect flooding or flow regimes for the study area. Soil erosion and run-off control measures and weed control (over a 3-year period) will be implemented as part of the mitigation measures undertaken for the proposal, thereby reducing potential impacts of the proposal to potential habitat for this species.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

The Large-eared Pied Bat is distributed from Rockhampton in Queensland south to Bungonia in the NSW Southern Highlands. It is generally rare with a very patchy distribution in NSW, and has not been recorded too far to the west of the Central West CMA. Thus, the species is likely to be close to the limit of its distribution at Crudine Ridge.

How is the proposal likely to affect current disturbance regimes?

Current disturbances at the site include cattle and sheep grazing, grazing by feral animals including the European Rabbit and Goat, and periods of drought and rainfall consistent with the southern oscillation index and resultant cycles of drought (El Niño) and wetter periods (La Niña). There has been no major fire event in the last decade.

The proposal is unlikely to alter the current fire regime at the study area. The risk of fire with wind farms is inherently low (CFA 2007). A low risk is associated with malfunctioning turbine bearings, inadequate crankcase lubrication, cable damage during rotation, electrical shorting or arcing occurring in transmission and distribution facilities (CFA 2007). A large portion of the study area is grassland and turbines in woodland areas have been located at least 30 m from trees wherever possible, therefore it unlikely that the proposal will dramatically alter fire patterns across the study area. Furthermore, a number of mitigation measures will be implemented during construction to prevent accidental fires.

Feral animals can have a detrimental impact on Large-eared Pied Bat habitat. In the case of grassy woodlands, grazing by feral animals such as the European Rabbit and Goat can result in loss of species diversity and tussock structure which in turn impacts the presence of insects as a food source for Large-eared Pied Bat. The proposal is unlikely to contribute to increasing feral animal activity across the project site and instead is likely to assist with the management of these species through the proposed mitigation measures to be implemented within the study area and on the proposed offset sites.

Threats to the Large-eared Pied Bat include poisoning from pesticides (OEH 2011b). It is unlikely that any pesticides used in feral animal management will impact on the species given insect control is unlikely to be required. Pesticides will not be used where alternative methods exist.

The proposal has the potential to increase erosion, sedimentation and runoff through the clearing of vegetation and the construction of roads, and produce conditions favourable to weed invasion. However, any increases in run-off in areas where the ground within the construction area will be compacted, gravelled or concreted will be small and localised. The proposal will not affect flooding or flow regimes for the study area. Soil erosion and run-off control measures and weed control will be implemented as part of the mitigation measures undertaken for the proposal.

How is the proposal likely to affect habitat connectivity?

The woodland and open forest areas of the project site naturally have large canopy gaps and a very open and more often absent understorey. Given the narrow linear nature of the proposal, sited on mostly cleared areas, it is unlikely that the proposal would create barriers to movement of Large-eared Pied Bat throughout the project site, which is highly mobile. The main habitat corridor through the project site along the eastern slopes of Crudine Ridge will be largely retained.

During the operational phase of the wind farm, there is a risk that Large-eared Pied Bat will accidentally collide with the moving turbines, affecting habitat connectivity. However, Large-eared Pied Bat moving about a location in the course of routine foraging most likely do so within or just below the height of the

canopy in which they feed. Thus, it is unlikely that the proposal will impact on habitat connectivity during the operational phase of the wind farm.

How is the proposal likely to affect critical habitat?

Not applicable - critical habitat cannot be declared for vulnerable species.

***Chalinolobus picatus* (Little Pied Bat)**

The Little Pied Bat is listed as a vulnerable species under the TSC Act. It is found in inland to coastal Queensland, and inland, semi-arid NSW (including Western Plains and slopes) extending slightly into South Australia and Victoria (Churchill 2008, OEH 2011b).

The Little Pied Bat occurs in dry open forest, open woodland, mulga woodlands, chenopod shrublands, cypress-pine forest, mallee, and Bimbil box. It can tolerate high temperatures and dryness but need access to nearby open water. Their flight is fast and highly manoeuvrable, and individuals change directions often. They fly close to vegetation and have been seen to glean from the canopy of *Casuarina* by flying among the foliage. The species feeds on moths and possibly other flying invertebrates (Churchill 2008, OEH 2011b).

The Little Pied Bat roosts in caves, rock outcrops, mine shafts, tunnels, tree hollows and buildings. It has also been recorded in a clump of dead mulga (near Bourke).

Harp trapping and anabat surveys were conducted in areas of suitable habitat across the proposed study area and project site mainly during November 2008 and January 2009, with some additional surveys conducted in March 2011. The Little Pied Bat was detected with certainty in anabat analyses from a single call. The species was recorded in the project site at an artificial dam, just outside of the study area, in the Pyramul Cluster within RSSGRBLLB.

How is the proposal likely to affect the lifecycle of a threatened species and/or population?

The proposal could impact on the life cycle of the Little Pied Bat by reducing the amount of foraging, roosting and breeding habitat available to the species (roosting and breeding habitat potentially represented by tree hollows), degrading their habitat (eg. through fragmentation), or increasing the species' mortality rates via collisions with turbines or through barotrauma.

Habitat for the Little Pied Bat within the study area exists in areas of BPBGRS, RSSGRBLLB and WBBRGYB (mostly wooded areas), although given the species is generally an inland species, habitat in these vegetation communities may represent marginal habitat. The proposal will require 7.98 ha of permanent habitat loss and 1.65 ha of temporary loss within these vegetation communities.

While the proposal will remove habitat for the Little Pied Bat, tree clearance for the proposal and hollow-bearing trees will be avoided wherever possible and the amount of trees being removed will be minimal with respect to the amount of potential habitat present for this species within the study area. Vegetation clearance is linear in nature and, therefore, will not result in large consolidated patches of vegetation clearance (the removal of any areas of potential habitat may result in the reduction of a territorial range but is unlikely to affect the entire territory). Only 4.33 % of habitat in the study area (222.17 ha) and 0.86 % of the project site (1121.32 ha) will be removed. The proposal will not significantly fragment the habitat of the species, which is highly mobile. Also, given habitat is widely spread across the project site, it is unlikely that the proposed wind farm would lead to the displacement of any individuals. Where the removal of habitat trees is required, a pre-clearance protocol will be developed and implemented to determine if roosts are present in hollows in any trees proposed for clearing. An ecologist will be present during clearing to capture and re-release individuals (where appropriate).

There is a risk that Little Pied Bats will accidentally collide with the moving turbines during the operational phase of the wind farm. Although the Little Pied Bat forages close to vegetation, and sometimes within the canopy, it often travels large distances, making nightly return trips of 14-34 km (Churchill 2008). As such, the risk matrix included in Appendix F considered the collision potential for this species to be moderate. Barotrauma is also likely to be moderate given that individuals could come

into proximity of turbine blades.

Should the turbines require lighting, selection of lighting that minimises the likelihood of attracting insects and foraging bats should be used to reduce the risk of bat strike. Monitoring bat strike will be undertaken, and an adaptive management approach implemented whereby additional measures are investigated should significant bat strike at certain turbines be recorded.

How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

Vegetation representing foraging, roosting and breeding habitat for the Little Pied Bat will be removed in linear strips (for turbines, access tracks and the associated ancillary structures required for the running of the wind farm), rather than one consolidated stand. As a worst case scenario, the area of vegetation to be cleared consists of a permanent loss of 7.98 ha and a temporary impact to 1.65 ha of potential habitat, totalling 9.63 ha.

However, the vegetation communities and habitat that will be lost represents 4.33 % of the potential habitat mapped within the study area, and 0.86 % of potential habitat mapped within the project site. Large wooded areas would remain in the project site. It is unlikely that the proposed vegetation clearance would impact on this species such that foraging, roosting or breeding resources would become limited within the study area. Thus, the proposal is unlikely to substantially reduce the amount of potential habitat for this species present within the project site. The removal of habitat trees, including trees with hollows (potential roosting and breeding habitat), will be avoided where possible. However, where the removal of habitat trees is required, a pre-clearance protocol will be developed and implemented to determine if roosts are present in any trees proposed for clearing. An ecologist will be present during clearing to capture and re-release individuals (where appropriate). The Little Pied Bat is also highly mobile and would be able to access foraging resources in the locality. Furthermore, the species is generally an inland, semi-arid species (Churchill 2008, OEH 2011b). Habitat present in the study area is considered to represent marginal habitat for the species.

The proposal may increase erosion, sedimentation and runoff through the clearing of vegetation and the construction of roads, and produce conditions favourable to weed invasion impacting on the species' habitat. However, any increases in run-off in areas where the ground within the construction area will be compacted, gravelled or concreted will be small and localised. The proposal will not affect flooding or flow regimes for the study area. Soil erosion and run-off control measures and weed control (over a 3-year period) will be implemented as part of the mitigation measures undertaken for the proposal, thereby reducing potential impacts of the proposal to potential habitat for this species.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

The Little Pied Bat is found in inland to coastal Queensland, and inland, semi-arid NSW (including Western Plains and slopes) extending slightly into South Australia and Victoria (Churchill 2008, OEH 2011b). The Crudine Ridge area is close to the limit of the species' known distribution.

How is the proposal likely to affect current disturbance regimes?

Current disturbances at the site include cattle and sheep grazing, grazing by feral animals including the European Rabbit and Goat, and periods of drought and rainfall consistent with the southern oscillation index and resultant cycles of drought (El Niño) and wetter periods (La Niña). There has been no major fire event in the last decade.

The proposal is unlikely to alter the current fire regime at the study area. The risk of fire with wind farms is inherently low (CFA 2007). A low risk is associated with malfunctioning turbine bearings, inadequate crankcase lubrication, cable damage during rotation, electrical shorting or arcing occurring in transmission and distribution facilities (CFA 2007). A large portion of the study area is grassland and turbines in woodland areas have been located at least 30 m from trees wherever possible, therefore it unlikely that the proposal will dramatically alter fire patterns across the study area. Furthermore, a number of mitigation measures will be implemented during construction to prevent accidental fires.

Feral animals can have a detrimental impact on Little Pied Bat habitat. In the case of grassy woodlands, grazing by feral animals such as the European Rabbit and Goat can result in loss of species diversity and tussock structure which in turn impacts the presence of insects as a food source for Little Pied Bat. Feral animals can also have a detrimental impact on Little Pied Bat directly; predation by cats is listed as a threat to the species (OEH 2011b). However, the proposal is unlikely to contribute to increasing feral animal activity across the project site and instead is likely to assist with the management of these species through the proposed mitigation measures to be implemented within the study area and on the proposed offset sites.

Threats to the Little Pied Bat include poisoning from pesticides (OEH 2011b). It is unlikely that any pesticides used in feral animal management will impact on the species given insect control is unlikely to be required. The application of herbicides should be restricted when alternative methods are available.

The proposal has the potential to increase erosion, sedimentation and runoff through the clearing of vegetation and the construction of roads, and produce conditions favourable to weed invasion. However, any increases in run-off in areas where the ground within the construction area will be compacted, gravelled or concreted will be small and localised. The proposal will not affect flooding or flow regimes for the study area. Soil erosion and run-off control measures and weed control will be implemented as part of the mitigation measures undertaken for the proposal.

How is the proposal likely to affect habitat connectivity?

The woodland and open forest areas of the project site naturally have large canopy gaps and a very open and more often absent understorey. Given the narrow linear nature of the proposal, sited on mostly cleared areas, it is unlikely that the proposal would create barriers to movement of Little Pied Bat throughout the project site, which is highly mobile. The main habitat corridor through the project site along the eastern slopes of Crudine Ridge will be largely retained.

During the operational phase of the wind farm, there is a risk that Little Pied Bat will accidentally collide with the moving turbines, affecting habitat connectivity. Much literature has been produced regarding potential impacts of wind farms on bats although most of the studies have been undertaken overseas. Bat strike will be monitored during the operation of the wind farm and an adaptive management approach implemented whereby additional measures are investigated should significant bat (and bird) strike at certain turbines be recorded.

How is the proposal likely to affect critical habitat?

Not applicable - critical habitat cannot be declared for vulnerable species.

***Miniopterus orianae oceanensis* (Eastern Bentwing-bat)**

The Eastern Bentwing Bat is listed as a vulnerable species under the TSC Act. The species has recently been revised from *Miniopterus orianae oceanensis* (Churchill 2008), recognising the subspecies to full species status. *Miniopterus orianae oceanensis* occupies a range of forested environments (including wet and dry sclerophyll forests, monsoon forest, open woodland, *Melaleuca* forests and open grasslands) along the coastal portion of eastern Australia, from Cape York in north Queensland to Castlemaine in Victoria. It occurs mainly east of the Great Dividing Range (Churchill 2008).

This species has a fast, level flight exhibiting swift shallow dives. It forages from just above the tree canopy, to many times the canopy height in forested areas, and will utilise open areas where it is known to forage at lower levels. It can travel up to 65 km in one night. Moths appear to be the main dietary component, with other prey items including flies, cockroaches and beetles (Churchill 2008, OEH 2011b).

This highly mobile species is capable of large regional movements in relation to seasonal differences in reproductive behaviour and winter hibernation. Though individuals often use numerous roosts, it congregates in large numbers at a small number of nursery caves to breed and hibernate (breeding or roosting colonies can number from 100 to 150,000 individuals). Although roosting primarily occurs in caves, it has also been recorded in mines, culverts, stormwater channels, buildings, and occasionally tree-hollows. This species occupies a number of roosts within specific territorial ranges usually within 300 km of the maternity cave, and may travel large distances between roost sites (DECC 2009).

Harp trapping and anabat surveys were conducted in areas of suitable habitat across the proposed study area and project site mainly during November 2008 and January 2009, with some additional surveys conducted in March 2011. The Eastern Bentwing Bat was detected with certainty in anabat analyses from 52 calls. The species was recorded at 6 locations (5 in the project site and 1 in the study area). In terms of the turbine clusters, 3 records were made in the Pyramul Cluster, 2 records were made in the Sallys Flat Cluster, while 1 record was made between the Pyramul and Sallys Flat Clusters. The majority of records were made within RSSGRBLLBt, although the record made within the study area (Sallys Flat Cluster) was made within WTG.

The Eastern Bentwing Bat has been previously recorded (in 2006) to the east of the study area approximately 14 km away, in a limestone mine at Kandos (OEH 2011a).

How is the proposal likely to affect the lifecycle of a threatened species and/or population?

The proposal could impact on the life cycle of the Eastern Bentwing Bat by reducing the amount of foraging habitat available to the species, degrading their habitat (eg. through fragmentation), or increasing the species' mortality rates via collisions with turbines or through barotrauma. The proposal would not impact on the breeding habitat of the Eastern Bentwing Bat given the species breeds in maternity caves away from the study area.

Habitat for the Eastern Bentwing Bat within the study area exists in areas of BPBGRS on the south eastern highlands, RSSGRBLLB, WTG areas of the tablelands, and WBBRGYB (wooded areas and pasture). The proposal will require 71.64 ha of permanent habitat loss and 31.58 ha of temporary loss within these vegetation communities.

While the proposal will remove habitat for the Eastern Bentwing Bat, tree clearance for the proposal will be avoided wherever possible and the amount of trees being removed will be minimal with respect to the amount of potential habitat present for this species within the study area. Vegetation clearance is linear in nature and, therefore, will not result in large consolidated patches of vegetation clearance (the removal of any areas of potential habitat may result in the reduction of a territorial range but is unlikely to

affect the entire territory). Only 6.67 % of habitat in the study area (1,547.61 ha) and 2.62 % of the project site (3,942.52 ha) will be removed. Further, the Eastern Bentwing Bat is a wide-ranging forager, which occurs over areas lacking trees. The proposal will not significantly fragment the habitat of the species, which is highly mobile. Also, given habitat is widely spread across the project site, it is unlikely that the proposed wind farm would lead to the displacement of any individuals.

There is a risk that Eastern Bentwing Bat will accidentally collide with the moving turbines during the operational phase of the wind farm. The species both forages at levels high above the canopy (many times the height of the canopy), and travels large distances while foraging and migrating (the species can travel up to 65 km in one night and will travel several hundred kilometres to over-wintering roosts). The species is also known to be attracted to lights and has been recorded foraging for insects around street lights. As such, the risk matrix included in Appendix F considered the collision potential for this species to be moderate. Barotrauma is also likely to be moderate given that individuals could come into proximity of turbine blades.

Should the turbines require lighting, selection of lighting that minimises the likelihood of attracting insects and foraging bats should be used to reduce the risk of bat strike. A commitment to monitoring strike across CRWF has been made. This will include the preparation of a bird and bat monitoring program prior to operation of the wind farm that, in consultation with OEH and SEWPAC, will identify the frequency of monitoring and reporting, the thresholds at which impacts are considered unacceptable and the adaptive management approaches which are acceptable.

How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

Vegetation representing foraging habitat for the Eastern Bentwing Bat will be removed in linear strips (for turbines, access tracks and the associated ancillary structures required for the running of the wind farm), rather than one consolidated stand. As a worst case scenario, the area of vegetation to be cleared consists of a permanent loss of 71.64 ha and a temporary impact to 31.58 ha of potential habitat, totalling 103.22 ha.

However, the vegetation communities and habitat that will be lost represents 6.67 % of the potential habitat mapped within the study area, and 2.62 % of potential habitat mapped within the project site. Large wooded areas would remain in the project site. It is unlikely that the proposed vegetation clearance would impact on this species such that foraging resources would become limited within the study area. The proposal would not impact on preferred roosting or breeding habitat for the species (caves, culverts). The removal of habitat trees, including trees with hollows (potential roosting, but not preferred roosting habitat), will be avoided where possible. However, where the removal of habitat trees is required, a pre-clearance protocol will be developed and implemented to determine if roosts are present in any trees proposed for clearing. An ecologist will be present during clearing to capture and re-release individuals (where appropriate). Thus, the proposal is unlikely to substantially reduce the amount of potential habitat for this species present within the project site. The Eastern Bentwing Bat is also highly mobile and would be able to access foraging resources in the locality.

The proposal may increase erosion, sedimentation and runoff through the clearing of vegetation and the construction of roads, and produce conditions favourable to weed invasion impacting on the species' habitat. However, any increases in run-off in areas where the ground within the construction area will be compacted, gravelled or concreted will be small and localised. The proposal will not affect flooding or flow regimes for the study area. Soil erosion and run-off control measures and weed control (over a 3-year period) will be implemented as part of the mitigation measures undertaken for the proposal, thereby reducing potential impacts of the proposal to potential habitat for this species.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

The Eastern Bentwing Bat occurs along the east coast of Australia, mainly east of the Great Dividing Range (Churchill 2008). However, the species occurs in the Lachlan, Murrumbidgee and Murray CMAs, which include areas further to the west of the project site. Thus, Crudine Ridge does not represent the limit of this species' distribution.

How is the proposal likely to affect current disturbance regimes?

Current disturbances at the site include cattle and sheep grazing, grazing by feral animals including the European Rabbit and Goat, and periods of drought and rainfall consistent with the southern oscillation index and resultant cycles of drought (El Niño) and wetter periods (La Niña). There has been no major fire event in the last decade.

The proposal is unlikely to alter the current fire regime at the study area. The risk of fire with wind farms is inherently low (CFA 2007). A low risk is associated with malfunctioning turbine bearings, inadequate crankcase lubrication, cable damage during rotation, electrical shorting or arcing occurring in transmission and distribution facilities (CFA 2007). A large portion of the study area is grassland and turbines in woodland areas have been located at least 30 m from trees wherever possible, therefore it unlikely that the proposal will dramatically alter fire patterns across the study area. Furthermore, a number of mitigation measures will be implemented during construction to prevent accidental fires.

Feral animals can have a detrimental impact on Eastern Bentwing Bat habitat. In the case of grassy woodlands, grazing by feral animals such as the European Rabbit and Goat can result in loss of species diversity and tussock structure which in turn impacts the presence of insects as a food source for Eastern Bentwing Bat. Feral animals can also have a detrimental impact on Eastern Bentwing Bat directly; predation by cats and foxes is listed as a threat to the species (OEH 2011b). However, the proposal is unlikely to contribute to increasing feral animal activity across the project site and instead is likely to assist with the management of these species through the proposed mitigation measures to be implemented within the study area and on the proposed offset sites.

Threats to the Eastern Bentwing Bat include poisoning from pesticides (OEH 2011b). It is unlikely that any pesticides used in feral animal management will impact on the species given insect control is unlikely to be required. The application of herbicides should be restricted when alternative methods are available.

The proposal has the potential to increase erosion, sedimentation and runoff through the clearing of vegetation and the construction of roads, and produce conditions favourable to weed invasion. However, any increases in run-off in areas where the ground within the construction area will be compacted, gravelled or concreted will be small and localised. The proposal will not affect flooding or flow regimes for the study area. Soil erosion and run-off control measures and weed control will be implemented as part of the mitigation measures undertaken for the proposal.

How is the proposal likely to affect habitat connectivity?

The woodland and open forest areas of the project site naturally have large canopy gaps and a very open and more often absent understorey. Given the narrow linear nature of the proposal, sited on mostly cleared areas, it is unlikely that the proposal would create barriers to movement of Eastern Bentwing Bat throughout the project site, which is highly mobile. The main habitat corridor through the project site along the eastern slopes of Crudine Ridge will be largely retained.

During the operational phase of the wind farm, there is a risk that Eastern Bentwing Bat will accidentally collide with the moving turbines, affecting habitat connectivity. Much literature has been produced regarding potential impacts of wind farms on bats although most of the studies have been undertaken overseas. A commitment to monitoring strike across CRWF has been made. This will include the preparation of a bird and bat monitoring program prior to operation of the wind farm that, in consultation with OEH and SEWPAC, will identify the frequency of monitoring and reporting, the thresholds at which impacts are considered unacceptable and the adaptive management approaches which are acceptable.

How is the proposal likely to affect critical habitat?

Not applicable - critical habitat cannot be declared for vulnerable species.

***Nyctophilus corbeni* (Greater (eastern) Long-eared Bat)**

The Greater Long-eared Bat is listed as a vulnerable species under both the TSC Act and EPBC Act. It has had a recent name change from *N. timoriensis* to *N. corbeni*. Overall, the distribution of the Greater Long-eared Bat coincides approximately with the Murray Darling Basin and the western slopes of the Great Dividing Range across south east Australia from south central Queensland through inland NSW to just south of the Murray River in Victoria and north of the Murray River in eastern South Australia (Churchill 2008). The Pilliga Scrub region is a distinct stronghold for this species (OEH 2011b).

The Greater Long-eared Bat inhabits a variety of vegetation types, including mallee, bulloke *Allocasuarina leuhmanni* and box eucalypt dominated communities, but it is distinctly more common in box/ironbark/cypress-pine vegetation that occurs in a north-south belt along the western slopes and plains of NSW and southern Queensland (OEH 2011b).

The species roosts in tree hollows less than 3 m above the ground with multiple small entrances of 5 cm – 10 cm. They also roost in crevices / fissures in branches, and under loose bark. It is a slow flying agile bat, utilising the understorey to hunt non-flying prey, especially caterpillars and beetles, and will even hunt on the ground. Movement patterns are not well known, although roost sites have been recorded as an average of 1.89 ± 1.61 km (range 0.34 – 7.06 km) from the capture point of bats (Schulz and Lumsden 2010). Churchill (2008) has documented that the species forages approximately 3 km from the roost. Foraging activities are concentrated around patches of trees in the landscape (Schulz and Lumsden 2010). Individuals appear to have defined foraging areas which they return to; they do not defend foraging areas and many individual from different species may share the same area. Trapping surveys have caught 600 bats (from a variety of species) in a 2 km foraging strip (Schulz and Lumsden 2010).

Mating takes place in autumn with one or two young born in late spring to early summer (OEH 2011b).

Harp trapping and anabat surveys were conducted in areas of suitable habitat across the proposed study area and project site mainly during November 2008 and January 2009, with some additional surveys conducted in March 2011. The Greater Long-eared Bat was not detected with certainty during field survey. However, the anabat analyses identified *Nyctophilus* species, which could belong to three species (namely *N. geoffroyi*, *N. gouldi* or *N. corbeni*), whose calls are difficult to tell apart. Thus, the Greater Long-eared Bat has been included as a precautionary measure. There are no previous records for the Greater Long-eared Bat in the locality. However, the lack of records may reflect the limited survey effort undertaken prior to this survey rather than the absence of the species in the locality.

How is the proposal likely to affect the lifecycle of a threatened species and/or population?

The proposal could impact on the life cycle of the Greater Long-eared Bat by reducing the amount of potential foraging, and roosting and breeding habitat (tree hollows, crevices / fissures in branches and under loose bark) available to the species, degrading their habitat (eg. through fragmentation), or increasing the species' mortality rates via collisions with turbines or through barotrauma.

Potential habitat for the Greater Long-eared Bat within the study area exists in areas of BPBGRS, RSSGRBLLB and WBBRGYB (mostly wooded areas), although habitat in the project site is considered to be marginal given the species is mainly a species of the NSW western slopes and plains using drier vegetation communities (Churchill 2008, Turbill *et al.* 2008). The proposal will require 7.98 ha of permanent habitat loss and 1.65 ha of temporary loss within these vegetation communities.

While the proposal will remove potential habitat for the Greater Long-eared Bat, tree clearance for the proposal and hollow-bearing trees will be avoided wherever possible and the amount of trees being

removed will be minimal with respect to the amount of potential habitat present for this species within the study area. Vegetation clearance is linear in nature and, therefore, will not result in large consolidated patches of vegetation clearance. The removal of any areas of potential habitat may result in the reduction of a territorial range but is unlikely to affect the entire territory. Only 4.33 % of potential habitat in the study area (222.17 ha) and 0.86 % of the project site (1,121.32 ha) will be removed. The proposal will not significantly fragment the habitat of the species, which would be able to traverse the distances between woodland patches, or significantly reduce the area of woodland remnants remaining in the project site to a size that could not be used by the species (the Greater Long-eared Bat requires large, intact areas of habitat to persist in an area; Turbill *et al.* 2008). Also, given habitat is widely spread across the project site, it is unlikely that the proposed wind farm would lead to the displacement of any individuals. Where the removal of habitat trees is required, a pre-clearance protocol will be developed and implemented to determine if roosts are present in any trees proposed for clearing. An ecologist will be present during clearing to capture and re-release individuals (where appropriate).

There is a risk that Greater Long-eared Bat will accidentally collide with the moving turbines during the operational phase of the wind farm. However, the Greater Long-eared Bat is a slow flying agile bat, which uses the understorey to hunt non-flying prey, especially caterpillars and beetles, even hunting on the ground (OEH 2011b). Foraging activities are also concentrated around patches of trees in the landscape (DSEWPAC 2011b). As such, the risk matrix included in Appendix F considered the collision potential for this species to be low. Barotrauma is also likely to be low given that individuals would not be in the vicinity of turbine blades.

Should the turbines require lighting, selection of lighting that minimises the likelihood of attracting insects and foraging bats should be used to reduce the risk of bat strike. Monitoring bat strike will be undertaken, and an adaptive management approach implemented whereby additional measures are investigated should significant bat strike at certain turbines be recorded.

How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

Vegetation representing potential foraging, roosting and breeding habitat for the Greater Long-eared Bat will be removed in linear strips (for turbines, access tracks and the associated ancillary structures required for the running of the wind farm), rather than one consolidated stand. As a worst case scenario, the area of vegetation to be cleared consists of a permanent loss of 7.98 ha and a temporary impact to 1.65 ha of potential habitat, totalling 9.63 ha.

However, the vegetation communities and habitat that will be lost represents 4.33 % of the potential habitat mapped within the study area, and 0.86 % of potential habitat mapped within the project site. Large wooded areas would remain in the project site. It is unlikely that the proposed vegetation clearance would impact on this species such that foraging, roosting and breeding resources would become limited within the study area. The removal of habitat trees, including trees with hollows, will be avoided where possible. However, where the removal of habitat trees is required, a pre-clearance protocol will be developed and implemented to determine if roosts are present in tree hollows, fissures/crevices, or under loose bark in any trees proposed for clearing. An ecologist will be present during clearing to capture and re-release individuals (where appropriate). The Greater Long-eared Bat is also mobile and would be able to access foraging resources in the locality. Thus, the proposal is unlikely to substantially reduce the amount of potential habitat for this species present within the project site.

The proposal may increase erosion, sedimentation and runoff through the clearing of vegetation and the construction of roads, and produce conditions favourable to weed invasion impacting on the species'

habitat. However, any increases in run-off in areas where the ground within the construction area will be compacted, gravelled or concreted will be small and localised. The proposal will not affect flooding or flow regimes for the study area. Soil erosion and run-off control measures and weed control (over a 3-year period) will be implemented as part of the mitigation measures undertaken for the proposal, thereby reducing potential impacts of the proposal to potential habitat for this species.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

Overall, the distribution of the Greater Long-eared Bat coincides approximately with the Murray Darling Basin and the western slopes of the Great Dividing Range across south east Australia from south central Queensland through inland NSW to just south of the Murray River in Victoria and north of the Murray River in eastern South Australia (Churchill 2008). Given the distribution of the Greater Long-eared Bat coincides approximately with the Murray Darling Basin, the species is close to the limit of its known distribution at Crudine Ridge.

How is the proposal likely to affect current disturbance regimes?

Current disturbances at the site include cattle and sheep grazing, grazing by feral animals including the European Rabbit and Goat, and periods of drought and rainfall consistent with the southern oscillation index and resultant cycles of drought (El Niño) and wetter periods (La Niña). There has been no major fire event in the last decade.

The proposal is unlikely to exacerbate grazing at the site. It may, in fact, contribute to a more sustainable grazing regime through the mitigation measures proposed in some parts of the site. In the absence of fire, grazing can be an important form of disturbance to prevent the accumulation of biomass that may not be favourable to some native flora species. Rotational periods of grazing and spelling help to foster healthy native pastures in the absence of fire.

The proposal is also unlikely to contribute to increasing feral animal activity across the project site and instead is likely to assist with the management of these species through the proposed mitigation measures to be implemented within the study area and on the proposed offset sites. No adverse impacts to potential Greater Long-eared Bat habitat is expected to result from a reduction in grazing pressure from livestock and feral animals.

The proposal is unlikely to alter the current fire regime at the study area. The risk of fire with wind farms is inherently low (CFA 2007). The location of wind turbines away from tall vegetation in the study area minimises the risk of fire. It is unlikely that the proposal will significantly affect the fire regime such that high intensity fire would have a detrimental impact on Greater Long-eared Bat foraging and roosting habitat. The proposed access roads will increase the accessibility across the site should a fire occur.

Threats to the Greater Long-eared Bat include poisoning from pesticides (OEH 2011b). It is unlikely that any pesticides used in feral animal management will impact on the species given insect control is unlikely to be required. The application of herbicides should be restricted when alternative methods are available.

The proposal has the potential to increase erosion, sedimentation and runoff through the clearing of vegetation and the construction of roads, and produce conditions favourable to weed invasion. However, any increases in run-off in areas where the ground within the construction area will be compacted, gravelled or concreted will be small and localised. The proposal will not affect flooding or flow regimes for the study area. Soil erosion and run-off control measures and weed control will be implemented as part of the mitigation measures undertaken for the proposal.

How is the proposal likely to affect habitat connectivity?

The woodland and open forest areas of the project site naturally have large canopy gaps and a very open and more often absent understorey. Given the narrow linear nature of the proposal, sited on mostly cleared areas, it is unlikely that the proposal would create barriers to movement of Greater Long-eared Bat, which is a mobile species, throughout the project site. The main habitat corridor through the project site along the eastern slopes of Crudine Ridge will be largely retained.

During the operational phase of the wind farm, there is a risk that Greater Long-eared Bat will accidentally collide with the moving turbines, affecting habitat connectivity. However, Greater Long-eared Bat moving about a location in the course of routine foraging most likely do so in the under-storey below the height of the canopy. Thus, it is unlikely that the proposal will impact on habitat connectivity during the operational phase of the wind farm.

How is the proposal likely to affect critical habitat?

Not applicable - critical habitat cannot be declared for vulnerable species.

Saccolaimus flaviventris* (Yellow-bellied Sheathtail-bat*)

The Yellow-bellied Sheathtail-bat is listed as a vulnerable species under the TSC Act. It is a wide-ranging species found across northern and eastern Australia, and occurs across NSW. In the most southerly part of its range, most of Victoria, south-western NSW and adjacent South Australia, it is a rare visitor in late summer and autumn. There are scattered records of this species across the New England Tablelands and North West Slopes (OEH 2011b).

Yellow-bellied Sheathtail-bat forages in most habitats across its very wide range, with and without trees (wet and dry sclerophyll forest, open woodland, Acacia shrubland, mallee, grasslands and desert; Churchill 2008, OEH 2011b). The species appears to defend an aerial territory. While foraging for insects, the species flies high and fast over the forest canopy, but lower in more open country and at the forest edge (Churchill 2008, OEH 2011b).

The species roosts singly or in groups of up to six, in tree hollows and buildings. In treeless areas the species is known to use mammal burrows. Breeding has been recorded from December to mid-March, when a single young is born. Seasonal movements are unknown; there is speculation about a migration to southern Australia in late summer and autumn (OEH 2011b).

Harp trapping and anabat surveys were conducted in areas of suitable habitat across the proposed study area and project site mainly during November 2008 and January 2009, with some additional surveys conducted in March 2011. The Yellow-bellied Sheathtail-bat was detected with a low level of certainty in anabat analyses (a possible detection, where detections have a medium to high probability of confusion with species with similar calls) from two calls. The species was recorded in the project site, just outside of the study area, in the Pyramul Cluster within RSSGRBLLB (pasture).

How is the proposal likely to affect the lifecycle of a threatened species and/or population?

The proposal could impact on the life cycle of the Yellow-bellied Sheathtail-bat by reducing the amount of foraging, roosting and breeding habitat available to the species, degrading their habitat (eg. through fragmentation), or increasing the species' mortality rates via collisions with turbines or through barotrauma.

Habitat for the Yellow-bellied Sheathtail-bat within the study area exists in areas of BPBGRS, RSSGRBLLB, WTG and WBBRGYB (wooded areas and pasture). The proposal will require 71.64 ha of permanent habitat loss and 31.58 ha of temporary loss within these vegetation communities.

While the proposal will remove habitat for the Yellow-bellied Sheathtail-bat, tree clearance for the proposal and hollow-bearing trees will be avoided wherever possible and the amount of trees being removed will be minimal with respect to the amount of potential habitat present for this species within the study area. Vegetation clearance is linear in nature and, therefore, will not result in large consolidated patches of vegetation clearance (the removal of any areas of potential habitat may result in the reduction of a territorial range but is unlikely to affect the entire territory). Only 6.67 % of habitat in the study area (1,547.61 ha) and 2.62 % of the project site (3,942.52 ha) will be removed. Further, the Yellow-bellied Sheathtail-bat is a wide-ranging forager, which occurs over areas lacking trees (Churchill 2008). The proposal will not significantly fragment the habitat of the species, which is highly mobile. Also, given habitat is widely spread across the project site, it is unlikely that the proposed wind farm would lead to the displacement of any individuals. Where the removal of habitat trees is required, a pre-clearance protocol will be developed and implemented to determine if roosts are present in hollows in any trees proposed for clearing. An ecologist will be present during clearing to capture and re-release individuals (where appropriate).

There is a risk that the Yellow-bellied Sheathtail-bat will accidentally collide with the moving turbines during the operational phase of the wind farm. The species forages at levels above the canopy, may roost on the project site, and may make migratory movements; there is speculation about a migration to southern Australia in late summer and autumn (OEH 2011b). As such, the risk matrix included in Appendix F considered the collision potential for this species to be high. There is the risk that this species may be impacted by barotrauma given that individuals could come into proximity of turbine blades.

Should the turbines require lighting, selection of lighting that minimises the likelihood of attracting insects and foraging bats should be used to reduce the risk of bat strike. Monitoring bat strike will be undertaken, and an adaptive management approach implemented whereby additional measures are investigated should significant bat strike at certain turbines be recorded.

How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

Vegetation representing foraging, roosting and breeding habitat for the Yellow-bellied Sheathtail-bat will be removed in linear strips (for turbines, access tracks and the associated ancillary structures required for the running of the wind farm), rather than one consolidated stand. As a worst case scenario, the area of vegetation to be cleared consists of a permanent loss of 71.64 ha and a temporary impact to 31.58 ha of potential habitat, totalling 103.22 ha.

However, the vegetation communities and habitat that will be lost represents 6.67 % of the potential habitat mapped within the study area, and 2.62 % of potential habitat mapped within the project site. Large wooded areas would remain in the project site. It is unlikely that the proposed vegetation clearance would impact on this species such that foraging, roosting or breeding resources would become limited within the study area. The removal of habitat trees, including trees with hollows, will be avoided where possible. However, where the removal of habitat trees is required, a pre-clearance protocol will be developed and implemented to determine if roosts are present in the tree hollows in any trees proposed for clearing. An ecologist will be present during clearing to capture and re-release individuals (where appropriate). The Yellow-bellied Sheathtail-bat is also highly mobile and would be able to access foraging, roosting and breeding resources in the locality. Thus, the proposal is unlikely to substantially reduce the amount of potential habitat for this species present within the project site.

The proposal may increase erosion, sedimentation and runoff through the clearing of vegetation and the construction of roads, and produce conditions favourable to weed invasion impacting on the species' habitat. However, any increases in run-off in areas where the ground within the construction area will be compacted, gravelled or concreted will be small and localised. The proposal will not affect flooding or flow regimes for the study area. Soil erosion and run-off control measures and weed control (over a 3-year period) will be implemented as part of the mitigation measures undertaken for the proposal, thereby reducing potential impacts of the proposal to potential habitat for this species.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

The Yellow-bellied Sheathtail-bat is a wide-ranging species found across northern and eastern Australia, and occurs across NSW. Thus, the species is not at the limit of its known distribution at Crudine Ridge.

How is the proposal likely to affect current disturbance regimes?

Current disturbances at the site include cattle and sheep grazing, grazing by feral animals including the European Rabbit and Goat, and periods of drought and rainfall consistent with the southern oscillation index and resultant cycles of drought (El Niño) and wetter periods (La Niña). There has been no major fire event in the last decade.

The proposal is unlikely to exacerbate grazing at the site. It may, in fact, contribute to a more sustainable grazing regime through the mitigation measures proposed in some parts of the site. In the absence of fire, grazing can be an important form of disturbance to prevent the accumulation of biomass that may not be favourable to some native flora species. Rotational periods of grazing and spelling help to foster healthy native pastures in the absence of fire.

The proposal is unlikely to contribute to increasing feral animal activity across the project site and instead is likely to assist with the management of these species through the proposed mitigation measures to be implemented within the study area and on the proposed offset sites. No adverse impacts to potential Yellow-bellied Sheathtail-bat habitat is expected to result from a reduction in grazing pressure from livestock and feral animals.

The proposal is unlikely to alter the current fire regime at the study area. The risk of fire with wind farms is inherently low (CFA 2007). The location of wind turbines away from tall vegetation in the study area minimises the risk of fire. It is unlikely that the proposal will significantly affect the fire regime such that high intensity fire would have a detrimental impact on Yellow-bellied Sheathtail-bat foraging and roosting habitat. The proposed access roads will increase the accessibility across the site should a fire occur.

Threats to the Yellow-bellied Sheathtail-bat include poisoning from pesticides (OEH 2011b). It is unlikely that any pesticides used in feral animal management will impact on the species given insect control is unlikely to be required. The application of herbicides should be restricted when alternative methods are available.

The proposal has the potential to increase erosion, sedimentation and runoff through the clearing of vegetation and the construction of roads, and produce conditions favourable to weed invasion. However, any increases in run-off in areas where the ground within the construction area will be compacted, gravelled or concreted will be small and localised. The proposal will not affect flooding or flow regimes for the study area. Soil erosion and run-off control measures and weed control will be implemented as part of the mitigation measures undertaken for the proposal.

How is the proposal likely to affect habitat connectivity?

The woodland and open forest areas of the project site naturally have large canopy gaps and a very open and more often absent understorey. Given the narrow linear nature of the proposal, sited on mostly cleared areas, it is unlikely that the proposal would create barriers to movement of the Yellow-bellied Sheathtail-bat, which is highly mobile, throughout the project site. The main habitat corridor through the project site along the eastern slopes of Crudine Ridge will be largely retained.

During the operational phase of the wind farm, there is a risk that Yellow-bellied Sheathtail-bat will accidentally collide with the moving turbines, affecting habitat connectivity. Much literature has been produced regarding potential impacts of wind farms on bats although most of the studies have been undertaken overseas. Bat strike will be monitored during the operation of the wind farm and an adaptive management approach implemented whereby additional measures are investigated should significant bat (and bird) strike at certain turbines be recorded.

How is the proposal likely to affect critical habitat?

Not applicable - critical habitat cannot be declared for vulnerable species.

***Vespadelus troughtoni* (Eastern Cave Bat)**

The Eastern Cave Bat is listed as a vulnerable species under the TSC Act. The Eastern Cave Bat is found in eastern Australia from Cape Melville in north Queensland to northern NSW (Churchill 2008). In NSW, it is found in a broad band on both sides of the Great Dividing Range from Cape York to Kempsey, with records from the New England Tablelands and the upper north coast of NSW. The western limit appears to be the Warrumbungle Range, and there is a single record from southern NSW, east of the ACT (OEH 2011b).

The Eastern Cave Bat is a predominantly cave-roosting species that is usually found in dry open forest and woodland, near cliffs or rocky overhangs. Occasionally, it has been found along cliff-lines in wet eucalypt forest and rainforest (OEH 2011b). Extensive surveys of forests in north eastern NSW has not recorded the species, suggesting that forests without natural roosting sites do not provide habitat for the species (Churchill 2008).

Little is understood of its feeding, roosting or breeding requirements or behaviour (OEH 2011b). However, the species forages over a small area. One male was observed foraging for 5 consecutive nights in an area of only 33 ha. Another male foraged along a creek, remaining less than 10 m above the surface and staying above the water rather than in the surrounding vegetation. They are capable of flying 500 m over cleared paddocks and have been observed hawking mosquitoes. Females appear to shift roosts with their young over few days (Churchill 2008).

The species has been recorded roosting in small groups in sandstone overhang caves, boulder piles, mines and occasionally in buildings and abandoned Fairy Martin nests, in colonies of 6-100 individuals (Churchill 2008), and in one instance, up to 500 individuals (OEH 2011b). Individuals roost near the entrance in reasonably well lit areas. Roost fidelity appears to be low (Churchill 2008).

Harp trapping and anabat surveys were conducted in areas of suitable habitat across the proposed study area and project site mainly during November 2008 and January 2009, with some additional surveys conducted in March 2011. The Eastern Cave Bat was detected with a low level of certainty in anabat analyses (a possible detection, where detections have a medium to high probability of confusion with species with similar calls) from two calls. The species was recorded at two locations within project site, within the Sallys Flat Cluster and between the Sallys Flat and Pyramul Clusters (trees).

How is the proposal likely to affect the lifecycle of a threatened species and/or population?

The proposal could impact on the life cycle of the Eastern Cave Bat by reducing the amount of foraging habitat available to the species, degrading their habitat (eg. through fragmentation), or increasing the species' mortality rates via collisions with turbines or through barotrauma. The proposal would have limited impact on the roosting or breeding habitat of the Eastern Cave Bat given the species primarily roosts and breeds in sandstone caves and rock overhangs.

Foraging habitat for the Eastern Cave Bat within the study area exists in areas of BPBGRS, RSSGRBLLB and WBBRGYB (wooded areas), although given the main areas where the species occurs lies further to the north, habitat in these communities may represent marginal habitat . The proposal will require 7.98 ha of permanent habitat loss and 1.65 ha of temporary loss within these vegetation communities.

While the proposal will remove habitat for the Eastern Cave Bat, tree clearance for the proposal will be avoided wherever possible and the amount of trees being removed will be minimal with respect to the amount of potential habitat present for this species within the study area. Vegetation clearance is linear in nature and, therefore, will not result in large consolidated patches of vegetation clearance (the

removal of any areas of potential habitat may result in the reduction of a territorial range but is unlikely to affect the entire territory). Only 4.33 % of habitat in the study area (222.17 ha) and 0.86 % of the project site (1,121.32 ha) will be removed. The proposal will not significantly fragment the habitat of the species. Also, given habitat is widely spread across the project site, it is unlikely that the proposed wind farm would lead to the displacement of any individuals.

There is a risk that Eastern Cave Bat will accidentally collide with the moving turbines during the operational phase of the wind farm. However, the species has been observed to forage at low levels (Churchill 2008). The species does not make large migratory movements. As such, the risk matrix included in Appendix F considered the collision potential for this species to be low. The risk of barotrauma is also likely to be low given that individuals would not be in the vicinity of turbine blades.

Should the turbines require lighting, selection of lighting that minimises the likelihood of attracting insects and foraging bats should be used to reduce the risk of bat strike. Monitoring bat strike will be undertaken, and an adaptive management approach implemented whereby additional measures are investigated should significant bat strike at certain turbines be recorded.

How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

Vegetation representing foraging habitat for the Eastern Cave Bat will be removed in linear strips (for turbines, access tracks and the associated ancillary structures required for the running of the wind farm), rather than one consolidated stand. As a worst case scenario, the area of vegetation to be cleared consists of a permanent loss of 7.98 ha and a temporary impact to 1.65 ha of potential habitat, totalling 9.63 ha.

However, the vegetation communities and habitat that will be lost represents 4.33 % of the potential habitat mapped within the study area, and 0.86 % of potential habitat mapped within the project site. Large wooded areas would remain in the project site. It is unlikely that the proposed vegetation clearance would impact on this species such that foraging resources would become limited within the study area. The proposal would not impact on preferred roosting or breeding habitat for the species (caves, overhangs). Thus, the proposal is unlikely to substantially reduce the amount of potential habitat for this species present within the project site. The Eastern Cave Bat would also be able to access foraging resources in the locality.

The proposal may increase erosion, sedimentation and runoff through the clearing of vegetation and the construction of roads, and produce conditions favourable to weed invasion impacting on the species' habitat. However, any increases in run-off in areas where the ground within the construction area will be compacted, gravelled or concreted will be small and localised. The proposal will not affect flooding or flow regimes for the study area. Soil erosion and run-off control measures and weed control (over a 3-year period) will be implemented as part of the mitigation measures undertaken for the proposal, thereby reducing potential impacts of the proposal to potential habitat for this species.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

The Eastern Cave Bat is found in a broad band on both sides of the Great Dividing Range from Cape York to Kempsey, with records from the New England Tablelands and the upper north coast of NSW. The western limit appears to be the Warrumbungle Range, and there is a single record from southern NSW, east of the ACT (OEH 2011b). Given the limit of the species is the Warrumbungle Range, the species is likely to be at the limit of its distribution at Crudine Ridge.

How is the proposal likely to affect current disturbance regimes?

Current disturbances at the site include cattle and sheep grazing, grazing by feral animals including the European Rabbit and Goat, and periods of drought and rainfall consistent with the southern oscillation index and resultant cycles of drought (El Niño) and wetter periods (La Niña). There has been no major fire event in the last decade.

The proposal is unlikely to exacerbate grazing at the site. It may, in fact, contribute to a more sustainable grazing regime through the mitigation measures proposed in some parts of the site. In the absence of fire, grazing can be an important form of disturbance to prevent the accumulation of biomass that may not be favourable to some native flora species. Rotational periods of grazing and spelling help to foster healthy native pastures in the absence of fire, which in turn can affect the abundance of invertebrates available as a food resource to microbats.

The proposal is also unlikely to contribute to increasing feral animal activity across the project site and instead is likely to assist with the management of these species through the proposed mitigation measures to be implemented within the study area and on the proposed offset sites. No adverse impacts to potential Eastern Cave Bat habitat is expected to result from a reduction in grazing pressure from livestock and feral animals.

The proposal is unlikely to alter the current fire regime at the study area. The risk of fire with wind farms is inherently low (CFA 2007). A low risk is associated with malfunctioning turbine bearings, inadequate crankcase lubrication, cable damage during rotation, electrical shorting or arcing occurring in transmission and distribution facilities (CFA 2007). A large portion of the study area is grassland and turbines in woodland areas have been located at least 30 m from trees wherever possible, therefore it unlikely that the proposal will dramatically alter fire patterns across the study area. Furthermore, a number of mitigation measures will be implemented during construction to prevent accidental fires and access to the study area for firefighting appliances will improve due to the construction of tracks.

Threats to the Eastern Cave Bat include poisoning from pesticides (OEH 2011b). It is unlikely that any pesticides used in feral animal management will impact on the species given insect control is unlikely to be required. The application of herbicides should be restricted when alternative methods are available.

The proposal has the potential to increase erosion, sedimentation and runoff through the clearing of vegetation and the construction of roads, and produce conditions favourable to weed invasion. However, any increases in run-off in areas where the ground within the construction area will be compacted, gravelled or concreted will be small and localised. The proposal will not affect flooding or flow regimes for the study area. Soil erosion and run-off control measures and weed control will be implemented as part of the mitigation measures undertaken for the proposal.

How is the proposal likely to affect habitat connectivity?

The woodland and open forest areas of the project site naturally have large canopy gaps and a very open and more often absent understorey. Given the narrow linear nature of the proposal, sited on mostly cleared areas, it is unlikely that the proposal would create barriers to movement of Eastern Cave Bat throughout the project site. The main habitat corridor through the project site along the eastern slopes of Crudine Ridge will be largely retained.

During the operational phase of the wind farm, there is a risk that Eastern Cave Bat will accidentally collide with the moving turbines, affecting habitat connectivity. However, Eastern Cave Bats moving about a location in the course of routine foraging most likely do so at low levels below the height of the canopy. Thus, it is unlikely that the proposal will impact on habitat connectivity during the operational

phase of the wind farm.

How is the proposal likely to affect critical habitat?

Not applicable - critical habitat cannot be declared for vulnerable species.

Birds – potential to occur

***Anthochaera phrygia* (Regent Honeyeater)**

The Regent Honeyeater is listed as critically endangered under the TSC Act and as endangered and migratory under the EPBC Act. Once recorded between Adelaide and the central coast of Queensland, its range has contracted dramatically in the last 30 years to between north-eastern Victoria and south-eastern Queensland (OEH 2011b).

The Regent Honeyeater inhabits dry open forest and woodland, particularly Box-Ironbark woodland, and riparian forests of River She-oak that support a significantly high abundance and richness of bird species. These woodlands have significantly large numbers of mature trees, high canopy cover and abundance of mistletoes. Every few years non-breeding flocks are seen foraging in flowering coastal Swamp Mahogany and Spotted Gum forests, particularly on the central coast and occasionally on the upper north coast. Birds are occasionally seen on the south coast (OEH 2011b).

The Regent Honeyeater is a generalist forager, which mainly feeds on the nectar from a wide range of eucalypts and mistletoes. Key eucalypt species include Mugga Ironbark, Yellow Box, Blakely's Red Gum, White Box and Swamp Mahogany. This species also utilises: *E. microcarpa*, *E. punctata*, *E. polyanthemos*, *E. moluccana*, *Corymbia robusta*, *E. crebra*, *E. caleyi*, *Corymbia maculata, E. mckieana*, *E. macrorhyncha*, *E. laevopinea* and *Angophora floribunda*. Nectar and fruit from the mistletoes *A. miquelii*, *A. pendula*, *A. cambagei* are also eaten during the breeding season. A shrubby understorey is an important source of insects and nesting material (OEH 2011b).

Colour-banding of Regent Honeyeater has shown that the species can undertake large-scale nomadic movements in the order of hundreds of kilometres. However, the exact nature of these movements is still poorly understood. It is likely that movements are dependent on spatial and temporal flowering and other resource patterns.

There are three known key breeding regions remaining: north-east Victoria (Chiltern-Albury), and in NSW at Capertee Valley and the Bundarra-Barraba region. In NSW, the distribution is very patchy and mainly confined to the two main breeding areas and surrounding fragmented woodlands, although other known breeding sites include the nearby Mudgee – Wollar region (Scientific Committee Final Determinations 2011). The species breeds between July and January in Box-Ironbark and other temperate woodlands and riparian gallery forest dominated by River She-oak. Regent Honeyeaters usually nest in horizontal branches or forks in tall mature eucalypts and She-oaks, although they also nest in mistletoe (OEH 2011b).

Diurnal bird surveys and opportunistic surveys were conducted in areas of suitable habitat across the proposed study area and project site during October and November 2008, and January 2009. The species was not recorded during field surveys, although it has been previously recorded in the locality: once (1996) to the north of the study area at upper Meroo (OEH 2011a), twice to the south of the study area near Crudine on Turondale Road approximately 2.5 km and just over 4 km south of the intersection with Hill End Road (records made in 1999 and 2003; BRC 2011), and four times to the north east or east of the study area at Lake Windamere (two records made in 1970 and 2003), Clandulla State Forest (one record made in 1993), and Ilford (one record made in 2004) (OEH 2011a).

How is the proposal likely to affect the lifecycle of a threatened species and/or population?

The proposal could impact on the life cycle of Regent Honeyeater by reducing the amount of foraging, sheltering and breeding habitat available to the species, degrading their habitat (eg. through fragmentation), changing foraging behaviour (through the removal of foraging habitat), or changing

migration / increasing the species' mortality rates through accidental strike with the turbines during operation of the wind farm.

Foraging habitat for the Regent Honeyeater within the study area exists in areas of BPBGRS, RSSGRBLLB and WBBRGYB (wooded areas and scattered trees within pasture). The study area lies approximately 40 km to the west of the Capertee Valley, one of the main breeding areas for the species, and approximately 55 km to the south west of the Mudgee – Wollar region, a less used breeding area, with the species known to breed in surrounding fragmented woodlands to the main breeding areas (OEH 2011b). The Regent Honeyeater mainly nests in mature eucalypts and she-oaks in Box-Ironbark and other temperate woodlands and riparian gallery forest dominated by River She-oak (OEH 2011b). The study area has limited Box-Gum Woodland and no riparian gallery forest. Thus, potential habitat within the study area is likely to represent foraging habitat only.

The proposal will permanently remove 11.19 ha and temporarily remove 3.15 ha of foraging habitat within the study area. However, tree clearance for the proposal will be avoided wherever possible and the amount of trees being removed will be minimal with respect to the amount of potential habitat present for this species within the study area. Only 4.96 % of habitat in the study area (288.65 ha) and 1.14 % of the project site (1,261.66 ha) will be removed. The proposal will not significantly fragment the foraging habitat of the species which is highly mobile. Also, given habitat is widely spread across the project site, it is unlikely that the proposed wind farm would lead to the displacement of any individuals.

During the operational phase of the wind farm, there is a risk that Regent Honeyeaters may accidentally collide with the moving turbines or change their migratory paths. The project site lies near known breeding areas (the Capertee Valley and Mudgee – Wollar region) and Regent Honeyeater is likely to be in the area. Much literature has been produced regarding potential impacts of wind farms on birds although most of the studies have been undertaken overseas. The impacts appear to be dependent on a number of factors including proximity to wetlands, migratory pathways, proximity to bird concentrations and forested areas.

A risk matrix was prepared for the recorded threatened species, commonly recorded species, and birds of prey recorded in the project site. If on site, the Regent Honeyeater is at likely to be at moderate to high risk of collision with turbines given it is migratory and that it moves between foraging areas at heights between 5 m and 50 m aboe the canopy. During the breeding season, Regent Honeyeaters in the Capertee Valley are unlikely to disperse far to forage. Nests may be located up to 1 km from the nearest preferred species of flowering eucalypts, though they are typically situated much closer to such foraging sites (DSEWPAC 2011b). When dispersing from the Capertee Valley following the breeding season, dispersal begins with short distance movements (up to 30 km) into forests on adjacent talus slopes during November and December. More extensive movements begin to occur in February, but the distances and destinations of these movements have yet to documented. Preliminary evidence suggests that dispersal is facilitated by narrow corridors of forest that extend from the valley floor to the talus slopes on the border of Wollemi National Park. There is no evidence of dispersal through the large areas of dry woodland on the sandstone plateau of the park (DSEWPAC 2011b).

Issues associated with bird strike have been addressed in the layout design to minimise the risk of bird strike where possible. Bird strike will be monitored during the operation of the wind farm and an adaptive management approach implemented whereby additional measures are investigated should significant bird strike at certain turbines be recorded.

However, given that preferred breeding habitat will not be impacted, a detrimental impact on the lifecycle of Regent Honeyeater is unlikely. An offset will be provided to compensate for the loss of foraging habitat and accident strike by the turbines will be monitored.

How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

Vegetation representing potential foraging habitat for Regent Honeyeater will be removed in linear strips (for turbines, access tracks and the associated ancillary structures required for the running of the wind farm), rather than one consolidated stand. As a worst case scenario, the area of vegetation to be cleared consists of a permanent loss of 11.19 ha and a temporary impact to 3.15 ha of potential foraging habitat, totalling 14.34 ha.

However, the vegetation communities and potential foraging habitat that will be lost represents 4.96 % of the potential foraging habitat mapped within the study area, and 1.14 % of potential foraging habitat mapped within the project site. It is unlikely that the proposed vegetation clearance would impact on this species such that foraging resources would become limited within the study area.

The proposal may increase erosion, sedimentation and runoff through the clearing of vegetation and the construction of roads, and produce conditions favourable to weed invasion impacting on the species' habitat. However, any increases in run-off in areas where the ground within the construction area will be compacted, gravelled or concreted will be small and localised. The proposal will not affect flooding or flow regimes for the study area. Soil erosion and run-off control measures and weed control (over a 3-year period) will be implemented as part of the mitigation measures undertaken for the proposal, thereby reducing potential impacts of the proposal to potential habitat for this species.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

The distribution of Regent Honeyeater originally encompassed a vast area within 300 km of the coast from Brisbane to Adelaide. Presently, the Regent Honeyeater is no longer found in South Australia and records from Queensland are now uncommon. The remaining population in Victoria and NSW is patchy, with little information available on the movement patterns of this highly mobile species. The reduction in the range of Regent Honeyeater is considered to have resulted from expanding agriculture and the clearing of 85 % of the box-ironbark woodlands, which were once extensively distributed across inland eastern Australia (DSEWPC 2011b). The proposed wind farm site is within the known range of the species and not at the limit of the species distribution.

How is the proposal likely to affect current disturbance regimes?

Current disturbances at the site include cattle and sheep grazing, soil disturbance and grazing by feral animals including the European Rabbit and Goat, and periods of drought and rainfall consistent with the southern oscillation index and resultant cycles of drought (El Niño) and wetter periods (La Niña). There have been no major fire events on the site in the last decade.

The proposal is unlikely to exacerbate over-grazing at the site, but may, in fact, contribute to a more sustainable grazing regime through the mitigation measures proposed in some parts of the site. In the absence of fire, grazing can be an important form of disturbance to prevent the accumulation of biomass that may not be favourable to some native flora species. Rotational periods of grazing and spelling help to foster healthy native pastures in the absence of fire. A spell in grazing may result in the increased regeneration of eucalypt feed trees for the Regent Honeyeater.

Grazing by feral animals such as the European Rabbit and Goat can reduce natural recruitment of eucalypt feed trees. The proposal is unlikely to contribute to increasing feral animal activity across the project site and instead is likely to assist with the management of these species through the proposed mitigation measures to be implemented within the study area and on the proposed offset sites.

The proposal is also unlikely to alter the current fire regime at the study area. The risk of fire with wind farms is inherently low (CFA 2007). A low risk is associated with malfunctioning turbine bearings, inadequate crankcase lubrication, cable damage during rotation, electrical shorting or arcing occurring in transmission and distribution facilities (CFA 2007). The location of wind turbines away from tall vegetation in the study area minimises the risk of fire. It is unlikely that the proposal will significantly affect the fire regime such that high intensity fire would have a detrimental impact on the Regent Honeyeater foraging habitat. The proposed access roads will increase the accessibility across the site should a fire occur.

The proposal has the potential to increase erosion, sedimentation and runoff through the clearing of vegetation and the construction of roads, and produce conditions favourable to weed invasion. However, any increases in run-off in areas where the ground within the construction area will be compacted, gravelled or concreted will be small and localised. The proposal will not affect flooding or flow regimes for the study area. Soil erosion and run-off control measures and weed control will be implemented as part of the mitigation measures undertaken for the proposal.

How is the proposal likely to affect habitat connectivity?

The woodland and open forest areas of the project site naturally have large canopy gaps and a very open and more often absent understorey. Given the narrow linear nature of the proposal, sited on mostly cleared areas, and the highly mobile nature of the Regent Honeyeater, which can move large distances in the 100s of km (the species is capable of dispersing more than 530 km; Scientific Committee Final Determinations 2011), it is unlikely that the proposal would create barriers to movement of Regent Honeyeater.

During the operational phase of the wind farm, there is a risk that the Regent Honeyeater will accidentally collide with the moving turbines, affecting habitat connectivity. Much literature has been produced regarding potential impacts of wind farms on birds although most of the studies have been undertaken overseas. The impacts appear to be dependent on a number of factors including proximity to wetlands, migratory pathways, proximity to bird concentrations and forested areas. However, the Regent Honeyeater is an arboreal species that forages mainly in the crowns of flowering trees (DSEWPAC 2011b).

Honeyeaters are thought to fly at or just above canopy height whilst foraging and move from ridge to ridge at a height between 5 m and 50 m above the canopy (pers comm. David Geering, OEH). Therefore, there is a risk that these species may also be struck by wind turbines when moving between foraging areas, particualrly in areas where White Box are present and when there is an abundant flowering event.

The likeklihood that honeyeaters would actively avoid the wind farm is also unknown. In the absence of sufficient studies or information, the likelihood of the Regent Honeyeater being struck cannot be accurately predicted. A commitment to monitoring strike across CRWF has been made. This will include the preparation of a bird and bat monitoring program prior to operation of the wind farm that, in consultation with OEH and SEWPAC, will identify the frequency of monitoring and reporting, the thresholds at which impacts are considered unacceptable and the adaptive management approaches which are acceptable.

How is the proposal likely to affect critical habitat?

Critical habitat for the Regent Honeyeater has not been declared.

***Burhinus grallarius* (Bush Stone-curlew)**

The Bush Stone-curlew is listed as an endangered species under the TSC Act. The Bush Stone-curlew is found throughout Australia except for the central southern coast and inland, the far south-east corner, and Tasmania. However, it is only common in northern Australia. In the south-east it is either rare or extinct throughout its former range (OEH 2011b).

The species inhabits open forests and woodlands with a sparse grassy groundlayer and fallen timber. It is largely nocturnal, being especially active on moonlit nights. During the day, Bush Stone-curlews are most commonly observed singly or in pairs roosting within or close to the edge of woodland remnants amongst fallen timber or ground litter (Johnson and Baker-Gabb 1994). It feeds on insects and small vertebrates, such as frogs, lizards and snakes.

Bush Stone-curlews nest directly on bare ground, with grass and leaves scraped away (Johnson and Baker-Gabb 1994). The nest site is typically in or near the edge of open grassy woodland or within a cleared paddock where there is good visibility across the surrounding lands (DEC 2006c). The same nesting areas may be used in successive years and some have been reported to have been used for almost 30 years (DEC 2006c). Two eggs are laid in spring and early summer (OEH 2011b). There may be more than one brood per season (DEC 2006c); however, a study in Victoria found that about half of breeding pairs manage to raise one young to independence each year (Johnson and Baker-Gabb 1994).

Information on home range characteristics of Bush Stone-curlews comes mainly from observational studies and anecdotal evidence. Home range sizes are likely to vary depending on the availability and proximity of roosting, foraging and breeding habitat (DEC 2006b). Home ranges appear much smaller during the breeding season compared to the non-breeding season.

Targeted survey for the Bush Stone-curlew was conducted within suitable habitat in the project site in November 2008. The species has not been recorded in the locality, nor was it recorded during the field survey. However, potential habitat for the species exists in the study area and project site.

How is the proposal likely to affect the lifecycle of a threatened species and/or population?

The proposal could impact on the life cycle of the Bush Stone-curlew by reducing the amount of foraging, roosting and breeding habitat available to the species. Bush Stone-curlews show some fidelity to roosting and breeding sites (DEC 2006b). It could also impact on the life cycle of the Bush Stone-curlew by degrading their habitat (eg. through fragmentation or disturbance), or changing foraging behaviour (through the removal of foraging habitat) through works associated with the construction phase of the wind farm.

Potential foraging, sheltering and breeding habitat for the Bush Stone-curlew is present within areas of

BPBGRS, RSSGRBLLB, WBBRGYB, and WTG. The proposal will permanently remove 71.64 ha and temporarily remove 31.58 ha of potential foraging, roosting and breeding habitat within the study area.

However, tree clearance for the proposal will be avoided wherever possible and the amount of trees and habitat elements preferred by the species (fallen timber and leaf litter) that will be removed will be minimal with respect to the amount of potential habitat present for this species within the study area. Further, vegetation clearance is linear in nature and, therefore, will not result in large consolidated patches of vegetation clearance (the removal of any areas of potential habitat may result in the reduction of a territorial range but is unlikely to affect the entire territory). Only 6.67 % of habitat in the study area (1,547.61 ha) and 2.62 % of the project site (3,942.52 ha) will be removed. The proposal will

not significantly fragment the foraging, roosting and breeding habitat of the species, which typically moves over 2 km during foraging excursions (DEC 2006b). Also, given habitat is widely spread across the project site, it is unlikely that the proposal would lead to the displacement of any individuals.

The Bush Stone-curlew is unlikely to fly at height as the species spends most of its time on the ground, taking food items from the ground, flying infrequently (generally only when frightened, to gain a better feeding ground or to socialise). Therefore, turbine strike is unlikely and the proposal is unlikely to affect the lifecycle of this species.

The species is susceptible to disturbance during its breeding season, and many breeding pairs have been recorded abandoning their nests following disturbance. It is possible that breeding pairs could be disturbed during the construction phase, or that nests could be present within clearance areas. Nesting sites are frequently located in relatively open areas, where ground cover is extremely low and/or sparse (less than 15cm). Nests are frequently recorded in areas lacking in native vegetation, such as mown lawns, ploughed paddocks and paddocks cut for hay, dirt and gravel roads, playing fields, vacant lots (DEC 2006b). Given this, surveys for Bush Stone-curlew nests will be conducted by a qualified ecologist (in conjunction with surveys for hollow-dependant fauna) prior to clearance works. Management measures outlined in the CEMP in relation to Bush Stone-curlew will be implemented should any Bush Stone-curlew nests be found during these surveys.

How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

The proposal will result in the permanent removal of 71.64 ha of woodland and the temporary loss of 31.58 ha of woodland representing potential foraging and sheltering/breeding habitat, totalling 103.22 ha. However, it is unlikely that the proposed vegetation clearance would impact on this species such that foraging and sheltering/breeding resources would become limited within the study area given that:

- Vegetation representing habitat for the Bush Stone-curlew will be removed in linear strips (for turbines, access tracks and the associated ancillary structures required for the running of the wind farm), rather than one consolidated stand. The species typically moves over 2 km during foraging excursions (DEC 2006b) and would be able to traverse cleared areas; and
- The habitat that will be lost represents a small area 6.67 % of the potential habitat mapped within the study area and 2.62 % of potential habitat mapped within the project site. Large areas of habitat would remain in the project site.

The proposal may increase erosion, sedimentation and runoff through the clearing of vegetation and the construction of roads, and produce conditions favourable to weed invasion impacting on the species' habitat. However, any increases in run-off in areas where the ground within the construction area will be compacted, gravelled or concreted will be small and localised. The proposal will not affect flooding or flow regimes for the study area. Soil erosion and run-off control measures and weed control (over a 3-year period) will be implemented as part of the mitigation measures undertaken for the proposal, thereby reducing potential impacts of the proposal to potential habitat for this species.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

The Bush Stone-curlew is found throughout Australia except for the central southern coast and inland, the far south-east corner, and Tasmania, although it is only common in northern Australia and in the

south-east it is either rare or extinct throughout its former range (OEH 2011b). The species is not at the limit of it distribution in the study area.

How is the proposal likely to affect current disturbance regimes?

Current disturbances at the site include cattle and sheep grazing, grazing by feral animals including the European Rabbit and Goat, and periods of drought and rainfall consistent with the southern oscillation index and resultant cycles of drought (El Niño) and wetter periods (La Niña). There has been no major fire event in the last decade.

The proposal is unlikely to alter the current fire regime at the study area. The risk of fire with wind farms is inherently low (CFA 2007). The location of wind turbines away from tall vegetation in the study area minimises the risk of fire. It is unlikely that the proposal will significantly affect the fire regime such that high intensity fire would have a detrimental impact on Bush Stone-curlew habitat. The proposed access roads will increase the accessibility across the site should a fire occur.

The proposal is also unlikely to exacerbate over-grazing at the site. It may, in fact, contribute to a more sustainable grazing regime through the mitigation measures proposed in some parts of the site. In the absence of fire, grazing can be an important form of disturbance to prevent the accumulation of biomass that may not be favourable to some native flora species. Rotational periods of grazing and spelling help to foster healthy native pastures and recruitment of eucalypts in the absence of fire.

As the Bush Stone-curlew nests on the ground, it is at high risk of predation by feral animals such as the European Red Fox. The proposal is unlikely to contribute to increasing feral animal activity across the project site and instead is likely to assist with the management of these species through the proposed mitigation measures to be implemented within the study area and on the proposed offset sites. No adverse impacts to potential Bush Stone-curlew habitat is expected to result from a reduction in grazing pressure from livestock and feral animals.

The proposal has the potential to increase erosion, sedimentation and runoff through the clearing of vegetation and the construction of roads, and produce conditions favourable to weed invasion. However, any increases in run-off in areas where the ground within the construction area will be compacted, gravelled or concreted will be small and localised. The proposal will not affect flooding or flow regimes for the study area. Soil erosion and run-off control measures and weed control will be implemented as part of the mitigation measures undertaken for the proposal.

How is the proposal likely to affect habitat connectivity?

The woodland and open forest areas of the study area have naturally large canopy gaps and a very open understorey. Given the linear nature of the proposal, sited on mostly cleared areas, it is unlikely that the proposal would create barriers to movement of Bush Stone-curlew throughout the project site; the species typically moves over 2 km during foraging excursions (DEC 2006b). The main habitat corridor through the project site along the eastern slopes of Crudine Ridge will be largely retained. Furthermore, given the ground-foraging habit of this species, it is unlikely that they would collide with turbines and hence turbines are unlikely to restrict movement across the project site.

How is the proposal likely to affect critical habitat?

Not applicable. Critical habitat has not been declared for this species.

***Callocephalon fimbriatum* (Gang Gang Cockatoo)**

The Gang Gang Cockatoo is listed as vulnerable under the TSC Act. It is distributed from southern Victoria through south- and central-eastern New South Wales. In New South Wales, the Gang-gang Cockatoo is distributed from the south-east coast to the Hunter region, and inland to the Central Tablelands and south-west slopes. It occurs regularly in the Australian Capital Territory. It is rare at the extremities of its range, with isolated records known from as far north as Coffs Harbour and as far west as Mudgee (OEH 2011b).

The Gang Gang Cockatoo is generally found in tall mountain forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests in summer. In winter, the species may occur at lower altitudes in drier more open eucalypt forests and woodlands, particularly in box-ironbark assemblages, or in dry forest in coastal areas, and is often found in urban areas. Gang Gang Cockatoo may also occur in sub-alpine Snow Gum *Eucalyptus pauciflora* woodland and occasionally in temperate rainforests, and as the species undertakes nomadic as well as seasonal movements, may occur at apparently random points within their range (OEH 2011b).

The species favours old growth attributes for nesting and roosting, requiring hollows in the trunks or large limbs of large trees in which to breed. Breeding usually occurs in tall mature sclerophyll forests that have a dense understorey, and occasionally in coastal forests. Nests are most commonly recorded in eucalypt hollows in live trees close to water. Breeding usually occurs between October and January, and individuals are likely to breed from around four years of age (OEH 2011b).

Diurnal bird surveys and opportunistic surveys were conducted in areas of suitable habitat across the proposed study area and project site during October and November 2008, and January 2009. The species was not recorded during field surveys, although it has been recorded on 3 occasions in the locality: once to the south of the study area near Crudine on Turondale Road approximately 2.5 km south of the intersection with Hill End Road (in 2002; BRC 2011), and twice (2007 and 2009) to the south east of the study area, near Razorback (Birds Australia 2011a).

How is the proposal likely to affect the lifecycle of a threatened species and/or population?

The proposal could impact on the life cycle of Gang Gang Cockatoo by reducing the amount of foraging and sheltering habitat available to the species (the study area does not support breeding habitat), degrading their foraging habitat (eg. through fragmentation), changing foraging behaviour (through the removal of foraging habitat), or increasing the species' mortality rates through accidental strike with the turbines during operation of the wind farm.

Foraging habitat for the Gang Gang Cockatoo within the study area exists in areas of BPBGRS, RSSGRBLLB and WBBRGYB (wooded areas and scattered trees within pasture). The proposal will permanently remove 7.98 ha and temporarily remove 1.65 ha of foraging habitat within the study area.

However, tree clearance for the proposal will be avoided wherever possible and the amount of trees being removed will be minimal with respect to the amount of potential habitat present for this species within the study area. Only 4.33 % of habitat in the study area (222.17 ha) and 0.86 % of the project site (1,121.32 ha) will be removed. The proposal will not significantly fragment the foraging habitat of the species which is highly mobile and makes regular seasonal and nomadic movements across large areas. Also, given habitat is widely spread across the project site, it is unlikely that the proposal would lead to the displacement of any individuals.

During the operational phase of the wind farm, there is a risk that Gang Gang Cockatoos will accidentally collide with the moving turbines. Much literature has been produced regarding potential

impacts of wind farms on birds although most of the studies have been undertaken overseas. The impacts appear to be dependent on a number of factors including proximity to wetlands, migratory pathways, proximity to bird concentrations and forested areas.

A risk matrix was prepared for the recorded threatened species, commonly recorded species, and birds of prey recorded in the project site. While the risk matrix did not include the Gang Gang Cockatoo, the results for parrots (e.g. Little Lorikeet, Crimson Rosella and Eastern Rosella) was moderate and is likely to be similar for the Gang Gang Cockatoo.

Issues associated with bird strike have been addressed in the layout design to minimise the risk of bird strike where possible. Bird strike will be monitored during the operation of the wind farm and an adaptive management approach implemented whereby additional measures are investigated should significant bird (and bat) strike at certain turbines be recorded.

However, given that breeding habitat will not be impacted, a detrimental impact on the lifecycle of Gang Gang Cockatoo is not anticipated. An offset will be prepared in accordance with the Biobanking tool to compensate for the loss of foraging habitat and accident strike by the turbines will be monitored.

How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

Vegetation representing potential foraging habitat for Gang Gang Cockatoo will be removed in linear strips (for turbines, access tracks and the associated ancillary structures required for the running of the wind farm), rather than one consolidated stand. As a worst case scenario, the area of vegetation to be cleared consists of a permanent loss of 7.98 ha and a temporary impact to 1.65 ha of potential foraging habitat, totalling 9.63 ha.

However, the vegetation communities and potential foraging habitat that will be lost represents 4.33 % of the potential foraging habitat mapped within the study area, and 0.86 % of potential foraging habitat mapped within the project site. It is unlikely that the proposed vegetation clearance would impact on this species such that foraging resources would become limited within the study area i.e. the proposal is unlikely to substantially reduce the amount of potential foraging habitat for this species present within the project site.

The proposal may increase erosion, sedimentation and runoff through the clearing of vegetation and the construction of roads, and produce conditions favourable to weed invasion impacting on the species' habitat. However, any increases in run-off in areas where the ground within the construction area will be compacted, gravelled or concreted will be small and localised. The proposal will not affect flooding or flow regimes for the study area. Soil erosion and run-off control measures and weed control (over a 3-year period) will be implemented as part of the mitigation measures undertaken for the proposal, thereby reducing potential impacts of the proposal to potential habitat for this species.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

The distribution of Gang Gang Cockatoo extends from southern Victoria through south- and central-eastern New South Wales. In New South Wales, the Gang-gang Cockatoo is distributed from the south-east coast to the Hunter region, and inland to the Central Tablelands and south-west slopes. While the study area lies within the distribution of Gang Gang Cockatoo, it is close to the limit of the range of Gang Gang Cockatoo, with the species occurring in the area mainly during winter months.

How is the proposal likely to affect current disturbance regimes?

Current disturbances at the site include cattle and sheep grazing, soil disturbance and grazing by feral animals including the European Rabbit and Goat, and periods of drought and rainfall consistent with the southern oscillation index and resultant cycles of drought (El Niño) and wetter periods (La Niña). There have been no major fire events on the site in the last decade.

The proposal is unlikely to exacerbate over-grazing at the site, but may, in fact, contribute to a more sustainable grazing regime through the mitigation measures proposed in some parts of the site. In the absence of fire, grazing can be an important form of disturbance to prevent the accumulation of biomass that may not be favourable to some native flora species. Rotational periods of grazing and spelling help to foster healthy native pastures in the absence of fire. A spell in grazing may result in the increased regeneration of eucalypt and acacia feed trees for the Gang Gang Cockatoo.

Grazing by feral animals such as the European Rabbit and Goat can reduce natural recruitment of eucalypt feed trees. The proposal is unlikely to contribute to increasing feral animal activity across the project site and instead is likely to assist with the management of these species through the proposed mitigation measures to be implemented within the study area and on the proposed offset sites.

The proposal is also unlikely to alter the current fire regime at the study area. The risk of fire with wind farms is inherently low (CFA 2007). A low risk is associated with malfunctioning turbine bearings, inadequate crankcase lubrication, cable damage during rotation, electrical shorting or arcing occurring in transmission and distribution facilities (CFA 2007). The location of wind turbines away from tall vegetation in the study area minimises the risk of fire. It is unlikely that the proposal will significantly affect the fire regime such that high intensity fire would have a detrimental impact on the foraging habitat of Gang Gang Cockatoo. The proposed access roads will increase the accessibility across the site should a fire occur.

The proposal has the potential to increase erosion, sedimentation and runoff through the clearing of vegetation and the construction of roads, and produce conditions favourable to weed invasion. However, any increases in run-off in areas where the ground within the construction area will be compacted, gravelled or concreted will be small and localised. The proposal will not affect flooding or flow regimes for the study area. Soil erosion and run-off control measures and weed control will be implemented as part of the mitigation measures undertaken for the proposal.

How is the proposal likely to affect habitat connectivity?

The woodland and open forest areas of the project site naturally have large canopy gaps and a very open and more often absent understorey. Given the narrow linear nature of the proposal, sited on mostly cleared areas, and the highly mobile nature of the Gang Gang Cockatoo, it is unlikely that the proposal would create barriers to movement of Gang Gang Cockatoo. The main habitat corridor through the project site along the eastern slopes of Crudine Ridge will be largely retained.

During the operational phase of the wind farm, there is a risk that Gang Gang Cockatoos will accidentally collide with the moving turbines, affecting habitat connectivity. Much literature has been produced regarding potential impacts of wind farms on birds although most of the studies have been undertaken overseas. The impacts appear to be dependent on a number of factors including proximity to wetlands, migratory pathways, proximity to bird concentrations and forested areas. These issues have been addressed in the layout design to minimise the risk of bird strike where possible. Bird strike will be monitored during the operation of the wind farm and an adaptive management approach implemented whereby additional measures are investigated should significant bird (and bat) strike at

certain turbines be recorded.

How is the proposal likely to affect critical habitat?

Not applicable - critical habitat cannot be declared for vulnerable species.

***Circus assimilus* (Spotted Harrier)**

The Spotted Harrier is listed as a vulnerable species under the TSC Act. It is distributed throughout the Australian mainland, except in densely forested or wooded habitats of the coast, escarpment and ranges, and rarely in Tasmania. In NSW, individuals disperse widely and comprise a single population (OEH 2011b).

Spotted Harrier occurs in grassy open woodland including acacia and mallee remnants, inland riparian woodland, grassland and shrub steppe, although it is found most commonly in native grassland. It also occurs in agricultural land, foraging over open habitats including edges of inland wetlands (OEH 2011b).

The species builds a stick nest in a tree and lays eggs in spring (or sometimes autumn), with young remaining in the nest for several months. Generation length is estimated as 10 years (Scientific Committee Final Determinations 2011).

The diet of the Spotted Harrier includes terrestrial mammals, (e.g. bandicoots, bettongs and rodents) birds and reptiles, occasionally large insects and rarely carrion. It was formerly heavily dependent on rabbits, but following the spread of rabbit calicivirus disease, and consequent decline in rabbit numbers by 65-85% in the arid and semi-arid zones, the Spotted Harrier is increasingly dependent on native prey. Many of its former native mammalian prey species are extinct in inland NSW. Many of the remaining key prey species (e.g. terrestrial grassland birds such as quail, button-quail, pipits, larks and songlarks) require ground cover and are sensitive to habitat degradation from grazing (Scientific Committee Final Determinations 2011).

Diurnal bird surveys and opportunistic surveys were conducted in areas of suitable habitat across the proposed study area and project site during October and November 2008, and January 2009. The species was not recorded during field surveys, but it has been predicted to occur in the locality by the Biobanking tool.

How is the proposal likely to affect the lifecycle of a threatened species and/or population?

The proposal could impact on the life cycle of Spotted Harrier by reducing the amount of habitat available to the species that may be used for both hunting and nesting, degrading their habitat (eg. through fragmentation), changing foraging behaviour (through the removal of foraging habitat), or increasing the species' mortality rates through accidental strike with the turbines during operation of the wind farm.

Potential foraging and breeding habitat for the Spotted Harrier within the study area exists in areas of

BPBGRS, RSSGRBLLB, and WBBRGYB(wooded areas and pasture). It also exists in WTG. The proposal will permanently remove 71.64 ha and temporarily remove 31.58 ha of potential foraging and breeding habitat within the study area.

However, tree clearance for the proposal will be avoided wherever possible and the amount of trees being removed will be minimal with respect to the amount of potential habitat present for this species within the study area. Only 6.67 % of habitat in the study area (1,547.61 ha) and 2.62 % of the project site (3,942.52 ha) will be removed. The proposal will not significantly fragment the foraging habitat of the species which is highly mobile, and nomadic in response to local conditions. Also, given habitat is widely spread across the project site, it is unlikely that the proposed wind farm would lead to the displacement of any individuals. Where the removal of habitat trees is required, a pre-clearance protocol will be developed and implemented to determine if nests are present in any trees proposed for clearing. An ecologist will be present during clearing to capture and re-release individuals (where

appropriate).

During the operational phase of the wind farm, there is a risk that Spotted Harriers will accidentally collide with the moving turbines. Much literature has been produced regarding potential impacts of wind farms on birds although most of the studies have been undertaken overseas. The impacts appear to be dependent on a number of factors including proximity to wetlands, migratory pathways, proximity to bird concentrations and forested areas.

A risk matrix was prepared for the threatened species, common species, and birds of prey recorded in the project site. While the risk matrix did not include the Spotted Harrier, the results showed that species considered to be at greatest risk are those that fly at high altitudes, at speed and are migratory. Raptors and birds of prey are known to sometimes collide with turbines whilst hunting prey. However, the Spotted Harrier is nomadic in response to local conditions, and tends to hunt low over vegetation (Simpson and Day 2004). Should the Spotted Harrier use the site at Crudine Ridge, the risk of collision with the turbines is considered likely to be moderate.

Issues associated with bird strike have been addressed in the layout design to minimise the risk of bird strike where possible. Bird strike will be monitored during the operation of the wind farm and an adaptive management approach implemented whereby additional measures are investigated should significant bird (and bat) strike at certain turbines be recorded.

However, given that the species was not recorded in the project site and extensive habitat is present, a detrimental impact on the lifecycle of Spotted Harrier is not anticipated. An offset will be prepared in accordance with the Biobanking tool to compensate for the loss of foraging habitat, and accident strike by the turbines will be monitored.

How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

Vegetation representing habitat for Spotted Harrier will be removed in linear strips (for turbines, access tracks and the associated ancillary structures required for the running of the wind farm), rather than one consolidated stand. As a worst case scenario, the area of vegetation to be cleared consists of a permanent loss of 71.64 ha and a temporary impact to 31.58 ha of potential habitat, totalling 103.22 ha.

However, the vegetation communities and habitat that will be lost represents 6.67 % of the potential habitat mapped within the study area, and 2.62 % of potential habitat mapped within the project site. It is unlikely that the proposed vegetation clearance would impact on this species such that prey species would become limited within the study area.

No breeding pairs or nests of the species were recorded during field survey. As such, it is unlikely that breeding habitat will be impacted.

The proposal may increase erosion, sedimentation and runoff through the clearing of vegetation and the construction of roads, and produce conditions favourable to weed invasion impacting on the species' habitat. However, any increases in run-off in areas where the ground within the construction area will be compacted, gravelled or concreted will be small and localised. The proposal will not affect flooding or flow regimes for the study area. Soil erosion and run-off control measures and weed control (over a 3-year period) will be implemented as part of the mitigation measures undertaken for the proposal, thereby reducing potential impacts of the proposal to potential habitat for this species.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

The Spotted Harrier is distributed throughout the Australian mainland, except in densely forested or wooded habitats of the coast, escarpment and ranges, and rarely in Tasmania. In NSW, individuals disperse widely and comprise a single population (OEH 2011b). Therefore, the Spotted Harrier is not at the limit of its known distribution at Crudine Ridge.

How is the proposal likely to affect current disturbance regimes?

Current disturbances at the site include cattle and sheep grazing, soil disturbance and grazing by feral animals including the European Rabbit and Goat, and periods of drought and rainfall consistent with the southern oscillation index and resultant cycles of drought (El Niño) and wetter periods (La Niña). There has been no major fire event in the last decade.

Grazing by feral animals such as the European Rabbit and Goat can reduce natural recruitment of canopy trees supporting prey species. The proposal is unlikely to exacerbate grazing at the site, but may, in fact, contribute to a more sustainable grazing regime through the mitigation measures proposed in some parts of the site. In the absence of fire, grazing can be an important form of disturbance to prevent the accumulation of biomass that may not be favourable to some native flora species. Rotational periods of grazing and spelling help to foster healthy native pastures in the absence of fire.

The proposal is unlikely to contribute to increasing feral animal activity across the project site and instead is likely to assist with the management of these species through the proposed mitigation measures to be implemented within the study area and on the proposed offset sites. No adverse impacts to potential Spotted Harrier habitat is expected to result from a reduction in grazing pressure from livestock and feral animals.

The proposal is also unlikely to alter the current fire regime at the study area. The risk of fire with wind farms is inherently low (CFA 2007). The location of wind turbines away from tall vegetation in the study area minimises the risk of fire. It is unlikely that the proposal will significantly affect the fire regime such that high intensity fire would have a detrimental impact on Spotted Harrier foraging and nesting habitat. The proposed access roads will increase the accessibility across the site should a fire occur.

Threats to the Spotted Harrier include secondary poisoning from rabbit baiting and rodenticides. Site management including rabbit control should consider alternatives to poisoning for the control of rabbits to avoid inadvertently poisoning higher food chain species like the Spotted Harrier.

The proposal has the potential to increase erosion, sedimentation and runoff through the clearing of vegetation and the construction of roads, and produce conditions favourable to weed invasion. However, any increases in run-off in areas where the ground within the construction area will be compacted, gravelled or concreted will be small and localised. The proposal will not affect flooding or flow regimes for the study area. Soil erosion and run-off control measures and weed control will be implemented as part of the mitigation measures undertaken for the proposal.

How is the proposal likely to affect habitat connectivity?

The woodland and open forest areas of the project site naturally have large canopy gaps and a very open and more often absent understorey. Given the narrow linear nature of the proposal, sited on mostly cleared areas, and the highly mobile nature of the Spotted Harrier, it is unlikely that the proposal would create barriers to movement of Spotted Harrier. The main habitat corridor through the project site along the eastern slopes of Crudine Ridge will be largely retained.

During the operational phase of the wind farm, there is a risk that Spotted Harrier will accidentally collide with the moving turbines. Much literature has been produced regarding potential impacts of wind farms on birds although most of the studies have been undertaken overseas. The impacts appear to be dependent on a number of factors including proximity to wetlands, migratory pathways, proximity to bird concentrations and forested areas. These issues have been addressed in the layout design to minimise the risk of bird strike where possible. Bird strike will be monitored during the operation of the wind farm and an adaptive management approach implemented whereby additional measures are investigated should significant bird (and bat) strike at certain turbines be recorded.

How is the proposal likely to affect critical habitat?

Not applicable - critical habitat cannot be declared for vulnerable species.

***Hieraaetus morphnoides* (Little Eagle)**

The Little Eagle is listed as a vulnerable species under the TSC Act and is found throughout the Australian mainland except in the most densely forested parts of the Dividing Range escarpment. It occurs as a single population throughout NSW (OEH 2011b).

The Little Eagle occupies habitats rich in prey within open eucalypt forest, woodland or open woodland. She-oak or acacia woodlands and riparian woodlands of interior NSW are also used. The species is a resident, territorial species and nests in tall living trees within a remnant patch, where pairs build a large stick nest in winter. The species lays two or three eggs during spring, and young fledge in early summer. Generation length has been estimated as 10 years (OEH 2011b, Scientific Committee Final Determinations 2011).

The Little Eagle eats birds, reptiles and mammals, occasionally adding large insects and carrion to its diet. It was formerly heavily dependent on rabbits, but following the spread of rabbit calicivirus disease, and consequent decline in rabbit numbers by 65-85% in the arid and semi-arid zones, the Little Eagle is increasingly dependent on native prey, although most of its former native mammalian prey species in inland NSW are extinct (terrestrial mammals of rabbit size or smaller, e.g. large rodents, bandicoots, bettongs, juvenile hare-wallabies and wallabies; Scientific Committee Final Determinations 2011).

Diurnal bird surveys and opportunistic surveys were conducted in areas of suitable habitat across the proposed study area and project site during October and November 2008, and January 2009. The species was not recorded during field surveys, although it has been previously recorded in the locality: once (2003) to the east of the study area at Aarons Pass off the Castlereagh Highway (OEH 2011a), and twice (1999 and 2000) to the west of the study area in the Lower Pyramul area, off Doughertys Junction Road (Birds Australia 2011a).

How is the proposal likely to affect the lifecycle of a threatened species and/or population?

The proposal could impact on the life cycle of Little Eagle by reducing the amount of habitat available to the species that may be used for both hunting and nesting, degrading their habitat (eg. through fragmentation), changing foraging behaviour (through the removal of foraging habitat), or increasing the species' mortality rates through accidental strike with the turbines during operation of the wind farm.

BPBGRS, RSSGRBLLB, WTG, and WBBRGYB(wooded areas and pasture). The proposal will permanently remove 71.64 ha and temporarily remove 31.58 ha of potential foraging and breeding habitat within the study area.

However, tree clearance for the proposal will be avoided wherever possible and the amount of trees being removed will be minimal with respect to the amount of potential habitat present for this species within the study area. Only 6.67 % of habitat in the study area (1,547.61 ha) and 2.62 % of the project site (3,942.52 ha) will be removed. The proposal will not significantly fragment the foraging habitat of the species which is highly mobile. Also, given habitat is widely spread across the project site, it is unlikely that the proposed wind farm would lead to the displacement of any individuals. Where the removal of habitat trees is required, a pre-clearance protocol will be developed and implemented to determine if nests are present in any trees proposed for clearing. An ecologist will be present during clearing to capture and re-release individuals (where appropriate).

During the operational phase of the wind farm, there is a risk that Little Eagles will accidentally collide with the moving turbines. Much literature has been produced regarding potential impacts of wind farms on birds although most of the studies have been undertaken overseas. The impacts appear to be dependent on a number of factors including proximity to wetlands, migratory pathways, proximity to bird

concentrations and forested areas.

A risk matrix was prepared for the threatened species, common species, and birds of prey recorded in the project site. While the risk matrix did not include the Little Eagle, the results showed that species considered to be at greatest risk are those that fly at high altitudes, at speed and are migratory. While the species is not known at the project site, should it utilise the site, the risk of collision with the turbines is considered likely to be moderate as raptors and birds of prey are known to sometimes collide with turbines whilst hunting prey.

Issues associated with bird strike have been addressed in the layout design to minimise the risk of bird strike where possible. Bird strike will be monitored during the operation of the wind farm and an adaptive management approach implemented whereby additional measures are investigated should significant bird (and bat) strike at certain turbines be recorded.

However, given that the species was not recorded in the project site, a detrimental impact on the lifecycle of Little Eagle is not anticipated. The species is resident in an area and is territorial (Scientific Committee Final Determinations 2011). An offset will be prepared in accordance with the Biobanking tool to compensate for the loss of foraging habitat, and accident strike by the turbines will be monitored.

How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

Vegetation representing habitat for Little Eagles will be removed in linear strips (for turbines, access tracks and the associated ancillary structures required for the running of the wind farm), rather than one consolidated stand. As a worst case scenario, the area of vegetation to be cleared consists of a permanent loss of 71.64 ha and a temporary impact to 31.58 ha of potential habitat, totalling 103.22 ha.

However, the vegetation communities and habitat that will be lost represents 6.67 % of the potential habitat mapped within the study area, and 2.62% of potential habitat mapped within the project site. It is unlikely that the proposed vegetation clearance would impact on this species such that prey species would become limited within the study area.

No breeding pairs or nests of the species were recorded during field survey. Given that the species is resident in an area and territorial (Scientific Committee Final Determinations 2011), it is unlikely that breeding habitat will be impacted.

The proposal may increase erosion, sedimentation and runoff through the clearing of vegetation and the construction of roads, and produce conditions favourable to weed invasion impacting on the species' habitat. However, any increases in run-off in areas where the ground within the construction area will be compacted, gravelled or concreted will be small and localised. The proposal will not affect flooding or flow regimes for the study area. Soil erosion and run-off control measures and weed control (over a 3-year period) will be implemented as part of the mitigation measures undertaken for the proposal, thereby reducing potential impacts of the proposal to potential habitat for this species.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

The Little Eagle is found throughout the Australian mainland excepting the most densely forested parts of the Dividing Range escarpment. It occurs as a single population throughout NSW. Therefore, the Little Eagle is not at the limit of its known distribution at Crudine Ridge.

How is the proposal likely to affect current disturbance regimes?

Current disturbances at the site include cattle and sheep grazing, soil disturbance and grazing by feral animals including the European Rabbit and Goat, and periods of drought and rainfall consistent with the southern oscillation index and resultant cycles of drought (El Niño) and wetter periods (La Niña). There has been no major fire event in the last decade.

Grazing by feral animals such as the European Rabbit and Goat can reduce natural recruitment of canopy trees supporting prey species. The proposal is unlikely to exacerbate grazing at the site, but may, in fact, contribute to a more sustainable grazing regime through the mitigation measures proposed in some parts of the site. In the absence of fire, grazing can be an important form of disturbance to prevent the accumulation of biomass that may not be favourable to some native flora species. Rotational periods of grazing and spelling help to foster healthy native pastures in the absence of fire.

The proposal is unlikely to contribute to increasing feral animal activity across the project site and instead is likely to assist with the management of these species through the proposed mitigation measures to be implemented within the study area and on the proposed offset sites. No adverse impacts to potential Little Eagle habitat is expected to result from a reduction in grazing pressure from livestock and feral animals.

The proposal is also unlikely to alter the current fire regime at the study area. The risk of fire with wind farms is inherently low (CFA 2007). The location of wind turbines away from tall vegetation in the study area minimises the risk of fire. It is unlikely that the proposal will significantly affect the fire regime such that high intensity fire would have a detrimental impact on Little Eagle foraging and nesting habitat. The proposed access roads will increase the accessibility across the site should a fire occur.

Threats to the Little Eagle include secondary poisoning from rabbit baiting. Site management including rabbit control should consider alternatives to poisoning for the control of rabbits to avoid inadvertently poisoning higher food chain species like the Little Eagle.

The proposal has the potential to increase erosion, sedimentation and runoff through the clearing of vegetation and the construction of roads, and produce conditions favourable to weed invasion. However, any increases in run-off in areas where the ground within the construction area will be compacted, gravelled or concreted will be small and localised. The proposal will not affect flooding or flow regimes for the study area. Soil erosion and run-off control measures and weed control will be implemented as part of the mitigation measures undertaken for the proposal.

How is the proposal likely to affect habitat connectivity?

The woodland and open forest areas of the project site naturally have large canopy gaps and a very open and more often absent understorey. Given the narrow linear nature of the proposal, sited on mostly cleared areas, and the highly mobile nature of the Little Eagle, it is unlikely that the proposal would create barriers to movement of Little Eagle. The main habitat corridor through the project site along the eastern slopes of Crudine Ridge will be largely retained.

During the operational phase of the wind farm, there is a risk that Little Eagle will accidentally collide with the moving turbines, affecting habitat connectivity. Much literature has been produced regarding potential impacts of wind farms on birds although most of the studies have been undertaken overseas. The impacts appear to be dependent on a number of factors including proximity to wetlands, migratory pathways, proximity to bird concentrations and forested areas. These issues have been addressed in the layout design to minimise the risk of bird strike where possible. Bird strike will be monitored during the operation of the wind farm and an adaptive management approach implemented whereby additional

measures are investigated should significant bird (and bat) strike at certain turbines be recorded.

How is the proposal likely to affect critical habitat?

Not applicable - critical habitat cannot be declared for vulnerable species.

***Daphoenositta chrysoptera* (Varied Sittella)**

The Varied Sittella is listed as a vulnerable species under the TSC Act. Varied Sittella has a widespread range across mainland Australia, excluding some areas of the arid interior (Nullabor, Pilbara and Simpson Desert). The species inhabits eucalypt forests and woodlands, especially rough-barked species and mature smooth-barked gums with dead branches, mallee and *Acacia* woodland (DECWW 2011b).

The Varied Sittella feeds on arthropods gleaned from crevices in rough bark, dead branches, standing dead trees, and from small branches and twigs in the tree canopy. The species builds a cup-shaped nest of plant fibres and cobwebs in an upright tree fork high in the living tree canopy, and individuals often re-uses the same fork or tree in successive years (OEH 2011b).

The Varied Sittella's population size in NSW is uncertain but is believed to have undergone a moderate reduction in population size on the basis of comparative atlas surveys over the past several decades. The apparent decline has been attributed to declining habitat cover and quality. The sedentary nature of the Varied Sittella makes cleared agricultural land a potential barrier to movement. Survival and population viability are sensitive to habitat isolation, reduced patch size and habitat simplification, including reductions in tree species diversity, tree canopy cover, shrub cover, ground cover, logs, fallen branches and litter (Scientific Committee Final Determinations 2011).

Diurnal bird surveys and opportunistic surveys were conducted in areas of suitable habitat across the proposed study area and project site during October and November 2008, and January 2009. The species was not recorded during field surveys, although it has been previously recorded in the locality: twice (both in 2002) to the south east of the study area, near Razorback (Birds Australia 2011a), and once (2009) to the south of the study area near Crudine on Turondale Road approximately 2.5 km south of the intersection with Hill End Road (Birds Australia 2011a).

How is the proposal likely to affect the lifecycle of a threatened species and/or population?

The proposal could impact on the life cycle of Varied Sittella by reducing the amount of foraging, sheltering and breeding habitat available to the species, degrading their habitat (eg. through fragmentation), or increasing the species' mortality rates via collisions with turbines.

Habitat for the Varied Sittella within the study area exists in areas of BPBGRS, RSSGRBLLB and WBBRGYB (wooded areas only). The proposal will require 7.98 ha of permanent habitat loss and 1.65 ha of temporary loss within these vegetation communities.

While the proposal will remove habitat for the Varied Sittella, tree clearance for the proposal will be avoided wherever possible, limiting clearance to small sections of grassy understorey, and the amount of trees being removed will be minimal with respect to the amount of potential habitat present for this species within the study area. Vegetation clearance is linear in nature and, therefore, will not result in large consolidated patches of vegetation clearance (the removal of any areas of potential habitat may result in the reduction of a territorial range but is unlikely to affect the entire territory). Only 4.33 % of habitat in the study area (222.17 ha) and 0.86 % of the project site (1,121.32 ha) will be removed. The proposal will not significantly fragment the habitat of the species that would cause it decline, with treed areas remaining within distances that could be traversed by the species (across a 6 m access road), or significantly reduce the area of woodland remnants remaining in the project site to a size that could not be used by the species (the sedentary nature of the Varied Sittella makes cleared land a potential barrier to movement. Survival and population viability are sensitive to habitat isolation, reduced patch size and habitat simplification; Scientific Committee Final Determinations 2011). Also, given habitat is

widely spread across the project site, it is unlikely that the proposal would lead to the displacement of any individuals. Where the removal of habitat trees is required, a pre-clearance protocol will be developed and implemented to determine if nests are present in any trees proposed for clearing. An ecologist will be present during clearing to capture and re-release individuals (where appropriate).

The Varied Sittella is unlikely to fly at height as it is a woodland foraging species that nests and forages at the tree canopy level. Therefore, turbine strike where turbines occur throughout open parts of woodland is unlikely. Given the flight habits of this species, the potential for this species being struck by turbines due to movement between woodland patches is considered low. Therefore the proposal is unlikely to affect the lifecycle of this species.

How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

Vegetation representing habitat for the Varied Sittella will be removed in linear strips (for turbines, access tracks and the associated ancillary structures required for the running of the wind farm), rather than one consolidated stand. As a worst case scenario, the area of vegetation to be cleared consists of a permanent loss of 7.98 ha and a temporary impact to 1.65 ha of potential habitat, totalling 9.63 ha.

However, the vegetation communities and habitat that will be lost represents 4.33 % of the potential habitat mapped within the study area, and 0.86 % of potential habitat mapped within the project site. Large contiguous wooded areas, required by the species, would remain in the project site. It is unlikely that the proposed vegetation clearance would impact on this species such that foraging and nesting resources would become limited within the study area; the majority of clearing would be in pasture rather than wooded areas with habitat elements such as a shrub layer, fallen logs and leaf litter, required by the species. Thus, the proposal is unlikely to substantially reduce the amount of potential habitat for this species present within the project site.

Where the removal of habitat trees is required, a pre-clearance protocol will be developed and implemented to determine if nests are present in any trees proposed for clearing. An ecologist will be present during clearing to capture and re-release individuals (where appropriate).

The proposal may increase erosion, sedimentation and runoff through the clearing of vegetation and the construction of roads, and produce conditions favourable to weed invasion impacting on the species' habitat. However, any increases in run-off in areas where the ground within the construction area will be compacted, gravelled or concreted will be small and localised. The proposal will not affect flooding or flow regimes for the study area. Soil erosion and run-off control measures and weed control (over a 3-year period) will be implemented as part of the mitigation measures undertaken for the proposal, thereby reducing potential impacts of the proposal to potential habitat for this species.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

The Varied Sittella is sedentary and inhabits most of mainland Australia except the treeless deserts and open grasslands. Distribution in NSW is nearly continuous from the coast to the far west (OEH 2011b). Therefore, the Crudine Ridge site is not at the limit of the Varied Sittella's known distribution.

How is the proposal likely to affect current disturbance regimes?

Current disturbances at the site include cattle and sheep grazing, soil disturbance and grazing by feral animals including the European Rabbit and Goat, and periods of drought and rainfall consistent with the southern oscillation index and resultant cycles of drought (El Niño) and wetter periods (La Niña). There

have been no major fire events on the site in the last decade.

A high intensity fire would result in a temporary loss of foraging habitat for the Varied Sittella and place the species at greater risk from predation by raptors during breeding. However the risk of fire with wind farms is inherently low (CFA 2007); the proposal is unlikely to alter the current fire regime at the study area. The location of wind turbines away from tall vegetation in the study area minimises the risk of fire. It is unlikely that the proposal will significantly affect the fire regime such that high intensity fire would have a detrimental impact on Varied Sittella habitat. The proposed access roads will increase the accessibility across the site should a fire occur.

The proposal is also unlikely to exacerbate grazing at the site, which could reduce the availability of insects as a food source for the Varied Sittella. It may, in fact, contribute to a more sustainable grazing regime through the mitigation and offset measures proposed in some parts of the site. In the absence of fire, grazing can be an important form of disturbance to prevent the accumulation of biomass that may not be favourable to some native flora species. Rotational periods of grazing and spelling help to foster healthy native pastures in the absence of fire.

The proposal has the potential to increase erosion, sedimentation and runoff through the clearing of vegetation and the construction of roads, and produce conditions favourable to weed invasion. However, any increases in run-off in areas where the ground within the construction area will be compacted, gravelled or concreted will be small and localised. The proposal will not affect flooding or flow regimes for the study area. Soil erosion and run-off control measures and weed control will be implemented as part of the mitigation measures undertaken for the proposal.

How is the proposal likely to affect habitat connectivity?

The apparent reduction in numbers of Varied Sittella has been attributed to declining habitat. The sedentary nature of the Varied Sittella makes cleared land a potential barrier to movement (OEH 2011b). However, the woodland and open forest areas of the study area have naturally large canopy gaps and a very open understorey. Given that vegetation removal is to occur as a narrow linear corridor, rather than one consolidated stand, it is unlikely that the proposal would create barriers to movement of Varied Sittella between woodland areas. The main habitat corridor through the project site along the eastern slopes of Crudine Ridge will be largely retained. Furthermore, given the flight characteristics of this species, it is unlikely that they would collide with turbines and hence turbines are unlikely to restrict movement across the project site.

How is the proposal likely to affect critical habitat?

Not applicable - critical habitat cannot be declared for vulnerable species.

***Lathamus discolour* (Swift Parrot)**

The Swift Parrot is listed as an endangered species under the TSC Act and an endangered and marine species under the EPBC Act. The Swift Parrot breeds in Tasmania during spring and summer, migrating in the autumn and winter months to south-eastern Australia from Victoria and the eastern parts of South Australia to south-east Queensland. In NSW this species mostly occurs on the coast and south west slopes (OEH 2011b).

This species migrates to the Australian south-east mainland between March and October. On the mainland they occur in areas where eucalypts are flowering profusely or where there are abundant lerp (from sap-sucking bugs) infestations, which are often on drainage lines and around slopes (OEH 2011b).

Favoured feed trees are winter-flowering species such as *Eucalyptus robusta* (Swamp Mahogany), *Corymbia maculata* (Spotted Gum), *C. gummifera* (Red Bloodwood), *E. sideroxylon* (Mugga Ironbark) and *E. albens* (White Box). Commonly used lerp infested trees include *E. microcarpa* (Inland Grey Box), *E. moluccana* (Grey Box) and *E. pilularis* (Blackbutt) (OEH 2011b). Swift Parrots also use insect-infested trees, which in the Crudine Ridge area, include *E. polyanthemos* (Red Box), *E. melliodora* (Yellow Box), and *E. blakelyi* (Blakely's Red Gum) (pers comm. Chris Tzaros, Birds Australia, July 2011).

Following winter they return to Tasmania where they breed from September to January, nesting in old trees with hollows and feeding in forests dominated by *Eucalyptus globulus* (Tasmanian Blue Gum) (OEH 2011b).

Diurnal bird surveys and opportunistic surveys were conducted in areas of suitable habitat across the proposed study area and project site during October and November 2008, and January 2009. The Swift Parrot was not recorded during field surveys, given that they were not conducted during the period where the species is present on the mainland. However, the species has been previously recorded in the locality (in 2002) to the south of the study area near Crudine on Turondale Road approximately 2.5 km south of the intersection with Hill End Road (BRC 2011). There is potential for the species to use the project site during their time on the mainland due to the presence of eucalyptus species which are prone to insect infestation *E. polyanthemos* (Red Box) *E. melliodora* (Yellow Box) and *E. blakelyi* (Blakely's Red Gum). *Eucalyptus blakelyi* is also winter-flowering, as is *E. goniocalyx* (Long-leaved Box), although the latter is not a prolific flowerer and is thus less likely to be used by the Swift Parrot (*pers comm*. Chris Tzaros, Birds Australia, July 2011).

How is the proposal likely to affect the lifecycle of a threatened species and/or population?

The proposal could impact on the life cycle of Swift Parrot by reducing the amount of foraging habitat available to the species, degrading the potential habitat, changing foraging behaviour (through the removal of foraging habitat), or increasing the species' mortality rates through accidental strike with the turbines during operation of the wind farm. No breeding habitat would be impacted by the proposal as the species does not breed on the mainland (it is a summer breeding migrant to Tasmania).

Potential foraging habitat for Swift Parrot is present within areas of BPBGRS, RSSGRBLLB and WBBRGYB (wooded areas and scattered trees within pasture). The proposal will permanently remove 3.15 ha and temporarily remove 11.19 ha of foraging habitat within the study area.

However, tree clearance for the proposal will be avoided wherever possible and the amount of trees being removed will be minimal with respect to the amount of potential habitat present for this species within the study area. Only 4.96 % of habitat in the study area (288.65 ha) and 1.14 % of the project site

(1261.66 ha) will be removed. The proposal will not significantly fragment the foraging habitat of the species which is highly mobile. Also, given habitat is widely spread across the project site, it is unlikely that the proposed wind farm would lead to the displacement of any individuals.

During the operational phase of the wind farm, there is a risk that Swift Parrots will accidentally collide with the moving turbines. The species is known to collide with objects such as wire netting fences, windows and cars (OEH 2011b). Much literature has been produced regarding potential impacts of wind farms on birds although most of the studies have been undertaken overseas. The impacts appear to be dependent on a number of factors including proximity to wetlands, migratory pathways, proximity to bird concentrations and forested areas.

A risk matrix was prepared for the recorded threatened species, commonly recorded species, and birds of prey recorded in the project site. While the risk matrix did not include the Swift Parrot, the results for other parrots (e.g. Little Lorikeet, Crimson Rosella and Eastern Rosella) was moderate and is likely to be similar for the Swift Parrot. However, the Swift Parrot is a migratory species and, therefore, it likely to be at a slightly greater risk that the other parrots. Swift Parrots moving about a location in the course of routine foraging generally do so within the height of the trees in which they feed. Less frequent movements between sites, between feeding and roosting areas and on migration may be higher (Smales 2005).

A study of the cumulative impacts of collision with turbines on the overall population of Swift Parrot, predicted by the modelling for all current and presently proposed wind farms within the species' range, are very small. Results for the range of avoidance rates modelled equate to slightly more or less than one parrot killed due to wind turbine collisions every ten years (Smales 2005).

Under the Swift Parrot Recovery Plan (Swift Parrot Recovery Team 2001) the two key threats to the species are loss of habitat and mortality, primarily through collision with artificial objects. One of the recovery actions for the species listed in the Plan is to reduce the incidence of swift parrot collisions with manmade structures including chain-link fences, windows and vehicles. Most likely these collisions occur principally where birds can see through glass or mesh without perceiving them to be barriers (Smales 2005).

Wind turbines are solid, structures and the risks posed by moving rotors are generally within the height range of between 30 and 120 metres above the ground. It is thus unlikely that the types of collision situations that the parrot presently encounters in urban environments will exist at wind farms (Smales 2005).

Therefore, the proposed wind farm at Crudine Ridge is unlikely to have a negative impact on the lifecycle of the Swift Parrot. The clearing of potential foraging habitat is low although there is the risk of collision with the turbines when moving between foraging areas.

How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

Vegetation representing habitat for Swift Parrots will be removed in linear strips (for turbines, access tracks and the associated ancillary structures required for the running of the wind farm), rather than one consolidated stand. As a worst case scenario, the area of vegetation to be cleared consists of a permanent loss of 11.19 ha and a temporary impact to 3.15 ha of potential habitat, totalling 14.34 ha.

However, the vegetation communities and habitat that will be lost represents 4.96 % of the potential habitat mapped within the study area, and 1.14 % of potential habitat mapped within the project site. It is unlikely that the proposed vegetation clearance would impact on this species such that foraging

resources would become limited within the study area i.e. the proposal is unlikely to substantially reduce the amount of potential foraging habitat for this species present within the project site.

Swift Parrot does not breed on the mainland. Thus, no breeding habitat will be impacted.

The proposal may increase erosion, sedimentation and runoff through the clearing of vegetation and the construction of roads, and produce conditions favourable to weed invasion impacting on the species' habitat. However, any increases in run-off in areas where the ground within the construction area will be compacted, gravelled or concreted will be small and localised. The proposal will not affect flooding or flow regimes for the study area. Soil erosion and run-off control measures and weed control (over a 3-year period) will be implemented as part of the mitigation measures undertaken for the proposal, thereby reducing potential impacts of the proposal to potential habitat for this species.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

In NSW, the Swift Parrot mostly occurs on the coast and south west slopes, but its range extends from Victoria and the eastern parts of South Australia to south-east Queensland (OEH 2011b). Therefore, Crudine Ridge is not at the limit of the Swift Parrot's known distribution.

How is the proposal likely to affect current disturbance regimes?

Current disturbances at the site include cattle and sheep grazing, soil disturbance and grazing by feral animals including the European Rabbit and Goat, and periods of drought and rainfall consistent with the southern oscillation index and resultant cycles of drought (El Niño) and wetter periods (La Niña). There have been no major fire events on the site in the last decade.

Fire regimes that impact foraging habitat are of most relevance to the Swift Parrot. However, the proposal is unlikely to alter the current fire regime at the study area. The risk of fire with wind farms is inherently low (CFA 2007). The location of wind turbines away from tall vegetation in the study area minimises the risk of fire. It is unlikely that the proposal will significantly affect the fire regime such that high intensity fire would have a detrimental impact on Swift Parrot foraging habitat. The proposed access roads will increase the accessibility across the site should a fire occur.

The proposal has the potential to increase erosion, sedimentation and runoff through the clearing of vegetation and the construction of roads, and produce conditions favourable to weed invasion. However, any increases in run-off in areas where the ground within the construction area will be compacted, gravelled or concreted will be small and localised. The proposal will not affect flooding or flow regimes for the study area. Soil erosion and run-off control measures and weed control will be implemented as part of the mitigation measures undertaken for the proposal.

How is the proposal likely to affect habitat connectivity?

The woodland and open forest areas of the project site naturally have large canopy gaps and a very open and more often absent understorey. Given the narrow linear nature of the proposal, sited on mostly cleared areas, and the highly mobile nature of the Swift Parrot, it is unlikely that the proposal would create barriers to movement of Swift Parrot. The main habitat corridor through the project site along the eastern slopes of Crudine Ridge will be largely retained.

During the operational phase of the wind farm, there is a risk that Swift Parrot will accidentally collide with the moving turbines, affecting habitat connectivity. However, Swift Parrots moving about a location in the course of routine foraging generally do so within the height of the trees in which they feed. While

movements between sites (between feeding and roosting areas and on migration) may be higher (Smales 2005), a study of the cumulative impacts of collision with turbines on the overall population of Swift Parrot, predicted by the modelling for all current and presently proposed wind farms within the species' range, are very small. Results for the range of avoidance rates modelled equate to slightly more or less than one parrot killed due to wind turbine collisions every ten years (Smales 2005). Further, wind turbines are solid, opaque structures and the risks posed by moving rotors are generally within the height range of between 30 and 120 metres above the ground. It is unlikely that the types of collision situations that the parrot presently encounters in urban environments will exist at wind farms (Smales 2005). Thus, it is unlikely that the proposal will impact on habitat connectivity during the operational phase of the wind farm.

How is the proposal likely to affect critical habitat?

Critical habitat for the Swift Parrot has not been declared.

***Melithreptus gularis gularis* (Black-chinned Honeyeater (eastern subspecies))**

The Black-chinned Honeyeater is listed as vulnerable under the TSC Act and has two subspecies, with only the nominate (*gularis*) occurring in NSW. The eastern subspecies extends south from central Queensland, through NSW, Victoria into south eastern South Australia, though it is very rare in the last state. In NSW it is widespread, with records from the tablelands and western slopes of the Great Dividing Range to the north-west and central-west plains and the Riverina. It is rarely recorded east of the Great Dividing Range, although regularly observed from the Richmond and Clarence River areas.

The Black-chinned Honeyeater occupies mostly upper levels of drier open forests or woodlands dominated by box and ironbark eucalypts, especially Mugga Ironbark (*Eucalyptus sideroxylon*), White Box (*E. albens*), Inland Grey Box (*E. microcarpa*), Yellow Box (*E. melliodora*) and Forest Red Gum (*E. tereticornis*). It also inhabits open forests of smooth-barked gums, stringybarks, ironbarks and tea-trees.

The species is gregarious, usually seen in pairs and small groups of up to 12 birds. Feeding territories are large making the species locally nomadic. Recent studies have found that the Black-chinned Honeyeater tends to occur in the largest woodland patches in the landscape, although birds forage over small home ranges of approximately 5 ha.

Individuals move quickly from tree to tree, foraging rapidly along outer twigs, underside of branches and trunks, probing for insects. Nectar is taken from flowers, and honeydew is gleaned from foliage. The species breeds solitarily or co-operatively, with up to five or six adults, from June to December. The nest is placed high in the crown of a tree, in the uppermost lateral branches, hidden by foliage. It is a compact, suspended, cup-shaped nest (OEH 2011b).

Diurnal bird surveys and opportunistic surveys were conducted in areas of suitable habitat across the proposed study area and project site during October and November 2008, and January 2009. The species was not recorded during field surveys, although it has been previously recorded in the locality: once (1972) to the south of the study area at Sofala (BRC 2011, OEH 2011a), and once to the south of the study area near Crudine on Turondale Road approximately 2.5 km south of the intersection with Hill End Road (1992; BRC 2011).

How is the proposal likely to affect the lifecycle of a threatened species and/or population?

The proposal could impact on the life cycle of Black-chinned Honeyeater by reducing the amount of foraging, sheltering and breeding habitat available to the species, degrading their habitat (eg. through fragmentation), or increasing the species' mortality rates via collisions with turbines.

Potential habitat for Black-chinned Honeyeater is present within areas of BPBGRS, RSSGRBLLB and WBBRGYB (wooded areas and trees within pasture). The proposal will require 11.19 ha of permanent potential habitat loss and 3.15 ha of temporary loss within these communities.

While the proposal will remove habitat for the Black-chinned Honeyeater, tree clearance for the proposal will be avoided wherever possible and the amount of trees being removed will be minimal with respect to the amount of potential habitat present for this species within the study area. Vegetation clearance is linear in nature and, therefore, will not result in large consolidated patches of vegetation clearance (the removal of any areas of potential habitat may result in the reduction of a territorial range but is unlikely to affect the entire territory). Only 4.96 % of habitat in the study area (288.65 ha) and 1.14 % of the project site (1261.66 ha) will be removed. The proposal will not significantly fragment the habitat of the species, or significantly reduce the area of woodland remnants remaining in the project site to a size that could not be used by the species (while the Black-chinned Honeyeater is mobile and

locally nomadic, the species appears unable to persist in remnants smaller than 200 ha with a home range of only 5 ha; Scientific Committee Final Determinations 2011). Also, given habitat is widely spread across the project site, it is unlikely that the proposed wind farm would lead to the displacement of any individuals. Where the removal of habitat trees is required, a pre-clearance protocol will be developed and implemented to determine if nests are present in any trees proposed for clearing. An ecologist will be present during clearing to capture and re-release individuals (where appropriate).

During the operational phase of the wind farm, there is a risk that Black-chinned Honeyeaters will accidentally collide with the moving turbines. Much literature has been produced regarding potential impacts of wind farms on birds although most of the studies have been undertaken overseas. The impacts appear to be dependent on a number of factors including proximity to wetlands, migratory pathways, proximity to bird concentrations and forested areas.

A risk matrix was prepared for the recorded threatened species, commonly recorded species, and birds of prey recorded in the project site. While the risk matrix did not include the Black-chinned Honeyeater, the results showed that species considered to be at greatest risk are those that fly at high altitudes, at speed and are migratory. The Black-chinned Honeyeater usually forages in the upper canopy and just above the canopy. While it is semi-nomadic, the species generally uses a small area, occupying a range of approximately 5 ha. Thus, as the Black-chinned Honeyeater is unlikely to fly at height while foraging and mostly moves within small areas, the risk of collision with the turbines is considered to be low.

Issues associated with bird strike have been addressed in the layout design to minimise the risk of bird strike where possible. Bird strike will be monitored during the operation of the wind farm and an adaptive management approach implemented whereby additional measures are investigated should significant bird (and bat) strike at certain turbines be recorded.

However, given that the species was not recorded in the project site, a detrimental impact on the lifecycle of Black-chinned Honeyeater is not anticipated. An offset will be prepared in accordance with the Biobanking tool to compensate for the loss of foraging habitat, and accident strike by the turbines will be monitored.

How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

Vegetation representing habitat for Black-chinned Honeyeater will be removed in linear strips (for turbines, access tracks and the associated ancillary structures required for the running of the wind farm), rather than one consolidated stand. As a worst case scenario, the area of vegetation to be cleared consists of a permanent loss of 11.19 ha and a temporary impact to 3.15 ha of potential habitat, totalling 14.34 ha.

However, the vegetation communities and habitat that will be lost represents 4.96 % of the potential habitat mapped within the study area, and 1.14 % of potential habitat mapped within the project site. Wooded areas larger than 200 ha, required by the species to persist in an area, would remain in the project site. It is unlikely that the proposed vegetation clearance would impact on this species such that foraging and sheltering resources (mostly tree canopies) would become limited within the study area.

Where the removal of habitat trees is required, a pre-clearance protocol will be developed and implemented to determine if nests are present in any trees proposed for clearing. An ecologist will be present during clearing to capture and re-release individuals (where appropriate).

The proposal may increase erosion, sedimentation and runoff through the clearing of vegetation and the

construction of roads, and produce conditions favourable to weed invasion impacting on the species' habitat. However, any increases in run-off in areas where the ground within the construction area will be compacted, gravelled or concreted will be small and localised. The proposal will not affect flooding or flow regimes for the study area. Soil erosion and run-off control measures and weed control (over a 3-year period) will be implemented as part of the mitigation measures undertaken for the proposal, thereby reducing potential impacts of the proposal to potential habitat for this species.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

The Black-chinned Honeyeater extends south from central Queensland, through NSW, Victoria into south eastern South Australia, though it is very rare in the last state. In NSW it is widespread, with records from the tablelands and western slopes of the Great Dividing Range to the north-west and central-west plains and the Riverina. It is rarely recorded east of the Great Dividing Range (OEH 2011b). Given the range of the Black-chinned Honeyeater across NSW, the species is not at the limit of its distribution at Crudine Ridge.

How is the proposal likely to affect current disturbance regimes?

Current disturbances at the site include cattle and sheep grazing, soil disturbance and grazing by feral animals including the European Rabbit and Goat, and periods of drought and rainfall consistent with the southern oscillation index and resultant cycles of drought (El Niño) and wetter periods (La Niña). There have been no major fire events on the site in the last decade.

Fire regimes that impact foraging habitat are of most relevance to the Black-chinned Honeyeater. However, the proposal is unlikely to alter the current fire regime at the study area. The risk of fire with wind farms is inherently low (CFA 2007). The location of wind turbines away from tall vegetation in the study area minimises the risk of fire. It is unlikely that the proposal will significantly affect the fire regime such that high intensity fire would have a detrimental impact on Black-chinned Honeyeater foraging habitat. The proposed access roads will increase the accessibility across the site should a fire occur.

The proposal has the potential to increase erosion, sedimentation and runoff through the clearing of vegetation and the construction of roads, and produce conditions favourable to weed invasion. However, any increases in run-off in areas where the ground within the construction area will be compacted, gravelled or concreted will be small and localised. The proposal will not affect flooding or flow regimes for the study area. Soil erosion and run-off control measures and weed control will be implemented as part of the mitigation measures undertaken for the proposal.

How is the proposal likely to affect habitat connectivity?

The landscape within the study area is one of open woodland, and turbine corridors have been deliberately focussed in areas of vegetation that have already undergone some historical clearing (for agricultural uses). Therefore the narrow and linear nature of the proposal is unlikely to result in fragmentation of habitat or create barriers to movement for this highly mobile species. The main habitat corridor through the project site along the eastern slopes of Crudine Ridge will be largely retained.

During the operational phase of the wind farm, there is a risk that Black-chinned Honeyeater will accidentally collide with the moving turbines, affecting habitat connectivity. Much literature has been produced regarding potential impacts of wind farms on birds although most of the studies have been undertaken overseas. The impacts appear to be dependent on a number of factors including proximity to wetlands, migratory pathways, proximity to bird concentrations and forested areas. These issues have been addressed in the layout design to minimise the risk of bird strike where possible. Bird strike

will be monitored during the operation of the wind farm and an adaptive management approach implemented whereby additional measures are investigated should significant bird (and bat) strike at certain turbines be recorded.

However, given the species generally moves within the height of the trees in which they feed, it is unlikely that the collisions would occur with moving turbines, affecting habitat connectivity.

How is the proposal likely to affect critical habitat?

Not applicable - critical habitat cannot be declared for vulnerable species.

***Ninox connivens* (Barking Owl)**

The Barking Owl is listed as a vulnerable species under the TSC Act and is found throughout Australia except for the central arid regions and Tasmania. It is quite common in parts of northern Australia, but is generally considered uncommon in southern Australia. It has declined across much of its distribution across NSW and now occurs only sparsely. It is most frequently recorded on the western slopes and plains. It is rarely recorded in the far west or in coastal and escarpment forests (OEH 2011b).

The Barking Owl inhabits woodland and open forest, including fragmented remnants and partly cleared farmland. This species is flexible in its habitat use and hunting can extend in to closed forest and more open areas. It is sometimes able to successfully breed along timbered watercourses in heavily cleared habitats (e.g. western NSW) due to the higher density of prey on these fertile soils. The species roosts in shaded portions of tree canopies, including tall mid-storey trees with dense foliage such as *Acacia* and *Casuarina* species. During the nesting season, the male perches in a nearby tree overlooking the hollow entrance (OEH 2011b).

The Barking Owl preferentially hunts small arboreal mammals such as Squirrel Gliders and Ringtail Possums, but when loss of tree hollows decreases these prey populations it becomes more reliant on birds, invertebrates and terrestrial mammals such as rodents and rabbits. The species can catch bats and moths on the wing, but typically hunts by sallying from a tall perch (OEH 2011b).

The Barking Owl requires very large permanent territories in most habitats due to sparse prey densities. Territories range from 30 to 200 ha and birds are present all year. Monogamous pairs hunt over as much as 6000 ha, with 2000 ha being more typical in NSW habitats (OEH 2011b).

Two or three eggs are laid in hollows of large, old trees including *Eucalyptus camaldulensis* (River Red Gum), *Eucalyptus albens (*White Box), *Eucalyptus polyanthemos* (Red Box) and *Eucalyptus blakelyi* (Blakely's Red Gum). Living eucalypts are preferred though dead trees are also used. Nest sites are used repeatedly over years by a pair, but they may switch sites if disturbed by predators (e.g. goannas). Nesting occurs during mid-winter and spring. Young are dependent for several months (OEH 2011b).

Diurnal bird surveys and opportunistic surveys were conducted in areas of suitable habitat across the proposed study area and project site during October and November 2008, and January 2009. The species was not recorded during field surveys, although it has been previously recorded in the locality (2002) to the south of the study area near Crudine on Turondale Road approximately 2.5 km south of the intersection with Hill End Road (BRC 2011).

How is the proposal likely to affect the lifecycle of a threatened species and/or population?

The proposal could impact on the life cycle of Barking Owl by reducing the amount of habitat available to the species that may be used for both hunting and nesting, degrading their habitat (eg. through fragmentation), changing foraging behaviour (through the removal of foraging habitat), or increasing the species' mortality rates through accidental strike with the turbines during operation of the wind farm.

Potential foraging and breeding habitat for the Barking Owl within the study area exists in areas of BPBGRS, RSSGRBLLB and WBBRGYB (wooded areas and pasture). The proposal will permanently remove 71.64 ha and temporarily remove 31.58 ha of potential foraging and breeding habitat within the study area.

However, tree clearance, particularly hollow-bearing trees, for, the proposal will be avoided wherever possible and the amount of trees that will be removed will be minimal with respect to the amount of potential habitat present for this species within the study area. Only 6.67 % of habitat in the study area

(1547.61 ha) and 2.62 % of the project site (3942.52 ha) will be removed. The proposal will not significantly fragment the foraging habitat of the species which is highly mobile. Also, given habitat is widely spread across the project site, it is unlikely that the proposed wind farm would lead to the displacement of any individuals. Where the removal of habitat trees is required, a pre-clearance protocol will be developed and implemented to determine if nests are present in any trees proposed for clearing. An ecologist will be present during clearing to capture and re-release individuals (where appropriate).

During the operational phase of the wind farm, there is a risk that Barking Owl will accidentally collide with the moving turbines or overhead powerlines. Collision with overhead lines is one of the major sources of mortality for the species (NPWS 2003). Much literature has been produced regarding potential impacts of wind farms on birds although most of the studies have been undertaken overseas. The impacts appear to be dependent on a number of factors including proximity to wetlands, migratory pathways, proximity to bird concentrations and forested areas.

A risk matrix was prepared for the threatened species recorded in the project site, commonly recorded species, and birds of prey recorded in the project site. The risk matrix did not include the Barking Owl, although it included other birds of prey. While other birds of prey were included, it is unlikely that results would be similar for Barking Owl. Unlike diurnal birds of prey, such as those included in the bird matrix, Barking Owl has a fast and direct flight enabling them to catch fast-flying prey such as birds and bats, with deep powerful wing-beats interspersed with short glides (Birds Australia 2011b). The species is likely to forage at the level of the canopy, as well as above and below the canopy, given foraging behaviours include short stay perch hunting (changing position after 1 min), hawking (short bursts of erratic flying) and long stay perch hunting (Bird 2011). They have been observed hunting in the early evening using short stay perch hunting whilst it is still light, and using long stay perch hunting scanning for prey in the dark (Bird 2011), and during late-summer and autumn, with the demands of the family reduced, have been observed “surfing” across the canopy of eucalypts to catch Christmas beetles (NatureWeb 2011). While moving between wooded areas, the flight levels of the species may be higher, although this is not documented.

Wind turbines are solid, opaque structures and the risks posed by moving rotors are generally within the height range of between 30 and 120 metres above the ground. Given the visibility of the turbines, and their height, the species is likely to have a low risk of collision with turbines. However, there is a moderate risk of collision with overhead powerlines, which are less visible.

Despite the moderate risk of collisions with overhead powerlines, a detrimental impact on the lifecycle of Barking Owl is not anticipated. Powerlines are already present in the locality and proposed powerlines would increase the amount of powerlines (at 200m or 250m intervals) by approximately 15 km. This is not considered to represent a significant increase in the amount of powerlines in the locality.

Nonetheless, an offset will be prepared in accordance with the Biobanking tool to compensate for the loss of foraging and breeding habitat, and accident strike by the turbines will be monitored.

How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

Vegetation representing habitat for Barking Owl will be removed in linear strips (for turbines, access tracks and the associated ancillary structures required for the running of the wind farm), rather than one consolidated stand. As a worst case scenario, the area of vegetation to be cleared consists of a permanent loss of 71.64 ha and a temporary impact to 31.58 ha of potential habitat, totalling 103.22 ha.

However, the vegetation communities and habitat that will be lost represents 6.67 % of the potential habitat mapped within the study area, and 2.62 % of potential habitat mapped within the project site. Large wooded areas would remain in the project site. It is unlikely that the proposed vegetation clearance would impact on this species such that prey species would become limited within the study area.

No breeding pairs of the species were recorded during field survey, and it is unknown whether breeding habitat will be impacted. Potential breeding habitat (hollows within *Eucalyptus polyanthemos* and *Eucalyptus blakelyi* is present in the study area and project site. However, the removal of potential nesting trees (and other habitat trees) will be avoided where possible. Following construction, all turbines will be at least 30 m from hollow-bearing trees. Removal of habitat trees will be further minimised during the detailed design phase. Where the removal of habitat trees is required, a pre-clearance protocol will be developed and implemented to survey for hollow-bearing fauna and determine if roosts or nests are present in any trees proposed for clearing. An ecologist will be present during clearing to capture and re-release individuals (where appropriate). Should a Barking Owl nest be recorded, amendments to the layout maybe required to ensure a 50 m buffer is maintained between the turbines and the nest tree.

The proposal may increase erosion, sedimentation and runoff through the clearing of vegetation and the construction of roads, and produce conditions favourable to weed invasion impacting on the species' habitat. However, any increases in run-off in areas where the ground within the construction area will be compacted, gravelled or concreted will be small and localised. The proposal will not affect flooding or flow regimes for the study area. Soil erosion and run-off control measures and weed control (over a 3-year period) will be implemented as part of the mitigation measures undertaken for the proposal, thereby reducing potential impacts of the proposal to potential habitat for this species.

The proposal will introduce powerlines which individuals could collied with. Despite the moderate risk of electrocution on overhead powerlines, a detrimental impact on the Barking Owl is not anticipated. Powerlines are already present in the locality and proposed powerlines would increase the amount of powerlines by approximately 15 km. This is not considered to represent a significant increase in the amount of powerlines in the locality.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

The Barking Owl is found throughout Australia except for the central arid regions and Tasmania. It is quite common in parts of northern Australia, but is generally considered uncommon in southern Australia. It has declined across much of its distribution across NSW and now occurs only sparsely, with records most frequently made on the western slopes and plains. Therefore, the Barking Owl is not at the limit of its known distribution at Crudine Ridge.

How is the proposal likely to affect current disturbance regimes?

Current disturbances at the site include cattle and sheep grazing, soil disturbance and grazing by feral animals including the European Rabbit and Goat, and periods of drought and rainfall consistent with the southern oscillation index and resultant cycles of drought (El Niño) and wetter periods (La Niña). There has been no major fire event in the last decade.

Grazing by livestock and feral animals such as the European Rabbit and Goat can reduce natural recruitment of canopy trees supporting prey species. The proposal is unlikely to exacerbate grazing at the site, but may, in fact, contribute to a more sustainable grazing regime through the mitigation

measures proposed in some parts of the site. In the absence of fire, grazing can be an important form of disturbance to prevent the accumulation of biomass that may not be favourable to some native flora species. Rotational periods of grazing and spelling help to foster healthy native pastures in the absence of fire.

The proposal is also unlikely to contribute to increasing feral animal activity across the project site and instead is likely to assist with the management of these species through the proposed mitigation measures to be implemented within the study area and on the proposed offset sites. No adverse impacts to potential Barking Owl habitat is expected to result from a reduction in grazing pressure from livestock and feral animals.

The proposal is unlikely to alter the current fire regime at the study area. The risk of fire with wind farms is inherently low (CFA 2007). The location of wind turbines away from tall vegetation in the study area minimises the risk of fire. It is unlikely that the proposal will significantly affect the fire regime such that high intensity fire would have a detrimental impact on Barking Owl foraging and nesting habitat. The proposed access roads will increase the accessibility across the site should a fire occur.

Threats to the Barking Owl include direct and secondary poisoning from agricultural poisons. Site management including rabbit control should consider alternatives to poisoning for the control of rabbits to avoid inadvertently poisoning higher food chain species like the Barking Owl.

The proposal will increase the number of overhead powerlines to the study area. Barking Owls are susceptible to collisions with powerlines. However, powerlines are already present in the locality and proposed powerlines would increase the amount of powerlines by approximately 15 km. This is not considered to represent a significant increase in the amount of powerlines in the locality.

The proposal has the potential to increase erosion, sedimentation and runoff through the clearing of vegetation and the construction of roads, and produce conditions favourable to weed invasion. However, any increases in run-off in areas where the ground within the construction area will be compacted, gravelled or concreted will be small and localised. The proposal will not affect flooding or flow regimes for the study area. Soil erosion and run-off control measures and weed control will be implemented as part of the mitigation measures undertaken for the proposal.

How is the proposal likely to affect habitat connectivity?

The woodland and open forest areas of the project site naturally have large canopy gaps and a very open and more often absent understorey. Given the narrow linear nature of the proposal, sited on mostly cleared areas, the preference of Barking Owl for open woodland and cleared areas, and the highly mobile nature of the Barking Owl, it is unlikely that the proposal would create barriers to movement of Barking Owl. The main habitat corridor through the project site along the eastern slopes of Crudine Ridge will be largely retained.

During the operational phase of the wind farm, there is a risk that Barking Owl will accidentally collide with the moving turbines or overhead powerlines, affecting habitat connectivity. Much literature has been produced regarding potential impacts of wind farms on birds although most of the studies have been undertaken overseas. The impacts appear to be dependent on a number of factors including proximity to wetlands, migratory pathways, proximity to bird concentrations and forested areas. These issues have been addressed in the layout design to minimise the risk of bird strike where possible. Bird strike will be monitored during the operation of the wind farm and an adaptive management approach implemented whereby additional measures are investigated should significant bird (and bat) strike at certain turbines be recorded. However, the risk of collision with turbines is considered to be low given

the foraging habit of Barking Owl. The overhead powerlines in study area additional to those in the locality are not considered to be significant.

How is the proposal likely to affect critical habitat?

Not applicable - critical habitat cannot be declared for vulnerable species.

***Ninox strenua* (Powerful Owl)**

Powerful Owl is listed as a vulnerable species under the TSC Act and is endemic to eastern and south-eastern Australia, mainly on the coastal side of the Great Dividing Range from Mackay to south-western Victoria and occurs at low densities (OEH 2011b). In NSW, it is widely distributed throughout the eastern forests from the coast inland to the tablelands, with scattered, mostly historical records on the western slopes and plains. There is no seasonal variation in distribution (OEH 2011b).

Powerful Owls occur primarily in densely vegetated gullies of open and tall open forest, but they are also found in a wider range of habitats, including forests and woodlands within the metropolitan regions of cities. However, optimal habitat requires large tracts of forest or woodland habitat, including a tall shrub layer and abundant hollows supporting high densities of arboreal marsupial prey species (OEH 2011b).

This species roosts in dense mid-canopy trees (such as Turpentines, She-oaks and rainforest trees), or tall shrubs in sheltered gullies, typically on wide creek flats and at the heads of minor drainage lines. Nesting occurs from late autumn to mid winter in large hollows (greater than 45 cm wide and greater than 100 cm deep) in eucalypts in unlogged, unburnt gullies and lower slopes within 100 m of streams or minor drainage lines. Nest trees are typically emergent, and are often the largest and oldest in a stand. Powerful Owls are faithful to traditional nesting hollows but can also use other hollows within the nesting gully (OEH 2011b).

Pairs of birds occupy large home ranges (300-1500 ha; DEC 2006c), utilising various portions of this area at different times, depending on the local abundance of arboreal mammals as a food source. Powerful Owls prey particularly on the Greater Glider and Ringtail Possum although the relative importance of prey items appears to vary regionally, with other prey such as Sugar Gliders, Brushtail Possums, Grey-headed Flying-foxes, insects and birds also used (OEH 2011b). The species forages by hunting from perches within the forest or woodland canopy (DEC 2006c).

Diurnal bird surveys and opportunistic surveys were conducted in areas of suitable habitat across the proposed study area and project site during October and November 2008, and January 2009. The species was not recorded during field surveys, although it has been previously recorded in the locality (2002) approximately 12 km south east of the study area, near Razorback (Birds Australia 2011a).

How is the proposal likely to affect the lifecycle of a threatened species and/or population?

The proposal could impact on the life cycle of Powerful Owl by reducing the amount of habitat available to the species that may be used for hunting, degrading their habitat (eg. through fragmentation), changing foraging behaviour (through the removal of foraging habitat), or increasing the species' mortality rates through accidental strike with the turbines during operation of the wind farm. The proposal is unlikely to impact on Powerful Owl nesting habitat given the species prefers large emergent trees that are within gullies or lower slopes within 100 m of streams (OEH 2011b).

Potential foraging habitat for the Powerful Owl within the study area exists in areas of BPBGRS, RSSGRBLLB and WBBRGYB (wooded areas and pasture). The proposal will permanently remove 71.64 ha and temporarily remove 31.58 ha of potential foraging habitat within the study area.

However, tree clearance for the proposal will be avoided wherever possible and the amount of trees that will be removed will be minimal with respect to the amount of potential habitat present for this species within the study area. Only 6.67 % of habitat in the study area (1547.61 ha) and 2.62 % of the project site (3942.52 ha) will be removed. The proposal will not significantly fragment the foraging habitat of the species which is highly mobile. Also, given habitat is widely spread across the project site, it is unlikely

that the proposed wind farm would lead to the displacement of any individuals.

During the operational phase of the wind farm, there is a risk that Powerful Owl will accidentally collide with the moving turbines or overhead powerlines. Much literature has been produced regarding potential impacts of wind farms on birds although most of the studies have been undertaken overseas. The impacts appear to be dependent on a number of factors including proximity to wetlands, migratory pathways, proximity to bird concentrations and forested areas.

A risk matrix was prepared for the threatened species recorded in the project site, commonly recorded species, and birds of prey recorded in the project site. The risk matrix did not include the Powerful Owl, although it included other birds of prey. While other birds of prey were included, it is unlikely that results would be similar for Powerful Owl. Unlike diurnal birds of prey, such as those included in the bird matrix, Powerful Owl does not soar high above the canopy. Rather, it forages by hunting from perches within the forest or woodland canopy (DEC 2006c). While moving between wooded areas, the flight levels of the species may be higher, although this is not documented.

Wind turbines are solid, structures and the risks posed by moving rotors are generally within the height range of between 30 and 120 metres above the ground. Given the visibility of the turbines, and their height, the species is likely to have a low risk of collision with turbines. The species is also likely to have a low risk of collision with overhead powerlines; unlike for other owl species, such as Barking Owl and Masked Owl, collision with wires or powerlines is not a major source of mortality for the Powerful Owl. Thus, a detrimental impact on the lifecycle of Powerful Owl is not anticipated.

Nonetheless, an offset will be prepared in accordance with the Biobanking tool to compensate for the loss of foraging habitat, and accident strike by the turbines will be monitored.

How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

Vegetation representing habitat for Powerful Owl will be removed in linear strips (for turbines, access tracks and the associated ancillary structures required for the running of the wind farm), rather than one consolidated stand. As a worst case scenario, the area of vegetation to be cleared consists of a permanent loss of 71.64 ha and a temporary impact to 31.58 ha of potential habitat, totalling 103.22 ha.

However, the vegetation communities and habitat that will be lost represents 6.67 % of the potential habitat mapped within the study area, and 2.62 % of potential habitat mapped within the project site. Large wooded areas would remain in the project site. It is unlikely that the proposed vegetation clearance would impact on this species such that prey species would become limited within the study area i.e. the proposal is unlikely to substantially reduce the amount of potential foraging habitat for this species present within the project site.

The Powerful Owl prefers to nest in large emergent trees that are within gullies or lower slopes within 100 m of streams (OEH 2011b). Thus, no breeding habitat is likely to be impacted by the proposal.

The proposal may increase erosion, sedimentation and runoff through the clearing of vegetation and the construction of roads, and produce conditions favourable to weed invasion impacting on the species' habitat. However, any increases in run-off in areas where the ground within the construction area will be compacted, gravelled or concreted will be small and localised. The proposal will not affect flooding or flow regimes for the study area. Soil erosion and run-off control measures and weed control (over a 3-year period) will be implemented as part of the mitigation measures undertaken for the proposal, thereby reducing potential impacts of the proposal to potential habitat for this species.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

The Powerful Owl is distributed across eastern and south-eastern Australia, mainly on the coastal side of the Great Dividing Range from Mackay to south-western Victoria and occurs at low densities (OEH 2011b). In NSW, it is widely distributed throughout the eastern forests from the coast inland to the tablelands, with scattered, records on the western slopes and plains. Therefore, the Powerful Owl is close to the limit of its known distribution at Crudine Ridge.

How is the proposal likely to affect current disturbance regimes?

Current disturbances at the site include cattle and sheep grazing, soil disturbance and grazing by feral animals including the European Rabbit and Goat, and periods of drought and rainfall consistent with the southern oscillation index and resultant cycles of drought (El Niño) and wetter periods (La Niña). There has been no major fire event in the last decade.

Grazing by livestock and feral animals such as the European Rabbit and Goat can reduce natural recruitment of canopy trees supporting prey species. The proposal is unlikely to exacerbate grazing at the site, but may, in fact, contribute to a more sustainable grazing regime through the mitigation measures proposed in some parts of the site. In the absence of fire, grazing can be an important form of disturbance to prevent the accumulation of biomass that may not be favourable to some native flora species. Rotational periods of grazing and spelling help to foster healthy native pastures in the absence of fire.

The proposal is also unlikely to contribute to increasing feral animal activity across the project site and instead is likely to assist with the management of these species through the proposed mitigation measures to be implemented within the study area and on the proposed offset sites. No adverse impacts to potential Powerful Owl habitat is expected to result from a reduction in grazing pressure from livestock and feral animals.

The proposal is unlikely to alter the current fire regime at the study area. The risk of fire with wind farms is inherently low (CFA 2007). The location of wind turbines away from tall vegetation in the study area minimises the risk of fire. It is unlikely that the proposal will significantly affect the fire regime such that high intensity fire would have a detrimental impact on Powerful Owl foraging habitat. The proposed access roads will increase the accessibility across the site should a fire occur.

Threats to the Powerful Owl include direct and secondary poisoning from pesticides. Site management including rabbit control should consider alternatives to poisoning for the control of rabbits to avoid inadvertently poisoning higher food chain species like the Powerful Owl.

The proposal has the potential to increase erosion, sedimentation and runoff through the clearing of vegetation and the construction of roads, and produce conditions favourable to weed invasion. However, any increases in run-off in areas where the ground within the construction area will be compacted, gravelled or concreted will be small and localised. The proposal will not affect flooding or flow regimes for the study area. Soil erosion and run-off control measures and weed control will be implemented as part of the mitigation measures undertaken for the proposal.

How is the proposal likely to affect habitat connectivity?

The woodland and open forest areas of the project site naturally have large canopy gaps and a very open and more often absent understorey. Given the narrow linear nature of the proposal, sited on mostly cleared areas, and the highly mobile nature of the Powerful Owl, it is unlikely that the proposal

would create barriers to movement of Powerful Owl. The main habitat corridor through the project site along the eastern slopes of Crudine Ridge will be largely retained.

During the operational phase of the wind farm, there is a risk that Powerful Owl will accidentally collide with the moving turbines or overhead powerlines, affecting habitat connectivity. Much literature has been produced regarding potential impacts of wind farms on birds although most of the studies have been undertaken overseas. The impacts appear to be dependent on a number of factors including proximity to wetlands, migratory pathways, proximity to bird concentrations and forested areas. These issues have been addressed in the layout design to minimise the risk of bird strike where possible. Bird strike will be monitored during the operation of the wind farm and an adaptive management approach implemented whereby additional measures are investigated should significant bird (and bat) strike at certain turbines be recorded. However, the risk of collision with turbines (and overhead powerlines) is considered to be low given the foraging habit of Powerful Owl.

How is the proposal likely to affect critical habitat?

Not applicable - critical habitat cannot be declared for vulnerable species.

***Petroica phoenicea* (Flame Robin)**

The Flame Robin is listed as a vulnerable species under the TSC Act and a marine species under the EPBC Act. It is endemic to south east Australia, and ranges from near the Queensland border to south east South Australia. It is also present in Tasmania. It is likely that there are two separate populations in NSW, one in the Northern Tablelands, and another ranging from the Central to Southern Tablelands (OEH 2011b).

The Flame Robin occurs in upland tall moist eucalypt forests, preferring clearings or areas with open understoreys and woodlands, often on ridges and slopes, and also occasionally occurs in temperate rainforest, herbfields, heathlands, shrublands and sedgelands at high altitudes. It often occurs in recently burnt areas; however, habitat becomes unsuitable as vegetation closes up following regeneration (OEH 2011b).

In spring to late summer, it breeds in upland tall moist eucalypt forests and woodlands, where the ground layer is dominated by native grasses and the shrub layer may be either sparse or dense. In autumn and winter, birds migrate to drier more open habitats in the lowlands (i.e. valleys below the ranges, and to the western slopes and plains) to dry forests, open woodlands and in pastures and native grasslands, with or without scattered trees, although it is occasionally seen in heathland or other shrublands in coastal areas during this time (OEH 2011b).

Birds forage from low perches, from which they sally or pounce onto small invertebrates which they take from the ground or off tree trunks, logs and other coarse woody debris. Flying insects are often taken in the air and sometimes gleans for invertebrates from foliage and bark. In their autumn and winter habitats, birds often sally from fence-posts or thistles and other prominent perches in open habitats (OEH 2011b).

The species occur singly, in pairs, or in flocks of up to 40 birds or more; in the non-breeding season they will join up with other insectivorous birds in mixed feeding flocks (OEH 2011b).

Nests are often near the ground and are built in sheltered sites, such as shallow cavities in trees, stumps or banks. The species builds an open cup nest made of plant materials and spider webs. Eggs are oval in shape and are pale bluish- or greenish-white and marked with brownish blotches; clutch size is three or four eggs (OEH 2011b).

Diurnal bird surveys and opportunistic surveys were conducted in areas of suitable habitat across the proposed study area and project site during October and November 2008, and January 2009. The species was not recorded during survey; however, it has previously been recorded in the locality (in 2006), approximately 12 km south east of the study area, near Razorback (Birds Australia 2011a).

How is the proposal likely to affect the lifecycle of a threatened species and/or population?

The proposal could impact on the life cycle of the Flame Robin by reducing the amount of potential foraging, sheltering and breeding habitat available to the species, degrading their habitat (eg. through fragmentation or the removal of woody debris), or increasing the species' mortality rates via collisions with turbines.

Potential foraging, sheltering and breeding habitat for the Flame Robin within the study area exists in areas of BPBGRS, RSSGRBLLB and WBBRGYB. The proposal will require 71.63 ha of permanent habitat loss and 31.56 ha of temporary loss within these vegetation communities.

While the proposal will remove potential habitat for the Flame Robin, tree clearance for the proposal will

be avoided wherever possible, and the amount of trees being removed will be minimal with respect to the amount of potential habitat present for this species within the study area. Vegetation clearance is linear in nature and, therefore, will not result in large consolidated patches of vegetation clearance (the removal of any areas of potential habitat may result in the reduction of a territorial range but is unlikely to affect the entire territory). Only 6.74 % of habitat in the study area (1,531.63 ha) and 2.64 % of the project site (3,912.81 ha) will be removed. The proposal will not significantly fragment the habitat of the species, which occurs in open grassy woodlands and grasslands with or without scattered trees. Also, given habitat is widely spread across the project site, it is unlikely that the proposed wind farm would lead to the displacement of any individuals. Where the removal of habitat trees is required, a pre-clearance protocol will be developed and implemented to determine if nests are present in any trees proposed for clearing. An ecologist will be present during clearing to capture and re-release individuals (where appropriate).

Regarding the potential increase in mortality rates via collisions with turbines, the Flame Robin is unlikely to fly at height as it is a woodland species that usually forages from low perches (eg. shrubs, fence posts, thistles in an open landscape), from which they sally or pounce onto small invertebrates which they take from the ground or off tree trunks, logs and other coarse woody debris (OEH 2011b). Therefore, turbine strike where turbines occur throughout open parts of woodland is unlikely. Given the flight habits of this species, the potential for this species being struck by turbines due to movement between woodland patches is considered low. Therefore, the proposal is unlikely to affect the lifecycle of this species.

How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

Vegetation representing habitat for Flame Robin will be removed in linear strips (for turbines, access tracks and the associated ancillary structures required for the running of the wind farm), rather than one consolidated stand. As a worst case scenario, the area of vegetation to be cleared consists of a permanent loss of 71.63 ha and a temporary impact to 31.56 ha of potential habitat, totalling 103.19 ha.

However, the vegetation communities and habitat that will be lost represents 6.74 % of the potential habitat mapped within the study area, and 2.64 % of potential habitat mapped within the project site. Large wooded areas would remain in the project site. It is unlikely that the proposed vegetation clearance would impact on this species such that foraging and nesting resources would become limited within the study area. Thus, the proposal is unlikely to substantially reduce the amount of potential habitat for this species present within the project site.

Where the removal of habitat trees is required, a pre-clearance protocol will be developed and implemented to determine if nests are present in any trees proposed for clearing. An ecologist will be present during clearing to capture and re-release individuals (where appropriate).

The proposal may increase erosion, sedimentation and runoff through the clearing of vegetation and the construction of roads, and produce conditions favourable to weed invasion impacting on the species' habitat. However, any increases in run-off in areas where the ground within the construction area will be compacted, gravelled or concreted will be small and localised. The proposal will not affect flooding or flow regimes for the study area. Soil erosion and run-off control measures and weed control (over a 3-year period) will be implemented as part of the mitigation measures undertaken for the proposal, thereby reducing potential impacts of the proposal to potential habitat for this species.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

The Flame Robin is found in south east Australia, ranging from near the Queensland border to south east South Australia. It is also present in Tasmania. In NSW, Flame Robin ranges from upland areas to inland slopes and plains (OEH 2011b). Thus, the species is not at the limit of its known distribution at Crudine Ridge.

How is the proposal likely to affect current disturbance regimes?

Current disturbances at the site include cattle and sheep grazing, grazing by feral animals including the European Rabbit and Goat, and periods of drought and rainfall consistent with the southern oscillation index and resultant cycles of drought (El Niño) and wetter periods (La Niña). There has been no major fire event in the last decade.

The fire regime of the study area is not expected to change as a result of the proposal, as the risk of fire with wind farms is inherently low (CFA 2007). A low risk is associated with malfunctioning turbine bearings, inadequate crankcase lubrication, cable damage during rotation, electrical shorting or arcing occurring in transmission and distribution facilities (CFA 2007). Furthermore, a number of mitigation measures will be implemented during construction to prevent accidental fires.

Flame Robin is threatened by overgrazing (OEH 2011b). However, the proposal is unlikely to exacerbate grazing at the site, but may, in fact, contribute to a more sustainable grazing regime through the mitigation and offset measures proposed in some parts of the site. In the absence of fire, grazing can be an important form of disturbance to prevent the accumulation of biomass that may not be favourable to some native flora species. Rotational periods of grazing and spelling help to foster healthy native pastures in the absence of fire.

Feral animals can have a detrimental impact on Flame Robin habitat. In the case of grasslands and grassy woodlands, grazing by feral animals such as the European Rabbit can result in loss of species diversity and tussock structure which in turn impacts the presence of insects as a food source for Flame Robin. However, the proposal is unlikely to contribute to increasing feral animal activity across the project site and instead is likely to assist with the management of these species through the proposed mitigation measures to be implemented within the study area and on the proposed offset sites.

The proposal has the potential to increase erosion, sedimentation and runoff through the clearing of vegetation and the construction of roads, and produce conditions favourable to weed invasion. However, any increases in run-off in areas where the ground within the construction area will be compacted, gravelled or concreted will be small and localised. The proposal will not affect flooding or flow regimes for the study area. Soil erosion and run-off control measures and weed control will be implemented as part of the mitigation measures undertaken for the proposal.

How is the proposal likely to affect habitat connectivity?

The woodland and open forest areas of the project site naturally have large canopy gaps and a very open and more often absent understorey. Given the narrow linear nature of the proposal, sited on mostly cleared areas, it is unlikely that the proposal would create barriers to movement of Flame Robin throughout the project site, particularly since the species is known to forage in open grassy woodlands and grasslands, with or without scattered trees. The main habitat corridor through the project site along the eastern slopes of Crudine Ridge will be largely retained. Furthermore, given the ground-foraging habit of this species, it is unlikely that they would collide with turbines and hence turbines are unlikely to restrict movement across the project site

How is the proposal likely to affect critical habitat?

Not applicable – critical habitat cannot be declared for vulnerable species.

***Polytelis swainsonii* (Superb Parrot)**

The Superb Parrot is listed as a vulnerable species under both the TSC Act and the EPBC Act. It is found throughout eastern inland NSW. On the South-western Slopes their core breeding area is roughly bounded by Cowra and Yass in the east, and Grenfell, Cootamundra and Coolac in the west. Birds breeding in this region are mainly absent during winter, when they migrate north to the region of the upper Namoi and Gwydir Rivers. The other main breeding sites are in the Riverina along the corridors of the Murray, Edward and Murrumbidgee Rivers where birds are present all year round. It is estimated that there are less than 5000 breeding pairs left in the wild (OEH 2011b).

The species inhabits Box-Gum, Box-Cypress-pine and Boree Woodlands and River Red Gum Forest. In the Riverina, the birds nest in the hollows of large trees (dead or alive) mainly in tall riparian River Red Gum Forest or Woodland. On the South West Slopes nest trees can be in open Box-Gum Woodland or isolated paddock trees. Species known to be used are Blakely's Red Gum, Yellow Box, Apple Box and Red Box (OEH 2011b).

The species nest in small colonies, often with more than one nest in a single tree. They breed between September and January. Individuals may forage up to 10 km from nesting sites, primarily in grassy box woodland. They feed in trees and understorey shrubs and on the ground and their diet consists mainly of grass seeds and herbaceous plants. Also eaten are fruits, berries, nectar, buds, flowers, insects and grain (OEH 2011b).

Diurnal bird surveys and opportunistic surveys were conducted in areas of suitable habitat across the proposed study area and project site during October and November 2008, and January 2009. The species was not recorded during field survey and there are no records for the species in the locality. However, it has been predicted to occur by the EPBC Protected Matters search tool (DSEWPAC 2011a).

How is the proposal likely to affect the lifecycle of a threatened species and/or population?

The proposal could impact on the life cycle of Superb Parrot by reducing the amount of potential foraging habitat available (used in the non-breeding season) to the species, degrading their habitat (eg. through fragmentation), or increasing the species' mortality rates via collisions with turbines. The proposal is unlikely to impact on breeding habitat, given that the Superb Parrot breeds mainly in the South-western Slopes and Riverina (OEH 2011b). The National Recovery Plan for the Superb Parrot (Baker-Gabb 2011) shows the project site to be outside of the species' breeding areas.

Potential foraging habitat for Superb Parrot is present within areas of BPBGRS, RSSGRBLLB and WBBRGYB (wooded areas), though it appears that woodland areas are preferred. The proposal will require 7.98 ha of permanent potential habitat loss and 1.65 ha of temporary loss within these communities.

While the proposal will remove potential foraging habitat for the Superb Parrot, tree clearance for the proposal will be avoided wherever possible and the amount of trees being removed will be minimal with respect to the amount of potential habitat present for this species within the study area. Further, vegetation clearance is linear in nature and, therefore, will not result in large consolidated patches of vegetation clearance. Vegetation will not be removed along waterways, along which the species is known to move (Baker-Gabb 2011). Only 4.33 % of habitat in the study area (222.17 ha) and 0.86 % of the project site (1121.32 ha) will be removed. The proposal will not significantly fragment the habitat of the species which is highly mobile, with the main wooded corridor through the project site (mainly on the eastern slopes of Crudine Ridge) retained. Also, given habitat is widely spread across the project site, it

is unlikely that the proposed wind farm would lead to the displacement of any individuals.

During the operational phase of the wind farm, there is a risk that Superb Parrots will accidentally collide with the moving turbines. Much literature has been produced regarding potential impacts of wind farms on birds although most of the studies have been undertaken overseas. The impacts appear to be dependent on a number of factors including proximity to wetlands, migratory pathways, proximity to bird concentrations and forested areas.

A risk matrix was prepared for the recorded threatened species, commonly recorded species, and birds of prey recorded in the project site. While the risk matrix did not include the Superb Parrot, the results for other parrots (e.g. Little Lorikeet, Crimson Rosella and Eastern Rosella) were a moderate risk of collision with turbines and a low risk of collision with overhead powerlines given their fast, high-low flight (depending on activity), and is likely to be similar for the Superb Parrot. The Superb Parrot is a semi-migratory species which flocks, moving from the south western Riverina area to northern NSW along the Namoi and Macquarie Rivers (Baker-Gabb 2011), and, therefore, it possible that the species is at a slightly greater risk that these other parrots, as is the case for Swift Parrot.

However, Superb Parrots generally move along wooded corridors when making local foraging movements, rarely crossing large areas of open ground (Baker-Gabb 2011). While not documented, it is likely that Superb Parrots move at a level within or just above the height of the trees in which they feed. A study of the cumulative impacts of collision with turbines on the overall population of Swift Parrot (Smales 2005), predicted by the modelling for all current and presently proposed wind farms within the species' range, are very small. Results for the range of avoidance rates modelled equate to slightly more or less than one parrot killed due to wind turbine collisions every ten years. It is possible that Superb Parrots would have a similarly low risk of collisions with turbines as Swift Parrot.

Therefore, the proposal is unlikely to have a negative impact on the lifecycle of the Superb Parrot.

How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

Vegetation representing potential foraging habitat for Superb Parrot will be removed in linear strips (for turbines, access tracks and the associated ancillary structures required for the running of the wind farm), rather than one consolidated stand. As a worst case scenario, the area of vegetation to be cleared consists of a permanent loss of 7.98 ha and a temporary impact to 1.65 ha of potential habitat, totalling 9.63 ha.

However, the vegetation communities and foraging habitat that will be lost represents 4.33 % of the potential habitat mapped within the study area, and 0.86 % of potential habitat mapped within the project site. The impact area will be along areas that have been previously cleared. It is unlikely that the proposed vegetation clearance would impact on this species such that foraging and sheltering resources would become limited within the study area.

The project site lies outside of the main Superb Parrot breeding areas, and does not lie within 10km of breeding areas, where the species forages during the breeding season. Thus, the proposal will not impact on breeding habitat.

The proposal may increase erosion, sedimentation and runoff through the clearing of vegetation and the construction of roads, and produce conditions favourable to weed invasion impacting on the species' habitat. However, any increases in run-off in areas where the ground within the construction area will be compacted, gravelled or concreted will be small and localised. The proposal will not affect flooding or flow regimes for the study area. Soil erosion and run-off control measures and weed control (over a

3-year period) will be implemented as part of the mitigation measures undertaken for the proposal, thereby reducing potential impacts of the proposal to potential habitat for this species.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

The Superb Parrot is found only in south-eastern Australia in NSW and northern Victoria, where it occurs on the inland slopes of the Great Divide and on adjacent plains, especially along the major river-systems. Vagrants have also been recorded in southern Queensland. In NSW, the Superb Parrot mostly occurs west of the Great Divide, where it mainly inhabits the Riverina, the South-west Slope and Southern Tableland Regions: west to Mathoura, Boorooban, Goolgowi, and east to Canberra, Yass and Cowra. Its range extends north to around Narrabri and Wee Waa in the North-west Plain Region, from a line joining Coonabarabran and Narrabri, and extending at least as far west as Tottenham and Quambone, with occasional records even further west. The Superb Parrot is near the eastern limit of its distribution at Crudine Ridge.

How is the proposal likely to affect current disturbance regimes?

Current disturbances at the site include cattle and sheep grazing, soil disturbance and grazing by feral animals including the European Rabbit and Goat, and periods of drought and rainfall consistent with the southern oscillation index and resultant cycles of drought (El Niño) and wetter periods (La Niña). There have been no major fire events on the site in the last decade.

The fire regime of the study area is not expected to change as a result of the proposal, as the risk of fire with wind farms is inherently low (CFA 2007). A low risk is associated with malfunctioning turbine bearings, inadequate crankcase lubrication, cable damage during rotation, electrical shorting or arcing occurring in transmission and distribution facilities (CFA 2007). Furthermore, a number of mitigation measures will be implemented during construction to prevent accidental fires.

The proposal is also unlikely to exacerbate grazing at the site, which may reduce the availability of seeds and herbaceous material for Superb Parrot. It may, in fact, contribute to a more sustainable grazing regime through the mitigation and offset measures proposed in some parts of the site. In the absence of fire, grazing can be an important form of disturbance to prevent the accumulation of biomass that may not be favourable to some native flora species. Rotational periods of grazing and spelling help to foster healthy native pastures in the absence of fire.

Feral animals can have a detrimental impact on Superb Parrot habitat. In the case of grasslands and grassy woodlands, grazing by feral animals such as the European Rabbit and Goat can result in loss of species diversity and tussock structure which in turn impacts the presence of insects as a food source for Superb Parrot. However, the proposal is unlikely to contribute to increasing feral animal activity across the project site and instead is likely to assist with the management of these species through the proposed mitigation measures to be implemented within the study area and on the proposed offset sites.

The proposal has the potential to increase erosion, sedimentation and runoff through the clearing of vegetation and the construction of roads, and produce conditions favourable to weed invasion. However, any increases in run-off in areas where the ground within the construction area will be compacted, gravelled or concreted will be small and localised. The proposal will not affect flooding or flow regimes for the study area. Soil erosion and run-off control measures and weed control will be implemented as part of the mitigation measures undertaken for the proposal.

How is the proposal likely to affect habitat connectivity?

The landscape within the study area is one of open woodland, and turbine corridors have been deliberately focussed in areas of vegetation that have already undergone some historical clearing (for agricultural uses). Therefore the narrow and linear nature of the proposal is unlikely to result in fragmentation of habitat or create barriers to movement for this highly mobile species. The main habitat corridor through the project site along the eastern slopes of Crudine Ridge will be largely retained.

During the operational phase of the wind farm, there is a risk that Superb Parrot may accidentally collide with the moving turbines, affecting habitat connectivity. Superb Parrots moving about a location in the course of routine foraging most likely do so within or just above the height of the trees in which they feed and therefore the risk of strike at this time is reduced. Movements between sites may be higher, although the species rarely crosses large areas of open ground (Baker-Gabb 2011). During migration from breeding to non-breeding sites, the species follows wooded areas along the Namoi and Macquarie Rivers (Baker-Gabb 2011), which are not present in the project site. It is unlikely that the proposal will impact on habitat connectivity during the operational phase of the wind farm.

How is the proposal likely to affect critical habitat?

Not applicable - critical habitat cannot be declared for vulnerable species.

Mammals – potential to occur

***Dasyurus maculatus* (Spotted-tailed Quoll)**

The Spotted-tailed Quoll is listed as a vulnerable species under the TSC Act and an endangered species under the EPBC Act. The range of the Spotted-tailed Quoll has contracted considerably since European settlement. It is now found on the east coast of NSW, Tasmania, eastern Victoria and north-eastern Queensland, and only considered as common in Tasmania (OEH 2011b).

The Spotted-tailed Quoll has been recorded across a range of habitat types, including rainforest, open forest, woodland, coastal heath and inland riparian forest, from the sub-alpine zone to the coastline. Occasional sightings have been made in open country, grazing lands, rocky outcrops and other treeless areas (DSEWPAC 2011b). Individual animals use hollow-bearing trees, fallen logs, small caves, rock crevices, boulder fields and rocky-cliff faces as den sites (OEH 2011b).

The species uses 'latrine sites', often on flat rocks among boulder fields and rocky cliff-faces; these may be visited by a number of individuals. Latrine sites can be recognised by the accumulation of the sometimes characteristic 'twisty-shaped' faeces deposited by animals (OEH 2011b).

It is mostly nocturnal, although it will also hunt during the day. While the species spends most of the time on the ground, it is also an excellent climber and may raid possum and glider dens and prey on roosting birds. Spotted-tail Quolls consumes a variety of prey, including gliders, possums, small wallabies, rats, birds, bandicoots, rabbits and insects; also eats carrion and takes domestic fowl (OEH 2011b).

Females occupy home ranges up to about 750 ha and males up to 3,500 ha, and individuals usually traverse their ranges along densely vegetated creek lines. The average litter size is five, and both sexes mature at about one year of age (OEH 2011b).

Remote camera surveys were conducted in areas of suitable habitat across the proposed study area and project site during November and December 2008, and January and February 2009. No Spotted-tailed Quolls were detected during field survey, although the species has previously been recorded in the locality in the Crudine area (1 record in 2003; BRC 2011, DECWW 2011a), Sofala area (1 record in 2004; OEH 2011a) and at Lake Windamere (1 record in 1996; OEH 2011a).

How is the proposal likely to affect the lifecycle of a threatened species and/or population?

The proposal could impact on the life cycle of the Spotted-tailed Quoll by reducing the amount of potential foraging and breeding habitat available to the species, degrading their habitat (eg. through fragmentation or disturbance), or changing foraging behaviour (through the removal of foraging habitat). The proposal would be unlikely to impact on the species during the operation of the wind farm.

Potential foraging and breeding habitat for the Spotted-tailed Quoll is present within areas of BPBGRS, RSSGRBLLB and WBBRGYB (mainly wooded areas). The proposal will permanently remove 7.98 ha and temporarily remove 1.65 ha of foraging and breeding habitat within the study area.

However, tree clearance for the proposal will be avoided wherever possible and the amount of trees being removed will be minimal with respect to the amount of potential habitat present for this species within the study area. Further, vegetation clearance is linear in nature and, therefore, will not result in large consolidated patches of vegetation clearance (the removal of any areas of potential habitat may result in the reduction of a territorial range but is unlikely to affect the entire territory). Only 4.33 % of habitat in the study area (222.17 ha) and 0.86 % of the project site (1121.32 ha) will be removed. The

proposal will not significantly fragment the foraging and breeding habitat of the species which is highly mobile. Also, given habitat is widely spread across the project site, it is unlikely that the proposed wind farm would lead to the displacement of any individuals.

Hollow-bearing tree clearance has been avoided where possible and will be further avoided where practical during the detailed design phase. To minimise the disturbance to potential den sites a pre-clearance protocol will be designed to identify how hollow-bearing fauna will be surveyed for and managed during clearing. These surveys will be undertaken to determine if dens are present in any areas proposed for clearing and a qualified ecologist will be present on site during clearing to capture and re-release fauna. Therefore, the disturbance to breeding Spotted-tailed Quoll will be minimised and managed during the clearing of potential habitat.

How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

The proposal will result in the permanent removal of 7.98 ha of woodland and the temporary loss of 1.65 ha of woodland representing potential foraging and breeding habitat, totalling 9.63 ha. However, it is unlikely that the proposed vegetation clearance would impact on this species such that foraging and breeding resources would become limited within the study area given that:

- Vegetation representing habitat for the Spotted-tailed Quoll will be removed in linear strips (for turbines, access tracks and the associated ancillary structures required for the running of the wind farm), rather than one consolidated stand;
- The habitat that will be lost represents a small area (4.33 % of the potential habitat mapped within the study area, and 0.86 % of potential habitat mapped within the project site). Large wooded areas would remain in the project site; and
- Trees, including hollow-bearing trees, will be avoided where possible, with the siting of wind turbines occurring within previously cleared areas where possible.

The Spotted-tailed Quoll also forages over a wide area of up to 750 ha for females and 3,500 ha for males. The preferred habitat for the species includes large, forested areas with hollow logs and rocky outcrops, particularly areas with thick understorey or dense vegetation along drainage lines. The habitat at Crudine Ridge is considered to be marginal for the species given the drainage lines are largely cleared of vegetation and the understorey is relatively sparse.

The proposal may increase erosion, sedimentation and runoff through the clearing of vegetation and the construction of roads, and produce conditions favourable to weed invasion impacting on the species' habitat. However, any increases in run-off in areas where the ground within the construction area will be compacted, gravelled or concreted will be small and localised. The proposal will not affect flooding or flow regimes for the study area. Soil erosion and run-off control measures and weed control (over a 3-year period) will be implemented as part of the mitigation measures undertaken for the proposal, thereby reducing potential impacts of the proposal to potential habitat for this species.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

The range of the Spotted-tailed Quoll has contracted considerably since European settlement. It is now found on the east coast of NSW, Tasmania, eastern Victoria and north-eastern Queensland (OEH

2011b). In NSW, the species occurs on both sides of the Great Dividing Range, although it is more common on the eastern side, with the northern section representing a stronghold for the species. The species is not at the limit of its distribution at Crudine Ridge, with records for the species occurring further west of the site and the predicted distribution extending to Bourke (NPWS 1999a); however, records on the western side of the range are scattered. The species is likely to be close to the limit of its range at the study area.

How is the proposal likely to affect current disturbance regimes?

Current disturbances at the site include cattle and sheep grazing, grazing by feral animals including the European Rabbit and Goat, and periods of drought and rainfall consistent with the southern oscillation index and resultant cycles of drought (El Niño) and wetter periods (La Niña). There has been no major fire event in the last decade.

The proposal is unlikely to exacerbate over-grazing at the site. It may, in fact, contribute to a more sustainable grazing regime through the mitigation measures proposed in some parts of the site. In the absence of fire, grazing can be an important form of disturbance to prevent the accumulation of biomass that may not be favourable to some native flora species. Rotational periods of grazing and spelling help to foster healthy native pastures in the absence of fire.

The proposal is also unlikely to contribute to increasing feral animal activity across the project site and instead is likely to assist with the management of these species through the proposed mitigation measures to be implemented within the study area and on the proposed offset sites. No adverse impacts to potential Spotted-tailed Quoll habitat is expected to result from a reduction in grazing pressure from livestock and feral animals. Feral animal control at the site involving poison-baiting techniques for cat and fox must consult with DECCW and use techniques least likely to affect quolls.

The fire regime of the study area is not expected to change as a result of the proposal. The risk of fire with wind farms is inherently low (CFA 2007). The location of wind turbines away from tall vegetation in the study area minimises the risk of fire. It is unlikely that the proposal will significantly affect the fire regime such that high intensity fire would have a detrimental impact on Spotted-tailed Quoll foraging and roosting habitat. The proposed access roads will increase the accessibility across the site should a fire occur.

The proposal has the potential to increase erosion, sedimentation and runoff through the clearing of vegetation and the construction of roads, and produce conditions favourable to weed invasion. However, any increases in run-off in areas where the ground within the construction area will be compacted, gravelled or concreted will be small and localised. The proposal will not affect flooding or flow regimes for the study area. Soil erosion and run-off control measures and weed control will be implemented as part of the mitigation measures undertaken for the proposal.

How is the proposal likely to affect habitat connectivity?

The woodland and open forest areas of the project site naturally have large canopy gaps and a very open and more often absent understorey. Given the narrow linear nature of the proposal, sited on mostly cleared areas, it is unlikely that the proposal would create barriers to movement of Spotted-tailed Quoll throughout the project site, which is highly mobile. The main habitat corridor through the project site along the eastern slopes of Crudine Ridge will be largely retained. It is unlikely that the proposal would have an impact on Spotted-tailed Quoll movements during the operation phase.

How is the proposal likely to affect critical habitat?

Not applicable - critical habitat cannot be declared for vulnerable species.

***Petaurus norfolcensis* (Squirrel Glider)**

The Squirrel Glider is listed as a vulnerable species under the TSC Act. The species is widely though sparsely distributed in eastern Australia, from northern Queensland to western Victoria. It inhabits mature or old growth Box, Box-Ironbark woodlands and River Red Gum forest west of the Great Dividing Range and Blackbutt-Bloodwood forest with heath understorey in coastal areas (OEH 2011b).

The species prefers mixed species stands with a shrub or *Acacia* midstorey, although reliably available food (and the presence of suitable tree hollows for refuge/nesting) is an important determinant of habitat suitability (Van Dyck and Strahan 2008). Diet varies seasonally and consists of *Acacia* gum, eucalypt sap, nectar, honeydew and manna, with invertebrates and pollen providing protein (OEH 2011b).

The presence of hollow bearing eucalypts is a critical habitat value to the Squirrel Glider (Quinn 1995). The species lives in family groups of a single adult male one or more adult females and offspring. The species require abundant tree hollows for refuge and nest sites with groups occupying multiple hollows over time (Van Der Ree and Suckling 2008). Births occur throughout the year, with females capable of raising two litters in a year (NPWS 1999b).

Nightly movements are estimated between 300 and 500 m. Individuals have been observed gliding up to 80 m between trees (Van Der Ree and Suckling 2008), although average gliding distances have been recorded as 21.5 ± 0.9 m (range 9-47 m; Goldingay and Taylor 2009). Home-ranges have been estimated between 0.65 and 8.55 ha and movements tend to be greater for males than females. The home-range of a family group is likely to vary according to habitat quality and availability of resources (NPWS 1999b).

Targeted surveys for the Squirrel Glider were conducted in an area of suitable habitat in the project site in November 2008 between the Sallys Flat and Pyramul Clusters. The species has not been recorded in the locality, nor was it recorded during the field survey. However, suitable habitat for the species exists in the study area and project site.

How is the proposal likely to affect the lifecycle of a threatened species and/or population?

The proposal could impact on the life cycle of the Squirrel Glider by reducing the amount of potential foraging, sheltering and breeding habitat available to the species, degrading their habitat (eg. through fragmentation or disturbance), or changing foraging behaviour (through the removal of foraging habitat) through works associated with the construction phase of the wind farm. The proposal would be unlikely to directly impact on the species during the operation of the wind farm.

Potential foraging, sheltering and breeding habitat for the Squirrel Glider is present within areas of RSSGRBLLB and WBBRGYB (wooded areas). Potential habitat has been based on the presence of hollow-bearing trees and foraging resources in these communities. The proposal will permanently remove 7.98 ha and temporarily remove 1.64 ha of potential foraging and breeding habitat within the study area.

However, tree clearance for the proposal will be avoided wherever possible and the amount of trees being removed will be minimal with respect to the amount of potential habitat present for this species within the study area. Further, vegetation clearance is linear in nature and, therefore, will not result in large consolidated patches of vegetation clearance (the removal of any areas of potential habitat may result in the reduction of a territorial range but is unlikely to affect the entire territory). Only 4.44 % of habitat in the study area (216.68 ha) and 0.87 % of the project site (1,100.88 ha) will be removed. The proposal will not significantly fragment the foraging and breeding habitat of the species, which can glide up to 80 m between trees (Van Der Ree and Suckling 2008), although the average gliding distance has

been recorded as 21.5 ± 0.9 m (range 9-47 m; Goldingay and Taylor 2009). No barbed wire fences will be introduced to the study area and project site, which might increase mortality rates for the species. Also, given habitat is widely spread across the project site, it is unlikely that the proposed wind farm would lead to the displacement of any individuals.

Hollow-bearing tree clearance has been avoided where possible and will be further avoided where practical during the detailed design phase. To minimise the disturbance to potential refuge, sheltering or breeding sites, a pre-clearance protocol will be designed to identify how hollow-bearing fauna will be surveyed for and managed during clearing. These surveys will be undertaken to determine if hollows used by Squirrel Gliders are present in any areas proposed for clearing and a qualified ecologist will be present on site during clearing to capture and re-release fauna. Therefore, the disturbance to breeding Squirrel Glider will be minimised and managed during the clearing of potential habitat.

How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

The proposal will result in the permanent removal of 7.98 ha of woodland and the temporary loss of 1.64 ha of woodland representing potential foraging and sheltering/breeding habitat, totalling 9.62 ha. However, it is unlikely that the proposed vegetation clearance would impact on this species such that foraging and sheltering/breeding resources would become limited within the study area given that:

- Vegetation representing habitat for the Squirrel Glider will be removed in linear strips (for turbines, access tracks and the associated ancillary structures required for the running of the wind farm), rather than one consolidated stand;
- The habitat that will be lost represents a small area 4.44 % of the potential habitat mapped within the study area, and 0.87 % of potential habitat mapped within the project site. Large wooded areas would remain in the project site; and
- Trees, including hollow-bearing trees, will be avoided where possible, with the siting of wind turbines occurring within previously cleared areas where possible.

The proposal may increase erosion, sedimentation and runoff through the clearing of vegetation and the construction of roads, and produce conditions favourable to weed invasion impacting on the species' habitat. However, any increases in run-off in areas where the ground within the construction area will be compacted, gravelled or concreted will be small and localised. The proposal will not affect flooding or flow regimes for the study area. Soil erosion and run-off control measures and weed control (over a 3-year period) will be implemented as part of the mitigation measures undertaken for the proposal, thereby reducing potential impacts of the proposal to potential habitat for this species.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

The species is widely though sparsely distributed in eastern Australia, from northern Queensland to western Victoria (OEH 2011b). The species is found inland as far as the Grampians in Victoria and the Pilliga and the Coonabarabran areas of NSW. The site at Crudine lies on the Dividing Range and, therefore, is not at the limit of the known distribution for the species.

How is the proposal likely to affect current disturbance regimes?

Current disturbances at the site include cattle and sheep grazing, grazing by feral animals including the European Rabbit and Goat, and periods of drought and rainfall consistent with the southern oscillation index and resultant cycles of drought (El Niño) and wetter periods (La Niña). There has been no major fire event in the last decade.

The proposal is unlikely to alter the current fire regime at the study area. The risk of fire with wind farms is inherently low (CFA 2007). The location of wind turbines away from tall vegetation in the study area minimises the risk of fire. It is unlikely that the proposal will significantly affect the fire regime such that high intensity fire would have a detrimental impact on Squirrel Glider habitat. The proposed access roads will increase the accessibility across the site should a fire occur.

The proposal is also unlikely to exacerbate over-grazing at the site. It may, in fact, contribute to a more sustainable grazing regime through the mitigation measures proposed in some parts of the site. In the absence of fire, grazing can be an important form of disturbance to prevent the accumulation of biomass that may not be favourable to some native flora species. Rotational periods of grazing and spelling help to foster healthy native pastures and recruitment of eucalypts in the absence of fire.

Feral animals can have a detrimental impact on threatened fauna through predation by species. The proposal is unlikely to contribute to increasing feral animal activity across the project site and instead is likely to assist with the management of these species through the proposed mitigation measures to be implemented within the study area and on the proposed offset sites. No adverse impacts to potential Squirrel Glider habitat is expected to result from a reduction in grazing pressure from livestock and feral animals.

The proposal has the potential to increase erosion, sedimentation and runoff through the clearing of vegetation and the construction of roads, and produce conditions favourable to weed invasion. However, any increases in run-off in areas where the ground within the construction area will be compacted, gravelled or concreted will be small and localised. The proposal will not affect flooding or flow regimes for the study area. Soil erosion and run-off control measures and weed control will be implemented as part of the mitigation measures undertaken for the proposal.

How is the proposal likely to affect habitat connectivity?

The woodland and open forest areas of the project site naturally have large canopy gaps and a very open and more often absent understorey. Given the narrow linear nature of the proposal, sited on mostly cleared areas, it is unlikely that the proposal would create barriers to movement of Squirrel Glider throughout the project site, which can glide up to 80 m between trees (Van Der Ree and Suckling 2008), although the average gliding distance has been recorded as 21.5 ± 0.9 m (range 9-47 m; Goldingay and Taylor 2009). This species can also move along the ground although this makes them more susceptible to predators. The main habitat corridor through the project site along the eastern slopes of Crudine Ridge will be largely retained. It is unlikely that the proposal would have an impact on Squirrel Glider movements during the operation phase.

How is the proposal likely to affect critical habitat?

Not applicable - critical habitat cannot be declared for vulnerable species.

***Phascogale tapoatafa* (Brush-tailed Phascogale)**

The Brush-tailed Phascogale is listed as a vulnerable species under the TSC Act. The species has a patchy distribution around the coast of Australia, from near sea level up to 1500m. Within NSW, the species appears to be most abundant in the north-east and south-east of the State, particularly within forest habitats on the Great Dividing Range (NPWS 1999c).

The preferred habitat of the Brush-tailed Phascogale is dry sclerophyll open forest, with a sparse ground cover of herbs, grasses, scleromorphic shrubs or leaf litter. However, individuals may also inhabit heathland, swamps, rainforest and wet sclerophyll forest (NPWS 1999c).

The mainly arboreal Brush-tailed Phascogale is an agile climber and often observed clinging head-down below branches. Individuals forage preferentially in rough-barked trees of 25cm DBH greater, where available. The species is nocturnal and carnivorous, feeding on invertebrates and arthropods (such as spiders, centipedes, beetles and cockroaches), nectar and occasionally small vertebrates. Individuals use their fingers to extract prey from crevices and under bark (NPWS 1999c).

The females inhabit territories of approximately 20-60 ha, while the males maintain territories of up to 100 ha, although territories can be smaller in high quality habitat. The territory of a female is exclusive, however, the territory of a male may overlap with other females and males. The Brush-tailed Phascogale nests and shelters in tree hollows, utilising many different hollows over a short time span (NPWS 1999c). Suitable hollows are 25-40mm wide lined with leaves and shredded bark and covered with faeces, which serves as a territorial marker (Soderquist and Rhind 2008).

Mating occurs between May and July, during which time males can travel long distances well beyond their territories. Males die soon after the mating season. The gestation period is around 30 days and the litter size is usually between 3 and 8. At 7 weeks, juveniles leave the pouch but remain in the nest until they are weaned at approximately 20 weeks. Mortality is usually high prior to and following weaning (Soderquist and Rhind 2008). After weaning, juvenile males disperse while females establish their home-range nearby, or remain within the natal range. Females can live for up to 3 years, but generally produce only one litter (Soderquist and Rhind 2008).

Targeted surveys for the Brush-tailed Phascogale were conducted in an area of suitable habitat in the project site in November 2008 between the Sallys Flat and Pyramul Clusters. The species was not recorded during the field survey. However, suitable habitat for the species exists in the study area and project site and the species has been predicted to occur in the locality (by the biobanking tool).

How is the proposal likely to affect the lifecycle of a threatened species and/or population?

The proposal could impact on the life cycle of the Brush-tailed Phascogale by reducing the amount of potential foraging, sheltering and breeding habitat available to the species, degrading their habitat (eg. through fragmentation or disturbance), or changing foraging behaviour (through the removal of foraging habitat) through works associated with the construction phase of the wind farm. The proposal would be unlikely to directly impact on the species during the operation of the wind farm.

Potential foraging, sheltering and breeding habitat for the Brush-tailed Phascogale is present within areas of BPBGRS, RSSGRBLLB and WBBRGYB (mainly wooded areas). Potential habitat has been based on the presence of hollow-bearing trees and foraging resources in these communities. The proposal will permanently remove 7.98 ha and temporarily remove 1.65 ha of potential foraging and breeding habitat within the study area.

However, tree clearance for the proposal will be avoided wherever possible and the amount of trees

being removed will be minimal with respect to the amount of potential habitat present for this species within the study area. Further, vegetation clearance is linear in nature and, therefore, will not result in large consolidated patches of vegetation clearance (the removal of any areas of potential habitat may result in the reduction of a territorial range but is unlikely to affect the entire territory). Only 4.33 % of habitat in the study area (222.17 ha) and 0.86 % of the project site (1121.32 ha) will be removed. The proposal will not significantly fragment the foraging and breeding habitat of the species, which are mobile and have home ranges approximately 20-60 ha and 100 ha in size for females and males, respectively (Soderquist and Rhind 2008). Also, given habitat is widely spread across the project site, it is unlikely that the proposed wind farm would lead to the displacement of any individuals.

Hollow-bearing tree clearance has been avoided where possible and will be further avoided where practical during the detailed design phase. To minimise the disturbance to potential refuge, sheltering or breeding sites, a pre-clearance protocol will be designed to identify how hollow-bearing fauna will be surveyed for and managed during clearing. These surveys will be undertaken to determine if hollows used by Brush-tailed Phascogales are present in any areas proposed for clearing and a qualified ecologist will be present on site during clearing to capture and re-release fauna. Therefore, the disturbance to breeding Brush-tailed Phascogales will be minimised and managed during the clearing of potential habitat.

How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

The proposal will result in the permanent removal of 7.98 ha of woodland and the temporary loss of 1.65 ha of woodland representing potential foraging and sheltering/breeding habitat, totalling 9.63 ha. However, it is unlikely that the proposed vegetation clearance would impact on this species such that foraging and sheltering/breeding resources would become limited within the study area given that:

- Vegetation representing habitat for the Brush-tailed Phascogale will be removed in linear strips (for turbines, access tracks and the associated ancillary structures required for the running of the wind farm), rather than one consolidated stand;
- The habitat that will be lost represents a small area (4.33 % of the potential habitat mapped within the study area, and 0.86 % of potential habitat mapped within the project site). Large wooded areas would remain in the project site; and
- Trees, including hollow-bearing trees, will be avoided where possible, with the siting of wind turbines occurring within previously cleared areas where possible.

The proposal may increase erosion, sedimentation and runoff through the clearing of vegetation and the construction of roads, and produce conditions favourable to weed invasion impacting on the species' habitat. However, any increases in run-off in areas where the ground within the construction area will be compacted, gravelled or concreted will be small and localised. The proposal will not affect flooding or flow regimes for the study area. Soil erosion and run-off control measures and weed control (over a 3-year period) will be implemented as part of the mitigation measures undertaken for the proposal, thereby reducing potential impacts of the proposal to potential habitat for this species.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

The species has a patchy distribution around the coast of Australia, from near sea level up to 1500m.

Within NSW, the species appears to be most abundant in the north-east and south-east of the State, particularly within forest habitats on the Great Dividing Range (NPWS 1999c). The site at Crudine Ridge lies on the Dividing Range and, therefore, is not at the limit of the known distribution for the species.

How is the proposal likely to affect current disturbance regimes?

Current disturbances at the site include cattle and sheep grazing, grazing by feral animals including the European Rabbit and Goat, and periods of drought and rainfall consistent with the southern oscillation index and resultant cycles of drought (El Niño) and wetter periods (La Niña). There has been no major fire event in the last decade.

The proposal is unlikely to alter the current fire regime at the study area. The risk of fire with wind farms is inherently low (CFA 2007). The location of wind turbines away from tall vegetation in the study area minimises the risk of fire. It is unlikely that the proposal will significantly affect the fire regime such that high intensity fire would have a detrimental impact on Brush-tailed Phascogale habitat. The proposed access roads will increase the accessibility across the site should a fire occur.

The proposal is also unlikely to exacerbate over-grazing at the site. It may, in fact, contribute to a more sustainable grazing regime through the mitigation measures proposed in some parts of the site. In the absence of fire, grazing can be an important form of disturbance to prevent the accumulation of biomass that may not be favourable to some native flora species. Rotational periods of grazing and spelling help to foster healthy native pastures and recruitment of eucalypts in the absence of fire.

Feral animals can have a detrimental impact on threatened fauna through predation by species; the Brush-tailed Phascogale is threatened by predation by cats and foxes (OEH 2011b). The proposal is unlikely to contribute to increasing feral animal activity across the project site and instead is likely to assist with the management of these species through the proposed mitigation measures to be implemented within the study area and on the proposed offset sites. No adverse impacts to potential Brush-tailed Phascogale habitat is expected to result from a reduction in grazing pressure from livestock and feral animals.

The proposal has the potential to increase erosion, sedimentation and runoff through the clearing of vegetation and the construction of roads, and produce conditions favourable to weed invasion. However, any increases in run-off in areas where the ground within the construction area will be compacted, gravelled or concreted will be small and localised. The proposal will not affect flooding or flow regimes for the study area. Soil erosion and run-off control measures and weed control will be implemented as part of the mitigation measures undertaken for the proposal.

How is the proposal likely to affect habitat connectivity?

The woodland and open forest areas of the project site naturally have large canopy gaps and a very open and more often absent understorey. Given the narrow linear nature of the proposal, sited on mostly cleared areas, it is unlikely that the proposal would create barriers to movement of Brush-tailed Phascogale throughout the project site, which is a mobile species with home ranges approximately 20-60 ha and 100 ha in size for females and males, respectively (Soderquist and Rhind 2008). The main habitat corridor through the project site along the eastern slopes of Crudine Ridge will be largely retained. It is unlikely that the proposal would have an impact on Brush-tailed Phascogale movements during the operation phase.

How is the proposal likely to affect critical habitat?

Not applicable - critical habitat cannot be declared for vulnerable species.

Bat

***Pteropus poliocephalus* (Grey-headed Flying-fox)**

The Grey-headed Flying Fox is listed as a vulnerable species under both the TSC Act and EPBC Act. The species is endemic to the east coast of Australia with a distribution from Bundaberg, Queensland, in the north to Melbourne, Victoria, in the south, from the western slopes of the Great Dividing Range (mostly in northern NSW; NPWS 2001) to the coast. The distribution of this species has recently suffered a southward contraction and a 30% population decline over the last ten years (OEH 2011b).

The Grey-headed Flying-fox is a highly mobile species whose migration patterns are determined by the availability of flowering food resources. The species can travel to distances up to 30 km from camps, and occasionally up to 60-70 km per night (Scientific Committee Final Determinations 2011). It is a canopy-feeding frugivore, blossom-eater and nectarivore, and occurs in rainforest, woodlands, paperbark swamps and Banksia woodlands. This species feeds in particular on the nectar and pollen of native trees, especially *Eucalyptus* spp., *Melaleuca* spp. and *Banksia* spp., and fruits of rainforest trees and vines. During times when native food resources are limited, the Grey-headed Flying-foxes forage on fruit crops and cultivated gardens (OEH 2011b).

The Grey-headed Flying-fox congregates in large colonies of up to 200,000 individuals in the summer season. Camp sites are generally located next to rivers or creeks, and occur in a range of vegetation communities including rainforest, wet sclerophyll forest, *Melaleuca* woodland, *Casuarina* forest or mangroves. These sites have a dense canopy, providing them with the moist, humid microclimate they require. Campsites are critical for mating, birthing, rearing of young and as diurnal refuge from predators. Urban gardens, cultivated fruit crops and roadside verges may also provide temporary roosting habitat for this species. Site fidelity to camps is high with some caps being used for over a century (OEH 2011b).

Spotlighting and opportunistic nocturnal surveys were conducted in areas of suitable habitat across the proposed study area and project site mainly during November 2008 and January 2009, with some additional surveys conducted in March 2011. The Grey-headed Flying-fox was not detected during field survey. However, the species has been previously recorded in the locality to the south of the study area near Crudine on Turondale Road approximately 2.5 km south of the intersection with Hill End Road (recorded in 2003; BRC 2011). The study area does not contain current or historic campsites. The closest campsite is located in near Wellington, approximately 80 km to the north west of the study area (DECCW 2008).

How is the proposal likely to affect the lifecycle of a threatened species and/or population?

The proposal could impact on the life cycle of Grey-headed Flying-fox by reducing the amount of foraging habitat available to the species, degrading their habitat (eg. through fragmentation), changing foraging behaviour (through the removal of foraging habitat), or increasing the species' mortality rates through accidental strike with the turbines during operation of the wind farm. The proposal would not impact on the breeding habitat of the Grey-headed Flying-fox as the species generally breeds in camps. The nearest known camp is located approximately 80 km away, near Wellington, to the north west of the study area (DECCW 2008).

Foraging habitat for the Grey-headed Flying-fox within the study area exists in areas of BPBGRS, RSSGRBLLB and WBBRGYB (wooded areas and scattered trees within pasture). The proposal will permanently remove 11.19 ha and temporarily remove 3.15 ha of foraging habitat within the study area.

However, tree clearance for the proposal will be avoided wherever possible and the amount of trees

being removed will be minimal with respect to the amount of potential foraging habitat present for this species within the study area. Vegetation clearance is linear in nature and, therefore, will not result in large consolidated patches of vegetation clearance. Only 4.96 % of habitat in the study area (288.65 ha) and 1.14 % of the project site (1,261.66 ha) will be removed. The proposal will not significantly fragment the foraging habitat of the species which is highly mobile and able to travel up to 30 km from camps, and occasionally up to 60 - 70 km per night (Scientific Committee Final Determinations 2011). Also, given habitat is widely spread across the project site, it is unlikely that the proposed wind farm would lead to the displacement of any individuals.

During the operational phase of the wind farm, there is a risk that Grey-headed Flying-foxes may accidentally collide with the moving turbines or overhead powerlines. Much literature has been produced regarding potential impacts of wind farms on bats although most of the studies have been undertaken overseas.

A risk matrix was prepared for the threatened species, common species, and birds of prey recorded in the project site. While the risk matrix did not include the Grey-headed Flying-fox, the results showed that species considered to be at greatest risk are those that fly at high altitudes, at speed and are migratory. While the species is not known at the project site, should it utilise the site, the risk of collision with the turbines/powerlines is considered likely to be moderate as the Grey-headed Flying-fox is wide ranging and is threatened by electrocution on powerlines (OEH 2011b). It is also shows a regular pattern of seasonal movement, with much of the population concentrating in May and June in northern NSW and Queensland to exploit winter-flowering trees such as *Eucalyptus robusta* (Swamp Mahogany), *E. tereticornis* (Forest Red Gum) and *Melaleuca quinquenervia* (Paperbark) (Scientific Committee Final Determinations 2011).

Issues associated with bat strike have been addressed in the layout design to minimise the risk of bat strike where possible. Bat strike will be monitored during the operation of the wind farm and an adaptive management approach implemented whereby additional measures are investigated should significant bat (and bird) strike at certain turbines be recorded. An offset will be prepared in accordance with the Biobanking tool to compensate for the loss of foraging habitat, and accident strike by the turbines will be monitored.

Despite the moderate risk of collisions with overhead powerlines, a detrimental impact on the lifecycle of Grey-headed Flying-fox is not anticipated. Powerlines are already present in the locality and proposed powerlines would increase the amount of powerlines by approximately 15 km. This is not considered to represent a significant increase in the amount of powerlines in the locality.

How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

Vegetation representing potential foraging habitat for the Grey-headed Flying-fox will be removed in linear strips (for turbines, access tracks and the associated ancillary structures required for the running of the wind farm), rather than one consolidated stand. As a worst case scenario, the area of vegetation to be cleared consists of a permanent loss of 11.19 ha and a temporary impact to 3.15 ha of potential foraging habitat, totalling 14.33 ha.

However, the vegetation communities and potential foraging habitat that will be lost represents 4.96 % of the potential foraging habitat mapped within the study area, and 1.14 % of potential foraging habitat mapped within the project site. It is unlikely that the proposed vegetation clearance would impact on this species such that foraging resources would become limited within the study area i.e. the proposal is unlikely to substantially reduce the amount of potential foraging habitat for this species present within

the project site.

No roosting or breeding habitat (camps) is present in the project site (DECCW 2008). Thus, the proposal will not impact on this habitat.

The proposal may increase erosion, sedimentation and runoff through the clearing of vegetation and the construction of roads, and produce conditions favourable to weed invasion impacting on the species' habitat. However, any increases in run-off in areas where the ground within the construction area will be compacted, gravelled or concreted will be small and localised. The proposal will not affect flooding or flow regimes for the study area. Soil erosion and run-off control measures and weed control (over a 3-year period) will be implemented as part of the mitigation measures undertaken for the proposal, thereby reducing potential impacts of the proposal to potential habitat for this species.

The proposal will introduce powerlines which could electrocute individuals. Despite the moderate risk of electrocution on overhead powerlines, a detrimental impact on the Grey-headed Flying-fox is not anticipated. Powerlines are already present in the locality and proposed powerlines would increase the amount of powerlines by approximately 15 km. This is not considered to represent a significant increase in the amount of powerlines in the locality.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

The Grey-headed Flying-fox is endemic to the east coast of Australia with a distribution from Bundaberg, Queensland, in the north to Melbourne, Victoria, in the south, extending from the western slopes of the Great Dividing Range to the coast (OEH 2011b). Given the distribution of the Grey-headed Flying-fox extends to the western slopes of the Great Dividing Range mostly in northern NSW (NPWS 2001), and occurs infrequently on the western side of the range (DSEWPAC 2011b), the Grey-headed Flying-fox is close to the limit of its distribution at Crudine Ridge.

How is the proposal likely to affect current disturbance regimes?

Current disturbances at the site include cattle and sheep grazing, soil disturbance and grazing by feral animals including the European Rabbit and Goat, and periods of drought and rainfall consistent with the southern oscillation index and resultant cycles of drought (El Niño) and wetter periods (La Niña). There have been no major fire events on the site in the last decade.

The proposal is unlikely to exacerbate grazing at the site, but may, in fact, contribute to a more sustainable grazing regime through the mitigation measures proposed in some parts of the site. In the absence of fire, grazing can be an important form of disturbance to prevent the accumulation of biomass that may not be favourable to some native flora species. Rotational periods of grazing and spelling help to foster healthy native pastures in the absence of fire. A spell in grazing may result in the increased regeneration of eucalypt feed trees for the Grey-headed Flying-fox.

The proposal is also unlikely to alter the current fire regime at the study area. The risk of fire with wind farms is inherently low (CFA 2007). A low risk is associated with malfunctioning turbine bearings, inadequate crankcase lubrication, cable damage during rotation, electrical shorting or arcing occurring in transmission and distribution facilities (CFA 2007). The location of wind turbines away from tall vegetation in the study area minimises the risk of fire. It is unlikely that the proposal will significantly affect the fire regime such that high intensity fire would have a detrimental impact on the foraging habitat of the Grey-headed Flying-fox. The proposed access roads will increase the accessibility across the site should a fire occur.

Grazing by feral animals such as the European Rabbit and Goat can reduce natural recruitment of eucalypt feed trees. The proposal is unlikely to contribute to increasing feral animal activity across the project site and instead is likely to assist with the management of these species through the proposed mitigation measures to be implemented within the study area and on the proposed offset sites.

The proposal will increase the number of overhead powerlines to the study area. Grey-headed Flying-fox is wide ranging and is threatened by electrocution on powerlines (OEH 2011b). However, electrocution of bats and bat strike with turbines will be monitored during the operation of the wind farm and an adaptive management approach implemented whereby additional measures are investigated should significant electrocution or bat strike at certain turbines be recorded. Powerlines are already present in the locality and proposed powerlines would increase the amount of powerlines by approximately 15 km. This is not considered to represent a significant increase in the amount of powerlines in the locality.

The proposal has the potential to increase erosion, sedimentation and runoff through the clearing of vegetation and the construction of roads, and produce conditions favourable to weed invasion. However, any increases in run-off in areas where the ground within the construction area will be compacted, gravelled or concreted will be small and localised. The proposal will not affect flooding or flow regimes for the study area. Soil erosion and run-off control measures and weed control will be implemented as part of the mitigation measures undertaken for the proposal.

How is the proposal likely to affect habitat connectivity?

The woodland and open forest areas of the project site naturally have large canopy gaps and a very open and more often absent understorey. Given the narrow linear nature of the proposal, sited on mostly cleared areas, and the highly mobile nature of the Grey-headed Flying-fox, which can move up to 70 km in one night (Scientific Committee Final Determinations 2011), it is unlikely that the proposal would create barriers to movement of the Grey-headed Flying-fox.

During the operational phase of the wind farm, there is a risk that the Grey-headed Flying-fox will accidentally collide with the moving turbines, affecting habitat connectivity. Much literature has been produced regarding potential impacts of wind farms on bats although most of the studies have been undertaken overseas. The impacts appear to be dependent on a number of factors including proximity to wetlands, migratory pathways, proximity to bird concentrations and forested areas. These issues have been addressed in the layout design to minimise the risk of bat strike where possible. Bat strike will be monitored during the operation of the wind farm and an adaptive management approach implemented whereby additional measures are investigated should significant bat (and bird) strike at certain turbines be recorded.

How is the proposal likely to affect critical habitat?

Not applicable - critical habitat cannot be declared for vulnerable species.

Reptile – potential to occur

***Aprasia parapulchella* (Pink-tailed Worm Lizard)**

The Pink-tailed Worm Lizard is listed as a vulnerable species under both the TSC Act and the EPBC Act and is only known from the Central and Southern Tablelands, and the South Western Slopes. There is a concentration of populations in the Canberra/Queanbeyan Region. Other populations have been recorded near Cooma, Yass, Bathurst, Albury and West Wyalong (OEH 2011b).

The Pink-tailed Worm Lizard inhabits sloping, open woodland areas with predominantly native grassy ground layers, particularly those dominated by *Themeda australis* (Kangaroo Grass). Sites where the species occur are typically well-drained, with rocky outcrops or scattered, partially-buried rocks on soils derived from volcanic or granitic parent materials. The species is commonly found beneath small, partially-embedded rocks and appear to spend considerable time in burrows, constructed by small black ants and termites below these rocks (OEH 2011b; DSEWPAC 2011b).

The Pink-tailed Worm Lizard feeds on the larvae and eggs of ants. It is thought that the species lays two eggs inside the ant nests during summer. The young first appear in March (OEH 2011b).

Targeted survey for the Pink-tailed Worm Lizard was conducted at ten sites within suitable habitat in the project site in November 2008 (eight sites within the Sallys Flat Cluster and two sites within the Pyramul Cluster). At seven of the sites, 500 rocks were rolled per location, while at three of the sites, 1000 rocks were rolled per location. Rock rolling was also undertaken opportunistically within potentially suitable habitat during other survey periods. The species has been recorded in the locality, approximately 11 km away at Sofala and off Box Ridge Road (BRC 2011), although it was not recorded during the field survey. Potential habitat for the species exists in the study area and project site.

How is the proposal likely to affect the lifecycle of a threatened species and/or population?

The proposal could impact on the life cycle of the Pink-tailed Worm Lizard by reducing the amount of foraging and sheltering habitat available to the species or degrading their habitat through works associated with the construction phase of the wind farm. It is unlikely that the proposal would impact on the life cycle of the Pink-tailed Worm Lizard during the operation of the wind farm.

Potential foraging, sheltering and breeding habitat for the Pink-tailed Worm Lizard is present within areas of BPBGRS, RSSGRBLLB and WBBRGYB (wooded areas and pasture). The proposal will permanently remove 71.15 ha and temporarily remove 31.56 ha of potential foraging, sheltering and breeding habitat within the study area, including partially-buried rocks.

However, all large rocks (15 cm diameter – 70 cm diameter) removed from within the proposed development areas will be relocated to adjacent areas to supplement habitat. Habitat elements removed which are preferred by the species will also be minimal with respect to the amount of potential habitat present for this species within the study area. Only 6.95 % of habitat in the study area (1,478.77 ha) and 2.69 % of the project site (3,813.82 ha) will be removed. The roads are unlikely to fragment habitat for the species which is likely to traverse the road widths. Also, given habitat is widely spread across the project site, it is unlikely that the proposed wind farm would lead to the displacement of any individuals.

Taking a conservative approach to manage against any potential uncertainty, pre-clearance surveys within suitable rocky habitat will be conducted prior to clearing, with any individuals found relocated to undisturbed areas of adjacent potential habitat.

How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

The proposal will result in the permanent removal of 71.15 ha and the temporary loss of 31.56 ha of potential foraging and sheltering/breeding habitat, totalling 102.71 ha. It will also introduce roads and other infrastructure to the area. However, it is unlikely that the proposed clearance would impact on this species such that foraging and sheltering/breeding resources would become limited given that the habitat that will be lost represents a small area 6.95 % of the potential habitat mapped within the study area and 2.69 % of potential habitat mapped within the project site. It is also unlikely that habitat would be fragmented by roads given the species would likely traverse the road widths. All large rocks (15 cm diameter – 70 cm diameter) removed from within the proposed development areas will be relocated to adjacent areas to supplement habitat.

The proposal may increase erosion, sedimentation and runoff through the clearing of vegetation and the construction of roads, and produce conditions favourable to weed invasion impacting on the species' habitat. However, any increases in run-off in areas where the ground within the construction area will be compacted, gravelled or concreted will be small and localised. The proposal will not affect flooding or flow regimes for the study area. Soil erosion and run-off control measures and weed control (over a 3-year period) will be implemented as part of the mitigation measures undertaken for the proposal, thereby reducing potential impacts of the proposal to potential habitat for this species.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

The Pink-tailed Worm Lizard is only known from the Central and Southern Tablelands, and the South Western Slopes (OEH 2011b). There is a concentration of populations in the Canberra/Queanbeyan Region. Other populations have been recorded near Cooma, Yass, Bathurst, Albury and West Wyalong (OEH 2011b). Given the species has been recorded to the north and west of the study area, it is not at the limit of its distribution in the study area; however, it is close to the limit of its distribution.

How is the proposal likely to affect current disturbance regimes?

Current disturbances at the site include cattle and sheep grazing, grazing by feral animals including the European Rabbit and Goat, and periods of drought and rainfall consistent with the southern oscillation index and resultant cycles of drought (El Niño) and wetter periods (La Niña). There has been no major fire event in the last decade.

The proposal is unlikely to alter the current fire regime at the study area. The risk of fire with wind farms is inherently low (CFA 2007). The location of wind turbines away from tall vegetation in the study area minimises the risk of fire. It is unlikely that the proposal will significantly affect the fire regime such that high intensity fire would have a detrimental impact on Pink-tailed Worm Lizard habitat. The proposed access roads will increase the accessibility across the site should a fire occur.

The proposal is also unlikely to exacerbate over-grazing at the site. It may, in fact, contribute to a more sustainable grazing regime through the mitigation measures proposed in some parts of the site. In the absence of fire, grazing can be an important form of disturbance to prevent the accumulation of biomass that may not be favourable to some native flora species. Rotational periods of grazing and spelling help to foster healthy native pastures and recruitment of eucalypts in the absence of fire.

The proposal has the potential to increase erosion, sedimentation and runoff through the clearing of vegetation and the construction of roads, and produce conditions favourable to weed invasion. However, any increases in run-off in areas where the ground within the construction area will be

compacted, gravelled or concreted will be small and localised. The proposal will not affect flooding or flow regimes for the study area. Soil erosion and run-off control measures and weed control will be implemented as part of the mitigation measures undertaken for the proposal.

How is the proposal likely to affect habitat connectivity?

The proposal will introduce roads to the study area. However, roads will be sited on mostly cleared areas, and as such, it is unlikely that the proposal would create additional barriers to movement of Pink-tailed Worm Lizard throughout the project site. The main habitat corridor through the project site along the eastern slopes of Crudine Ridge will be largely retained.

How is the proposal likely to affect critical habitat?

Not applicable - critical habitat cannot be declared for vulnerable species.