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Environmental Impact Statement

EnergyConnect (NSW – Eastern Section)

Technical paper 1 – Biodiversity Development Assessment Report

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JANUARY 2022

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Transgrid

WSP
Level 27, 680 George Street
Sydney NSW 2000
GPO Box 5394
Sydney NSW 2001

Tel: +61 2 9272 5100
Fax: +61 2 9272 5101
wsp.com

REV	DATE	DETAILS
Final	12/01/2022	Final for exhibition

	NAME	DATE	SIGNATURE
Prepared by:	Mark Stables; Toby Lambert	12/01/2022	
Reviewed by:	Alex Cockerill	12/01/2022	
Approved by:	Emma Taylor	12/01/2022	

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Glossary

Affected species	A species that is likely to be affected by direct and/or indirect impacts as a result of the proposal.
Avoid	Measures taken by a proponent such as careful site selection or actions taken through the design, planning, construction and operational phases of the development to completely avoid impacts on biodiversity values, or certain areas of biodiversity.
Biodiversity	The biological diversity of life is commonly regarded as being made up of the following three components: – genetic diversity – the variety of genes (or units of heredity) in any population – species diversity – the variety of species – ecosystem diversity – the variety of communities or ecosystems.
Biodiversity Assessment Method (BAM)	The Biodiversity Assessment Method 2020 (Department of Planning Industry and Environment 2020)
Biodiversity Assessment Method Calculator (BAM-C)	The web application that provides decision support to assessors and proponents by applying the BAM, and which calculates the number and class of biodiversity credits required to offset the impacts of a development or created at a biodiversity stewardship site.
Biodiversity credits	Ecosystem credits or species credits
Biodiversity Credit Report	The report produced by the Biodiversity Assessment Method Calculator (BAM-C) that sets out the number and class of biodiversity credits required to offset the remaining adverse impacts on biodiversity values at a development site, or on land to be biodiversity certified, or that sets out the number and class of biodiversity credits that are created at a biodiversity stewardship site.
Biodiversity offsets	Management actions that are undertaken to achieve a gain in biodiversity values on areas of land to compensate for losses to biodiversity values from the impacts of development.
Biodiversity value	Are the following values: — vegetation integrity – being the degree to which the composition, structure and function of vegetation at a particular site and the surrounding landscape has been altered from a near natural state — habitat suitability – being the degree to which the habitat needs of threatened species are present at a particular site. biodiversity values, or biodiversity-related values, prescribed by the regulations under the BC Act.
Candidate species	A species credit species that is likely to have suitable habitat on the subject land. Referred to as ‘candidate species credit species’ in the BAM-C and require further assessment in accordance with subsection 5.2.3 of the BAM.

Disturbance area	The area that would be used for the construction of the proposal. Also referred to as the construction impact area. The area is identified based on realistic proposal component locations and areas however it is indicative at this stage.
Dual credit species	A threatened species where part of the habitat is assessed as an ecosystem credit (e.g. foraging habitat) and part as a species credit (e.g. breeding habitat). In this report, dual credit species will be included in both ecosystem and species credit assessment.
Ecosystem credit	A measurement of the value of threatened species habitat for species that can be reliably predicted to occur with a PCT.
Ecosystem credit species	Ecosystem credit species are threatened species whose occurrence can generally be predicted by vegetation surrogates and/or landscape features, or that have a low probability of detection using targeted surveys.
Groundwater	Water found in the subsurface in the saturated zone below the water table or piezometric surface i.e. the water table marks the upper surface of groundwater systems.
Hollow bearing tree (HBT)	A living or dead tree that has at least one hollow. A tree is considered to contain a hollow if: (a) the entrance can be seen; (b) the entrance width is at least 5 cm; (c) the hollow appears to have depth (i.e. you cannot see solid wood beyond the entrance); (d) the hollow is at least 1m above the ground. Trees must be examined from all angles.
IBRA region	A bioregion identified under the Interim Biogeographic Regionalisation for Australia (IBRA) system, which divides Australia into bioregions on the basis of their dominant landscape-scale attributes.
IBRA subregion	A subregion of a bioregion identified under the IBRA system.
Indirect impact	An impact on biodiversity values that occurs when development related activities affect threatened species, threatened species habitat, or ecological communities in a manner other than direct impact.
Locality	The area within 10 kilometres of the subject land.
Local population	The population that occurs in the proposal area. In cases where multiple populations occur in the proposal area or a population occupies part of the proposal area, impacts on each subpopulation must be assessed separately.
Minimise	A process applied throughout the development planning and design life cycle which seeks to reduce the residual impacts of the proposal on biodiversity values.
Mitchell landscape	Landscapes with relatively homogeneous geomorphology, soils and broad vegetation types, mapped at a scale of 1:250,000.
Mitigation	Action to reduce the severity of an impact.
Mitigation measure	Any measure that facilitates the safe movement of wildlife and/or prevents wildlife mortality.

Native vegetation	Means any of the following types of plants native to New South Wales: — trees (including any sapling or shrub or any scrub) — understorey plants — groundcover (being any type of herbaceous vegetation) — plants occurring in a wetland.
Patch size	An area of intact native vegetation that: — occurs on the proposal site or biodiversity stewardship site — includes native vegetation that has a gap of less than 100m from the next area of moderate to good condition native vegetation (or ≤30m for non-woody ecosystems). Patch size may extend onto adjoining land that is not part of the proposal site or biodiversity stewardship site.
PCT classification system	The system of classifying native vegetation approved by the NSW Plant Community Type Control Panel and described in the BioNet Vegetation Classification.
Plant community type	A NSW plant community type identified using the PCT classification system.
Population	A group of organisms, all of the same species, occupying a particular area.
(the) proposal (EnergyConnect)	An electrical interconnector of around 900 kilometres between the electricity grids of South Australia and New South Wales, with an added connection to north west Victoria. In NSW, EnergyConnect comprises two sections – Western Section (which has been the subject of a separate environmental assessment and approval) and the Eastern Section (the proposal and subject of this EIS). The proposal is as defined in chapters 5 and 6 of the EIS.
Species credits	The class of biodiversity credits created or required for the impact on threatened species that cannot be reliably predicted to use an area of land based on habitat surrogates. Species that require species credits are listed in the Threatened Biodiversity Data Collection.
Species credit species	Threatened species that are assessed in accordance with section 6.4 of the BAM. Species credit species are threatened species for which vegetation surrogates and/or landscape features cannot reliably predict the likelihood of their occurrence or components of their habitat. A targeted survey or an expert report is required to confirm the presence of these species on the subject land. Alternatively, a species may be assumed present within a proposal site.
Stage 1: Biodiversity Assessment	Stage 1 of the Biodiversity Assessment Method. It establishes a single consistent approach to assessing the biodiversity values on land subject to the proposal.
Stage 2: Impact Assessment	Stage 2 of the Biodiversity Assessment Method. It provides for an impact assessment on biodiversity values on land subject to the proposal.
Threatened Biodiversity Data Collection (TBDC)	Part of the BioNet database, published by EES and accessible from the BioNet website at www.bionet.nsw.gov.au.
Threatened ecological community	Means a critically endangered ecological community, an endangered ecological community or a vulnerable ecological community listed in Schedule 2 of the BC Act or any additional ecological community listed under Part 13 of the EPBC Act as critically endangered, endangered or vulnerable.

Threatened species	Critically endangered, endangered or vulnerable threatened species as defined by Schedule 1 of the BC Act, or any additional threatened species listed under Part 13 of the EPBC Act as critically endangered, endangered or vulnerable.
Vegetation class	A level of classification of vegetation communities defined in Keith (Keith 2004). There are 99 vegetation classes in NSW.
Vegetation formation	A broad level of vegetation classification as defined in Keith (Keith 2004). There are 16 vegetation formations and sub-formations in NSW.
Vegetation integrity	The condition of native vegetation assessed for each vegetation zone against the benchmark for the PCT.
Vegetation integrity score	The quantitative measure of vegetation condition.
Vegetation type	A NSW plant community type (PCT)
Vegetation zone	A relatively homogenous area of native vegetation that is the same PCT and broad condition state.

Abbreviations

BA Act	NSW *Biosecurity Act 2015*
BAM	Biodiversity Assessment Method 2020
BAM-C	Biodiversity Assessment Method Calculator
BC Act	NSW *Biodiversity Conservation Act 2016*
BC Reg	NSW Biodiversity Regulation 2017
BDAR	Biodiversity Development Assessment Report
BMP	Biodiversity Management Plan
BOS	NSW Biodiversity Offset Scheme
BSA	Biodiversity Stewardship Agreement
CEEC	Critically Endangered Ecological Community
CEMP	Construction Environmental Management Plan
CSSI	Critical State Significant Infrastructure
DNG	Derived native grassland
EEC	Endangered Ecological Community
EES	Environment, Energy and Science Group – a division of the Department of Planning, Industry and Environment (DPIE) (formerly NSW Office of Environment and Heritage)
EIS	Environmental impact statement
EP&A Act	NSW *Environmental Planning and Assessment Act 1979*
EPBC Act	Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*
FM Act	NSW *Fisheries Management Act 1994* (NSW)
GDE	Groundwater dependant ecosystems
HBT	Hollow bearing tree
HTW	High threat weed listed under BAM 2020
IBRA	Interim Biogeographic Regionalisation of Australia
LGA	Local Government Area
MNES	Matters of National Environment and Significance
NSW	New South Wales
PCT	Plant Community Type
SAII	Serious and irreversible impact
SEARs	Secretary's Environmental Assessment Requirements

SSI	State Significant Infrastructure
TBCD	Threatened Biodiversity Data Collection: part of the BioNet database, published by the Department and accessible from the BioNet website at www.bionet.nsw.gov.au
TEC	Threatened Ecological Community
VIS	Vegetation information system (BioNet Vegetation Classification)
WONs	Weeds of National Significance

Executive summary

The proposal

Transgrid (electricity transmission operator in New South Wales (NSW)) and ElectraNet (electricity distributor in South Australia (SA)) are currently investigating the proposed construction and operation of a new electrical interconnector and network support options between NSW and SA, with an added connection to north-west Victoria.

The proposal, focussing on the eastern section of EnergyConnect in NSW, would include the construction and operation of new high voltage transmission lines between the existing Buronga substation and existing Wagga Wagga substation, a new 330kV substation (referred to as the proposed Dinawan 330kV substation), upgrade and expansion of the existing Wagga Wagga substation as well as other ancillary infrastructure.

Transgrid is seeking approval under Division 5.2, Part 5 of the *Environmental Planning and Assessment Act 1979* (the EP&A Act) to construct and operate the proposal. The proposal has been declared as Critical State Significant Infrastructure (CSSI) under Section 5.13 of the EP&A Act.

The proposal was also declared a controlled action on 26 June 2020 and requires a separate approval under the (Commonwealth) *Environment Protection and Biodiversity Conservation Act 1999* (the EPBC Act). The proposal is subject to the bilateral assessment process that has been established between the Australian and NSW governments.

The purpose of this Biodiversity Development Assessment Report (BDAR) is to identify and assess the potential impacts of the proposal in relation to biodiversity. It responds directly to the NSW Biodiversity Assessment Method 2020 (BAM) (Department of Planning 2020) and Secretary's environmental assessment requirements (SEARs).

Landscape features overview

The proposal would traverse a wide diversity of landscapes which have varying degrees of disturbance. The western third of the proposed alignment is dominated by semi-arid and largely naturally vegetated Mallee rangelands and riverine floodplains. The central portion of the proposed alignment is generally occupied by native dominated and derived grasslands/ chenopod shrublands that have been largely altered by historical sheep grazing and cropping. While the eastern portion largely transverses the fertile soils and intensive agricultural/cropping areas with relatively minor intersection of remnant native vegetation in the form of roadside remnants and isolated fragmented patches.

The proposal occurs with three Interim Biogeographic Regionalisation of Australia (IBRA) regions that comprise of five IBRA subregions, being:

- Murray Darling Depression region
  - South Olary Plain subregion
- Riverina region
  - Lachlan subregion
  - Murrumbidgee subregion
- NSW South Western Slopes region
  - Lower Slopes subregion
  - Inland slopes subregion.

The main important landscape features identified within the proposal study area are:

- Colombo Creek
- Murrumbidgee River
- Yanco Creek.

In accordance with the Biodiversity Assessment Method 2020 (BAM) (Department of Planning 2020), calculations have been undertaken for each IBRA subregion. Given the large linear distance of the proposal alignment (~540 kilometres) and the extent of native vegetation, patch size analysis for BAM calculation has been estimated to be greater than 100 hectares for all vegetation zones in the South Olary Plain, Lachlan and Murrumbidgee subregions. For the NSW South Western Slopes region, estimates of patch size were applied for individual vegetation zones.

Native vegetation cover for BAM landscape calculation purposes has been estimated as greater than 70 percent in the South Olary Plain, Lachlan and Murrumbidgee subregions. For the NSW South Western Slopes region, 10–30% vegetation cover was calculated for the Lower Slopes subregion and 0–10% cover was calculated for the Inland Slopes subregion.

Native vegetation overview

Native vegetation recorded within the proposed disturbance area is diverse and has been assigned to ten vegetation formations that occur within five IBRA subregions. The recorded vegetation formations are:

- Arid Shrublands (Acacia sub-formation)
- Arid Shrublands (Chenopod sub-formation)
- Dry Sclerophyll Forests (Shrubby sub-formation)
- Forested Wetlands
- Freshwater Wetlands
- Grasslands
- Grassy Woodlands
- Saline Wetlands
- Semi-arid Woodlands (Grassy sub-formation)
- Semi-arid Woodlands (Shrubby sub-formation).

Of the ten recorded native vegetation formations, these have been assigned to 16 vegetation classes, 39 plant community types (PCTs) and 95 vegetation zones and 183 disturbance management zones.

Six threatened ecological community listed under the NSW *Biodiversity Conservation Act 2016* (BC Act) have been recorded within the proposed disturbance area, being:

- *Acacia melvillei* Shrubland in the Riverina and Murray-Darling Depression bioregions – Endangered
- *Allocasuarina luehmannii* Woodland in the Riverina and Murray-Darling Depression Bioregions – Endangered
- Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions – Endangered
- Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South Western Slopes bioregions – Endangered
- Sandhill Pine Woodland in the Riverina, Murray-Darling Depression and NSW South Western Slopes bioregions– Endangered
- White Box Yellow Box Blakely's Red Gum grassy woodland and derived native grassland – Critically Endangered.

Seven threatened ecological community listed under the EPBC Act have been recorded within the proposed disturbance area, being:

- Buloke Woodlands of the Riverina and Murray-Darling Depression Bioregions - Endangered
- Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia – Endangered
- Natural Grasslands of the Murray Valley Plains – Critically Endangered
- Plains mallee box woodland of the Murray Darling Depression, Riverina and Naracoorte Coastal Plains bioregions- Critically Endangered
- Seasonal Herbaceous Wetlands (Freshwater) of the Temperate Lowland Plains – Critically Endangered
- Weeping Myall Woodlands – Endangered
- White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland – Critically Endangered.

Threatened species overview

In accordance with the BAM threatened species have been assessed as predicted or ecosystem credit species and species credit species.

Predicted species (ecosystem credit species)

A total of 81 threatened fauna species have been identified as predicted or ecosystem credit species within the disturbance area.

Threatened flora (species credit species)

A total of 45 candidate threatened flora species were considered to have potential associated habitat within the disturbance area and were the subject of targeted surveys. Of these, nine threatened flora species have been recorded. These are:

- *Brachyscome papillosa* (Mossgiel Daisy) – listed as vulnerable under the BC Act and EPBC Act
- *Lepidium monoplocoides* (Winged Peppercress) – listed as endangered under the BC Act and EPBC Act
- *Leptorhynchos orientalis* (Lanky Buttons) – listed as endangered under the BC Act
- *Maireana cheelii* (Chariot Wheels) – listed as vulnerable under the BC Act and EPBC Act
- *Pilularia novae-hollandiae* (Austral Pillwort) – listed as endangered under the BC Act (SAII)
- *Pimelea serpyllifolia* subsp. *serpyllifolia* (Thyme Rice-Flower) – listed as endangered under the BC Act (SAII)
- *Santalum murrayanum* (Bitter Quandong) – listed as endangered under the BC Act
- *Swainsona murrayana* (Slender Darling Pea) – listed as vulnerable under the BC Act and EPBC Act
- *Swainsona sericea* (Silky Swainson-pea) – listed as vulnerable under the BC Act.

One threatened flora species is considered an assumed species due to seasonal survey limitation, being:

- Cullen parvum (Small Scurf-pea) – listed as Endangered under the BC Act.

Threatened fauna (species credit species)

A total of 44 candidate threatened fauna species were considered to have potential associated habitat within the disturbance area and were the subject of targeted surveys. Of these, six species are considered affected by the proposal based on observation, being:

- *Myotis macropus* (Southern Myotis) – listed as vulnerable under the BC Act
- *Pedionomus torquatus* (Plains-wanderer) – listed as endangered under the BC Act and EPBC Act
- *Petaurus norfolcensis* (Squirrel Glider) – listed as vulnerable under the BC Act
- *Polytelis anthopeplus monarchoides* (Regent Parrot (eastern subspecies)) – listed as Endangered under the BC Act and vulnerable under EPBC Act
- *Lophochroa leadbeateri* (Major Mitchell's Cockatoo) – listed as vulnerable under the BC Act
- *Polytelis swainsonii* (Superb Parrot) – listed as vulnerable under the BC Act and EPBC Act.

Four other threatened fauna species were also conservatively considered to be potentially indirectly impacted by line strike and electric and magnetic fields, being:

- *Hieraaetus morphnoides* (Little Eagle)
- *Lophochroa leadbeateri* (Major Mitchell's Cockatoo)
- *Polytelis anthopeplus monarchoides* (Regent Parrot (eastern subspecies))
- *Polytelis swainsonii* (Superb Parrot).

Avoidance and design refinements

The proposal has been refined to avoid and minimise potential impacts on biodiversity values including:

- positioning of preferred corridor to co-locate where possible with existing infrastructure (i.e. Buronga substation to Four Corners and Lockhart to Wagga Wagga substation)
- design refinements such as proposed transmission line realignment near Bundure Siding, micrositing of tower locations, re-routing of access tracks and adoption of location specific bespoke construction phase stringing methodologies to avoid where possible any direct impacts to mapped Plain Wanderer habitat
- relocation of preferred corridor north at Gums Lane to avoid high biodiversity value areas that contains the critically endangered Box Gum Woodland
- targeting narrow crossing points of waterways and flood out areas (and their associated riparian habitats such as around the Murrumbidgee River, the Coleambally irrigation channels, Yanco Creek, Columbo Creek and Lake Cullivel)
- identification and focus on the use of existing access tracks to minimise additional disturbance to the transmission line easement wherever possible. This would include the use of existing farm track, alternative property access points and similar existing infrastructure. This has now been accounted for in the definition of disturbance area A (identified as the area where to ground impacts are expected with full vegetation clearing)
- reduction in the use of longitudinal access tracks where existing roads are located adjacent to the proposed transmission line alignment
- changes to the categorisation of disturbance along the transmission line alignment to reflect refinements to the vegetation clearing strategy.

Ongoing commitment to avoid and minimise impacts on biodiversity values would be further achieved through micro siting – where practicable – new transmission line structures, brake/winch sites and access tracks during the design refinement phase.

Impact summary

The impact assessment presented is based on the current understanding of design and construction methodology and the associated disturbance area for these items. The disturbance area is identified based on realistic proposal component locations and areas however it is indicative at this stage. The area would be confirmed during finalisation of design and construction methodology and would be developed as part of the consideration of avoidance and impact minimisation.

Impacts unable to be avoided by the proposal have been assessed in accordance with Stage 2 of the BAM, Item 16 of Appendix A of the SEARs and Matters of National Environmental Significance – Significant impact guidelines 1.1 (2013) EPBC Act.

Impacts on biodiversity values resulting from the proposal and the disturbance area comprise:

- The proposal would directly impact on 39 native vegetation PCTs and six threatened ecological community listed under the BC Act and seven threatened ecological communities listed under the EPBC Act. Direct impacts on native vegetation because of the proposal would include:
  - direct impacts on 1,554.88 hectares of native vegetation
  - direct impacts on up to 204.11 hectares of threatened ecological community listed under the BC Act in the form of:
    - 5.18 hectares of *Acacia melvillei* Shrubland in the Riverina and Murray-Darling Depression bioregions listed as endangered under the BC Act
    - 2.93 hectares of *Allocasuarina luehmannii* Woodland in the Riverina and Murray-Darling Depression Bioregions listed as endangered under the BC Act
    - 26.95 hectares of Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions listed as endangered under the BC Act
    - 101.21 hectares of Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South Western Slopes bioregions listed as endangered under the BC Act
    - 31.99 hectares of Sandhill Pine Woodland in the Riverina, Murray-Darling Depression and NSW South Western Slopes bioregions listed as endangered under the BC Act
    - 41.44 hectares of White Box Yellow Box Blakely's Red Gum grassy woodland and derived native grassland listed as critically endangered under the BC Act.
- Indirect impacts on native vegetation are considered unlikely due to the longer term retention of shrub and ground stratum native vegetation retention to a height of between four and 10 meters in areas buffering direct permanent loss. Mitigation measures would further minimise any residual indirect impact to native vegetation is managed during both the construction and operational phases of the proposal.
- Indirect impacts to avifauna due to the potential increased risk of collision with lines and electric and magnetic fields with the new infrastructure are considered possible. A total of four threatened fauna species potentially affected by the proposal due to potential operational indirect impacts include:
  - 11.31 hectares for *Hieraaetus morphnoides* (Little Eagle)
  - 8.33 hectares for *Lophochroa leadbeateri* (Major Mitchell's Cockatoo)
  - 0.41 hectares for *Polytelis anthopeplus monarchoides* (Regent Parrot (eastern subspecies))
  - 14.70 hectares for *Polytelis swainsonii* (Superb Parrot)
- The proposal would not impact on groundwater and is considered unlikely to lead to any adverse impact on the groundwater availability or status for groundwater dependent ecosystems.

- Impacts on threatened species have been considered in accordance with the BAM based on ecosystem credit species and species credit species. Impacts resulting from the proposal on threatened species includes:
  - loss of habitat for 81 threatened fauna species identified and/or predicted as ecosystem credit species
  - a total of nine threatened flora species credit species affected by the proposal. These include impacts to:
    - 71.17 hectares of habitat for *Brachyscome papillosa* (Mossgiel Daisy) – listed as vulnerable under the BC Act and EPBC Act (18.69 hectares of area of occupancy and 52.48 hectares of assumed habitat)
    - 50.31 hectares of assumed habitat for *Cullen parvum* (Small Scurf-pea) – listed as endangered under the BC Act. (50.31 hectares of assumed habitat)
    - 7 hectares of habitat for *Lepidium monoplocoides* (Winged Peppercress) – listed as endangered under the BC and EPBC Act (0.20 hectares of area of occupancy and 6.8 hectares of assumed habitat)
    - 15.32 hectares of habitat for *Leptorhynchos orientalis* (Lanky Buttons) – listed as endangered under the BC Act (0.63 hectares of area of occupancy and 14.69 of assumed habitat)
    - 109.68 hectares of habitat for *Maireana cheelii* (Chariot Wheels) – listed as vulnerable under the BC Act and EPBC Act (7.01 hectares of area of occupancy and 102.67 of assumed habitat)
    - 8.62 hectares of habitat for *Pilularia novae-hollandiae* (Austral Pillwort) – listed as endangered under the BC Act (0.32 hectares of area of occupancy and 8.62 hectares of assumed habitat)
    - 1.70 hectares of habitat for *Pimelea serpyllifolia* subsp. *serpyllifolia* (Thyme Rice-Flower) – listed as endangered under the BC Act (1.70 hectares of area of occupancy)
    - 232.35 hectares of habitat for *Swainsona murrayana* (Slender Darling Pea) – listed as vulnerable under the BC Act and EPBC Act (80.67 hectares of area of occupancy and 80.67 hectares of assumed habitat)
    - 109.17 hectares of habitat for *Swainsona sericea* (Silky Swainson-pea) – Vulnerable (10.32 hectares of area of occupancy and 98.85 hectares of assumed habitat)
  - a total of six threatened fauna species credit species affected by the proposal due to direct impacts. This includes impacts to:
    - 32.36 hectares of habitat for *Lophochroa leadbeateri* (Major Mitchell's Cockatoo) – listed as vulnerable under the BC Act
    - 4.77 hectares of habitat for *Myotis macropus* (Southern Myotis) – listed as vulnerable under the BC Act
    - 0.41 hectares of habitat for *Pedionomus torquatus* (Plains-wanderer) – listed as endangered under the BC Act and EPBC Act
    - 52.70 hectares of habitat for *Petaurus norfolcensis* (Squirrel Glider) – listed as vulnerable under the BC Act
    - 32.36 hectares of habitat for *Polytelis anthopeplus monarchoides* (Regent Parrot (eastern subspecies)) – listed as Endangered under the BC Act
    - 36.57 hectares of habitat for *Polytelis swainsonii* (Superb Parrot).
- The proposal is considered unlikely to lead to a significant impact on any threatened aquatic species, ecological communities or their habitats.

The final design for the proposal has not been completed and as a result the disturbance area is indicative only to enable assessment of the likely quantum and type of impacts of the proposal. Further refinements to the design, such as tower siting, access track design and other measures would be developed to reduce impacts.

In terms of impacts on Matters of National Environmental Significance the proposal would:

- impact on known or assumed habitat for seven threatened ecological communities
- impact on known or assumed habitat for four threatened flora species listed under the EPBC Act
- impact on known or potential habitat for 31 threatened fauna species comprising of one insect, three amphibians, two reptiles, 14 birds, five mammals and six fish listed under the EPBC Act
- impact on potential habitat for 12 migratory species listed under the EPBC Act.

The impact assessment outcomes for Matters of National Environmental Significance conclude that:

- the proposal is likely to lead to a significant impact on three threatened flora species and/or their habitat and four threatened ecological communities listed under the EPBC Act.
- the proposal is considered unlikely to substantially modify, destroy or isolate an area of important habitat for any EPBC Act listed migratory species and is unlikely to seriously disrupt the lifecycle of an ecologically significant proportion of a population of migratory birds
- the proposal would not impact on any wetlands of national or international importance.

Mitigation and management

The specific performance outcomes for the proposal regarding biodiversity include:

- minimising or where possible avoiding impacts to threatened flora and fauna species, and ecological communities listed under the BC Act and EPBC Act through the design refinement and construction methodology refinement processes
- offsetting impacts to threatened ecological communities and species.

A Construction Environmental Management Plan (CEMP) describes the approach to environmental management, monitoring and reporting during construction. Specifically, it lists the requirements to be addressed by the construction contractor including sub-plans, and other supporting documentation for each specific environmental aspect.

A specific sub-plan from the CEMP that would be developed to address biodiversity values would include a Biodiversity Management Plan and Connectivity Strategy.

Approaches to operational maintenance and the biodiversity impacts from the proposal will be in accordance with the detail provided in this report and the EIS.

Offsetting biodiversity impacts

Residual impacts that are not able to be managed through mitigation would be offset in accordance with BAM calculations for both ecosystem and species credits. The proposal offset obligation based on the disturbance area has been calculated to require the following biodiversity credits:

- 42,426 ecosystem credits
- 25,938 species credits.

The calculations in this BDAR are based on disturbance areas only, as design finalisation for the proposal has not yet been completed. Accordingly, the final biodiversity offset liability is subject to the timing of design refinements and would be determined at that stage.

The proposal offset obligations would be met through implementing a combination of the following offset delivery options, being:

- the purchase and retirement of existing biodiversity credits currently available on the biodiversity credit register
- establishing biodiversity stewardship site(s) (BSAs) on lands with like for like biodiversity values to those impacted by the proposal
- making a payment into the Biodiversity Conservation Fund (BCF) for residual credits not sourced from the preferred approach to established BSAs
- alternative strategic offset outcomes.

Delivery of the Biodiversity Offset Scheme (BOS) is proposed to be prepared for the combined EnergyConnect (Eastern and Western) proposals as follows:

- The proposed program provides a commitment to establish additional BSAs and/or meet residual EnergyConnect (NSW – Eastern Section) full credit liability prior to the completion of construction of EnergyConnect (NSW – Eastern Section) by end of 2025.
- It sees Transgrid meet approximately 10% of its EnergyConnect (NSW – Eastern Section) estimated liability and at least 25% of combined proposal liability prior to EnergyConnect (NSW – Eastern Section) commencement of disturbance.

Stage 1 – Biodiversity assessment

1 Introduction

1.1 Certification

As required under *Section 6.15 Currency of biodiversity assessment report* of the *NSW Biodiversity Conservation Act 2016* (BC Act), the accredited person certifies that the report has been prepared on the basis of the requirements of (and information provided under) the Biodiversity Assessment Method as at 12 January 2022. This date is within 14 days of the date the report being submitted.

1.2 Overview of EnergyConnect

Transgrid (electricity transmission operator in New South Wales (NSW)) and ElectraNet (electricity transmission operator in South Australia (SA)) are seeking regulatory and environmental planning approval for the construction and operation of a new High Voltage (HV) interconnector between NSW and SA, with an added connection to north west Victoria. Collectively, the proposed interconnector is known as EnergyConnect.

EnergyConnect aims to reduce the cost of providing secure and reliable electricity transmission between NSW and SA in the near term, while facilitating the longer-term transition of the energy sector across the National Electricity Market (NEM) to low emission energy sources.

EnergyConnect has been identified as a priority transmission project in the NSW Transmission Infrastructure Strategy (NSW Department of Planning and Environment (DPE), 2018), linking the SA and NSW energy markets and would assist in transporting energy from the South-West Renewable Energy Zone to major demand centres.

EnergyConnect comprises several sections (shown on Figure 1-1) that would be subject to separate environmental planning approvals under the relevant jurisdictions. It includes:

- NSW sections including:
  - Western section, which would extend from:
    - the SA/NSW border (near Chowilla in SA) to Transgrid's existing Buronga substation
    - Buronga substation to the NSW/Victoria border at Monak (near Red Cliffs in Victoria)
  - Eastern section, which would extend from the Buronga substation to the existing Wagga Wagga 330kV substation
- a Victorian section, which would extend from the NSW/Victoria border to Red Cliffs substation
- a SA section, which would extend from Robertstown to the SA/NSW border.

Transgrid is currently seeking planning approval for the NSW – Eastern Section (the proposal), which is the subject of this EIS.

Transgrid has previously sought and received separate environmental planning approvals for the NSW – Western Section of EnergyConnect and Victorian Section. ElectraNet is responsible for obtaining environmental planning approval for the section of EnergyConnect located in SA.

1.2.1 Proposal objectives

The primary objective for EnergyConnect (including the proposal) is to reduce the cost of electricity by providing secure electricity transmission between NSW and SA in the near term and facilitate the longer-term transition of the energy sector across the NEM to low emission energy generation sources. More specifically, EnergyConnect (including the proposal) aims to:

- lower power prices
- improve energy security
- increase economic activity
- support the transition to a lower carbon emission energy system
- support a greater mix of renewable energy in the NEM.

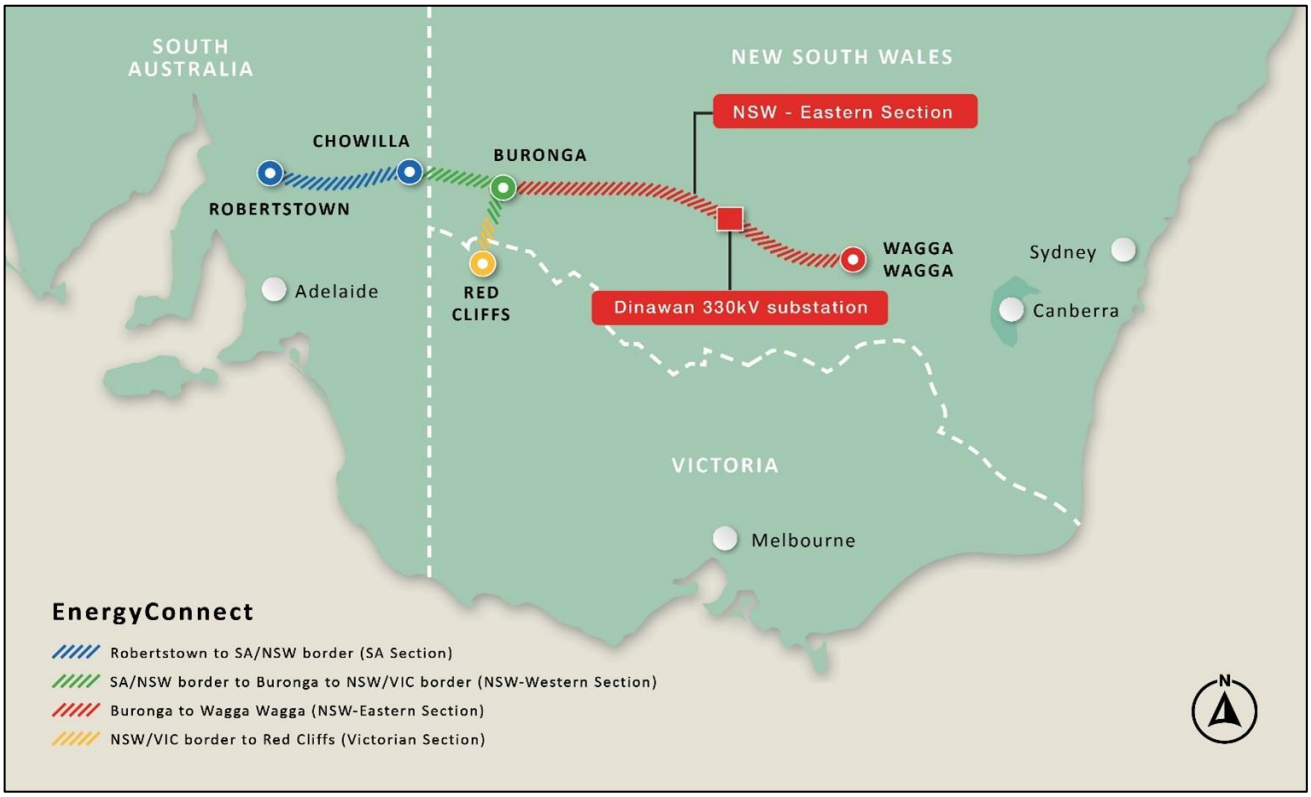


Figure 1-1 Overview of EnergyConnect

1.3 The proposal

Transgrid is seeking approval under Division 5.2, Part 5 of the *Environmental Planning and Assessment Act 1979* (the EP&A Act) to construct and operate the proposal. The proposal has been declared as Critical State significant infrastructure under Section 5.13 of the EP&A Act.

The proposal was also declared a controlled action on 30 September 2020 and requires a separate approval under the (Commonwealth) *Environment Protection and Biodiversity Conservation Act 1999*. The proposal is subject to the bilateral assessment process that has been established between the Australian and NSW governments.

1.4 Proposal overview

1.4.1 Study areas

The proposal study area comprises a generally one-kilometre-wide corridor between the Buronga substation and the Wagga Wagga substation. It traverses around 540 kilometres in total. It encompasses the construction impact area which has been applied to identify the constraints nearby to the proposal which may or may not be indirectly impacted by the proposal. Access tracks are located within the proposal study area.

The proposal study area is located in regional western NSW across a number of Local Government Areas (LGAs), including: Wentworth; Balranald; Murray River; Edward River; Hay; Murrumbidgee; Federation; Lockhart Shire; and Wagga Wagga LGAs.

The biodiversity study area for this assessment is defined as a 200-metre-wide corridor where field surveys in accordance with the Biodiversity Assessment Method (BAM) (Department of Planning 2020) have been applied.

1.4.2 Key features of the proposal

The key components of the proposal include:

- about 375 kilometres of new 330 kilovolt (kV) double circuit transmission line and associated infrastructure between the Buronga substation and the proposed Dinawan 330kV substation
- connection of the proposed transmission lines to the existing Buronga 330kV substation
- construction of a new 330kV substation around 30 kilometres south of Coleambally, referred to as the proposed Dinawan 330kV substation
- connection of the proposed transmission lines to the proposed Dinawan substation
- about 162 kilometres of new 500kV double circuit transmission line and associated infrastructure between the proposed Dinawan 330kV substation and the existing Wagga Wagga substation at Wagga Wagga, NSW
- upgrade and expansion of the Wagga Wagga substation to accommodate the new transmission line connections including the installation of new line bays, relocation and upgrade of existing bays and associated electrical and civil works (road, kerb, gutter, drainage works and earthworks)
- provision of three optical repeater structures and associated connections to existing local electrical supplies
- new and/or upgrade of access tracks as required
- ancillary works required to facilitate the construction of the proposal (e.g. laydown and staging areas, concrete batching plants, brake/winch sites, site offices and accommodation camps).

An overview of the proposal is provided in Figure 1-2. Further detail on the key infrastructure components of the proposal and construction activities are provided in Chapter 5 and Chapter 6 of the main EIS document respectively.

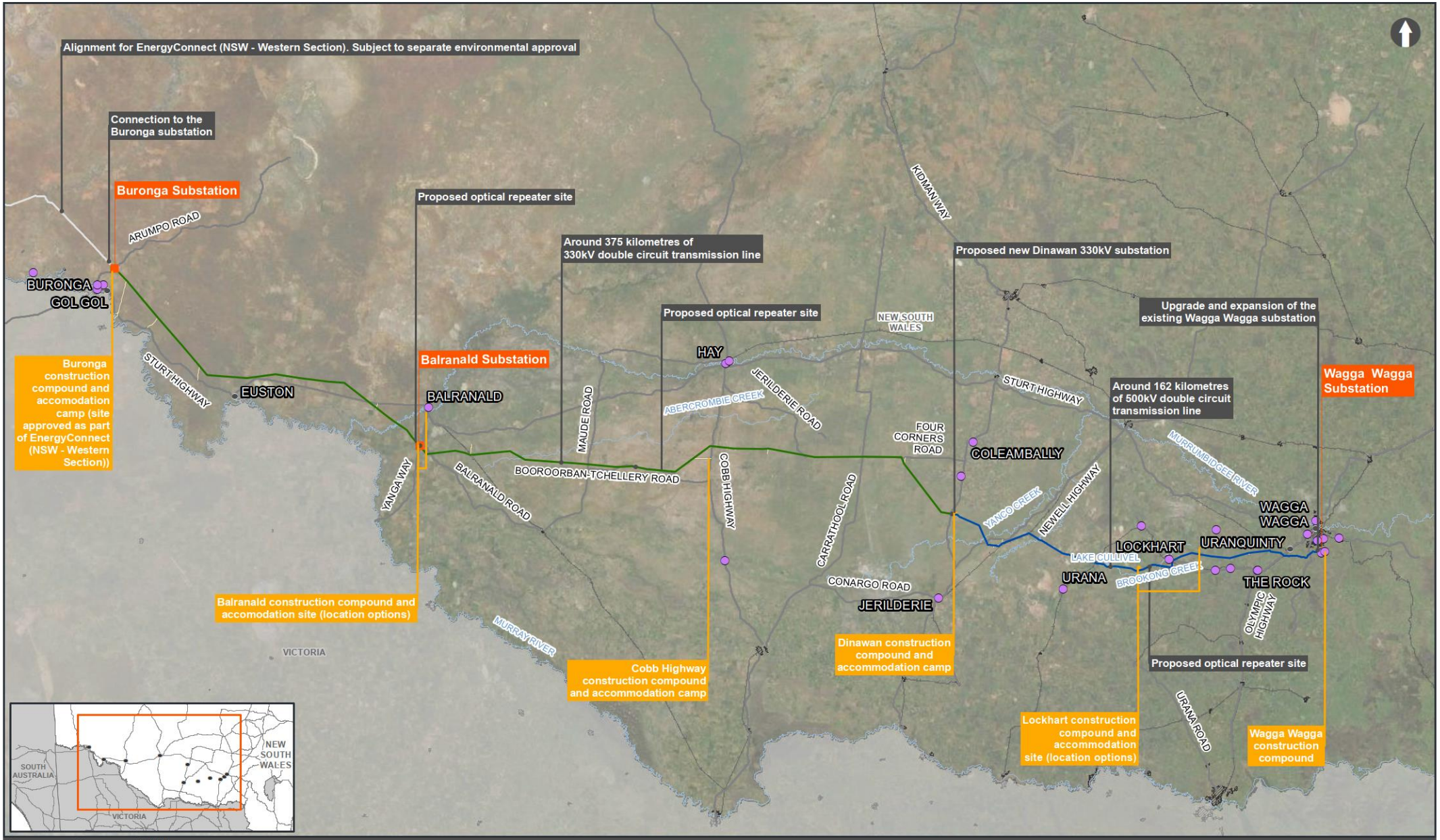


Figure 1-2

Proposal Overview - EnergyConnect (NSW - Eastern section)

1.4.3 Construction

1.4.3.1 Key construction works

Key construction works for the proposal would typically include (but not be limited to):

- site establishment works, which may include (but not be limited to):
  - establishment of construction compound and accommodation sites, access tracks and service relocations
  - vegetation clearance
- ancillary works to facilitate the construction of the proposal (e.g. intermediate laydown and staging areas, concrete batching plants, brake/winch sites, site offices and accommodation camps)
- construction of the proposed transmission lines, which would include (but not be limited to):
  - access tracks to accommodate safe access of construction machinery and materials to each transmission line structure site
  - earthworks (including establishment of construction pads) and the construction of footings and foundations for each transmission line structure
  - erection of the new transmission line structures using crane(s) and or helicopter(s)
  - stringing of the conductors and overhead earth wires and optical ground wire
  - installation of earthing conductors
  - testing and commissioning of the transmission lines
- construction of the proposed 330kV Dinawan substation, which would include (but not be limited to):
  - civil construction works including earthworks
  - slab construction at the expanded substation site
  - electrical fit out with new substation equipment
  - testing and commissioning of the new substation equipment.
- upgrade and expansion of the existing Wagga Wagga substation to enable the proposed connection and operation of the new transmission lines which would include (but not be limited to):
  - civil construction works including earthworks and slab construction at the expanded substation site
  - electrical fit out with new substation equipment
  - testing and commissioning of the new substation equipment
  - connection of the proposed transmission lines to the existing Buronga substation
  - demobilisation and remediation of areas disturbed by construction activities.

A detailed description of construction works for the proposal is further described in Chapter 6 of the main EIS document.

1.4.3.2 Construction program

Construction of the proposal would commence in late-2022 (enabling works), subject to NSW Government and Commonwealth planning approvals.

The main construction works for the transmission lines and substation facilities would take around 18 months. The upgraded Wagga Wagga substation and proposed Dinawan 330kV substation are expected to be operational by late-2024. Site decommissioning and remediation would extend around six months beyond the commissioning (operational) phase, with estimated completion mid-2025.

The final program would be confirmed as part of finalisation of the proposal infrastructure following approval of the proposal.

1.4.3.3 Indicative duration of transmission line construction activities

Construction at each transmission line structure would be intermittent and construction activities would not occur for the full duration at any one location. Figure 1-3 presents an indicative duration of construction activities associated with the transmission line structures. These durations could vary and breaks between activities may be shorter which may lead to longer inactive periods in subsequent stages of construction at an individual transmission line structure. Durations of any particular construction activity, and respite periods, may vary for a number of reasons including (but not limited to), multiple work fronts, resource and engineering constraints, works sequencing and location.

These activities would also have multiple work fronts, therefore (for example) foundation works or tower erection would be occurring in several locations along the easement at the same time.

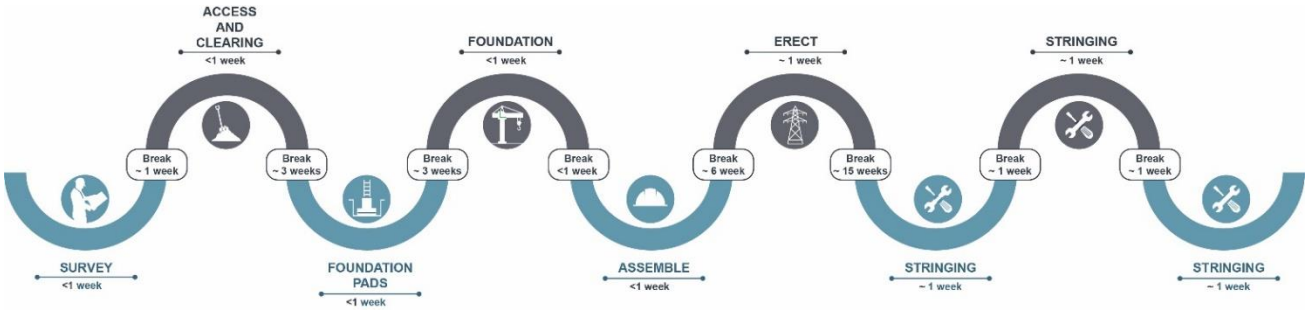


Figure 1-3 Indicative duration of construction activities at transmission line structures

1.5 Purpose of this technical report

This technical paper is one of a number of technical papers that form part of the EIS for the proposal. The purpose of this technical paper is to identify and assess the potential impacts of the proposal in relation to biodiversity. It responds directly to the Secretary's environmental assessment requirements (SEARs) (refer to Section 1.5.1) and has been prepared with consideration of:

- NSW *Biodiversity Conservation Act* 2016 (BC Act)
- NSW Biodiversity Regulation 2017 (BC Reg)
- NSW Biodiversity Assessment Method 2020 (BAM) (Department of Planning 2020)
- NSW Biodiversity Assessment Method Operational Manual – Stage 1 (Department of Planning 2020)
- NSW Biodiversity Assessment Method Operational Manual – Stage 2 (Department of Planning 2020)
- NSW Fisheries Management Act 1994 (FM Act)
- Commonwealth *Environment Protection and Biodiversity Conservation Act* 1999 (EPBC Act).

This report has the following objectives:

- to provide an assessment of biodiversity values within the proposal study area and the disturbance area
- demonstrate the proposals effort to avoid and minimise impacts on biodiversity values
- mitigate and manage impacts on biodiversity values
- calculate the offset requirement for impacts on biodiversity values that are unable to be avoided
- provide an assessment of significance on threatened species, ecological communities or their habitats listed under the FM Act and EPBC Act.

Further detail on the methodology applied in this assessment are detailed in Chapters 4 and 5 of this technical paper.

1.5.1 *Secretary's environmental assessment requirements*

The NSW Department of Planning, Industry and Environment (DPIE) has provided the SEARs for the EIS. The requirements specific to this assessment and where these aspects are addressed in this technical report are outlined in Table 1-1.

Table 1-1 Secretary's environmental assessment requirements – Biodiversity

REFERENCE	SECRETARY'S ENVIRONMENTAL ASSESSMENT REQUIREMENTS	WHERE ADDRESSED
Biodiversity Key issues	an assessment of the biodiversity impacts of the proposal, in accordance with the NSW Biodiversity Conservation Act 2016, the Biodiversity Assessment Method (BAM) and documented in a Biodiversity Development Assessment Report (BDAR)	This report is a BDAR that has been prepared in accordance with the BC Act and BAM
	the BDAR must document the application of the avoid, minimise and offset framework including assessing all direct, indirect and prescribed impacts in accordance with the BAM	Refer to Chapters 8, 9 and 12
	a strategy to offset any residual impacts of the development	Refer to Chapter 12
	an assessment of the impacts of the proposal on aquatic ecology including impacts on key fish habitat and threatened species of fish	Refer to Section 5.7 and 9.4

In addition, Appendix A of the SEARs outlines biodiversity Matters of National Environmental Significance (MNES) including protected matters listed under the EPBC Act that require consideration within the BDAR. Appendix A of the SEARs states the list of protected matters are based on the information in the referral documentation, the location of the action, species records and likely habitat present in the area, that there are likely to be significant impacts to:

- Grey Box Grassy Woodland (Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia) – endangered
- Weeping Myall Woodlands – endangered
- Plains Wanderer (*Pedionomus torquatus*) – critically endangered
- Regent Parrot (Eastern) (*Polytelis anthopeplus monarchoides*) – vulnerable; and
- Superb Parrot (*Polytelis swainsonii*) – vulnerable.

Additionally, Appendix A of the SEARs states there is a possibility that the proposed action will have or is likely to have significant impacts on the following species and ecological communities and levels of impact should be further investigated:

- Australasian Bittern (*Botaurus poiciloptilus*) – endangered
- Australian Painted Snipe (*Rostratula australis*) – endangered
- *Austrostipa metatoris* – vulnerable
- *Austrostipa wakoolica* – endangered
- *Atriplex infrequens* – vulnerable
- Black-eared Miner (*Manorina melanotis*) – endangered
- Chariot Wheels (*Maireana cheelii*) – vulnerable
- Corben's Long-eared Bat (*Nyctophilus corbeni*) – vulnerable, recorded in traps in the study area
- Curlew Sandpiper (*Calidris ferruginea*) – critically endangered
- Greater Glider (*Petauroides volans*) – vulnerable
- Grey-headed Flying Fox (*Pteropus poliocephalus*) – vulnerable
- Koala (*Phascolarctos cinereus*) – vulnerable
- Malleefowl (*Leipoa ocellata*) – vulnerable
- Mallee Emu-wren (*Stipiturus mallee*) – endangered
- Menindee Nightshade (*Solanum karsense*) – vulnerable

- Mountain Swainson-pea (*Swainsona recta*) – endangered
- Mossgiel Daisy (*Brachyscome papillosa*) – vulnerable
- Mueller Daisy (*Brachyscome muelleroides*) – vulnerable
- Northern Siberian Bar-tailed Godwit (*Limosa lapponica menzbieri*) – critically endangered
- Painted Honeyeater (*Grantiella picta*) – vulnerable
- Pink-tailed Worm-lizard (*Aprasia parapulchella*) – vulnerable
- Purple-wood Wattle (*Acacia carneorum*) – vulnerable
- Red Darling-pea (*Swainsona plagiotropis*) – vulnerable
- Red-lored Whistler (*Pachycephala rufogularis*) – vulnerable
- Regent Honeyeater (*Anthochaera Phrygia*) – critically endangered
- River Swamp Wallaby-grass (*Amphibromus fluitans*) – vulnerable
- Sand-hill Spider-orchid (*Caladenia arenaria*) – endangered
- Slender Darling-pea (*Swainsona murrayana*) – vulnerable
- Southern Bell Frog *(Litoria raniformis*) – vulnerable
- Spike-Rush (*Eleocharis obicis*) – vulnerable
- Spiny Pepper-cress (*Lepidium aschersonii*) – vulnerable
- Striped Legless Lizard (*Delma impar*) – vulnerable
- Swift Parrot (*Lathamus discolor*) – critically endangered
- Tarengo Leek Orchid (*Prasophyllum petilum*) – endangered
- Turnip Copperburr (*Sclerolaena napiformis*) – endangered
- White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland – critically endangered
- White-throated Needletail (*Hirundapus caudacutus*) – vulnerable
- Winged Pepper-cress (*Lepidium monoplocoides*) – endangered
- Yass Daisy (*Ammobium craspedioides*) – vulnerable; and
- Yellow Swainson-pea (*Swainsona pyrophila*) – vulnerable.

MNES are addressed in Chapter 7, Section 9.5 and Appendix D of this BDAR.

1.6 Structure of this report

The structure and content of this report is as follows:

Stage 1 – Biodiversity assessment

- *Chapter 1 – Introduction*: Outlines the background and need for the proposal, and the purpose of this report.
- *Chapter 2 – Legislative and policy context*: Provides an outline of the key legislative requirements and policy guidelines relating to the proposal.
- *Chapter 3 – Landscape context*: Provides information on a range of landscape features in accordance with section 3 of the BAM that occur on the proposal study area and broader locality.
- *Chapter 4 – Native vegetation*: Provides information on native vegetation in accordance with section 4 of the BAM and matters relating to the BC Act.
- *Chapter 5 – Threatened species*: Provides information on threatened species in accordance with section 5 of the BAM and matters relating to the BC Act.
- *Chapter 6 – Prescribed impacts*: Provides information on potential prescribed biodiversity impacts on threatened entities in accordance with section 6 of the BAM and matters relating to the BC Act.
- *Chapter 7 – Matters on national environmental significance*: Describes biodiversity matters relating to Commonwealth legislation under the EPBC Act.

Stage 2 – Impact assessment

- *Chapter 8 – Avoid and minimise impacts*: Provides information on avoiding and minimising impacts on biodiversity values through the planning and design phase of the proposal in accordance with section 7 of the BAM.
- *Chapter 9 – Assessment of impacts*: Describes the potential impacts associated with the proposal in accordance with section 8 of the BAM.
- *Chapter 10 – Mitigation and management of impacts*: Outlines the proposed mitigation measures for the proposal on biodiversity matters.
- *Chapter 11 – Impact summary – thresholds for assessment and offsetting impacts*: Outlines the impact thresholds and offset requirements for residual impacts to biodiversity values after the avoid, minimise and mitigate hierarchy has been applied as required under section 9 of the BAM.
- *Chapter 12 – Impact summary – no net loss standard*: Applies the no net loss biodiversity standard as required under section 10 of the BAM.
- *Chapter 13 – Conclusion: Provides a conclusion of the potential impacts of the proposal on biodiversity*: Provides a conclusion of the potential impacts of the proposal on biodiversity.
- *Chapter 14 – Limitations:* Identifies the general limitations considered in the preparation of this report.
- *Chapter 15 – References:* Identifies the key reports and documents used to generate this report.

Appendices to this report includes:

- *Appendix A* – Landscape context
- *Appendix B* – Native vegetation
- *Appendix C* – Threatened species
- *Appendix D* – Matters of national environmental significance
- *Appendix E* – Impact assessment
- *Appendix F* – Biodiversity credit report.

1.7 Report terminology

The following terms are discussed throughout this report and are defined as:

- **Alignment** – proposed centreline of the transmission line component of the proposal.
- **Biodiversity study area** – for this assessment this is defined as a 200-metre-wide corridor where field surveys in accordance with the Biodiversity Assessment Method (BAM) have been applied. Throughout this report this is also referred to as study area.
- **Locality** – the area within 10 kilometres of the proposal study area.
- **Subject land** – this is the same area as the proposal study area and used in the Stage 1 of the BAM.
- **Construction impact area** – this area is also referred to as the disturbance area in this BDAR. It refers to the area that would be directly impacted by construction of the proposal comprising the following:
  - construction of all proposal infrastructure elements (including the proposed transmission line alignment, transmission line easement, substation site works (at both the proposed Dinawan 330kV and upgraded and expanded Wagga Wagga substations), optical repeater infrastructure, and other ancillary works)
  - locations for construction elements such as construction compounds and accommodation camps, access tracks (excluding public roads proposed to be used for access routes), site access points, water supply points, laydown and staging areas, concrete batching plants, brake/winch sites and site offices.

This area includes the operational impact area (including areas required for maintenance) as these areas would be established during the construction process.

The area is identified based on realistic proposal component locations and areas however it is indicative at this stage. The area would be confirmed during finalisation of design and construction methodology and would be developed as part of the consideration of avoidance and impact minimisation.

- **Disturbance area** – the area that would be directly impacted by both construction and operation of the proposal. This term has the same meaning as construction impact area. The area is identified based on realistic proposal component locations and areas however it is indicative at this stage. The area would be confirmed during finalisation of design and construction methodology and would be developed as part of the consideration of avoidance and impact minimisation

  Disturbance area has the same meaning as 'Development site' as defined in the BAM.

  The disturbance area would have varying degrees of physical disturbance along the transmission line alignment to reflect construction and operational requirements and these have been applied to the biodiversity assessment. For the purpose of this BDAR, disturbance area has been divided into the following areas consisting of:

  - **Disturbance area A** – assumed for complete removal of vegetation. This includes the disturbance area A (centreline) category as outlined below.
  - **Disturbance area B** – assumed to have no ground disturbance except in circumstances associated with the operational requirements for vegetation maintenance to meet the vegetation clearance heights. This assessment has applied subsets of disturbance area B for impact identification purposes in consideration of the vegetation clearing requirements:
    - **Disturbance area B4** – assumed partial vegetation clearing is restricted to clearance of vegetation with growth height potential of 4 metres or above. Vegetation that is to be removed would have root balls removed except where practicable to retain.
    - **Disturbance area B10** – assumed partial vegetation clearing is restricted to clearance of vegetation with growth height potential of 10 metres or above. Vegetation that is to be removed would have root balls removed except where practicable to retain.
  - The width of the disturbance areas A, B4 and B10 areas for transmission line components vary for the 330kV and 500kV transmission lines based on their vegetation clearing requirements and construction methodologies. Figure 1-4 and Figure 1-5 identify the allocation of each area for each line type.

- **Disturbance area A** – refers to an area at and around the transmission line towers, areas for brake and winch sites and for new/upgraded access tracks in which vegetation would be removed during construction. The area also includes the proposed Dinawan substation site, the existing Wagga Wagga substation site and each of the main construction compounds and accommodation camps at Balranald, the Cobb Highway, Dinawan (Kidman Way), Lockhart and Wagga Wagga.

  It would include vegetation (including tree) removal and potential sub-surface impacts through construction activities such as grading, excavation, and full tree removal. Except in areas where only temporary disturbance is required (i.e. temporary access tracks and brake and winch sites), this area would also be subject to ongoing maintenance during operation (i.e. removal to ground level) for operational and safety requirements (including bushfire).

- **Disturbance area A (centreline)** – refers to a centreline area between the proposed transmission line towers in which all vegetation (including trees) would be removed during construction to ground level.

  In areas of known or potential heritage subsurface sensitivity (i.e. potential archaeological deposits (PADs)) sub-surface impacts in these areas would be avoided. In these areas vegetation would be cut to ground level and rootballs would be retained as necessary to avoid subsurface impacts.

Additionally, in areas of key Plains Wanderer primary habitat these centreline areas would not be subject to vegetation clearing. Alternate methods would be adopted in these key habitat areas for the conductor stringing activities.

This area would also be subject to ongoing maintenance during operation (i.e. removal to maintain vegetation clearance requirements) for operational and safety requirements (including bushfire).

- **Disturbance area B** – refers to an area between transmission line towers in the easement in which removal of vegetation (including trees) would be undertaken where they have the potential to exceed vegetation clearance heights. This removal may result in temporary ground disturbance. Vegetation clearance heights are set by Transgrid for operational and safety requirements, including bushfire risk management. This area would also be subject to ongoing maintenance during operation. This zone is a subset to the disturbance area.

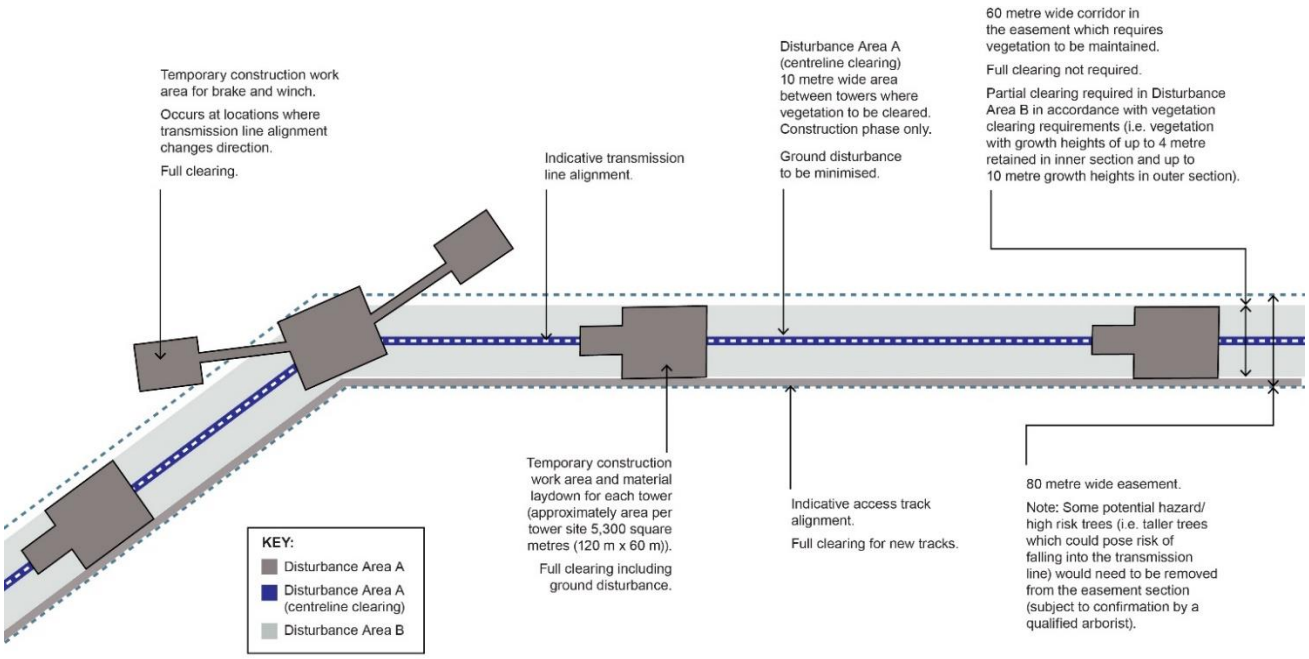


Figure 1-4 Indicative disturbance area definition for a typical 330kV transmission line section

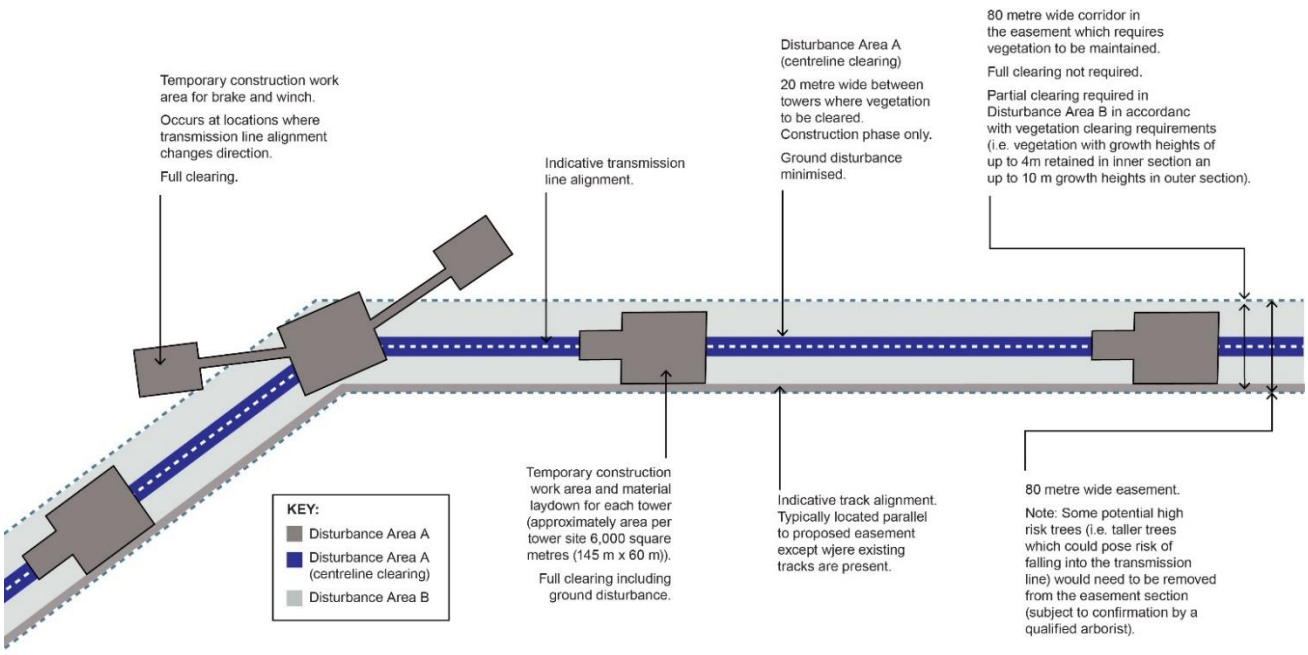


Figure 1-5 Indicative disturbance area definition for a typical 500kV transmission line section

2 Legislation and policy context

This chapter provides an outline of the key biodiversity legislative requirements and policy guidelines relating to the proposal.

2.1 Australian Government

2.1.1 Environment Protection and Biodiversity Conservation Act 1999

The Preliminary Biodiversity Assessment (WSP 2020), prepared as part of the Environmental Scoping Report – EnergyConnect (NSW – Eastern Section) (WSP 2020) identified the potential for unavoidable impacts to five EPBC Act listed entities to occur as a result of the Proposal and a referral under the EPBC Act was submitted on 27 May 2020. The Australian Government Department of Agriculture, Water and the Environment (DAWE) declared the Proposal to be a controlled action under sections 18 and 18A of the EPBC Act for impacts on listed threatened species and communities.

In February 2015, the Australian and NSW Governments entered a bilateral agreement under section 45 of the EPBC Act. Under Section 45 of the EPBC Act allows for the Minister for Agriculture, Water and the Environment to enter into a bilateral agreement on behalf of the Australian Government. A bilateral agreement under section 45 of the EPBC Act, is a written agreement that provides for 'minimising duplication in the environmental assessment and approval process through Commonwealth accreditation of the processes of the State or Territory (or vice versa)'.Since entering that agreement, the NSW Government has amended the accredited process through the repealing of the *Threatened Species Conservation Act 1995* and the commencement of the BC Act and the *Environmental Planning and Assessment Amendment Act 2017*. The current bilateral agreement provides for certain actions that are State significant development or State significant infrastructure within the meaning of the EP&A Act to be accredited for the purposes of meeting the requirements for assessment and public exhibition of an action under the provisions of the EPBC Act.

Based on the proposal being deemed a controlled action by DAWE, the proposal is subject to the bilateral assessment process that has been established between the Australian and NSW governments. The requirements to meet this bilateral process have been included within the SEARs (refer to Section 1.5.1) and addressed in this report.

2.2 State government

2.2.1 Environmental Planning and Assessment Act 1979

The EP&A Act provides the statutory controls that establish a framework governing what development is permitted or prohibited, and the processes for how assessment and gaining approval for development is undertaken in NSW. It is supported by the Environmental Planning and Assessment Regulation 2000 (EP&A Regulation) which provides additional detail and gives effect to the legislation.

Of relevance to the proposal, Part 5 of the EP&A Act deals with infrastructure and environmental impact assessment. Division 5.2 of Part 5 sets out the requirements for the assessment and approval of State Significant Infrastructure (SSI) and Critical State Significant Infrastructure (CSSI).

The Minister for Planning and Public Spaces has declared the proposal to be a CSSI project under Section 5.13 of the EP&A Act.

2.2.2 Biodiversity Conservation Act 2016

The BC Act, together with the *Biodiversity Conservation Regulation 2017* (BC Reg), outlines the framework for assessment and approval of biodiversity impacts associated with developments that require consent under the EP&A Act. It introduces a Biodiversity Offsets Scheme (BOS), a framework to avoid, minimise and offset impacts on biodiversity from development and clearing. The proponent for a development to which the BOS applies is required to prepare a Biodiversity Development Assessment Report (BDAR) in support of an application for approval to undertake that development. The BDAR uses the Biodiversity Assessment Method 2020 (BAM) established under these biodiversity reforms to provide a methodology for determining the number and type of biodiversity credits required to offset biodiversity impacts.

CSSI projects are required to prepare a BDAR to identify and assess biodiversity impacts under the provisions of the BC Act and offset those impacts by retiring biodiversity credits, determined using the BAM, through the BOS.

This BDAR has been specifically prepared to address the BAM and associated guidance documents to enable development approval under Part 5 of the EP&A Act.

2.2.3 Biosecurity Act 2015

The *Biosecurity Act 2015* provides for risk-based management of biosecurity in NSW. It provides a statutory framework to protect the NSW economy, environment and community from the negative impact of pests, diseases and weeds.

The primary object of the Act is to provide a framework for the prevention, elimination and minimisation of biosecurity risks posed by biosecurity matter, dealing with biosecurity matter, carriers and potential carriers, and other activities that involve biosecurity matter.

In NSW, all plants are regulated with a general biosecurity duty aimed to prevent, eliminate or minimise any biosecurity risk they may pose. Any person who deals with any plant, who knows (or ought to know) of any biosecurity risk, has a duty to ensure the risk is prevented, eliminated or minimised, so far as is reasonably practicable.

Priority weeds recorded in the study area and their control measures are detailed in Section 4.6.

2.2.4 Fisheries Management Act 1994

The FM Act was introduced to conserve, develop and share the fishery resources of the State for the benefit of present and future generations, and applies to all waters within the area occupied by the proposal. Part 7 of the FM Act relates to the protection of fish and aquatic habitats with the objective of conserving the biodiversity of fish and aquatic vegetation. It provides for the management of certain works located on land that is permanently or intermittently submerged by water.

Pursuant to sections 201, 205 and 219 of the FM Act, works and activities such as those required for the proposal, may be undertaken under the authority of a permit.

However, as the proposal has been declared as CSSI under section 5.13 of the EP&A Act, a permit under section 201, 205 or 219 or the FM Act is not required in accordance with section 5.23(1) of the EP&A Act.

Nevertheless, this report addresses biodiversity matters relating to threatened aquatic entities listed under the FM Act.

2.2.5 Local Land Services Act 2013

The Local Land Services (LLS) Act was introduced to provide direction around programs and services associated with agricultural production, biosecurity, natural resource management and emergency management. It aims to ensure the proper management of natural resources in the social, economic and environmental interests of the State, consistent with the principles of ecologically sustainable development. One of the ways that it intends to achieve this is through the regulation of clearing of native vegetation.

Part 5A of the LLS Act sets out the ways in which the regulating of activities (in connection with land management) would occur and the areas of the State to which it would apply. Section 60A applies Part 5A to rural area including lands associated with the proposal study area. Although Section 60O of the LLS Act excludes clearing that is authorised under other legislation. Furthermore, under the provisions of Section 60O of the LLS Act the clearing of native vegetation is authorised if the clearing was authorised by a State significant infrastructure approval under Division 5.2 of the EP&A Act.

Under the BC Act, section 6.8(3) regulates that the BAM is to exclude the assessment of the impacts of any clearing of native vegetation and loss of habitat on category 1-exempt land (within the meaning of Part 5A of LLS Act).

Category 1-exempt land is defined under the LLS Act (Part 5A Division 2 Section 60H) as:

Land is to be designated as category 1-exempt land if the Environment Agency Head reasonably believes that:

- *the land was cleared of native vegetation as at 1 January 1990, or*
- *the land was lawfully cleared of native vegetation between 1 January 1990 and the commencement of this Part.*

Land is to be designated as category 1-exempt land if the Environment Agency Head reasonably believes that:

- *the land contains low conservation value grasslands, or*
- *the land contains native vegetation that was identified as regrowth in a property vegetation plan referred to in section 9 (2) (b) of the Native Vegetation Act 2003, or*
- *the land is of a kind prescribed by the regulations as category 1-exempt land.*

All other rural lands that do not meet category 1 definition form part of the assessment area subject to this BDAR. The method for determining category 1 – exempt land for this proposal is outlined in Section 4.2.

3 Landscape context

This chapter address landscape context in accordance with Chapter 3 of the BAM and has been prepared in accordance with Part 1 of the BAM 2020 Operational Manual – Stage 1 (Department of Planning 2020). It provides information on a range of landscape features that occur on the proposal site and in surrounding areas. The landscape features outlined below are used to inform the habitat suitability for threatened species and the potential movement of species across the landscape. This information is used in the landscape context component of BAM-C.

This chapter also provides an assessment of native vegetation cover that is used in BAM-C to predict threatened species likely to occur or use habitat within the proposal study area.

3.1 Landscape features

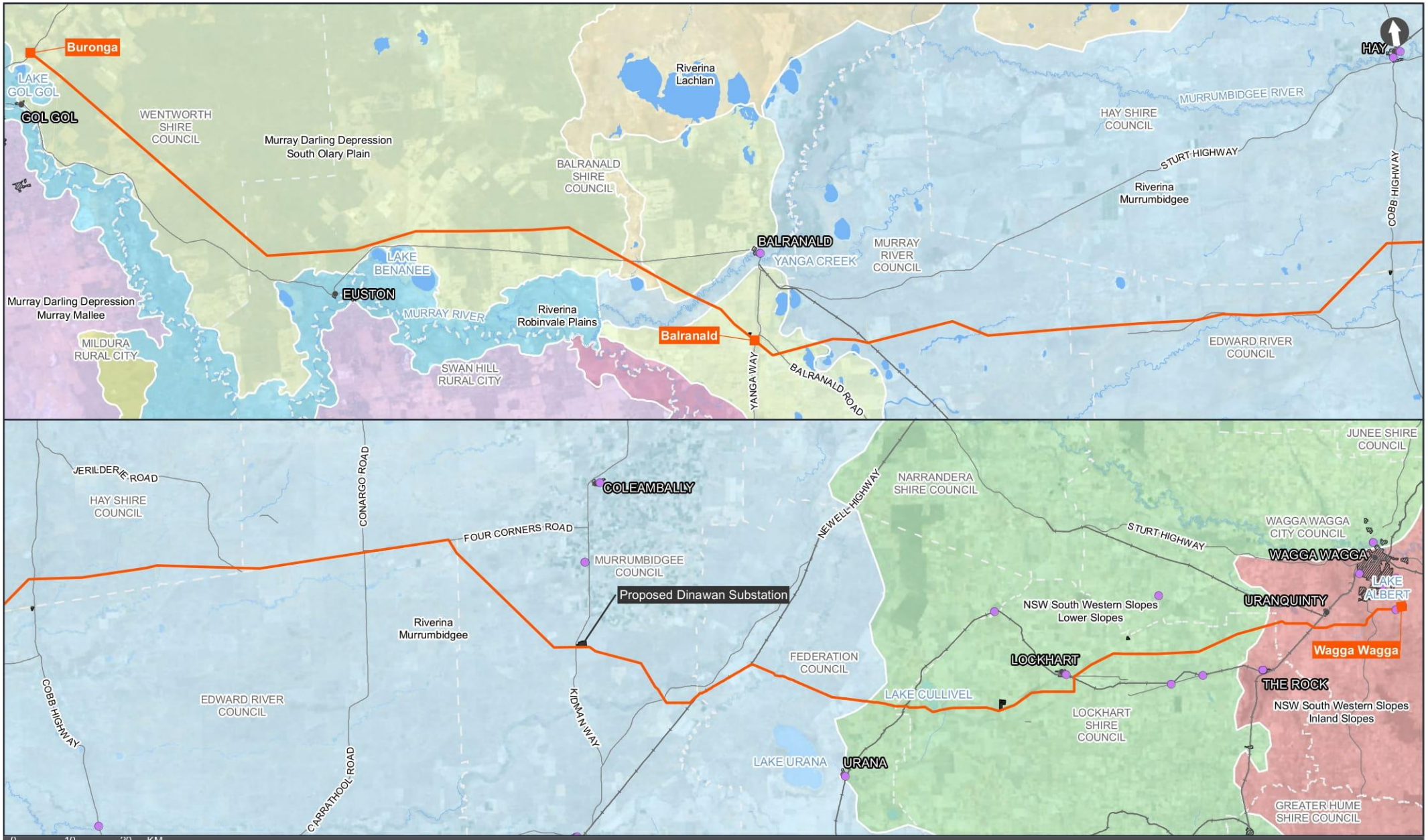
3.1.1 Identification of IBRA regions and subregions

The proposal study area occurs with three IBRA regions that comprise of five IBRA subregions. An overview of each IBRA region and subregion is presented in Table 3-1 and Figure 3-1.

Table 3-1 IBRA regions and subregions

IBRA REGION	IBRA SUBREGION	PROPOSAL STUDY AREA (HA)	DISTURBANCE AREA (HA)
Murray Darling Depression	South Olary Plain	3,000	906
Riverina	Lachlan	137	41
	Murrumbidgee	5,693	1,896
NSW South Western Slopes	Lower slopes	1,528	631
	Inland slopes	536	203

Given the long linear length nature of the proposal (540 kilometres) and that it traverses five separate IBRA subregions, habitat suitability assessments and BAM calculations have been undertaken for each subregion.



BDAR - Figure 3-1

Overview of IBRA Regions and Subregions

Project Components
- Proposed Alignment
- Access Tracks
- Main Construction Compounds and Accomodation
- Water Supply Point
- Existing Substation
- Existing Railway
- Local Government Areas
- Built Up Areas
- Waterbody

IBRA Regions and Subregions
- Murray Darling Depression - Lowan Mallee
- Murray Darling Depression - Murray Mallee
- Murray Darling Depression - South Olary Plain
- NSW South Western Slopes - Inland Slopes
- NSW South Western Slopes - Lower Slopes
- Riverina - Lachlan
- Riverina - Murray Fans
- Riverina - Murrumbidgee
- Riverina - Robinvale Plains

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Source: NSWSS, ESRI, Transgrid, WSP

3.1.2 Identification of landscape features

An overview of landscape features for each IBRA subregion is presented in

Figure 3-2 with details presented in Appendix A-1 and Appendix A-2. A summary of landscape features for each IBRA subregion is provided in Table 3-2, Table 3-3, Table 3-4, Table 3-5 and Table 3-6.

3.1.2.1 South Olary Plain IBRA subregion

Table 3-2 Summary of landscape features for the South Olary Plain IBRA subregion

LANDSCAPE FEATURE	OCCURRENCE IN PROPOSAL STUDY AREA
NSW landscape regions (Mitchell landscapes)	The flowing five Mitchell landscape units have been recorded within the study area for the South Olary Plain IBRA subregion. — Mallee Cliffs Linear Dunes – 1,400.11 hectares — Mallee Cliffs Sandplains – 1,148.57 hectares — Murrumbidgee Channels and Floodplains – 0.25 hectares — Murrumbidgee Depression Plains – 320.31 hectares — Murrumbidgee Scalded Plains – 126.79 hectares — Murrumbidgee Source-bordering Dunes – 4.39 hectares. The largest extent of Mitchell landscape was used for BAM-C calculation purpose, being Mallee Cliffs Linear Dunes. All Mitchell landscape units within the South Olary Plain IBRA subregion are shown in Figure 3-2 and Appendix A-1.
Local Government Area (LGA)	Within the South Olary Plain IBRA subregion, the proposal traverses three LGAs being: — Balranald Shire Council — Murray River Council — Wentworth Shire Council.
Rivers, streams and estuaries	A total of 10 streams have been identified and includes the following Strahler stream orders: — Strahler stream order 4: — one unnamed — Strahler stream order 2: — Condouple Creek — two unnamed — Strahler stream order 1: — six unnamed
Important and local wetlands	The proposal does not intersect with any important or local wetland area. The nearest local wetlands to the proposal are: — Lake Gol Gol – about 2.2 kilometres southwest of Buronga Substation — Dry Lake – about 700 metres to the south of the alignment — Lake Benanee – about 1.5 kilometres to the south of the alignment.
Connectivity features	The proposal has been co-located parallel to the existing 220kV transmission line (X5) for its entire length within the South Olary Plain IBRA subregion and as such the proposal is not considered to fragment or isolate any existing connectivity features.
Areas of geological significance and soil hazard features	No areas of geological significance and soil hazard features that impacts biodiversity values have been recorded.
Areas of outstanding biodiversity value	No areas of outstanding biodiversity value have been declared for this area.

3.1.2.2 Lachlan IBRA subregion

Table 3-3 Summary of landscape features for the Lachlan IBRA subregion

LANDSCAPE FEATURE	OCCURRENCE IN PROPOSAL STUDY AREA
NSW landscape regions (Mitchell landscapes)	The flowing three Mitchell landscape units have been recorded within the study area for the Lachlan IBRA subregion. — Mallee Cliffs Sandplains – 1.30 hectares — Murrumbidgee Channels and Floodplains – 85.85 hectares — Murrumbidgee Source-bordering Dunes – 50.28 hectares The largest extent of Mitchell landscape was used for BAM-C calculation purpose, being Murrumbidgee Channels and Floodplains. All Mitchell landscape units within the Lachlan IBRA subregion are shown in Figure 3-2 and Appendix A-1.
Local Government Area (LGA)	Within the Lachlan IBRA subregion, the proposal traverses one LGA being: — Balranald Shire Council.
Rivers, streams and estuaries	One stream, being Box Creek with a Strahler stream order of 8 has been recorded.
Important and local wetlands	The proposal does not intersect with any important or local wetland area. The nearest local wetland to the proposal is: — Waldaira Lake about 1.5 kilometres to the southwest of the alignment.
Connectivity features	The proposal has been co-located parallel to the existing 220kV transmission line (X5) for its entire length within the Lachlan IBRA subregion and as such the proposal is not considered to fragment or isolate any existing connectivity features.
Areas of geological significance and soil hazard features	No areas of geological significance and soil hazard features that impacts biodiversity values have been recorded.
Areas of outstanding biodiversity value	No areas of outstanding biodiversity value have been declared for this area.

3.1.2.3 Murrumbidgee IBRA subregion

Table 3-4 Summary of landscape features for the Murrumbidgee IBRA subregion

LANDSCAPE FEATURE	OCCURRENCE IN PROPOSAL STUDY AREA
NSW landscape regions (Mitchell landscapes)	The flowing seven Mitchell landscape units have been recorded within the study area for the Murrumbidgee IBRA subregion. — Buckingbong Gravels – 27.97 hectares — Mallee Cliffs Sandplains – 0.01 hectares — Murrumbidgee Channels and Floodplains – 580.65 hectares — Murrumbidgee Depression Plains – 2,413.03 hectares — Murrumbidgee Lakes, Swamps and Lunettes – 16.74 hectares — Murrumbidgee Scalded Plains – 2,400.15 hectares — Murrumbidgee Source-bordering Dunes – 50.92 hectares. The largest extent of Mitchell landscape was used for BAM-C calculation purpose, being Murrumbidgee Depression Plains. All Mitchell landscape units within the Murrumbidgee IBRA subregion are shown in Figure 3-2 and Appendix A-1.

LANDSCAPE FEATURE	OCCURRENCE IN PROPOSAL STUDY AREA
Local Government Area (LGA)	Within the Murrumbidgee IBRA subregion, the proposal traverses six LGAs being: — Balranald Shire Council — Edward River Council — Federation Council — Hay Shire Council — Murray River Council — Murrumbidgee Council
Rivers, streams and estuaries	A total of 37 rivers and streams have been identified and includes the following Strahler stream orders: — Strahler stream order 9: — Abercrombie Creek — Coleambally Outfall Drain — Colombo Creek — Curtains Creek — Murrumbidgee River — Nyangay Creek — Yanco Creek — Strahler stream order 4: — Eurolie Creek — Strahler stream order 3: — four unnamed — Strahler stream order 2: — Coonong Creek — Yellow Clay Creek — four unnamed — Strahler stream order 1: — Bublebundie Creek — 18 unnamed
Important and local wetlands	The proposal does not intersect with any important or local wetland area. The nearest local wetlands to the proposal is: — Lake Urana – about 7 kilometres to the south/southwest of the alignment — Lake Yanga – about 6 kilometres to the north of the alignment.
Connectivity features	The main connectivity features within the Murrumbidgee IBRA subregion are: — Colombo Creek — Murrumbidgee River — Yanco Creek.
Areas of geological significance and soil hazard features	No areas of geological significance and soil hazard features that impacts biodiversity values have been recorded.
Areas of outstanding biodiversity value	No areas of outstanding biodiversity value have been declared for this area.

3.1.2.4 Lower slopes IBRA subregion

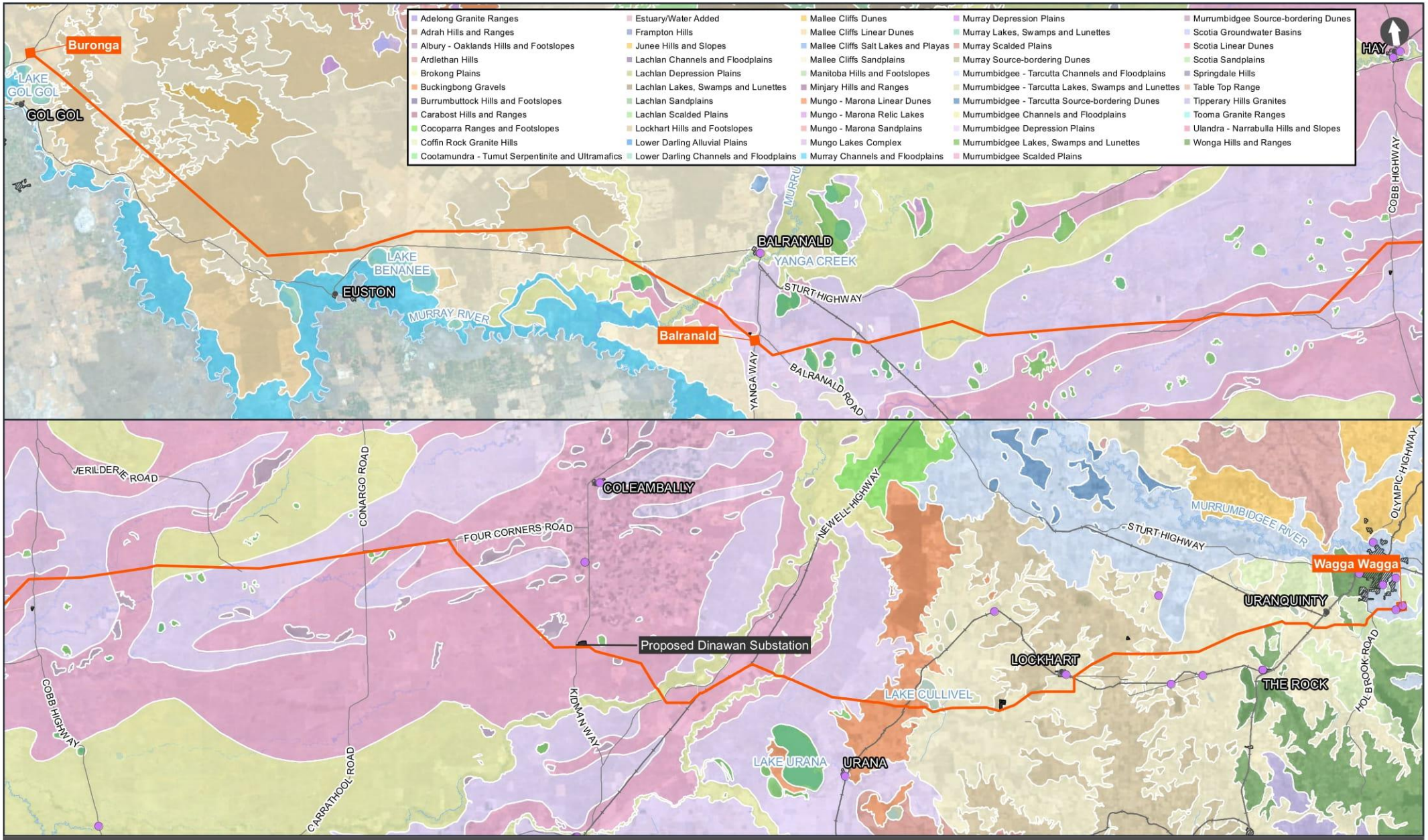
Table 3-5 Summary of landscape features for the Lower Slopes IBRA subregion

LANDSCAPE FEATURE	OCCURRENCE IN PROPOSAL STUDY AREA
NSW landscape regions (Mitchell landscapes)	The flowing five Mitchell landscape units have been recorded within the study area for the Lower Slopes IBRA subregion. — Brokong Plains – 957.09 hectares — Buckingbong Gravels – 214.42 hectares — Lockhart Hills and Footslopes – 311.32 hectares — Murrumbidgee – Tarcutta Lakes, Swamps and Lunettes – 35.78 hectares — Wonga Hills and Ranges – 9.08 hectares. — The largest extent of Mitchell landscape was used for BAM-C calculation purpose, being Brokong Plains. All Mitchell landscape units within the Lower Slopes IBRA subregion are shown in Figure 3-2 and Appendix A-1.
Local Government Area (LGA)	Within the Lachlan IBRA subregion, the proposal traverses two LGAs being: — Federation Council — Lockhart Shire Council.
Rivers, streams and estuaries	A total of 33 rivers and streams have been identified and includes the following Strahler stream orders: — Strahler stream order 6: — Bullenbong Creek — Burkes Creek — one unnamed — Strahler stream order 5: — Brookong Creek — Hallidays Cut — Strahler stream order 4: — Brookong Creek — two unnamed — Strahler stream order 3: — four unnamed — Strahler stream order 3: — five unnamed — Strahler stream order 1: — 16 unnamed.
Important and local wetlands	The proposal does not intersect with any important or local wetland area. The nearest local wetland to the proposal is: — Lake Cullivel – about 300 metres to the north of the alignment.
Connectivity features	The main connectivity features within the Lower Slopes IBRA subregion are: — Bullenbong Creek — Burkes Creek — Brookong Creek — Cullivel State Forest — Hallidays Cut.
Areas of geological significance and soil hazard features	No areas of geological significance and soil hazard features that impacts biodiversity values have been recorded.
Areas of outstanding biodiversity value	No areas of outstanding biodiversity value have been declared for this area.

3.1.2.5 Inland slopes IBRA subregion

Table 3-6 Summary of landscape features for the Inland Slopes IBRA subregion

LANDSCAPE FEATURE	OCCURRENCE IN PROPOSAL STUDY AREA
NSW landscape regions (Mitchell landscapes)	The flowing five Mitchell landscape units have been recorded within the study area for the Inland Slopes IBRA subregion. — Brokong Plains – 228.83 hectares — Coffin Rock Granite Hills – 136.23 hectares — Murrumbidgee – Tarcutta Channels and Floodplains – 120.41 hectares — Wonga Hills and Ranges – 51.76 hectares. The largest extent of Mitchell landscape was used for BAM-C calculation purpose, being Brokong Plains. All Mitchell landscape units within the Inland Slopes IBRA subregion are shown in Figure 3-2 and Appendix A-1.
Local Government Area (LGA)	Within the Inland Slopes IBRA subregion, the proposal traverses two LGAs being: — Lockhart Shire Council — Wagga Wagga City Council.
Rivers, streams and estuaries	A total of 45 rivers and streams have been identified and includes the following Strahler stream orders: — Strahler stream order 6: — Sandy Creek — Strahler stream order 5: — Crooked Creek — Strahler stream order 4: — Boiling Down Creek — one unnamed — Strahler stream order 3: — nine unnamed — Strahler stream order 3: — seven unnamed — Strahler stream order 1: — 25 unnamed.
Important and local wetlands	The proposal does not intersect with any important or local wetland area.
Connectivity features	The main connectivity features within the Inland Slopes IBRA subregion are: — Boiling Down Creek — Crooked Creek — Sandy Creek.
Areas of geological significance and soil hazard features	No areas of geological significance and soil hazard features that impacts biodiversity values have been recorded.
Areas of outstanding biodiversity value	No areas of outstanding biodiversity value have been declared for this area.


Adelong Granite Ranges
Adrah Hills and Ranges
Albury - Oaklands Hills and Footslopes
Ardlethan Hills
Brokong Plains
Buckingbong Gravels
Burrumbuttock Hills and Footslopes
Carabost Hills and Ranges
Cocoparra Ranges and Footslopes
Coffin Rock Granite Hills
Cootamundra - Tumut Serpentinite and Ultramafics
Estuary/Water Added
Frampton Hills
Junee Hills and Slopes
Lachlan Channels and Floodplains
Lachlan Depression Plains
Lachlan Lakes, Swamps and Lunettes
Lachlan Sandplains
Lachlan Scalded Plains
Lockhart Hills and Footslopes
Lower Darling Alluvial Plains
Lower Darling Channels and Floodplains
Mallee Cliffs Dunes
Mallee Cliffs Linear Dunes
Mallee Cliffs Salt Lakes and Playas
Mallee Cliffs Sandplains
Manitoba Hills and Footslopes
Minjary Hills and Ranges
Mungo - Marona Linear Dunes
Mungo - Marona Relic Lakes
Mungo - Marona Sandplains
Mungo Lakes Complex
Murray Channels and Floodplains
Murray Depression Plains
Murray Lakes, Swamps and Lunettes
Murray Scalded Plains
Murray Source-bordering Dunes
Murrumbidgee - Tarcutta Channels and Floodplains
Murrumbidgee - Tarcutta Lakes, Swamps and Lunettes
Murrumbidgee - Tarcutta Source-bordering Dunes
Murrumbidgee Channels and Floodplains
Murrumbidgee Depression Plains
Murrumbidgee Lakes, Swamps and Lunettes
Murrumbidgee Scalded Plains
Murrumbidgee Source-bordering Dunes
Scotia Groundwater Basins
Scotia Linear Dunes
Scotia Sandplains
Springdale Hills
Table Top Range
Tipperary Hills Granites
Tooma Granite Ranges
Ulandra - Narrabulla Hills and Slopes
Wonga Hills and Ranges
Buronga
LAKE GOL GOL
GOL GOL
HAY
COBB HIGHWAY
BALRANALD
YANGA CREEK
LAKE BENANEE
EUSTON
MURRAY RIVER
STURT HIGHWAY
Balranald
YANGA WAY
BALRANALD ROAD
JERILDERIE ROAD
CONARGO ROAD
COLEAMBALLY
FOUR CORNERS ROAD
NEWELL HIGHWAY
MURRUMBIDGEE RIVER
OLYMPIC HIGHWAY
Wagga Wagga
URANQUINTY
Proposed Dinawan Substation
LOCKHART
THE ROCK
HOLBROOK ROAD
LAKE CULLIVEL
KIDMAN WAY
LAKE URANA
URANA
CARRATHOOL ROAD
0
10
20 KM
BDAR - Figure 3-2
Overview of Landscape Features
Project Components
Proposed
Access Tracks
Main Construction Compounds and Accomodation
Water Supply Point
Existing Substation
Existing Railway
Built Up Areas
Waterbody
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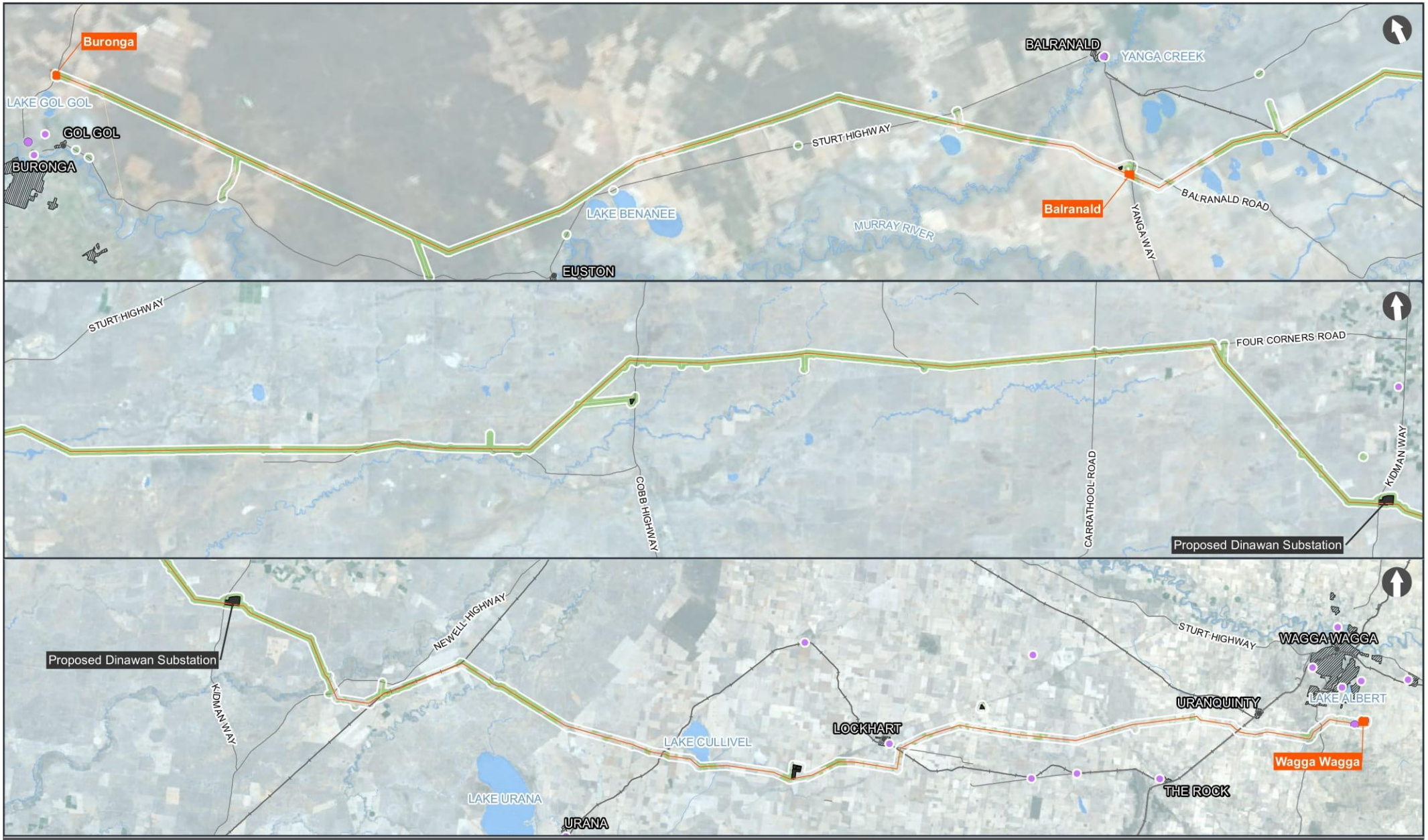
Source: NSWSS, ESRI, Transgrid, WSP

3.2 Assessing native vegetation cover

Native vegetation cover has been assessed in accordance with Section 3.2 of the BAM. Due the linear shape of the proposal, a 500 metre buffer following the proposed construction impact area proposal has been applied for native vegetation cover calculations. Native vegetation cover has been calculated for each IBRA subregion and assigned to cover classes range from 0–10%, >10–30%, >30–70% and >70% within BAM-C. A summary of native vegetation cover is presented in Table 3-7 and shown in Figure 3-3 and Appendix A-3.

Table 3-7 Assessment of native vegetation cover

IBRA SUB-REGION	ASSESSMENT AREA	TOTAL ASSESSMENT AREA (HA)	AREA OF NATIVE VEGETATION COVER (HA)	NATIVE VEGETATION PERCENTAGE COVER	BAM NATIVE VEGETATION COVER CLASS
South Olary Plain	500 metres along each side of the centre line of the proposed construction impact area	18,644	13,347	72%	>70%
Lachlan		814	577	71%	>70%
Murrumbidgee		34,375	30,072	87%	>70%
Lower Slopes		9,595	1,585	17%	10–30%
Inland Slopes		3,637	289	8%	0–10%


Buronga
LAKE GOL GOL
GOL GOL
BURONGA
STURT HIGHWAY
BALRANALD
YANGA CREEK
Balranald
BALRANALD ROAD
YANGA WAY
LAKE BENANEE
MURRAY RIVER
EUSTON
STURT HIGHWAY
FOUR CORNERS ROAD
COBB HIGHWAY
CARRATHOOL ROAD
KIDMAN WAY
Proposed Dinawan Substation
Proposed Dinawan Substation
NEWELL HIGHWAY
KIDMAN WAY
STURT HIGHWAY
WAGGA WAGGA
LAKE ALBERT
URANQUINTY
LOCKHART
LAKE CULLIVEL
Wagga Wagga
THE ROCK
LAKE URANA
URANA
0
10
20 KM
Project Components
Proposed Alignment
Access Tracks
Main Construction Compounds and Accomodation Sites
Water Supply Point
Existing Substation
Existing Railway
Built Up Areas
Waterbody
Disturbance Area Buffer (500m)
Native Vegetation
BDAR - Figure 3-3
Overview of Native Vegetation Cover
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Source: NSWSS, ESRI, Transgrid, WSP

4 Native vegetation

This chapter assesses native vegetation, threatened ecological communities and vegetation integrity within the proposal study area in accordance with Chapter 4 of the BAM and has been prepared in accordance with Part 2 of the BAM 2020 Operational Manual – Stage 1 (Department of Planning 2020).

4.1 Nomenclature

Names of vegetation communities used in this report are based on the Plant Community Type (PCT) used in the NSW BioNet Vegetation Classification Database (Environment Energy and Science Group 2020).

These names are cross-referenced with those used for threatened ecological communities listed under the BC Act final determinations and/or the EPBC Act listing advice.

Names of plants used in this document follow PlantNET (Royal Botanic Gardens 2021) and VICFLORA (VicFlora 2020). Scientific names are used in this report for species of plant. The names of introduced species are denoted with an asterisk (*).

4.2 Native vegetation regulatory mapping – Category 1 'Exempt Lands'

This section summarises the method and results of native vegetation regulatory mapping of proposed category 1 – exempt land within the proposal study area.

In accordance with section 6.8 (3) of the BC Act, the BAM excludes the assessment of impacts on category 1-exempt land (within the meaning of Part 5A of the Local Land Services Act 2013), other than any impacts prescribed by the regulations under section 6.3.

The LLS Act defines 'category 1-exempt land' as areas of the State to which Part 5A of the LLS Act applies, which are designated as category 1-exempt land on the 'native vegetation regulatory map', prepared and published under the LLS Act. A native vegetation regulatory map is being developed by EES, however this is currently incomplete and no category 1 land has been mapped within NSW.

Section 60F of the LLS Act provides transitional requirements which identify how the relevant categorisation of land is to be determined pursuant to section 60H of the LLS Act in the absence of a native vegetation regulatory map. Accredited assessors may determine the categorisation of land during this transitional period in accordance with Section 60F. The method applied to determine the categorisation is provided below.

4.2.1 Background to Category 1 – Exempt land

Under the NSW Land Management Framework, the categorisation of land determines the native vegetation management options available to landholders. Rural land in NSW is categorised into three main categories:

- Category 1 – exempt land is land where native vegetation can be cleared without approval from Local Land Services.
- Category 2 – land is divided into:
  - Category 2 – regulated land is Category 2 land that is not Vulnerable or Sensitive regulated land. You may need authorisation from Local Land Services to clear native vegetation from rural zoned land in this category.
  - Category 2 – vulnerable regulated land is land where clearing of native vegetation may not be permitted under the Land Management (Native Vegetation) Code 2018, and a limited range of allowable activities are permitted.
  - Category 2 – sensitive regulated land is land where clearing is not permitted under the Land Management Code (Native Vegetation) Code 2018, and a limited range of allowable activities is permitted.

- Excluded land – is land where the Land Management (Native Vegetation) Code 2018 and allowable activities do not apply.

4.2.2 Land category criteria

Each land category is determined by various criteria as outlined in the Local Land Services Act 2013 (LLS Act). Category 1 – exempt land is defined in 60H of the LLS Act as the below:

1 Land is to be designated as Category 1 – exempt land if the Environment Agency Head reasonably believes that:

- **a** the land was cleared of native vegetation as at 1 January 1990, or
- **b** the land was lawfully cleared of native vegetation between 1 January 1990 and the commencement of this Part.

2 Land is to be designated as Category 1 – exempt land if the Environment Agency Head reasonably believes that:

- **a** the land contains low conservation value grasslands, or
- **b** the land contains native vegetation that was identified as regrowth in a property vegetation plan referred to in section 9 (2) (b) of the Native Vegetation Act 2003, or
- **c** the land is of a kind prescribed by the regulations as Category 1 – exempt land.

3 Land is to be designated as Category 1 – exempt land if the land is biodiversity certified under Part 8 of the Biodiversity Conservation Act 2016 or under any Act repealed by that Act.

4 However:

- **a** land described in subsection (1) or (2) is not to be designated as Category 1 – exempt land if section 60I (2) requires the land to be designated as category 2-regulated land, and
- **b** land described in subsection (1) (a) is not to be designated as Category 1 – exempt land if the land was unlawfully cleared of native vegetation after 1 January 1990, and
- **c** land described in subsection (2) (a) is not to be designated as Category 1 – exempt land if the land was unlawfully cleared of native vegetation after 1 January 1990.

5 The regulations may make provision for the purposes of determining whether grasslands are low conservation value grasslands for the purposes of this Division.

4.2.3 Determination of mapped category of land

The matters relating to determination of mapped category of land are outlined in 60J of the LLS Act. Section 60J of the LLS Act is reproduced below:

1 This section makes provision relating to the mapping of land under this Division as category 1-exempt land or Category 2 – regulated land.

2 Native vegetation that comprises grasslands or other non-woody vegetation is taken to have been cleared if the native vegetation was significantly disturbed or modified. The regulations may make provision for the purposes of determining whether native vegetation has been significantly disturbed or modified for the purposes of this Division.

3 Determinations may be made by the Environment Agency Head that land was unlawfully cleared of native vegetation only if compliance or enforcement action of a kind prescribed by regulations was taken in relation to the clearing.

4 Determinations may be made by the Environment Agency Head that land was cleared of native vegetation as at 1 January 1990 or between that date and the commencement of this Part only on the basis of the best available aerial photographs or satellite imagery before and after the relevant date, and any evidence provided by the landholder under section 60K (8).

5 Determinations made (or taken on appeal to have been made) by the Environment Agency Head as to whether land was or was not unlawfully cleared of native vegetation does not affect any decision made with respect to compliance or enforcement action taken under this or any other Act in relation to the clearing.

4.2.4 Biodiversity assessment method requirements

In accordance with section 6.8 (3) of the *Biodiversity Conservation Act 2016* (BC Act), when applying the Biodiversity Assessment Method (BAM) the assessor is to exclude the assessment of impacts of any clearing of native vegetation and loss of habitat on Category 1 – exempt land (within the meaning of Part 5A of the LLS Act), other than any impacts prescribed by the regulations under section 6.3.

All other rural lands that do not meet the definition of Category 1 – exempt land form part of the assessment area subject to the BAM.

4.2.5 Assessment of Category 1 exempt land

The LLS Act publishes maps (the native vegetation regulatory map) that show areas of the State to which Part 5A of the LLS Act applies, which are designated as Category 1 – exempt land. However, the native vegetation regulatory map is currently incomplete, and Category 1 – exempt land has not yet been mapped within NSW.

Section 60F of the LLS Act provides transitional requirements which identify how the relevant categorisation of land is to be determined pursuant to section 60H of the LLS Act in the absence of a native vegetation regulatory map.

WSP have developed a desktop land characterisation methodology that builds on previous land categorisation assessments and with reference to the Native vegetation regulatory map (NVR): method statement (OEH 2017).

In defining the area Category 1 – exempt land, an initial analysis of the following spatial datasets has been undertaken:

- Land use: NSW Land Use 2017 v1.2, published June 2020.
- Woody vegetation: NSW Woody Vegetation Extent 2011, published 2015.
- NVR: Transitional Native Vegetation Regulatory Map, version 3.0, published 26 March 2021.
- Zoning: EPI LEP LZN Land Zoning, current at 23 April 2021.
- Travelling Stock Routes, LPI, supplied by ARTC 30 October 2020.
- State Vegetation Type Map.
- Aerial photos (to determine areas that were/are obviously under cultivation or improved pasture or otherwise disturbed).

Each of these datasets was used to determine whether native vegetation has been significantly disturbed or modified (and therefore cleared) in accordance with 60J of the LLS Act.

The steps in identifying Category 1 – exempt land included the following:

1. An initial inclusion of all land use classifications 3, 4 and most of 5 as mapped by the Land use: NSW Land Use 2017 v1.2, published June 2020 (consistent with figure 7 of the NVR method statement) (OEH 2017).
2. The land use classification was subsequently overlayed with the Transitional Native Vegetation Regulatory Map, version 3.0, published 26 March 2021 and any areas of the subject site mapped as Category 2 lands were excluded.
3. This was followed by the exclusion of areas of extant remnant vegetation as published within the Woody vegetation: NSW Woody Vegetation Extent 2011, (OEH, 2015) which were also included within the Category 2 lands.
4. Finally, State Vegetation mapping and field verification surveys were used to further classify any areas of mapped native vegetation, including derived native grasslands and were included within the Category 2 lands.

A summary of this process is provided in Figure 4-1.

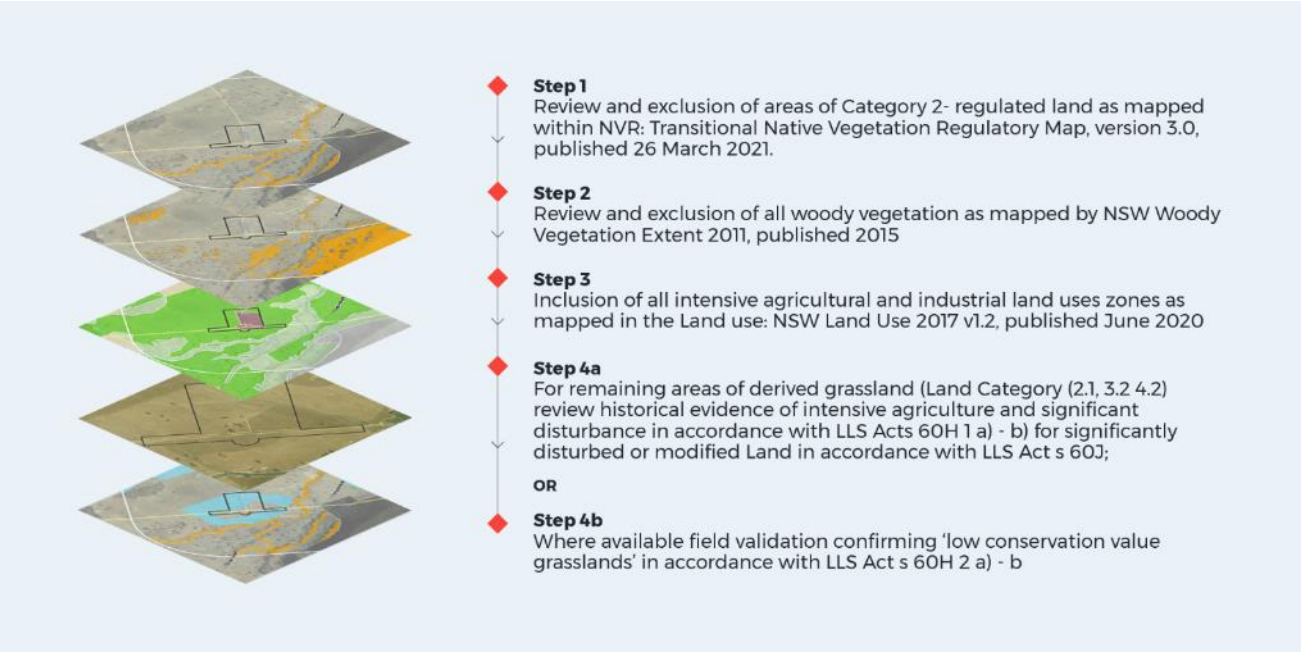
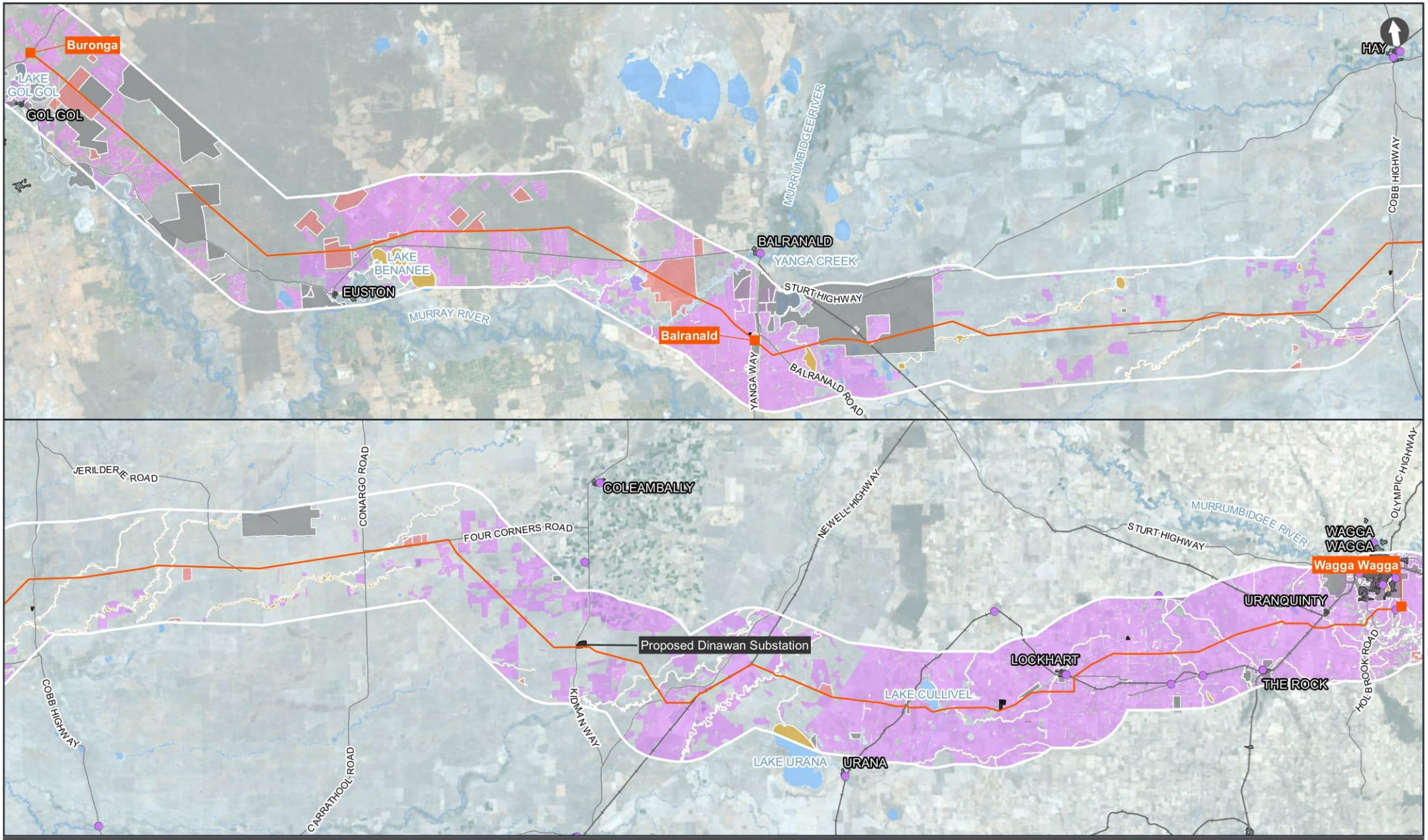


Figure 4-1 Approach to identifying Category 1 - exempt land

The outcome of native vegetation regulatory mapping category 1-exempt land is presented in Figure 4-2 and Appendix B-1.

All category 1 lands identified within the proposal site are exempt from BAM assessment and are not considered further in this BDAR.



BDAR - Figure 4-2

Overview of Native Vegetation Regulatory Mapping Category 1 - Exempt Land

Project Components
- Proposed Alignment
- Access Tracks
- Main Construction Compounds and Accomodation Sites
- Water Supply Point
- Existing Substation
- Existing Railway
- Built Up Areas
- Waterbody

Native Vegetation Regulatory Mapping
- Category 1 - Exempt Land
- Category 2 - Vulnerable Regulated Land
- Category 2 - Sensitive Regulated Land
- Category 2 - Vulnerable and Sensitive Regulated Land
- Excluded Land

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Source: NSWSS, ESRI, Transgrid, WSP

4.3 Native vegetation survey methods

Native vegetation survey methods were undertaken were undertaken within the proposal site during the following dates:

- 24–26 May 2019
- 10–18 February 2020
- 19–20 March 2020
- 4–10 September 2020
- 20–28 October 2020
- 23–31 March 2021
- 8–15 April 2021
- 7–8 June 2021
- 5–16 August 2021
- 7–16 September 2021
- 11–13 October 2021
- 18–22 October 2021
- 30 October – 1 November 2021.

4.3.1 Native vegetation extent

Mapping of native vegetation extent within the proposal site is required under section 4.1 of the BAM with detailed requirements outlined in section 3.2 of the BAM 2020 Operational Manual.

In determining native vegetation extent within the proposal study area the following method was employed:

- Preliminary mapping of vegetation community boundaries was undertaken through analysis of existing vegetation mapping and aerial photograph interpretation.
- Vegetation within the proposal study area and locality has been mapped at the regional scale in:
  - State Vegetation Type Map: Western Region Version v1.0 – VIS_ID 4492 (Department of Planning 2016)
  - State Vegetation Type Map: Riverina Region Version v1.2 – VIS_ID 4469 (Department of Planning 2016).
- This mapping was further refined within the proposal study area as part of preliminary documentation for the proposal in:
  - Environmental Scoping Report – EnergyConnect (NSW – Eastern Section), prepared for Transgrid (WSP 2020).
- Data on geology, dominant canopy species, native species richness, vegetation structure and condition were collected from areas able to be accessed during field surveys to validate and refine this existing vegetation mapping to determine their associated PCT in accordance with the BioNet Vegetation Classification System (Environment Energy and Science 2021).
- In areas that could not be surveyed due to access restrictions, existing mapping undertaken as part of the State vegetation mapping of the Western Region (Department of Planning 2016) and Riverina Region (Department of Planning 2016) and was adopted.

4.3.2 Mapping of native vegetation zones

The vegetation within the study area was firstly assessed to a PCT level and then aligned to a vegetation zone which is defined in the BAM as ‘an area of native vegetation on the proposal site that is the same PCT and has the same broad condition state’.

A broad condition state infers that the vegetation has a similar tree cover, shrub cover, ground cover, weediness or combinations of these attributes which determine vegetation condition.

Broad condition state is used for stratifying areas of the same PCT into a vegetation zone for determining the vegetation integrity score. Broad condition states used for this report are outlined in Table 4-1.

Table 4-1 Native vegetation broad condition states

BROAD CONDITION STATE	DESCRIPTION
Moderate - good	Native vegetation is relatively intact with all structural layers present. Exotic weed cover is generally less than 30%. Two variants of this broad condition state were applied to the Mallee vegetation, being 'Bull' and 'Whipstick'. These variants were used to distinguish between areas which either contained a mature or semi-mature canopy cohort due to past disturbances such as fire regimes and past tree clearing. Where these disturbances were higher the canopy cohort was generally younger and had not yet had time to form hollows (whipstick variant). Where these disturbances were less, the canopy cohort was generally older (Bull) and contained hollow bearing trees.
Moderate	Native vegetation where one or more structural understorey components of the vegetation is entirely removed or severely reduced. Vegetation integrity scores are generally less than 60 and exotic cover is generally greater than 30%.
Poor	Vegetation has retained a native canopy or the canopy cover is showing signs of regeneration. The understorey and groundcover layers are generally dominated or co-dominated by exotic species. Native species diversity is generally relatively low and the mid and low stratums have been structurally modified due to weed incursions, clearing, agricultural practises such as cropping or direct seeding.
Derived	Native vegetation generally lacking a native over-storey and mid stratum. For this proposal, it includes PCTs that have changed to an alternative stable state because of land management practices since European settlement. Over-storey structural components of derived communities have either entirely been removed or are severely reduced (i.e. derived native grasslands with or without scatted paddock trees). Derived grassland was assigned to patches of vegetation where native perennial cover was greater than 50%.

4.3.3 Vegetation integrity plot method

Vegetation integrity plots were completed in accordance with BAM. A schematic diagram illustrating the layout of each vegetation integrity plot is provided in Figure 4-3.

Figure 4-3 Vegetation integrity plot layout

The following site attributes were recorded at each vegetation integrity plot location:

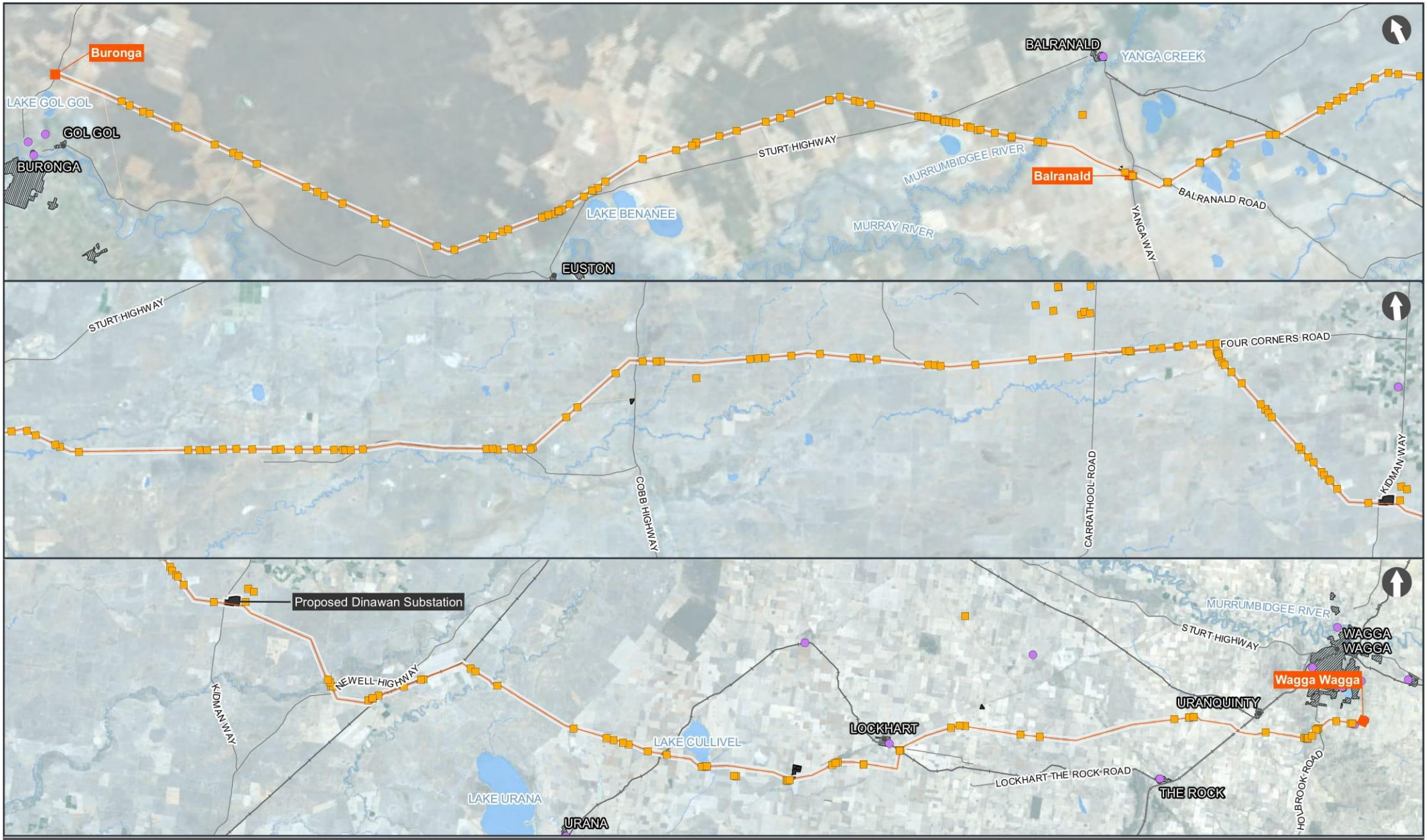
- **Location:** (easting – northing grid type MGA 94, Zone 54 & 55).
- **Vegetation structure and dominant species and vegetation condition:** Vegetation structure was recorded through estimates of percentage foliage cover, average height and height range for each vegetation layer.
- **Native and exotic species richness** (within a 400-metre squared quadrat): This consisted of recording all species by systematically walking through each 20 metre x 20 metre plot. The cover and abundance (percentage of area of quadrat covered) of each species was estimated. The growth form, stratum/layer and whether each species was native/exotic/high threat weed was also recorded.
- **Number of trees with hollows** (1000 metre squared quadrat): This was the frequency of hollows within living and dead trees within each 50 metre x 20 metre plot. A hollow was only recorded if (a) the entrance could be seen: (b) the estimated entrance width was at least five centimetres across: (c) the hollow appeared to have depth: (d) the hollow was at least one metre above the ground and the (e) the centre of the tree was located within the sampled quadrat.
- **Number of large trees and stem size diversity** (1000 metre squared quadrat): tree stem size diversity was calculated by measuring the diameter at breast height (DBH) (i.e. 1.3 metre from the ground) of all living trees (greater than five centimetre DBH) within each 50 metre x 20 metre plot. For multi-stemmed living trees, only the largest stem was included in the count. Number of large trees was determined by comparing living tree stem DBH against the PCTs benchmarks.
- **Total length of fallen logs** (1000 metre squared quadrat): This was the cumulative total of logs within each 50 metre x 20 metre plot with a diameter of at least 10 centimetres and a length of at least 0.5 metre.
- **Litter cover:** This comprised estimating the average percentage groundcover of litter (i.e. leaves, seeds, twigs, branchlets and branches with a diameter less than 10 centimetre which is detached from a living plant) from within five 1 metre x 1 metre sub-plots spaced evenly either side of the 50-metre central transect.
- **Evaluation of regeneration:** This was estimated as the presence/absence of overstorey species present at the site that was regenerating (i.e. saplings with a diameter at breast height less than or equal to five centimetres).

Prior to establishing plot survey locations, vegetation stratification was undertaken to provide a representative vegetation zone for sampling. Stratification involved marking waypoints and bearings randomly to provide a representative assessment of the vegetation integrity of the vegetation zone in the study area and establishing the required number of plots at some of these waypoints.

4.3.4 Vegetation integrity plot survey effort

A total of 243 vegetation integrity plots were sampled using the method contained in the BAM and as described in Section 4.3.3. The minimum number of vegetation integrity plots required per vegetation zone is presented in Table 4-2, Table 4-3, Table 4-4, Table 4-5 and Table 4-6 with plot locations details outlined in Figure 4-4 and Appendix C-5. For areas in which State vegetation mapping has been applied (areas that could not be surveyed due to access restrictions), benchmark conditions set out by the BioNet Vegetation Classification System (Environment Energy and Science 2021) were assumed in order to take a conservative approach.

In terms of plot selection for BAM-C calculations, the same suite of plots were used for each vegetation broad condition state for all disturbance area calculations (i.e. a PCT in moderate to good condition used the same suite of plots for disturbance area A, B4 and B10 to ensure consistency of vegetation integrity for the same broad condition state).



BDAR - Figure 4-4

Overview of Vegetation Integrity Plots

Project Components

- Proposed Alignment
- Access Tracks
- Main Construction Compounds and Accomodation Sites
- Water Supply Point
- Existing Substation
- Existing Railway
- Built Up Areas
- Waterbody
- Biodiversity Study Area
- BAM Vegetation Integrity Plot

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Source: NSWSS, ESRI, Transgrid, WSP

Where native vegetation broad condition state was observed to be consistent in adjoining IBRA subregions, surrogate plots from adjacent regions were used for BAM-C calculation purpose. The use of these plots were considered representative based on the following rationale:

- recorded vegetation composition, structure and function were representative to that observed within the adjacent IBRA subregion
- agricultural disturbance regimes within the PCT were consistent between IBRA subregions
- climatic variables such as rainfall and temperature prior to surveys were generally consistent between IBRA subregions
- vegetation integrity plot selection utilised closely located representative plots between each adjoining IBRA subregion.

Table 4-2 Minimum number of vegetation integrity plots required per vegetation zone area for the South Olary Plain IBRA subregion

NATIVE VEGETATION ZONE (PCT)	VEG ZONE # (BAM-C)	VEG ZONE NAME (BAM-C)	AREA (HA)	# PLOTS REQUIRED	PLOTS SAMPLED
Arid Shrublands (Acacia sub-formation)					
PCT 143 – Narrow-leaved Hopbush – Scrub Turpentine – Senna shrubland on semi-arid and arid sandplains and dunes	VZ #5	143_Mod-good	2.20	2	Q127E Q130E Q134E
PCT 199 – Hooked Needlewood – Needlewood Mulga – Turpentine Bush open shrubland of the semi-arid and arid plains	VZ #11	199_Mod-good	1.31	1	Q119E
Arid Shrublands (Chenopod sub-formation)					
PCT 163 – Dillon Bush (Nitre Bush) shrubland of the semi-arid and arid zones	VZ #6	163_Mod-good	8.18	3	Q5E Q146E Q161E
Semi-arid Woodlands (Grassy sub-formation)					
PCT 15 – Black Box open woodland wetland with chenopod understorey mainly on the outer floodplains in south-western NSW (mainly Riverina Bioregion and Murray Darling Depression Bioregion)	VZ #1	15_Mod-good	5.75	3	Q26E Q162E Q163E
Semi-arid Woodlands (Shrubby sub-formation)					
PCT 22 – Semi-arid shrubby Buloke – Slender Cypress Pine woodland, far south-western NSW	VZ #2	22_Mod-good	2.93	2	Q166E Q229E
PCT 23 – Yarran tall open shrubland of the sandplains and plains of the semi-arid (warm) and arid climate zones	VZ #3	23_Mod-good	5.07	3	Q4E Q8E Q122E Q142E

NATIVE VEGETATION ZONE (PCT)	VEG ZONE # (BAM-C)	VEG ZONE NAME (BAM-C)	AREA (HA)	# PLOTS REQUIRED	PLOTS SAMPLED
PCT 58 – Black Oak – Western Rosewood open woodland on deep sandy loams mainly in the Murray Darling Depression Bioregion	VZ #4	58_Mod-good	67.32	5	Q125E Q137E Q160E Q164E Q165E
	VZ #14	58_SVM_Bench	8.17	n/a	Benchmark
PCT 170 – Chenopod sandplain mallee woodland/ shrubland of the arid and semi-arid (warm) zones	VZ #7	170_Mod-good_bull	57.30	5	Q10E Q24E Q115E Q116E Q120E
	VZ #8	170_Mod-good_whip	221.71	6	Q7E Q16E Q19E Q46E Q47E Q126E
	VZ #12	170_Derived	5.16	3	Q128E Q132E Q167E
	VZ #15	170_SVM_Bench	8.83	n/a	Benchmark
PCT 171 – Spinifex linear dune mallee mainly of the Murray Darling Depression Bioregion	VZ #9	171_Mod-good_whip	43.84	4	Q11E Q17E Q22E Q117E Q121E
	VZ #13	171_Derived	0.63	1	Q144E
PCT 172 – Deep sand mallee of irregular dunefields of the semi-arid (warm) zone	VZ #10	172_Mod-good_whip	45.31	4	Q14E Q21E Q44E Q45E

Table 4-3 Minimum number of vegetation integrity plots required per vegetation zone area for the Lachlan IBRA subregion

NATIVE VEGETATION ZONE (PCT)	VEG ZONE # (BAM-C)	VEG ZONE NAME (BAM-C)	AREA (HA)	# PLOTS REQUIRED	PLOTS SAMPLED
Arid Shrublands (Chenopod sub-formation)					
PCT 163 – Dillon Bush (Nitre Bush) shrubland of the semi-arid and arid zones	VZ #5	24_Mod-good	5.66	3	Q148E Q150E Q151E
Freshwater Wetlands					
PCT 24 – Canegrass swamp tall grassland wetland of drainage depressions, lakes and pans of the inland plains	VZ #3	24_Mod-good	0.37	1	Q6E Q149E
Semi-arid Woodlands (Grassy sub-formation)					
PCT 15 – Black Box open woodland wetland with chenopod understorey mainly on the outer floodplains in south-western NSW (mainly Riverina Bioregion and Murray Darling Depression Bioregion)	VZ #1	15_Mod-good	0.07	1	Q153E Q162E
	VZ #7	15_Derived	0.91	1	Q154E Q155E
Semi-arid Woodlands (Shrubby sub-formation)					
PCT 23 – Yarran tall open shrubland of the sandplains and plains of the semi-arid (warm) and arid climate zones	VZ #2	23_Mod-good	0.11	1	Q142E
PCT 58 – Black Oak – Western Rosewood open woodland on deep sandy loams mainly in the Murray Darling Depression Bioregion	VZ #4	58_Mod-good	3.69	2	Q158E Q159E
PCT 170 – Chenopod sandplain mallee woodland/ shrubland of the arid and semi-arid (warm) zones	VZ #6	170_Mod-good_bull	6.36	3	Q2E Q156E Q157E

Table 4-4 Minimum number of vegetation integrity plots required per vegetation zone area for the Murrumbidgee IBRA subregion

NATIVE VEGETATION ZONE (PCT)	VEG ZONE # (BAM-C)	VEG ZONE NAME (BAM-C)	AREA (HA)	# PLOTS REQUIRED	PLOTS SAMPLED
Arid Shrublands (Acacia sub-formation)					
PCT 143 – Narrow-leaved Hopbush – Scrub Turpentine – Senna shrubland on semi-arid and arid sandplains and dunes	VZ #28	143_Mod-good	0.05	1	Q143E
Arid Shrublands (Chenopod sub-formation)					
PCT 157 – Bladder Saltbush shrubland on alluvial plains in the semi-arid (warm) zone including Riverina Bioregion	VZ #23	157_Mod-good	35.80	4	Q48E Q49E Q50E Q55E Q68E
	VZ #45	157_SVM_Bench	11.80	n/a	Benchmark
PCT 163 – Dillon Bush (Nitre Bush) shrubland of the semi-arid and arid zones	VZ #25	163_Mod-good	87.79	5	Q42E Q57E Q61E Q66E Q88E
	VZ #48	163_SVM_Bench	7.73	n/a	Benchmark
PCT 164 – Cotton Bush open shrubland of the semi-arid (warm) zone	VZ #26	164_Mod-good	89.23	5	Q35E Q52E Q56E Q64E Q83E
	VZ #45	164_SVM_Bench	43.12	n/a	Benchmark
PCT 216 – Black Roly Poly low open shrubland of the Riverina	VZ #29	216_Mod-good	14.96	3	Q107E Q177E Q214E
Freshwater Wetlands					
PCT 17 – Lignum shrubland wetland of the semi-arid (warm) plains (mainly Riverina Bioregion and Murray Darling Depression Bioregion)	VZ #8	17_Mod-good	13.10	3	Q37E Q63E Q65E Q74E
	VZ #35	17_SVM_Bench	4.10	n/a	Benchmark
PCT 24 – Canegrass swamp tall grassland wetland of drainage depressions, lakes and pans of the inland plains	VZ #11	24_Mod-good	11.85	3	Q70E Q71E Q73E
	VZ #36	24_SVM_Bench	0.01	n/a	Benchmark

NATIVE VEGETATION ZONE (PCT)	VEG ZONE # (BAM-C)	VEG ZONE NAME (BAM-C)	AREA (HA)	# PLOTS REQUIRED	PLOTS SAMPLED
PCT 47 – Swamp grassland wetland of the Riverine Plain	VZ #19	47_Mod-good	2.13	2	Q194E
	VZ #42	47_SVM_Bench	0.88	n/a	Benchmark
PCT 53 – Shallow freshwater wetland sedgeland in depressions on floodplains on inland alluvial plains and floodplains	VZ #20	53_Mod-good	1.73	1	Benchmark
PCT 160 – Nitre Goosefoot shrubland wetland on clays of the inland floodplains	VZ #24	160_Mod-good	27.24	4	Q75E Q76E Q84E Q209E
	VZ #46	160_SVM_Bench	0.95	n/a	Benchmark
PCT 182 – Cumbungi rushland wetland of shallow semi-permanent water bodies and inland watercourses	VZ #30	182_Mod-good	0.07	1	Benchmark
Forested Wetlands					
PCT 5 – River Red Gum herbaceous-grassy very tall open forest wetland on inner floodplains in the lower slopes sub-region of the NSW South Western Slopes Bioregion and the eastern Riverina Bioregion	VZ #1	5_Mod-good	4.88	2	Q106E Q198E
PCT 7 – River Red Gum – Warrego Grass – herbaceous riparian tall open forest wetland mainly in the Riverina Bioregion	VZ #2	7_Mod-good	0.77	1	Q199E
	VZ #33	7_SVM_Bench	0.01	n/a	Benchmark
PCT 8 – River Red Gum – Warrego Grass – Couch Grass riparian tall woodland wetland of the semi-arid (warm) climate zone (Riverina Bioregion and Murray Darling Depression Bioregion)	VZ #3	8_Mod-good	4.77	2	Q23E
PCT 11 – River Red Gum – Lignum very tall open forest or woodland wetland on floodplains of semi-arid (warm) climate zone (mainly Riverina Bioregion and Murray Darling Depression Bioregion)	VZ #4	11_Mod-good	13.86	3	Q1E Q99E Q104E
Grasslands					
PCT 44 – Forb-rich Speargrass – Windmill Grass – White Top grassland of the Riverina Bioregion	VZ #16	44_Mod-good	36.75	4	Q79E Q86E Q189E Q212E Q213E
	VZ #39	44_SVM_Bench	8.40	n/a	Benchmark

NATIVE VEGETATION ZONE (PCT)	VEG ZONE # (BAM-C)	VEG ZONE NAME (BAM-C)	AREA (HA)	# PLOTS REQUIRED	PLOTS SAMPLED
PCT 45 – Plains Grass grassland on alluvial mainly clay soils in the Riverina Bioregion and NSW South Western Slopes Bioregion	VZ #17	45_mod-good	27.25	4	Q190E Q193E Q218E Q220E Q221E
	VZ #40	45_SVM_Bench	10.01	n/a	Benchmark
PCT 46 – Curly Windmill Grass – speargrass – wallaby grass grassland on alluvial clay and loam on the Hay plain, Riverina Bioregion	VZ #18	46_Mod-good	45.18	4	Q178E Q179E Q182E Q191E Q216E Q217E
	VZ #41	46_SVM_Bench	23.08	n/a	Benchmark
Saline Wetlands					
PCT 166 – Disturbed annual saltbush forbland on clay plains and inundation zones mainly of south-western NSW	VZ #46	166_SVM_Bench	0.95	n/a	Benchmark
Semi-arid Woodlands (Grassy sub-formation)					
PCT 13 – Black Box – Lignum woodland wetland of the inner floodplains in the semi-arid (warm) climate zone (mainly Riverina Bioregion and Murray Darling Depression Bioregion)	VZ #5	13_Mod-good	9.76	3	Q169E Q172E Q173E Q176E
	VZ #47	13_SVM_Bench	0.24	n/a	Benchmark
PCT 15 – Black Box open woodland wetland with chenopod understorey mainly on the outer floodplains in south-western NSW (mainly Riverina Bioregion and Murray Darling Depression Bioregion)	VZ #6	15_Mod-good	14.49	3	Q87E Q153E Q162E
	VZ #7	15_Derived	1.89	1	Q41E Q85E
	VZ #34	15_SVM_Bench	0.14	n/a	Benchmark
PCT 26 – Weeping Myall open woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion	VZ #12	26_Mod-good	63.42	5	Q28E Q98E Q168E Q171E Q175E
	VZ #13	26_Moderate	37.70	4	Q96E Q97E Q181E Q183E Q197E

NATIVE VEGETATION ZONE (PCT)	VEG ZONE # (BAM-C)	VEG ZONE NAME (BAM-C)	AREA (HA)	# PLOTS REQUIRED	PLOTS SAMPLED
	VZ #14	26_Derived	212.33	6	Q100E Q102E Q103E Q109E Q174E
	VZ #37	26_SVM_Bench	0.09	n/a	Benchmark
Semi-arid Woodlands (Shrubby sub-formation)					
PCT 23 – Yarran tall open shrubland of the sandplains and plains of the semi-arid (warm) and arid climate zones	VZ #9	23_Mod-good	5.62	3	Q4E Q38E Q122E
	VZ #10	23_Derived	7.71	3	Q39E Q91E Q92E Q94E
PCT 28 – White Cypress Pine open woodland of sand plains, prior streams and dunes mainly of the semi-arid (warm) climate zones	VZ #15	28_Mod-good	19.76	3	Q40E Q101E Q170E Q180E
	VZ #38	28_SVM_Bench	9.39	n/a	Benchmark
PCT 58 – Black Oak – Western Rosewood open woodland on deep sandy loams mainly in the Murray Darling Depression Bioregion	VZ #21	58_Mod-good	36.06	4	Q36E Q93E Q123E Q124E
	VZ #27	58_Moderate	0.30	1	Q58E
	VZ #22	58_Derived	4.81	2	Q59E Q77E
PCT 75 – Yellow Box – White Cypress Pine grassy woodland on deep sandy-loam alluvial soils of the eastern Riverina Bioregion and western NSW South Western Slopes Bioregion	VZ #32	75_Mod-good	0.21	1	Q188E
PCT 170 – Chenopod sandplain mallee woodland/ shrubland of the arid and semi-arid (warm) zones	VZ #31	170_Mod-good_whip	0.21	1	Q145E

Table 4-5 Minimum number of vegetation integrity plots required per vegetation zone area for the Lower Slopes IBRA subregion

NATIVE VEGETATION ZONE (PCT)	VEG ZONE # (BAM-C)	VEG ZONE NAME (BAM-C)	AREA (HA)	PLOTS REQUIRED	PLOTS SAMPLED
Forested Wetlands					
PCT 5 – River Red Gum herbaceous-grassy very tall open forest wetland on inner floodplains in the lower slopes sub-region of the NSW South Western Slopes Bioregion and the eastern Riverina Bioregion	VZ #1	5_Mod-good	2.68	2	Q106E Q112E
PCT 249 – River Red Gum swampy woodland wetland on cowals (lakes) and associated flood channels in central NSW	VZ #7	249_Moderate	4.03	2	Q224E Q225E
	VZ #8	249_Derived	2.10	2	Q222E Q223E
Grassy Woodlands					
PCT 74 – Yellow Box – River Red Gum tall grassy riverine woodland of NSW South Western Slopes Bioregion and Riverina Bioregion	VZ #14	74_Mod-good	0.91	1	Q239E
PCT 76 – Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions	VZ #3	76_Mod-good	1.31	1	Q231E
	VZ #15	76_SVM_Bench	0.03	n/a	Benchmark
PCT 80 – Western Grey Box – White Cypress Pine tall woodland on loam soil on alluvial plains of NSW South Western Slopes Bioregion and Riverina Bioregion	VZ #5	80_Mod-good	11.86	3	Q184E Q207E Q230E
	VZ #4	80_Moderate	8.93	3	Q34E Q203E 203Ea
	VZ #6	80_Derived	1.51	1	Q228E
	VZ #12	80_SVM_Bench	0.50	n/a	Benchmark
Semi-arid Woodlands (Shrubby sub-formation)					
PCT 28 – White Cypress Pine open woodland of sand plains, prior streams and dunes mainly of the semi-arid (warm) climate zone	VZ #11	28_SVM_Bench	2.84	n/a	Benchmark
PCT 75 – Yellow Box – White Cypress Pine grassy woodland on deep sandy-loam alluvial soils of the eastern Riverina Bioregion and western NSW South Western Slopes Bioregion	VZ #2	75_Mod-good	28.80	4	Q110E Q111E Q200E Q204E Q226E
	VZ #9	75_Poor	1.5	1	Q187E
	VZ #10	75_Derived	4.69	2	Q205E Q206E
	VZ #13	75_SVM_Bench	0.42	n/a	Benchmark

Table 4-6 Minimum number of vegetation integrity plots required per vegetation zone area for the Inland Slopes IBRA subregion

NATIVE VEGETATION ZONE (PCT)	VEG ZONE # (BAM-C)	VEG ZONE NAME (BAM-C)	AREA (HA)	PLOTS REQUIRED	PLOTS SAMPLED
Dry Sclerophyll Forests (Shrubby sub-formation)					
PCT 110 – Western Grey Box – Cypress Pine shrubby woodland on stony footslopes in the NSW South Western Slopes Bioregion and Riverina Bioregion	VZ #3	110_Mod-good	2.67	2	Q113E Q125E
Forested Wetlands					
PCT 5 – River Red Gum herbaceous-grassy very tall open forest wetland on inner floodplains in the lower slopes sub-region of the NSW South Western Slopes Bioregion and the eastern Riverina Bioregion	VZ #9	5_Poor	0.88	1	Q234E
Grassy Woodlands					
PCT 74 – Yellow Box – River Red Gum tall grassy riverine woodland of NSW South Western Slopes Bioregion and Riverina Bioregion	VZ #1	74_Mod-good	1.16	1	Q239E[1]
PCT 80 – Western Grey Box – White Cypress Pine tall woodland on loam soil on alluvial plains of NSW South Western Slopes Bioregion and Riverina Bioregion	VZ #2	80_Poor	1.64	1	Q233E
PCT 267 – White Box – White Cypress Pine – Western Grey Box shrub/grass/forb woodland in the NSW South Western Slopes Bioregion	VZ #6	267_Mod-good	0.26	1	Q89E
PCT 277 – Blakely's Red Gum – Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion	VZ #4	277_Mod-good	2.92	2	Q202E Q242E
	VZ #7	277_Derived	0.57	1	Q241E
Semi-arid Woodlands (Grassy sub-formation)					
PCT 319 – Tumbledown Red Gum – White Cypress Pine hill woodland in the southern part of the NSW South Western Slopes Bioregion	VZ #5	319_Mod-good	12.52	3	Q114E Q201E Q232E
	VZ #10	319_Poor	0.42	1	Q240E
	VZ #8	319_Derived	6.27	3	Q208E Q243E Q244E

(1) Plot was recorded from the Lower Slopes IBRA subregion and used as representative for the Inland slopes due to access issues

4.4 Native vegetation recorded

Native vegetation has been recorded by vegetation formation, class and associated PCT in accordance with the NSW BioNet Vegetation Classification System (Environment Energy and Science 2021). The mapping of vegetation zones was based on the sampling of native vegetation broad conditions states as described in Section 4.3.2.

Vegetation mapping undertaken for this BDAR was completed over a 100 metre section of the proposal study area to inform avoidance measures during design development. In accordance with the requirements of the BAM, vegetation integrity scores have been calculated using the disturbance area.

4.4.1 Overview

Native vegetation recorded within the disturbance area is diverse and has been assigned to ten vegetation formations that occur within five IBRA subregions. The recorded vegetation formations are:

- Arid Shrublands (Acacia sub-formation)
- Arid Shrublands (Chenopod sub-formation)
- Dry Sclerophyll Forests (Shrubby sub-formation)
- Freshwater Wetlands
- Forested Wetlands
- Grasslands
- Grassy Woodlands
- Saline Wetlands
- Semi-arid Woodlands (Grassy sub-formation)
- Semi-arid Woodlands (Shrubby sub-formation).

Of the ten recorded native vegetation formations, these have been assigned to 16 vegetation classes, 39 PCTs and 95 vegetation zones and 183 disturbance management zones. An overview of each vegetation formation, class, PCT and zone within each IBRA subregion is presented Section 4.4.2 to 4.4.6.

A detailed description of each PCT, including selection justification, floristic and structural composition along with representative photos and summary of BAM plot data against IBRA region benchmarks are provided in Appendix C-2. Detailed vegetation integrity plot data for each PCT and associated vegetation zone is presented in Appendix C-3.

An overview of mapped native vegetation is shown in Figure 4-4 with detailed native vegetation mapping shown in Appendix B-5.

4.4.2 Native vegetation types and zones of the South Olary Plain IBRA subregion

Native vegetation recorded within the disturbance area for the South Olary Plain IBRA subregion comprises of four NSW vegetation formations that form part of 7 vegetation classes, 10 PCTs and 15 vegetation zones. The recorded PCTs are:

- PCT 15 – Black Box open woodland wetland with chenopod understorey mainly on the outer floodplains in south-western NSW (mainly Riverina Bioregion and Murray Darling Depression Bioregion)
- PCT 22 – Semi-arid shrubby Buloke - Slender Cypress Pine woodland, far south-western NSW
- PCT 23 – Yarran tall open shrubland of the sandplains and plains of the semi-arid (warm) and arid climate zones
- PCT 58 – Black Oak – Western Rosewood open woodland on deep sandy loams mainly in the Murray Darling Depression Bioregion
- PCT 143 – Narrow-leaved Hopbush – Scrub Turpentine – Senna shrubland on semi-arid and arid sandplains and dunes
- PCT 163 – Dillon Bush (Nitre Bush) shrubland of the semi-arid and arid zones
- PCT 170 – Chenopod sandplain mallee woodland/ shrubland of the arid and semi-arid (warm) zones
- PCT 171 – Spinifex linear dune mallee mainly of the Murray Darling Depression Bioregion
- PCT 172 – Deep sand mallee of irregular dunefields of the semi-arid (warm) zone
- PCT 199 – Hooked Needlewood – Needlewood – Mulga - Turpentine Bush open shrubland of the semi-arid and arid plains

A summary of native vegetation recorded within the South Olary Plain IBRA subregion is presented in Table 4-7.

Table 4-7 Native vegetation types, zones and integrity recorded within the South Olary Plain IBRA subregion.

VEGETATION TYPE	VEGETATION CLASS	PCT % CLEARED	ASSOCIATED TEC?	PATCH SIZE CLASS	VEGETATION ZONE (BAM-C #)	DISTURBANCE AREA A (HA)[1]	DISTURBANCE AREA B4 (HA)[2]	DISTURBANCE AREA B10 (HA)[3]	COMPOSITION CONDITION SCORE	STRUCTURE CONDITION SCORE	FUNCTION CONDITION SCORE	VEGETATION INTEGRITY SCORE
Arid Shrublands (Acacia sub-formation)												
PCT 143	Sand Plain Mulga Shrublands	30%	No	>100 ha	VZ #5 143_Mod-good	2.20	0	0	84.9	100	n/a	92.2
PCT 199	Sand Plain Mulga Shrublands	25%	No	>100 ha	#11 199_Mod-good	0.72	0.59	0	66.3	91.2	n/a	77.8
Arid Shrublands (Chenopod sub-formation)												
PCT 163	Riverine Chenopod Shrublands	26%	No	>100 ha	#6 163_Mod-good	8.18	0	0	68.7	67.7	n/a	68.2
Semi-arid Woodlands (Grassy sub-formation)												
PCT 15	Inland Floodplain Woodlands	50%	No	>100 ha	#1 15_Mod-good	2.01	2.09	1.65	81.1	28.1	77.3	56.1
Semi-arid Woodlands (Shrubby sub-formation)												
PCT 22	Riverine Sandhill Woodlands	70%	Yes	>100 ha	#2 22_Mod-good	1.20	1.04	0.69	100	100	22.4	60.8
PCT 23	Riverine Sandhill Woodlands	71%	Yes	>100 ha	#3 23_Mod-good	2.32	2.75	0	97.2	100	47.8	77.4

VEGETATION TYPE	VEGETATION CLASS	PCT % CLEARED	ASSOCIATED TEC?	PATCH SIZE CLASS	VEGETATION ZONE (BAM-C #)	DISTURBANCE AREA A (HA)[1]	DISTURBANCE AREA B4 (HA)[2]	DISTURBANCE AREA B10 (HA)[3]	COMPOSITION CONDITION SCORE	STRUCTURE CONDITION SCORE	FUNCTION CONDITION SCORE	VEGETATION INTEGRITY SCORE
PCT 58	Semi-arid Sand Plain Woodlands	50%	No	>100 ha	#4 58_Mod-good	20.68	26.85	19.79	94.1	92.5	98.6	95
					#14 58_SVM_ Bench	3.28	2.73	2.15	100	100	100	100
PCT 170	Sand Plain Mallee Woodlands	41%	Partial	>100 ha	#7 170_Mod-good_bull	24.87	32.43	0	82.9	64.8	78.6	75
					#8 170_Mod-good_whip	102.39	119.32	0	92.1	59.1	62.1	69.7
					#12 170_Derived	5.16	0	0	77.5	35.2	0	4.3
					#15 170_SVM_ Bench	4.31	4.52	0	100	100	100	100
PCT 171	Dune Mallee Woodlands	19%	No	>100 ha	#9 171_Mod-good_whip	22.14	21.70	0	99.7	99.4	62.1	85.1
					#13 171_Derived	0.63	0	0	81.3	36	26.8	42.8
PCT 172	Dune Mallee Woodlands	1%	No	>100 ha	#10 172_Mod-good_whip	20.88	24.43	0	99.4	99.5	36.8	71.4

(1) Disturbance area A = is a subset of the disturbance area where all native vegetation is removed

(2) Disturbance area B4 = is a subset of the disturbance area where only native vegetation removal for vegetation with potential growth heights of 4 metres or greater in height is required

(3) Disturbance area B10 = is a subset of the disturbance area where only native vegetation removal for vegetation with potential growth heights of 10 metres or greater in height is required

4.4.3 Native vegetation types and zones of the Lachlan IBRA subregion

Native vegetation recorded within the disturbance area for the Lachlan IBRA subregion comprises of four NSW vegetation formations that form part of six vegetation classes, six PCTs and seven vegetation zones. The recorded PCTs are:

- PCT 15 – Black Box open woodland wetland with chenopod understorey mainly on the outer floodplains in south-western NSW (mainly Riverina Bioregion and Murray Darling Depression Bioregion)
- PCT 23 – Yarran tall open shrubland of the sandplains and plains of the semi-arid (warm) and arid climate zones
- PCT 24 – Canegrass swamp tall grassland wetland of drainage depressions, lakes and pans of the inland plains
- PCT 58 – Black Oak – Western Rosewood open woodland on deep sandy loams mainly in the Murray Darling Depression Bioregion
- PCT 163 – Dillon Bush (Nitre Bush) shrubland of the semi-arid and arid zones
- PCT 170 – Chenopod sandplain mallee woodland/ shrubland of the arid and semi-arid (warm) zones.

A summary of native vegetation recorded within the Lachlan IBRA subregion is presented in Table 4-8.

Table 4-8 Native vegetation types, zones and integrity recorded within the Lachlan IBRA subregion

VEGETATION TYPE	VEGETATION CLASS	PCT % CLEARED	ASSOCIATED TEC?	PATCH SIZE CLASS	VEGETATION ZONE (BAM-C #)	DISTURBANCE AREA A (HA)[1]	DISTURBANCE AREA B4 (HA)[2]	DISTURBANCE AREA B10 (HA)[3]	COMPOSITION CONDITION SCORE	STRUCTURE CONDITION SCORE	FUNCTION CONDITION SCORE	VEGETATION INTEGRITY SCORE
Arid Shrublands (Chenopod sub-formation)												
PCT 163	Riverine Chenopod Shrublands	26%	not a TEC	>100 ha	#5 163_Mod-good	0.37	0	0	82.8	50	n/a	64.3
Freshwater Wetlands												
PCT 24	Inland Floodplain Shrublands	20%	not a TEC	>100 ha	#3 24_Mod-good	0.37	0	0	82.8	50	n/a	64.3
Semi-arid Woodlands (Grassy sub-formation)												
PCT 15	Inland Floodplain Woodlands	50%	No	>100 ha	#1 15_Mod-good	0.06	0	0.01	79.5	92.1	76.9	82.6
					#7 15_Derived	0.91	0	0	58.9	57.9	0	3.9
Semi-arid Woodlands (Shrubby sub-formation)												
PCT 23	Riverine Sandhill Woodlands	71%	Yes	>100 ha	#2 23_Mod-good	0.04	0.07	0	83	44.9	39.2	52.6
PCT 58	Semi-arid Sand Plain Woodlands	50%	not a TEC	>100 ha	#4 58_Mod-good	1.11	1.43	1.15	47.4	28.1	74.8	46.4
PCT 170	Sand Plain Mallee Woodlands	41%	Partial	>100 ha	#6 170_Mod-good_bull	3.10	3.26	0	28.9	36.6	65.8	41.2

(1) Disturbance area A = is a subset of the disturbance area where all native vegetation is removed

(2) Disturbance area B4 = is a subset of the disturbance area where only native vegetation trimming above 4 metres in height is required

(3) Disturbance area B10 = is a subset of the disturbance area where only native vegetation trimming above 10 metres in height is required

4.4.4 Native vegetation types and zones of the Murrumbidgee IBRA subregion

Native vegetation recorded within the disturbance area for the Murrumbidgee IBRA subregion comprises of eight NSW vegetation formations that form part of 11 vegetation classes, 27 PCTs and 48 vegetation zones. The recorded PCTs are:

- PCT 5 – River Red Gum herbaceous-grassy very tall open forest wetland on inner floodplains in the lower slopes sub-region of the NSW South Western Slopes Bioregion and the eastern Riverina Bioregion
- PCT 7 – River Red Gum – Warrego Grass – herbaceous riparian tall open forest wetland mainly in the Riverina Bioregion
- PCT 8 – River Red Gum - Warrego Grass - Couch Grass riparian tall woodland wetland of the semi-arid (warm) climate zone (Riverina Bioregion and Murray Darling Depression Bioregion)
- PCT 11 – River Red Gum – Lignum very tall open forest or woodland wetland on floodplains of semi-arid (warm) climate zone (mainly Riverina Bioregion and Murray Darling Depression Bioregion)
- PCT 13 – Black Box – Lignum woodland wetland of the inner floodplains in the semi-arid (warm) climate zone (mainly Riverina Bioregion and Murray Darling Depression Bioregion)
- PCT 15 – Black Box open woodland wetland with chenopod understorey mainly on the outer floodplains in south-western NSW (mainly Riverina Bioregion and Murray Darling Depression Bioregion)
- PCT 17 – Lignum shrubland wetland of the semi-arid (warm) plains (mainly Riverina Bioregion and Murray Darling Depression Bioregion)
- PCT 23 – Yarran tall open shrubland of the sandplains and plains of the semi-arid (warm) and arid climate zones
- PCT 24 – Canegrass swamp tall grassland wetland of drainage depressions, lakes and pans of the inland plains
- PCT 26 – Weeping Myall open woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion
- PCT 28 – White Cypress Pine open woodland of sand plains, prior streams and dunes mainly of the semi-arid (warm) climate zones
- PCT 44 – Forb-rich Speargrass – Windmill Grass – White Top grassland of the Riverina Bioregion
- PCT 45 – Plains Grass grassland on alluvial mainly clay soils in the Riverina Bioregion and NSW South Western Slopes Bioregion
- PCT 46 – Curly Windmill Grass – speargrass – wallaby grass grassland on alluvial clay and loam on the Hay plain, Riverina Bioregion
- PCT 47 – Swamp grassland wetland of the Riverine Plain
- PCT 53 – Shallow freshwater wetland sedgeland in depressions on floodplains on inland alluvial plains and floodplains
- PCT 58 – Black Oak – Western Rosewood open woodland on deep sandy loams mainly in the Murray Darling Depression Bioregion
- PCT 75 – Yellow Box – White Cypress Pine grassy woodland on deep sandy-loam alluvial soils of the eastern Riverina Bioregion and western NSW South Western Slopes Bioregion
- PCT 143 – Narrow-leaved Hopbush – Scrub Turpentine – Senna shrubland on semi-arid and arid sandplains and dunes
- PCT 157 – Bladder Saltbush shrubland on alluvial plains in the semi-arid (warm) zone including Riverina Bioregion
- PCT 160 – Nitre Goosefoot shrubland wetland on clays of the inland floodplains
- PCT 163 – Dillon Bush (Nitre Bush) shrubland of the semi-arid and arid zones
- PCT 164 – Cotton Bush open shrubland of the semi-arid (warm) zone
- PCT 166 – Disturbed annual saltbush forbland on clay plains and inundation zones mainly of south-western NSW
- PCT 170 – Chenopod sandplain mallee woodland/shrubland of the arid and semi-arid (warm) zones
- PCT 182 – Cumbungi rushland wetland of shallow semi-permanent water bodies and inland watercourses
- PCT 216 – Black Roly Poly low open shrubland of the Riverina

A summary of native vegetation recorded within the Murrumbidgee IBRA subregion is presented in Table 4-9.

Table 4-9 Native vegetation types, zones and integrity recorded within the Murrumbidgee IBRA subregion.

VEGETATION TYPE	VEGETATION CLASS	PCT % CLEARED	ASSOCIATED TEC?	PATCH SIZE CLASS	VEGETATION ZONE (BAM-C #)	DISTURBANCE AREA A (HA)[1]	DISTURBANCE AREA B4 (HA)[2]	DISTURBANCE AREA B10 (HA)[3]	COMPOSITION CONDITION SCORE	STRUCTURE CONDITION SCORE	FUNCTION CONDITION SCORE	VEGETATION INTEGRITY SCORE
Arid Shrublands (Acacia sub-formation)												
PCT 143	Sand Plain Mulga Shrublands	30%	No	>100 ha	VZ #28 143_Mod-good	0.05	0	0	37.9	73.7	n/a	52.9
Arid Shrublands (Chenopod sub-formation)												
PCT 157	Riverine Chenopod Shrublands	60%	No	>100 ha	VZ #23 157_Mod-good	35.80	0	0	90.3	74.2	n/a	81.9
					VZ #43 157_SVM_ Bench	11.80	0	0	100	100	n/a	100
PCT 163	Riverine Chenopod Shrublands	26%	No	>100 ha	VZ #25 163_Mod-good	88.15	0	0	98.4	98.4	n/a	98.4
					VZ #48 163_SVM_ Bench	7.73	0	0	100	100	n/a	100
PCT 164	Riverine Chenopod Shrublands	8%	No	>100 ha	VZ #26 164_Mod-good	89.23	0	0	99.8	96.7	n/a	98.2
					VZ #45 164_SVM_ Bench	43.12	0	0	100	100	n/a	100

VEGETATION TYPE	VEGETATION CLASS	PCT % CLEARED	ASSOCIATED TEC?	PATCH SIZE CLASS	VEGETATION ZONE (BAM-C #)	DISTURBANCE AREA A (HA)[1]	DISTURBANCE AREA B4 (HA)[2]	DISTURBANCE AREA B10 (HA)[3]	COMPOSITION CONDITION SCORE	STRUCTURE CONDITION SCORE	FUNCTION CONDITION SCORE	VEGETATION INTEGRITY SCORE
PCT 216	Riverine Chenopod Shrublands	0%	No	>100 ha	VZ #29 216_Mod-good	14.96	0	0	66.1	100	n/a	81.3
Freshwater Wetlands												
PCT 17	Inland Floodplain Shrublands	63%	No	>100 ha	VZ #8 17_Mod-good	13.10	0	0	95.5	100	n/a	97.7
					VZ #35 17_SVM_ Bench	4.10	0	0	100	100	n/a	100
PCT 24	Inland Floodplain Shrublands	20%	No	>100 ha	VZ #11 24_Mod-good	11.85	0	0	88.9	88.8	n/a	88.9
					VZ #36 24_SVM_ Bench	0.01	0	0	100	100	n/a	100
PCT 47	Inland Floodplain Shrublands	50%	Yes	>100 ha	VZ #19 47_Mod-good	2.13	0	0	76.2	89.3	n/a	82.5
					VZ #42 47_SVM_ Bench	0.88	0	0	100	100	n/a	100
PCT 53	Inland Floodplain Shrublands	67%	No	>100 ha	VZ #20 53_Mod-good	1.73	0	0	100	100	n/a	100

VEGETATION TYPE	VEGETATION CLASS	PCT % CLEARED	ASSOCIATED TEC?	PATCH SIZE CLASS	VEGETATION ZONE (BAM-C #)	DISTURBANCE AREA A (HA)[1]	DISTURBANCE AREA B4 (HA)[2]	DISTURBANCE AREA B10 (HA)[3]	COMPOSITION CONDITION SCORE	STRUCTURE CONDITION SCORE	FUNCTION CONDITION SCORE	VEGETATION INTEGRITY SCORE
PCT 160	Inland Floodplain Shrublands	28%	No	>100 ha	VZ #24 160_Mod-good	27.24	0	0	95.5	100	n/a	97.7
					VZ #44 160_SVM_ Bench	1.17	0	0	100	100	n/a	100
PCT 182	Inland Floodplain Shrublands	25%	No	>100 ha	VZ #30 182_Mod-good	0.07	0	0	100	100	n/a	100
Forested Wetlands												
PCT 5	Inland Riverine Forests	40%	No	>100 ha	VZ #1 5_Mod-good	1.64	1.95	1.29	94.3	49.2	56.4	64
PCT 7	Inland Riverine Forests	15%	No	>100 ha	VZ #2 7_Mod-good	0.25	0.36	0.16	32.6	82.4	77.8	59.4
					VZ #33 7_SVM_Bench	0.01	0	0	100	100	100	100
PCT 8	Inland Riverine Forests	17%	No	>100 ha	VZ #3 8_Mod-good	1.70	1.73	1.34	70.9	33.4	99.7	61.8
PCT 11	Inland Riverine Forests	42%	No	>100 ha	VZ #4 11_Mod-good	5.00	5.33	3.53	88.8	78.5	79.6	82.2

VEGETATION TYPE	VEGETATION CLASS	PCT % CLEARED	ASSOCIATED TEC?	PATCH SIZE CLASS	VEGETATION ZONE (BAM-C #)	DISTURBANCE AREA A (HA)[1]	DISTURBANCE AREA B4 (HA)[2]	DISTURBANCE AREA B10 (HA)[3]	COMPOSITION CONDITION SCORE	STRUCTURE CONDITION SCORE	FUNCTION CONDITION SCORE	VEGETATION INTEGRITY SCORE
Grasslands												
PCT 44	Riverine Plain Grasslands	73%	Yes	>100 ha	VZ #16 44_Mod-good	36.75	0	0	96.1	81.7	n/a	88.6
					VZ #39 44_SVM_ Bench	8.40	0	0	100	100	n/a	100
PCT 45	Riverine Plain Grasslands	60%	Yes	>100 ha	VZ #17 45_Mod-good	27.25	0	0	78.2	99.4	n/a	88.1
					VZ #40 45_SVM_ Bench	10.01	0	0	100	100	n/a	100
PCT 46	Riverine Plain Grasslands	20%	Yes	>100 ha	VZ #18 46_Mod-good	45.18	0	0	95.3	97.9	n/a	96.5
					VZ #41 46_SVM_ Bench	23.08	0	0	100	100	n/a	100
Saline Wetlands												
PCT 166	Inland Saline Lakes	34%	No	>100 ha	VZ #46 166_SVM_ Bench	0.95	0	0	100	100	n/a	100

VEGETATION TYPE	VEGETATION CLASS	PCT % CLEARED	ASSOCIATED TEC?	PATCH SIZE CLASS	VEGETATION ZONE (BAM-C #)	DISTURBANCE AREA A (HA)[1]	DISTURBANCE AREA B4 (HA)[2]	DISTURBANCE AREA B10 (HA)[3]	COMPOSITION CONDITION SCORE	STRUCTURE CONDITION SCORE	FUNCTION CONDITION SCORE	VEGETATION INTEGRITY SCORE
Semi-arid Woodlands (Grassy sub-formation)												
PCT 13	Inland Floodplain Woodlands	57%	No	>100 ha	VZ #5 13_Mod-good	5.76	2.33	1.67	92.1	100	98.1	96.7
					VZ #47 13_SVM_ Bench	0.20	0.04	0	100	100	100	100
PCT 15	Inland Floodplain Woodlands	50%	No	>100 ha	VZ #6 15_Mod-good	5.30	5.31	3.88	81.9	92.6	78	84
					VZ #7 15_Derived	1.89	0	0	78.5	51.4	13.6	38
					VZ #34 15_SVM_ Bench	0.01	0.04	0.09	100	100	100	100
PCT 26	Riverine Plain Woodlands	90%	Yes	>100 ha	VZ #12 26_Mod-good	32.57	30.85	0	92.9	99.3	87.4	93.1
					VZ #13 26_Moderate	19.69	18.01	0	83.5	97	33.2	64.5
					VZ #14 26_Derived	212.33	0	0	71.6	87.3	10.4	40.2
					VZ #37 26_SVM_ Bench	0.07	0.02	0	100	100	100	100

VEGETATION TYPE	VEGETATION CLASS	PCT % CLEARED	ASSOCIATED TEC?	PATCH SIZE CLASS	VEGETATION ZONE (BAM-C #)	DISTURBANCE AREA A (HA)[1]	DISTURBANCE AREA B4 (HA)[2]	DISTURBANCE AREA B10 (HA)[3]	COMPOSITION CONDITION SCORE	STRUCTURE CONDITION SCORE	FUNCTION CONDITION SCORE	VEGETATION INTEGRITY SCORE
Semi-arid Woodlands (Shrubby sub-formation)												
PCT 23	Riverine Sandhill Woodlands	71%	Yes	>100 ha	VZ #9 23_Mod-good	2.51	3.11	0	99.6	90.7	42.1	72.5
					VZ #10 23_Derived	7.71	0	0	92.9	93.8	8.6	42.2
PCT 28	Riverine Sandhill Woodlands	73%	Yes	>100 ha	VZ #15 28_Mod-good	6.99	7.56	5.21	79.4	42.4	55.5	57.2
					VZ #38 28_SVM_ Bench	6.84	1.49	1.06	100	100	100	100
PCT 58	Semi-arid Sand Plain Woodlands	50%	No	>100 ha	VZ #21 58_Mod-good	11.99	13.92	10.15	67.4	93.2	71.8	76.7
					VZ #27 58_Moderate	0.09	0.14	0.07	59.2	88.8	27.6	52.6
					VZ #22 58_Derived	4.81	0	0	33.8	88.7	0	14.4
PCT 75	Riverine Sandhill Woodlands	92%	Yes	>100 ha	VZ #32 75_Mod-good	0.06	0.10	0.05	88.3	98.5	60.4	80.7
PCT 170	Sand Plain Mallee Woodlands	41%	Partial	>100 ha	VZ #31 170_Mod-good_whip	0.06	0.15	0	76.2	81.2	64.9	74

(1) Disturbance area A = is a subset of the disturbance area where all native vegetation is removed

(2) Disturbance area B4 = is a subset of the disturbance area where only native vegetation trimming above 4 metres in height is required

(3) Disturbance area B10 = is a subset of the disturbance area where only native vegetation trimming above 10 metres in height is required

4.4.5 Native vegetation types and zones of the Lower Slopes IBRA subregion

Native vegetation recorded within the disturbance area for the Lower Slopes IBRA subregion comprises of three NSW vegetation formations that form part of four vegetation classes, seven PCTs and 14 vegetation zones. The recorded PCTs are:

- PCT 5 – River Red Gum herbaceous-grassy very tall open forest wetland on inner floodplains in the lower slopes sub-region of the NSW South Western Slopes Bioregion and the eastern Riverina Bioregion
- PCT 28 – White Cypress Pine open woodland of sand plains, prior streams and dunes mainly of the semi-arid (warm) climate zone
- PCT 74 – Yellow Box – River Red Gum tall grassy riverine woodland of NSW South Western Slopes Bioregion
- PCT 75 – Yellow Box – White Cypress Pine grassy woodland on deep sandy-loam alluvial soils of the eastern Riverina Bioregion and western NSW South Western Slopes Bioregion
- PCT 76 – Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions
- PCT 80 – Western Grey Box – White Cypress Pine tall woodland on loam soil on alluvial plains of NSW South Western Slopes Bioregion and Riverina Bioregion
- PCT 249 – River Red Gum swampy woodland wetland on cowals (lakes) and associated flood channels in central NSW.

A summary of native vegetation recorded within the Lower Slopes IBRA subregion is presented in Table 4-10.

Table 4-10 Native vegetation types, zones and integrity recorded within the Lower Slopes IBRA subregion.

VEGETATION TYPE	VEGETATION CLASS	PCT % CLEARED	ASSOCIATED TEC?	PATCH SIZE CLASS	VEGETATION ZONE (BAM-C #)	DISTURBANCE AREA A (HA)[1]	DISTURBANCE AREA B4 (HA)[2]	DISTURBANCE AREA B10 (HA)[3]	COMPOSITION CONDITION SCORE	STRUCTURE CONDITION SCORE	FUNCTION CONDITION SCORE	VEGETATION INTEGRITY SCORE
Forested Wetlands												
PCT 5	Inland Riverine Forests	40%	No	>100 ha	VZ #1 5_Mod-good	1.02	1.01	0.65	90.3	66.6	61.3	71.7
PCT 249	Inland Riverine Forests	50%	No	>100 ha	VZ #7 249_Moderate	1.56	1.86	0.61	68.2	48.2	42.6	51.9
					VZ #8 249_Derived	2.10	0	0	60.5	36.6	15.4	32.4
Grassy Woodlands												
PCT 74	Floodplain Transition Woodland	73%	Yes	10 ha	VZ #14 74_Mod-good	0.30	0.40	0.21	53.8	88.4	77.2	71.6
PCT 76	Floodplain Transition Woodland	92%	Yes	10 ha	VZ #3 76_Mod-good	0.54	0.53	0.24	81.1	85.6	48.6	69.7
					VZ #15 76_SVM_Bench	0.03	0	0	100	100	100	100
PCT 80	Floodplain Transition Woodland	83%	Yes	>100 ha	VZ #5 80_Mod-good	4.76	4.36	2.74	95.7	100	71	87.9
				10 ha	VZ #4 80_Moderate	3.51	3.52	1.90	60.5	64.1	45.4	56

VEGETATION TYPE	VEGETATION CLASS	PCT % CLEARED	ASSOCIATED TEC?	PATCH SIZE CLASS	VEGETATION ZONE (BAM-C #)	DISTURBANCE AREA A (HA)[1]	DISTURBANCE AREA B4 (HA)[2]	DISTURBANCE AREA B10 (HA)[3]	COMPOSITION CONDITION SCORE	STRUCTURE CONDITION SCORE	FUNCTION CONDITION SCORE	VEGETATION INTEGRITY SCORE
				10 ha	VZ #6 80_Derived	1.51	0	0	59.1	41.1	9.5	28.5
				>100 ha	VZ #12 80_SVM_Bench	0.32	0.07	0.11	100	100	100	100
Semi-arid Woodlands (Shrubby sub-formation)												
PCT 28	Riverine Sandhill Woodlands	73%	Yes	>100 ha	VZ #11 28_SVM_Bench	1.15	1.04	0.65	100	100	100	100
PCT 75	Riverine Sandhill Woodlands	92%	Yes	>100 ha	VZ #2 75_Mod-good	12.01	10.97	5.82	86.9	100	82.2	89.4
				25 ha	VZ #9 75_Poor	1.09	0.12	0.29	45.6	25.1	78.6	44.8
				10 ha	VZ #10 75_Derived	4.69	0	0	79.4	90	0.2	10.2
				25 ha	VZ #13 75_SVM_Bench	0.32	0.02	0.08	100	100	100	100

(1) Disturbance area A = is a subset of the disturbance area where all native vegetation is removed

(2) Disturbance area B4 = is a subset of the disturbance area where only native vegetation trimming above 4 metres in height is required

(3) Disturbance area B10 = is a subset of the disturbance area where only native vegetation trimming above 10 metres in height is required

4.4.6 Native vegetation types and zones of the Inland Slopes IBRA subregion

Native vegetation recorded within the disturbance area for the Inland Slopes IBRA subregion comprises of four NSW vegetation formations that form part of five vegetation classes, seven PCTs and nine vegetation zones. The recorded PCTs are:

- PCT 5 – River Red Gum herbaceous-grassy very tall open forest wetland on inner floodplains in the lower slopes sub-region of the NSW South Western Slopes Bioregion and eastern Riverina Bioregion
- PCT 74 – Yellow Box – River Red Gum tall grassy riverine woodland of NSW South Western Slopes Bioregion and Riverina Bioregion
- PCT 80 – Western Grey Box – White Cypress Pine tall woodland on loam soil on alluvial plains of NSW South Western Slopes Bioregion and Riverina Bioregion
- PCT 110 – Western Grey Box – Cypress Pine shrubby woodland on stony footslopes in the NSW South Western Slopes Bioregion and Riverina Bioregion
- PCT 267 – White Box – White Cypress Pine – Western Grey Box shrub/grass/forb woodland in the NSW South Western Slopes Bioregion
- PCT 277 – Blakely's Red Gum – Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion
- PCT 319 – Tumbledown Red Gum – White Cypress Pine hill woodland in the southern part of the NSW South Western Slopes Bioregion.

A summary of native vegetation recorded within the Inland Slopes IBRA subregion is presented in Table 4-11.

Table 4-11 Native vegetation types, zones and integrity recorded within the Inland Slopes IBRA subregion

VEGETATION TYPE	VEGETATION CLASS	PCT % CLEARED	ASSOCIATED TEC?	PATCH SIZE CLASS	VEGETATION ZONE (BAM-C #)	DISTURBANCE AREA A (HA)[1]	DISTURBANCE AREA B4 (HA)[2]	DISTURBANCE AREA B10 (HA)[3]	COMPOSITION CONDITION SCORE	STRUCTURE CONDITION SCORE	FUNCTION CONDITION SCORE	VEGETATION INTEGRITY SCORE
Dry Sclerophyll Forests (Shrubby sub-formation)												
PCT 110	Western Slopes Dry Sclerophyll Forests	75%	No	>100 ha	VZ #3 110_Mod-good	0.70	1.27	0.70	57.6	53	89.8	64.9
Forested Wetlands												
PCT 5	Inland Riverine Forests	40%	No	10	VZ #9 5_Poor	0.29	0.44	0.15	21.8	22.9	38.1	26.7
Grassy Woodlands												
PCT 74	Floodplain Transition Woodland	73%	Yes	10	VZ #1 74_Mod-good	0.53	0.37	0.26	53.8	88.4	82.1	73.1
PCT 80	Floodplain Transition Woodland	83%	Yes	10	VZ #2 80_Poor	0.80	0.70	0.14	9.2	44.9	42.1	25.9
PCT 267	Western Slopes Grassy Woodlands	89%	Yes	10	VZ #6 267_Mod-good	0.09	0.13	0.04	77.2	82.5	39.7	63.2

VEGETATION TYPE	VEGETATION CLASS	PCT % CLEARED	ASSOCIATED TEC?	PATCH SIZE CLASS	VEGETATION ZONE (BAM-C #)	DISTURBANCE AREA A (HA)[1]	DISTURBANCE AREA B4 (HA)[2]	DISTURBANCE AREA B10 (HA)[3]	COMPOSITION CONDITION SCORE	STRUCTURE CONDITION SCORE	FUNCTION CONDITION SCORE	VEGETATION INTEGRITY SCORE
PCT 277	Western Slopes Grassy Woodlands	94%	Yes	10	VZ #4 277_Mod-good	1.41	1.04	0.47	76.4	88.8	75	79.8
					VZ #7 277_Derived	0.57	0	0	18.5	54.6	1.3	11
Semi-arid Woodlands (Shrubby sub-formation)												
PCT 319	Inland Rocky Hill Woodlands	60%	No	>100	VZ #5 319_Mod-good	5.18	5.05	2.29	66.8	87.2	60.5	70.6
					VZ #10 319_Poor	0.18	0.15	0.09	11.3	48.6	37.4	27.4
					VZ #8 319_Derived	6.27	0	0	63.1	37.2	25.8	39.3

(1) Disturbance area A = is a subset of the disturbance area where all native vegetation is removed

(2) Disturbance area B4 = is a subset of the disturbance area where only native vegetation trimming above 4 metres in height is required

(3) Disturbance area B10 = is a subset of the disturbance area where only native vegetation trimming above 10 metres in height is required

4.5 Threatened ecological communities

Native vegetation recorded within the proposal study area is considered to meet the final determination of six threatened ecological communities listed under the BC Act being:

- *Acacia melvillei* Shrubland in the Riverina and Murray-Darling Depression bioregions
- *Allocasuarina luehmannii* Woodland in the Riverina and Murray-Darling Depression Bioregions
- Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions
- Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South Western Slopes bioregions
- Sandhill Pine Woodland in the Riverina, Murray-Darling Depression and NSW South Western Slopes bioregions
- White Box Yellow Box Blakely's Red Gum grassy woodland and derived native grassland.

Each threatened ecological community is assessed below against final determination criteria and recorded native vegetation within the disturbance area.

4.5.1 *Acacia melvillei* shrubland in the Riverina and Murray Darling Depression bioregions – Endangered

Within the proposal study area one vegetation type was considered likely to be associated with this threatened ecological community, PCT 23 – Yarran tall open shrubland of the sandplains and plains of the semi-arid (warm) and arid climate zones.

A summary of *Acacia melvillei* shrubland threatened ecological community, associated PCT and extent within the disturbance area for each IBRA subregion is summarized in Table 4-12. The location of *Acacia melvillei* shrubland threatened ecological community is shown in Figure B-6 in Appendix B with photographic representation shown in Photo 4-1 and Photo 4-2.

Table 4-12 Summary of *Acacia melvillei* shrubland within the disturbance area.

THREATENED ECOLOGICAL COMMUNITY	VEGETATION TYPE	IBRA SUBREGION	VEG ZONE NAME (BAM-C)	DIRECT IMPACT (HA)
Acacia melvillei shrubland in the Riverina and Murray Darling Depression bioregions	PCT 23 – Yarran tall open shrubland of the sandplains and plains of the semi-arid (warm) and arid climate zones	South Olary Plain	VZ #3 23_Mod-good	5.07
		Lachlan	VZ #2 23_Mod-good	0.11
Total				**5.18**

A comparison of the final determination for *Acacia melvillei* shrubland threatened ecological community and candidate PCT is provided in Table 4-13. Each element for the final determination including locality, species composition, characteristic species and resilience is compared to each condition class for candidate PCTs to determine if vegetation recorded is consistent with the listing criteria.

Table 4-13 Assessment of BC Act listed *Acacia melvillei* shrubland and associated PCT

SCIENTIFIC DETERMINATION	PCT 23
Does the PCT occur in the south-western portion of NSW in the Riverina or Murray darling Depression bioregions?	Yes This PCT was recorded to occur in the Murray Darling Depression (South Olary Plain subregion) and Riverina (Lachlan and Murrumbidgee subregion) IBRA bioregions.
Does the PCT have an upper stratum that is dominated by *Acacia melvillei*?	Yes *Acacia melvillei* was often the only tree species present within the associated PCT and recorded a projected foliar cover between 7 – 35%. In areas where other tree species were present, projected foliar cover did not reach above 5%.
Does the PCT occur on sandhills and undulating sandplains?	Yes PCT was recorded on sandhills and undulating sandplains.
Does the PCT occur on red-brown, sandy loam soils?	Yes PCT was recorded to occur on red-brown, sandy loam soils.
Does the PCT structure comprise of an open canopy of shrubs or small trees, sometimes with scattered mid-shrubs, and with a sometimes sparse, but highly variable ground layer dominated by grasses, chenopods and herbs.	Yes PCT recorded a projected canopy cover between 7–35% and a max height of <4 m. Scatter mid-shrubs occasionally present. Varying degrees of ground cover recorded based off rainfall, grazing pressures and historic land use practices.
Paragraph 2 Does the PCT contain an assemblage of species that are listed as frequently occurring within this EEC?	Yes Species recorded include *Acacia melvillei, Alectryon oleifolius* subsp. *canescens, Austrostipa nitida, Brachyscome lineariloba, Einadia nutans* subsp. *nutans, Enchylaena tomentosa, Erodium crenatum, Maireana pyramidata, Maireana sclerolaenoides, Nitraria billardierei, Rhagodia spinescens, Salsola australis* (formerly *S. tragus*), *Sclerolaena obliquicuspis* and *Sida corrugata.*
There is no condition threshold described for this community in the determination. Any vegetation in which characteristic native species dominate any structural layer present is considered to constitute the community.	Yes This PCT has characteristic dominant native species in the canopy layer, understorey and ground-layer for all condition classes recorded. All condition classes will meet criteria.
Outcome	**Meets criteria – forms part of the threatened ecological community**

Photo 4-1 *Acacia melvillei* shrubland Q142E recorded from Yanga National park

Photo 4-2 *Acacia melvillei* shrubland (VZ #3 23_Mod-good – South Olary Plain)

4.5.2 *Allocasuarina luehmanii* woodland in the Riverina and Murray-Darling Depression bioregions – Endangered (SAII)

Allocasuarina luehmanii woodland in the Riverina and Murray-Darling Depression bioregions is a threatened ecological community dominated by the tree species Buloke (*Allocasuarina luehmannii*). The community occurs in the southern part of the Riverina bioregion near Urana and Mulwala with known occurrences in the southern part of the Murray-Darling Depression bioregion near Euston.

Within the proposal study area one vegetation type was considered likely to be associated with this threatened ecological community being, PCT 22 – Semi-arid shrubby Buloke – Slender Cypress Pine woodland, far south-western NSW

A summary of *Allocasuarina luehmanii* woodland threatened ecological community, associated PCT and extent within the disturbance area for each IBRA subregion is summarized in Table 4-14. The location of *Allocasuarina luehmanii* woodland threatened ecological community is shown in Figure B-6 in Appendix B.

Table 4-14 Summary of *Allocasuarina luehmanii* woodland within the disturbance area.

THREATENED ECOLOGICAL COMMUNITY	VEGETATION TYPE	IBRA SUBREGION	VEG ZONE NAME (BAM-C)	DIRECT IMPACT (HA)
Allocasuarina luehmanii woodland in the Riverina and Murray-Darling Depression bioregions	PCT 22 – Semi-arid shrubby Buloke – Slender Cypress Pine woodland, far south-western NSW	South Olary Plain	VZ #2 22_Mod-good	2.93
Total				**2.93**

A comparison of the final determination for *Allocasuarina luehmanii* woodland threatened ecological community and candidate PCT is provided in Table 4-15. Each element for the final determination including locality, species composition, characteristic species and resilience is compared to each condition class for candidate PCTs to determine if vegetation recorded is consistent with the listing criteria.

Table 4-15 Assessment of BC Act listed *Allocasuarina luehmanii* woodland and associated PCT

SCIENTIFIC DETERMINATION	**PCT 22**
Does the PCT occur in the Riverina or Murray – Darling depression bioregions?	Yes This PCT was recorded in the Murray – Darling Depression.
Does the PCT have an upper stratum that is dominated by *Allocasuarina luehmanii*? Other canopy species may include *Callitris glaucophylla, Callitris gracilis, Eucalyptus largiflorens* and *Melaleuca lanceolata.*	Yes *Allocasuarina luehmanii* is the dominant tree species it has been thinned due to past logging practices (refer to Photo 4-3 and Photo 4-4) Other canopy species included scattered *Callitris gracilis* and *Alectryon oleifolius* subsp. *canescens.*
Does this PCT occur on red-brown loamy sands with alkaline sub-soils on an alluvial plain of the Murray River or its tributaries?	Yes This PCT was recorded on red-brown loamy sands from the alluvial plain of the Murray River.
Does the PCT structure comprise of an open tree canopy with scattered shrubs and/or small trees, and with a sparse, but highly variable ground layer dominated by grasses and herbs.	Yes Confirmed in the field by Dr Ian Sluiter
Does the PCT have the assemblage of species, paragraph 2 of the listing advice, that are listed as frequently and infrequently occurring within this EEC?	Yes Species recorded includes *Allocasuarina luehmannii, Austrostipa elegantissima, Einadia nutans, Enchylaena tomentosa, Oxalis perennans* and *Rhagodia spinescens.*
There is no condition threshold described for this community in the determination. Any vegetation in which characteristic native species dominate any structural layer present is considered to constitute the community.	Yes This PCT has characteristic dominant native species in the canopy layer, understorey and ground-layer for all condition classes recorded. All condition classes that have retained their canopy structure will meet criteria.
Outcome	**Meets criteria – forms part of the threatened ecological community**

Photo 4-3 *Allocasuarina luehmanii* woodland at Balranald substation

Photo 4-4 *Allocasuarina luehmanii* with mature fruiting bodies

4.5.3 Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions – Endangered

Within the proposal study area four vegetation types were considered likely to be associated with this threatened ecological community, these are:

- PCT 76 – Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions
- PCT 80 – Western Grey Box – White Cypress Pine tall woodland on loam soil on alluvial plains of NSW South Western Slopes Bioregion and Riverina Bioregion
- PCT 110 – Western Grey Box – Cypress Pine shrubby woodland on stony footslopes in the NSW South Western Slopes Bioregion and Riverina Bioregion.

A summary of Inland Grey Box woodland threatened ecological community, associated PCTs and extent within the disturbance area for each IBRA subregion is summarized in Table 4-16. The location of Inland Grey Box woodland threatened ecological community is shown in Figure B-6 in Appendix B.

Table 4-16 Summary of Inland Grey Box woodland within the disturbance area

THREATENED ECOLOGICAL COMMUNITY	VEGETATION TYPE	IBRA SUBREGION	VEG ZONE NAME (BAM-C)	DIRECT IMPACT (HA)
Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions	PCT 76 – Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions	Lower Slopes	VZ #3 76_Mod-good	1.31
			VZ #15 76_SVM_Bench	0.03
	PCT 80 – Western Grey Box – White Cypress Pine tall woodland on loam soil on alluvial plains of NSW South Western Slopes Bioregion and Riverina Bioregion	Lower Slopes	VZ #5 80_Mod-good	11.86
			VZ #4 80_Moderate	8.93
			VZ #12 80_SVM_Bench	0.50
		Inland Slopes	VZ #2 80_Poor	1.64
	PCT 110 – Western Grey Box – Cypress Pine shrubby woodland on stony footslopes in the NSW South Western Slopes Bioregion and Riverina Bioregion	Inland Slopes	VZ #3 110_Mod-good	2.67
Total				**26.94**

A comparison of the final determination for Inland Grey Box woodland threatened ecological community and candidate PCT is provided in Table 4-17. Each element for the final determination including locality, species composition, characteristic species and resilience is compared to each condition class for candidate PCTs to determine if vegetation recorded is consistent with the listing criteria.

Table 4-17 Assessment of BC Act listed Inland Grey Box grassy woodland and associated PCTs

SCIENTIFIC DETERMINATION	PCT 76	PCT 80	PCT 110
Does the PCT occur in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar or Brigalow Belt South IBRA Bioregions?	Yes This PCT was recorded to occur in the NSW South Western Slopes (Lower Slopes and Inland Slopes subregions) IBRA bioregions.	Yes This PCT was recorded to occur in the NSW South Western Slopes (Lower Slopes and Inland Slopes subregions) IBRA bioregions.	Yes This PCT was recorded to occur in the NSW South Western Slopes (Inland Slopes subregions) IBRA bioregions.
Does this PCT occur on fertile alluvial soils (or occasionally colluvial or eluvial)?	Yes This PCT was recorded on alluvial soils.	Yes This PCT was recorded on alluvial soils.	Marginal This PCT was recorded on eluvial soils on low granite hills. Soil type not typical but can occasionally occur within TEC.
Does the PCT contain Inland Grey Box (*Eucalyptus microcarpa*) as the dominant tree species?	Yes The canopy of this PCT is dominated by *Eucalyptus microcarpa.*	Yes The canopy of this PCT is dominated by *Eucalyptus microcarpa* with a sub-canopy dominated by *Callitris glaucophylla.*	Yes The canopy of this PCT is dominated by *Eucalyptus microcarpa.*
Does the PCT occur as an open woodland with sparse or absent shrub layer and a variable ground layer containing grass and herbaceous species?	Yes The canopy of this PCT occurs as an open woodland with a sparse shrub layer. Ground cover varies in density and contains both grasses and herbaceous species.	Yes The canopy of this PCT occurs as an open woodland with a dense sub-canopy and an absent shrub layer. Ground cover varied based on historic land use practices, exotic vegetation incursion, rainfall and seasonality.	Yes The canopy of this PCT occurs as an open woodland with a sparse shrub layer. Ground cover varies in density and contains both grasses and herbaceous species.

SCIENTIFIC DETERMINATION	PCT 76	PCT 80	PCT 110
Does the PCT have the assemblage of species that are listed as frequently occurring within this EEC?	Yes Species include *Acacia hakeoides, Austrostipa scabra* subsp. *falcata, Crassula sieberiana, Einadia nutans, Enteropogon acicularis, Eremophila debilis, Eucalyptus microcarpa, Rytidosperma caespitosum, Rytidosperma setaceum* and *Scleroleana muricata*	Yes Species include *Atriplex semibaccata, Austrostipa scabra, Callitris glaucophylla, Calotis cuneifolia, Crassula sieberiana, Brachychiton populneus* subsp. *populneus, Einadia nutans, Enteropogon acicularis, Eucalyptus melliodora, Eucalyptus microcarpa, Goodenia pinnatifida, Lomandra filiformis, Maireana enchylaenoides, Microlaena stipoides, Oxalis perennans, Rytidosperma caespitosum, Rytidosperma setaceum, Sclerolaena muricata, Senna artemisioides, Sida corrugata, Vittadinia gracilis*	Yes Species include *Austrostipa scabra, Callitris glaucophylla, Eucalyptus macrocarpa, Hibbertia obtusifolia, Oxalis perennans, Rumex brownii* and *Rytidsperma caespitsoum.*
There is no condition threshold described for this community in the determination. Any vegetation in which characteristic native species dominate any structural layer present is considered to constitute the community.	All patches of PCT 76 will meet BC Act.	All patches of PCT 80 with an intact canopy layer will meet BC Act. Derived forms of this community lack a native canopy layer and are therefore not considered to meet the threatened ecological community.	All patches of PCT 110 will meet BC Act.
Outcome	**Meets criteria – forms part of the threatened ecological community**	**Meets criteria – forms part of the threatened ecological community**	**Meets criteria – forms part of the threatened ecological community**

Photo 4-5 PCT 80_Moderate – Q207E

Photo 4-6 PCT 80_Moderate – Q203E

4.5.4 Myall woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray – Darling Depression, Riverina and NSW South Western Slopes bioregions – Endangered

Within the proposal study area one vegetation type was considered likely to be associated with this threatened ecological community, PCT 26 – Weeping Myall open woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion.

A summary of Weeping Myall woodland threatened ecological community, associated PCT and extent within the disturbance area for each IBRA subregion is summarized in Table 4-18. The location of Weeping Myall woodland threatened ecological community is shown in Figure B-6 in Appendix B.

Table 4-18 Summary of Weeping Myall woodland within the disturbance area.

THREATENED ECOLOGICAL COMMUNITY	VEGETATION TYPE	IBRA SUBREGION	VEG ZONE NAME (BAM-C)	DIRECT IMPACT (HA)
Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray – Darling Depression, Riverina and NSW South Western Slopes bioregions	PCT 26 – Weeping Myall open woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion	Murrumbidgee	VZ #12 26_Mod-good	63.42
			VZ #13 26_Moderate	37.70
			VZ #38 26_SVM_Bench	0.09
Total				**101.21**

A comparison of the final determination for Weeping Myall woodland threatened ecological community and candidate PCT is provided in Table 4-19. Each element for the final determination including locality, species composition, characteristic species and resilience is compared to each condition class for candidate PCTs to determine if vegetation recorded is consistent with the listing criteria. Plots recorded during drought conditions have not been used for the purpose of this analysis (Q27E and Q28E).

Table 4-19 Assessment of BC Act listed Weeping Myall Woodland and associated PCTs

SCIENTIFIC DETERMINATION	**PCT 26**
Does the PCT occur in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina or NSW South Western Slopes bioregions?	Yes This PCT was recorded to occur in the Riverina (Murrumbidgee subregion) IBRA bioregion.
Does the community occur on red-brown earths, heavy textured grey or brown alluvial soils?	Yes The community was recorded to occur on red-brown earths and brown alluvial soils.
Is *Acacia pendula* (Weeping Myall) the characteristic or only tree species present?	Yes *Acacia pendula* was the dominant tree species recorded.
The structure of the community can vary based on condition and disturbance history from low woodland, low open woodland, low sparse woodland or open shrubland. The understorey will include an open layer of chenopod shrubs and other woody plant species and open to continuous groundcover of grasses and herbs.	Yes The structure of the community varied across sites from low woodland to low sparse woodland with an understorey contain both chenopods and other woody plant species. Ground covers varied based off recent rainfall, seasonality and grazing pressures.
Does the PCT contain the assemblage of species that characterizes Weeping Myall Woodland?	Yes Species include *Acacia oswaldii, Acacia pendula, Amyema quandang, Asperula conferta, Atriplex leptocarpa, Atriplex semibaccata, Austrostipa aristiglumis, Austrostipa scabra, Calocephalus sonderi, Calotis scabiosifolia, Chrysocephalum apiculatum, Einadia nutans, Enchylaena tomentosa, Enteropogon acicularis, Hypoxis glabella* var. *glabella, Iseilema membranaceum, Maireana aphylla, Maireana pentagona, Maireana excavata, Marsilea drummondii, Oxalis perennans, Panicum decompositum, Plantago varia, Rhagodia spinescens, Rhodanthe corymbiflora, Rhodanthe pygmaea, Rytidosperma caespitosum, Rytidosperma setaceum, Salsola australis, Sclerolaena brachyptera, Sclerolaena muricata, Sclerolaena stelligera, Sida corrugata, Sida trichopoda, Solanum esuriale, Sporobolus caroli, Teucrium racemosum* and *Vittadinia cuneata*
There is no condition threshold described for this community in the determination. Any vegetation in which characteristic native species dominate any structural layer present is considered to constitute the community.	Yes This PCT has characteristic dominant native species in the canopy layer, understorey and ground-layer for all condition classes recorded. All condition classes that have retained their canopy structure will meet criteria.
Outcome	**Meets criteria – forms part of the threatened ecological community**

Photo 4-7 PCT 26 moderate to good Q98E

Photo 4-8 PCT 26 moderate Q96E

4.5.5 Sandhill Pine Woodland in the Riverina, Murray-Darling Depression and NSW South Western Slopes bioregions – Endangered

Within the proposal study area two vegetation types were considered likely to be associated with this threatened ecological community, these are

- PCT 28 – White Cypress Pine open woodland of sand plains, prior streams and dunes mainly of the semi-arid (warm) climate zones
- PCT 75 – Yellow Box – White Cypress Pine grassy woodland on deep sandy-loam alluvial soils of the eastern Riverina Bioregion and western NSW South Western Slopes Bioregion.

Of the above, PCT 75 was determined to not meet the scientific description of the ecological community.

A summary of Sandhill Pine woodland threatened ecological community, associated PCTs and extent within the disturbance area for each IBRA subregion is summarized in Table 4-20. The location of Sandhill Pine woodland threatened ecological community is shown in Figure B-6 in Appendix B.

Table 4-20 Summary of Sandhill Pine woodland within the disturbance area.

THREATENED ECOLOGICAL COMMUNITY	VEGETATION TYPE	IBRA SUBREGION	VEG ZONE NAME (BAM-C)	DIRECT IMPACT (HA)
Sandhill Pine woodland in the Riverina, Murray – Darling Depression and NSW South Western Slopes bioregions	PCT 28 – White Cypress Pine open woodland of sand plains, prior streams and dunes mainly of the semi-arid (warm) climate zones	Murrumbidgee	VZ #15 28_Mod-good	19.76
			VZ #38 28_SVM_Bench	9.39
		Lower Slopes	VZ #11 28_SVM_Bench	2.84
Total				**31.99**

A comparison of the final determination for Sandhill Pine woodland threatened ecological community and candidate PCTs is provided in Table 4-21. Each element for the final determination including locality, species composition, characteristic species and resilience is compared to each condition class for candidate PCTs to determine if vegetation recorded is consistent with the listing criteria.

Table 4-21 Assessment of BC Act listed Sandhill Pine woodland and associated PCTs

SCIENTIFIC DETERMINATION	PCT 28	PCT 75
Does the PCT occur in the Riverina, Murray-Darling Depression or NSW South Western Slopes Bioregions?	Yes This PCT was recorded in the Riverina (Murrumbidgee subregion) IBRA bioregion.	Yes This PCT was recorded in the Riverina (Murrumbidgee) and NSW South Western Slopes (Lower Slopes subregion) IBRA bioregion.
Is the PCT dominated by *Callitris glaucophylla* or infrequently by *Callitris gracilis subsp. murrayensis*	Yes This PCT is dominated by *Callitris glaucophylla.*	No This PCT was recorded to be dominated by *Eucalyptus melliodora* (Yellow Box) with either scattered *Callitris glaucophylla* in the canopy or a sub-canopy dominated by *Callitris glaucophylla.*
Does the PCT occur on red-brown loamy sands with alkaline sub-soils on the alluvial plain of the Murray River and its tributaries, and on parts of the sandplain in south-western NSW? Or In the Riverina bioregion and the far south-western portion of the NSW South Western Slopes bioregion, the community is typically associated with prior streams and aeolian source-bordering dunes, which are scattered within an extensive alluvial clay plain dominated by chenopod shrublands. Or Murray-Darling Depression bioregion, the community occurs as scattered patches on sandhills and lunettes within an extensive aeolian sandplain dominated by woodlands of mallee eucalypts or belah.	Yes This PCT occurred on, often isolated, aeolian sand dunes within a larger alluvial clay plain (Hay plain).	Does not meet above criteria
Does the PCT structure comprise of an open tree canopy with sometimes sparse, but highly variable ground layer dominated by grasses and herbs, sometimes with scattered shrubs and/or small trees?	Yes This PCT has an open tree canopy with percentage tree cover ranging from 8 - 12% The understory is dominated by a high % cover of herbs. A low percentage cover of grasses and shrubs was recorded.	Does not meet above criteria

SCIENTIFIC DETERMINATION	PCT 28	PCT 75
Paragraph 2 Does the PCT have the assemblage of species that are listed as frequently and infrequently occurring within this EEC	Yes For frequently recorded species – *Allocasuarina luehmannii, Atriplex semibaccata, Austrostipa nodosa, Austrostipa scabra, Callitris glaucophylla, Cotula australis, Crassula sieberiana, Enteropogon acicularis, Erodium crinitum, Salsola australis* and *Sida corrugata* For infrequently recorded species – *Rhagodia spinescens*	Does not meet above criteria
Paragraph 3 There is no condition threshold described for this community in the determination. Any vegetation in which characteristic native species dominate any structural layer present is considered to constitute the community.	Yes This PCT has characteristic dominant native species in the canopy layer, understorey and ground-layer for all condition classes recorded. All condition classes will meet criteria.	Does not meet above criteria
Does this PCT meet the criteria for this EEC?	**Meets criteria – forms part of the threatened ecological community**	**Does not meet scientific determination criteria – does not form part of the ecological community**

Photo 4-9 PCT 28_Mod-good – Q101E

Photo 4-10 An example of PCT 28_Mod-good

4.5.6 White Box Yellow Box Blakely's Red Gum grassy woodland and derived native grassland – Critically Endangered (SAII)

Within the proposal study area four vegetation types were considered likely to associate with this threatened ecological community, these are:

- PCT 74 – Yellow Box – River Red Gum tall grassy riverine woodland of NSW South Western Slopes Bioregion and Riverina Bioregion
- PCT 75 – Yellow Box – White Cypress Pine grassy woodland on deep sandy-loam alluvial soils of the eastern Riverina Bioregion and western NSW South Western Slopes Bioregion
- PCT 267 – White Box – White Cypress Pine – Western Grey Box shrub/grass/forb woodland in the NSW South Western Slopes Bioregion
- PCT 277 – Blakely's Red Gum – Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion.

A summary of White Box – Yellow Box – Blakely's Red Gum grassy woodland threatened ecological community, associated PCT and extent within the disturbance area for each IBRA subregion is presented in Table 4-22.

Table 4-22 Summary of White Box – Yellow Box – Blakely's Red Gum grassy woodland within the disturbance area

THREATENED ECOLOGICAL COMMUNITY	VEGETATION TYPE	IBRA SUBREGION	VEG ZONE NAME (BAM-C)	DIRECT IMPACT (HA)
White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland	PCT 74 – Yellow Box – River Red Gum tall grassy riverine woodland of NSW South Western Slopes Bioregion and Riverina Bioregion	Lower Slopes	VZ #14 74_Mod-good	0.91
		Inland slopes	VZ #1 74_Mod-good	1.16
	PCT 75 – Yellow Box – White Cypress Pine grassy woodland on deep sandy-loam alluvial soils of the eastern Riverina Bioregion and western NSW South Western Slopes Bioregion	Murrumbidgee	VZ #32 75_Mod-good	0.21
		Lower Slopes	VZ #2 75_Mod-good	28.80
			VZ #9 75_Poor	1.50
			VZ #10 75_Derived	4.69
			VZ #13 75_SVM_Bench	0.42
	PCT 267 – White Box – White Cypress Pine – Western Grey Box shrub/grass/forb woodland in the NSW South Western Slopes Bioregion	Inland Slopes	VZ #6 267_Mod-good	0.26
	PCT 277 – Blakely's Red Gum – Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion	Inland Slopes	VZ #5 277_Mod-good	2.92
			VZ #7 277_Derived	0.57
Total				**41.44**

A comparison of the final determination for White Box – Yellow Box – Blakely's Red Gum grassy woodland threatened ecological community and candidate PCT is provided in Table 4-23. Each element for the final determination including locality, species composition, characteristic species and resilience is compared to each condition class for candidate PCTs to determine if vegetation recorded is consistent with the listing criteria.

Photo 4-11 PCT 277_Mod-good – Q202E

Photo 4-12 PCT 75_Mod-good – Q200E

Table 4-23 Assessment of BC Act listed White box yellow box Blakely's red gum woodland and associated PCTs

SCIENTIFIC DESCRIPTION	PCT 74	PCT 75	PCT 267	PCT 277
Does the PCT occur on NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern highlands or NSW South Western Slopes bioregions?	Yes This PCT was recorded in the NSW South Western Slopes (Inland Slopes subregion) IBRA bioregion.	Yes This PCT was recorded in the NSW South Western Slopes (Lower Slopes subregion) IBRA bioregion.	Yes This PCT was recorded in the NSW South Western Slopes (Inland Slopes subregion) IBRA bioregion.	Yes This PCT was recorded in the NSW South Western Slopes (Lower Slopes subregion) IBRA bioregion.
Is the characteristic tree species or was the characteristic tree species one of the following or a combination of the following – *Eucalyptus albens* (White Box), *Eucalyptus melliodora* (Yellow Box) and/or *Eucalyptus blakelyi* (Blakey's Red Gum)	Yes This PCT was recorded to have a co-dominant canopy of *Eucalyptus camaldulensis* and *Eucalyptus melliodora* with *E. camaldulensis* being dominant in the creekline and *E.melliodora* being dominant on the upper banks. Due to historic clearing and land use practices of the upper banks of the creek line it is thought that a general reduction in *Eucalyptus melliodora* has occurred reducing its dominance.	Yes This PCT was recorded to be dominated by *Eucalyptus melliodora.*	Yes This PCT was recorded to be dominated by *Eucalyptus albens.*	Yes This PCT was recorded to be dominated by *Eucalyptus melliodora.*
Is the PCT found on relatively fertile soils?	Yes This PCT was recorded on fertile soils.	Yes This PCT was recorded on fertile soils.	Yes This PCT was recorded on fertile soils.	Yes This PCT was recorded on fertile soils.

SCIENTIFIC DESCRIPTION	PCT 74	PCT 75	PCT 267	PCT 277
Is the PCT characterised with a sparse or absent shrub layer and a ground layer generally dominated by grassy or herbaceous species?	Yes This PCT was recorded to have a shrub cover of 0.6%, a grass or grass like cover of 62.1% and a forb cover of 0.7%.	Yes This PCT was recorded to have a shrub cover between 0 -5.6%, a grass or grass like cover of 0.5% – 100% and a forb cover of 2.6 – 23.4%.	Yes This PCT was recorded to have a shrub cover of 2%, a grass or grass like cover of 16.5% and a forb cover of 7.7%.	Yes This PCT was recorded to have a shrub cover of 4%, a grass or grass like cover of 9.8% and a forb cover of 1.9%.
Paragraph 3 Does the PCT contain the characteristic assemblage of species?	Yes Only 4 out of the 14 native species recorded are classed as characteristic for White box – Yellow Box – Blakely's Red Gum Woodland. However, *Austrostipa scabra* was recorded to compose 95% of the native ground layer. Other species recorded include *Chloris truncata, Eucalyptus melliodora* and *Sida corrugata.*	Yes Species recorded include *Aristida behriana, Asperula conferta, Austrostipa aristiglumis, Austrostipa nodosa, Austrostipa scabra, Bulbine bulbosa, Callitris glaucophylla, Cheilanthes sieberi, Chrysocephalum apiculatum, Dianella revoluta, Eucalyptus melliodora, Goodenia pinnatifida, Geranium solanderi, Glycine tabacina, Oxalis perennans, Rumex brownii, Sida corrugata* and *Stackhousia monogyna*	Yes Species recorded include *Austrostipa blackii, Austrostipa scabra, Brachychiton populneus, Callitris glaucophylla, Cheilanthes sieberi, Eucalyptus albens, Germanium solanderi, Lomandra filiformis* and *Sida corrugata*	Yes Species recorded include *Asperula conferta, Austrostipa nodosa, Brachychiton populneus, Cheilanthes sieberi, Dianella revoluta, Oxalis perennans* and *Rumex brownii*

SCIENTIFIC DESCRIPTION	PCT 74	PCT 75	PCT 267	PCT 277
There is no condition threshold described for this community in the determination. Any vegetation in which characteristic native species dominate any structural layer present is considered to constitute the community.	Yes This PCT has characteristic dominant native species in the canopy layer, understorey and ground-layer for all condition classes recorded. All condition classes will meet criteria including those that have lost their canopy layer.	Yes This PCT has characteristic dominant native species in the canopy layer, understorey and ground-layer for all condition classes recorded. All condition classes will meet criteria including those that have lost their canopy layer.	Yes This PCT has characteristic dominant native species in the canopy layer, understorey and ground-layer for all condition classes recorded. All condition classes will meet criteria including those that have lost their canopy layer.	Yes This PCT has characteristic dominant native species in the canopy layer, understorey and ground-layer for all condition classes recorded. All condition classes will meet criteria including those that have lost their canopy layer.
Outcome	**Meets criteria – forms part of the threatened ecological community**	**Meets criteria – forms part of the threatened ecological community**	**Meets criteria – forms part of the threatened ecological community**	**Meets criteria – forms part of the threatened ecological community**

4.6 Scattered trees assessment

4.6.1 Overview

The streamline assessment module 'scattered trees assessment' has been undertaken to assess the impact of clearing scattered trees as outlined in Appendix B of the BAM. Scattered trees are defined as species listed in the tree growth form group that:

- have a percent foliage cover that is less than 25% of the benchmark for tree cover for the most likely plant community type and are on category 2-regulated land and surrounded by category 1-exempt land on the Native Vegetation Regulatory Map under the LLS Act, or
- have a DBH of greater than or equal to 5 cm and are located more than 50 m away from any living tree that is greater than or equal to 5 cm DBH, and the land between the scattered trees is comprised of vegetation that are all ground cover species on the widely cultivated native species list, or exotic species or human-made surfaces or bare ground, or
- are three or fewer trees that have a DBH of greater than or equal to 5 cm and are within a distance of 50 m of each other, that in turn, are greater than 50 m away from the nearest living tree that is greater than or equal to 5 cm DBH, and the land between the scattered trees is comprised of vegetation that are all ground cover species on the widely cultivated native species list, or exotic species or human-made surfaces or bare ground.

In undertaking the scattered tree assessment, the following information is required as outlined in Appendix B.2 of the BAM:

- a map that identifies the scattered trees proposed to be cleared (refer to Appendix B-7)
- identify the genus and species of each tree
- assign each tree or group of trees to be cleared into a class as per:
  - Class 1: trees that are <20 cm DBH and without hollows
  - Class 2: trees that are ≥20 cm DBH and less than the large tree benchmark for the most likely plant community type or trees that are <20 cm DBH that contain at least one hollow
  - Class 3: trees that are greater than or equal to the large tree benchmark for the most likely plant community type
- record any sightings (e.g. in hollows) or evidence (e.g. scats) of threatened species (flora or fauna) using the scattered trees.

In respect to Appendix B.4 of the BAM, no candidate threatened species are considered likely to use any recorded scattered trees for habitat.

Due to the large-scale nature of the proposal and access restrictions, there were several areas in which scattered trees could not be field verified. In these locations satellite imagery was used to identify scattered trees. The nearest or most likely PCT, given landscape position, was assigned to each tree along with the corresponding dominant tree species. Taking a conservative approach, Class 3 and hollows were assigned to each tree

A total of 94 Class 3 and Class 2 scattered trees were recorded within the disturbance area. A breakdown, per IBRA subregion, of each scattered tree type, class and associated PCT is provided in Table 4-24, Table 4-25, Table 4-26 and Table 4-27. The location of each recorded tree is shown in Appendix B-7. Scattered trees with negligible biodiversity value are those trees identified as Class 1 and do not contain hollows.

4.6.2 Scattered tree assessment of the South Olary Plain IBRA subregion

A total of 12 scattered trees were recorded in the South Olary Plain IBRA subregion. These trees form part of three PCTs and comprise of three tree species. The associated PCTs are:

- PCT 15 – Black Box open woodland wetland with chenopod understorey mainly on the outer floodplains in the south-western NSW (mainly Riverina Bioregion and Murray Darling Depression Bioregion)
- PCT 58 – Black Oak – Western Rosewood open woodland on deep sandy loams mainly in the Murray Darling Depression Bioregion
- PCT 170 – Chenopod sandplain mallee woodland/ shrubland of the arid and semi-arid (warm) zones.

A summary of scattered tree class, associated PCT and number of tree species recorded are presented in Table 4-24.

Table 4-24 Assessment of scattered trees within the disturbance area for the South Olary Plain IBRA subregion

SCATTERED TREE CLASS	ASSOCIATED PCT	SCATTERED TREE SPECIES	NUMBER OF TREES
Class 3 (contains hollows)	PCT 15 – Black Box open woodland wetland with chenopod understorey mainly on the outer floodplains in the south-western NSW (mainly Riverina Bioregion and Murray Darling Depression Bioregion)	*Eucalyptus largiflorens* (Black Box)	1
	PCT 58 – Black Oak – Western Rosewood open woodland on deep sandy loams mainly in the Murray Darling Depression Bioregion	*Casuarina pauper* (Black Oak)	1
	PCT 170 – Chenopod sandplain mallee woodland/ shrubland of the arid and semi-arid (warm) zones	*Eucalyptus gracilis* (Yorrell)	10
Total scattered trees			**12**

4.6.3 Scattered tree assessment of the Murrumbidgee IBRA subregion

A total of 14 scattered trees were recorded in the Murrumbidgee IBRA subregion. These trees form part of two PCTs and comprise of two tree species. The associated PCTs are:

- PCT 11 – River Red Gum – Lignum very tall open forest or woodland wetland on floodplains of semi-arid (warm) climate zone (mainly Riverina Bioregion and Murray Darling Depression Bioregion)
- PCT 75 – Yellow Box – White Cypress Pine grassy woodland on deep sandy-loam alluvial soils of the eastern Riverina Bioregion and western NSW South Western Slopes Bioregion.

A summary of scattered tree class, associated PCT and number of tree species recorded are presented in Table 4-25.

Table 4-25 Assessment of scattered trees within the disturbance area for the Murrumbidgee IBRA subregion

SCATTERED TREE CLASS	ASSOCIATED PCT	SCATTERED TREE SPECIES	NUMBER OF TREES
Class 3 (contains hollows)	PCT 11 – River Red Gum – Lignum very tall open forest or woodland wetland on floodplains of semi-arid (warm) climate zone (mainly Riverina Bioregion and Murray Darling Depression Bioregion)	*Eucalyptus camaldulensis* (River red Gum)	6
	PCT 75 – Yellow Box – White Cypress Pine grassy woodland on deep sandy-loam alluvial soils of the eastern Riverina Bioregion and western NSW South Western Slopes Bioregion	*Eucalyptus melliodora* (Yellow Box)	3

SCATTERED TREE CLASS	ASSOCIATED PCT	SCATTERED TREE SPECIES	NUMBER OF TREES
Class 2 (does not contain hollows)	PCT 75 – Yellow Box – White Cypress Pine grassy woodland on deep sandy-loam alluvial soils of the eastern Riverina Bioregion and western NSW South Western Slopes Bioregion	*Eucalyptus melliodora* (Yellow Box)	5
Total scattered trees			**14**

4.6.4 Scattered tree assessment of the Lower Slopes IBRA subregion

A total of 52 scattered trees were recorded in the Lower Slopes IBRA subregion. These trees form part of four PCTs and comprise of four tree species. The associated PCTs are:

- PCT 75 – Yellow Box – White Cypress Pine grassy woodland on deep sandy-loam alluvial soils of the eastern Riverina Bioregion and western NSW South Western Slopes Bioregion
- PCT 76 – Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions
- PCT 80 – Western Grey Box – White Cypress Pine tall woodland on loam soil on alluvial plains of NSW South Western Slopes Bioregion and Riverina Bioregion
- PCT 277 – Blakely's Red Gum – Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion.

A summary of scattered tree class, associated PCT and number of tree species recorded are presented in Table 4-26.

Table 4-26 Assessment of scattered trees within the disturbance area for the Lower Slopes IBRA subregion

SCATTERED TREE CLASS	ASSOCIATED PCT	SCATTERED TREE SPECIES	NUMBER OF TREES
Class 3 (contains hollows)	PCT 75 – Yellow Box – White Cypress Pine grassy woodland on deep sandy-loam alluvial soils of the eastern Riverina Bioregion and western NSW South Western Slopes Bioregion	*Eucalyptus melliodora* (Yellow Box)	11
	PCT 76 – Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions	*Eucalyptus microcarpa* (Grey Box)	13
	PCT 80 – Western Grey Box – White Cypress Pine tall woodland on loam soil on alluvial plains of NSW South Western Slopes Bioregion and Riverina Bioregion	*Eucalyptus microcarpa* (Grey Box)	10
	PCT 277 – Blakely's Red Gum – Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion	*Eucalyptus melliodora* (Yellow Box)	2
Class 3 (does not contain hollows)	PCT 75 – Yellow Box – White Cypress Pine grassy woodland on deep sandy-loam alluvial soils of the eastern Riverina Bioregion and western NSW South Western Slopes Bioregion	*Eucalyptus melliodora* (Yellow Box)	1
	PCT 80 – Western Grey Box – White Cypress Pine tall woodland on loam soil on alluvial plains of NSW South Western Slopes Bioregion and Riverina Bioregion	*Eucalyptus microcarpa* (Grey Box)	7

SCATTERED TREE CLASS	ASSOCIATED PCT	SCATTERED TREE SPECIES	NUMBER OF TREES
Class 2 (does not contain hollows)	PCT 75 – Yellow Box – White Cypress Pine grassy woodland on deep sandy-loam alluvial soils of the eastern Riverina Bioregion and western NSW South Western Slopes Bioregion	*Allocasuarina luehmannii* (Buloke)	1
		Callitris glaucophylla (White Cypress Pine)	1
	PCT 76 – Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions	*Allocasuarina luehmannii* (Buloke)	1
	PCT 80 – Western Grey Box – White Cypress Pine tall woodland on loam soil on alluvial plains of NSW South Western Slopes Bioregion and Riverina Bioregion	*Eucalyptus microcarpa* (Grey Box)	2
		Eucalyptus melliodora (Yellow Box)	1
		Callitris glaucophylla (White Cypress Pine)	2
Total scattered trees			**52**

4.6.5 Scattered tree assessment of the Inland Slopes IBRA subregion

A total of 16 scattered trees were recorded in the Inland Slopes IBRA subregion. These trees form part of two PCTs and comprise of two tree species. The associated PCTs are:

- PCT 80 – Western Grey Box – White Cypress Pine tall woodland on loam soil on alluvial plains of NSW South Western Slopes Bioregion and Riverina Bioregion
- PCT 277 – Blakely's Red Gum – Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion.

A summary of scattered tree class, associated PCT and number of tree species recorded are presented in Table 4-27.

Table 4-27 Assessment of scattered trees within the disturbance area for the Inland Slopes IBRA subregion

SCATTERED TREE CLASS	ASSOCIATED PCT	SCATTERED TREE SPECIES	NUMBER OF TREES
Class 3 (contains hollows)	PCT 80 – Western Grey Box – White Cypress Pine tall woodland on loam soil on alluvial plains of NSW South Western Slopes Bioregion and Riverina Bioregion	*Eucalyptus microcarpa* (Grey Box)	8
	PCT 277 – Blakely's Red Gum – Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion	*Eucalyptus melliodora* (Yellow Box)	8
Total scattered trees			**16**

4.7 Priority weeds and weeds of national significance recorded

Three exotic flora species recorded within the proposal study area during field surveys were listed under the NSW *Biosecurity Act 2015* (BA Act) as priority weeds for the Western region and/or Riverina region (Department of Primary Industries 2021). These three species are also listed as Weeds of National Significance (WONS) (Australian Weeds Committee 2021). All priority weeds and WONS are outlined below in Table 4-28 and Table 4-29.

Table 4-28 Priority weeds and weeds of national significant recorded within the Western Local Land services region

SPECIES NAME	PRIORITY WEEDS	WONS
Lycium ferocissimum (African boxthorn)	**Prohibition on dealings** Must not be imported into the State or sold. **Regional Recommended Measure** Land managers mitigate the risk of the plant spreading from their land. Land managers reduce impact of plant on priority assets (riparian areas and floodplains).	Yes
Opuntia species including *Opuntia elata** and *Opuntia robusta** (Wheel Cactus)	**Prohibition on dealings** Must not be imported into the State or sold Except for *Opuntia ficus-indica* (Indian fig). **Regional Recommended Measure** Land managers should mitigate the risk of new weeds being introduced to their land. Land managers should mitigate spread from their land. The plant should not be bought, sold, grown, carried or released into the environment. This Regional Recommended Measure applies to all species of Opuntia except for *Opuntia ficus-indica* (Indian fig).	Yes

Table 4-29 Priority weeds and weeds of national significant recorded within the proposal study area in the Riverina Local Land services region

SPECIES NAME	PRIORITY WEEDS	WONS
Lycium ferocissimum (African boxthorn)	**Prohibition on dealings** Must not be imported into the State or sold.	Yes

In addition to priority weeds and WONS, the following environmental weeds were also recorded:

- *Asphodelus fistulosus** (Onion weed)
- *Carthamus lanatus** (Saffron thistle)
- *Centaurea solstitialis** (St. Barnaby's thistle)
- *Cirsium vulgare** (Spear thistle)
- *Echium plantagineum** (Paterson's curse)
- *Eragrostis curvula** (African lovegrass)
- *Heliotropium amplexicaule** (Blue heliotrope)
- *Hypericum perforatum** (St. John's wort)
- *Marrubium vulgare** (Horehound)
- *Onopordum acaulon** (Stemless Thistle)
- *Xanthium occidentale** (Noogoora Burr)
- *Xanthium spinosum** (Bathurst Burr).

A full inventory of weed species recorded within each BAM vegetation integrity plots, including high threat weeds, is provided in Appendix B-4.

4.8 Groundwater Dependent Ecosystems

Impacts to Groundwater Dependent Ecosystems (GDEs) have been assessed as part of the Groundwater Impact Assessment (WSP 2021). This report undertook a GDE search by reviewing the relevant water sharing plan documents and their additional appendices that list and graphically display identified high priority GDEs. A second search involving GDE data downloaded from the National Groundwater Information System (NGIS) database (Bureau of Meteorology 2021) was graphically presented and data confined to the groundwater study area using GIS software. A search of the Protected Matters Search Tool (Department of Agriculture Water and the Environment 2021) was conducted to identify any Ramsar wetlands within 10 kilometres of the construction impact footprint.

As the protection of GDEs in water sharing plans needs to be balanced with the demands of licenced water users, protection is legislatively restricted to high priority GDEs (DPIE, 2021). Publicly available location data in GIS format, including information on high priority GDEs detailed in the 2020 water sharing plans, is currently not available through the NSW SEED portal for the new water sharing plans that were enacted on 1 July 2020. Therefore, an assessment using the approximate location determined from the high priority GDE location figures in the corresponding 2020 water sharing plans was undertaken. The assessment concluded that the high priority GDEs generally match the location of high potential GDEs recorded in the NGIS database (Bureau of Meteorology 2021).

The proposal overlies the following three defined groundwater hydrostratigraphic units (HSUs):

- Murrumbidgee Alluvium, which corresponds to the Lower Murrumbidgee Alluvium groundwater source identified within the Water Sharing Plan for the Murrumbidgee Alluvial Groundwater Sources 2020.
- Porous rock, which corresponds to the Western Porous Rock groundwater source identified within the Water Sharing Plan for the NSW Murray-Darling Basin Porous Rock Groundwater Sources 2020.
- Lachlan fractured rock, which corresponds to the Lachlan Fold Belt Murray-Darling Basin groundwater source identified within the Water Sharing Plan for the NSW Murray-Darling Basin Fractured Rock Groundwater Sources 2020.

High potential GDEs, there associated PCT and HSU are listed in Table 4-30, with their location, including low and moderate potential GDEs shown in Appendix B-8.

Table 4-30 GDEs with high potential for groundwater interaction within the groundwater study area (Bureau of Meteorology 2021)

GDE TYPE	NAME	ASSOCIATED PCT	HSU
Aquatic	Coloboralli Creek	n/a	Lachlan fractured rock
Aquatic	Stringybark Creek	n/a	Lachlan fractured rock
Aquatic	Boiling down Creek	n/a	Lachlan fractured rock
Aquatic	Crooked Creek	n/a	Lachlan fractured rock
Aquatic	Sandy Creek	n/a	Lachlan fractured rock
Aquatic	Lake Cullival	n/a	Lachlan fractured rock
Aquatic	Wetlands	PCT 47 and 53	Lachlan fractured rock and Murrumbidgee Alluvium
Terrestrial	River Red Gum	PCT 5, 7, 8 and 11	Lachlan fractured rock
Terrestrial	Red River Gum and Warrego Grass	PCT 7 and 8	Murrumbidgee Alluvium

GDE TYPE	NAME	ASSOCIATED PCT	HSU
Terrestrial	Red River Gum and Wallaby Grass	PCT 5	Murrumbidgee Alluvium
Terrestrial	Red River Gum and Lignum	PCT 11	Murrumbidgee Alluvium
Terrestrial	Red River Gum and Black Box	PCT 10 (not recorded)	Murrumbidgee Alluvium
Terrestrial	Lignum shrubland	PCT 17	Murrumbidgee Alluvium
Terrestrial	Black box	PCT 13 and 15	Murrumbidgee Alluvium
Terrestrial	Canegrass Swamp	PCT 24	Porous rock
Terrestrial	Dillon bush (Nitre bush)	PCT 163	Porous rock
Terrestrial	Nitre Goosefoot shrubland	PCT 160	Porous rock

The Groundwater Impact Assessment (WSP 2021) has assessed the impacts of the proposal on the above HSUs, including identified GDEs having regard to the NSW Aquifer Interference Policy and relevant water sharing plans and through the proposed mitigation and management measures is anticipated to have a low impact on the groundwater environment.

4.9 Native vegetation and fauna habitats

The seven main stratified broad fauna habitats recorded within the proposal study area are described below.

4.9.1 Arid woodland/shrublands

Native woodland and shrublands broadly associated with arid interior areas including mallee, black oak, acacia and hakea communities. This fauna stratification unit mostly occurs in the western part of the proposal study area east to Balranald. It is primarily dominated by Mallee. The Mallee understorey is often dominated by spinifex or chenopod understorey strata, but there are areas where shrubby understories dominate, sometime quite diverse, particularly within the Sunshine conservation land to the west of Balranald. Typically, these communities are highly or partially modified because of agriculture and grazing use, which results in maximum grazing especially in dry times to the detriment of native plant diversity. While these communities still provide habitats for those fauna that primarily rely on tree canopies, or are tolerant of relatively sparse lower strata, those species that require complex shrub strata and groundcovers are less likely to be present. Tree hollows generally do not occur within this fauna stratification unit at a high density, even in the older Mallee areas as the Mallee is mostly too young to form hollows.

4.9.2 Chenopod shrublands

This fauna habitat stratification unit occurs in the arid and semi-arid interior parts of the proposal study area. They do not contain a dense or dominant tree canopy but are dominated by dense shrubs such as Dillon Bush, Cotton Bush and saltbush. Like much of the other fauna habitat stratification units, these have also generally been impacted by agriculture and grazing, with few extensive areas of dense shrublands suitable for a diverse community of native fauna species to persist throughout this unit.

4.9.3 Grasslands

Large stretches of the disturbance area traverse grassland habitats, the majority of which are used for the grazing of cattle and/or sheep. Large expanses of these habitats south of Hay represent the key home range of a specialist grassland bird species, the Plains-wanderer. The Plains-wanderer has highly specific habitat preferences for grassland structure, due to their inability to navigate through dense grassland habitats. Therefore, they prefer open grasslands with relatively high percentages of bare soil, where dense grass growth is suppressed, and the growth of herby native groundcover flora is promoted. Specific patches of Plains-wanderer preferred habitat, where substrates have been denuded of the A horizon, are accurately mapped for management purposes.

Where the disturbance area traverses the plains south of Hay, several landholders have adopted grazing regimes in liaison with recovery officers to manage pasture for Plains-wanderers. The management of Plains-wanderer habitat has flow on benefits for other open country fauna, such as birds of prey, which frequent these areas and rely on productive grasslands for hunting native grassland fauna species. Much of the open grassy areas have remnants of Weeping Myall stands, providing open woodland habitats for woodland birds and supporting mistletoe communities for mistletoe foraging birds, such as Superb Parrot and Painted Honeyeaters.

4.9.4 Grassy woodlands

Throughout the eastern portion of the proposal study area, the landscape continues to be flat, and the vegetation is largely dominated by box/gum woodland communities, interspersed by riparian habitats along water courses. There are very few large stands of box/gum woodland associated with the disturbance area in these lands of low relief, but State Forest patches remain east of the Hay Plains at Cullivel State Forest and Brookong State Forest. From Lockhart east, the landscape continues to be dominated by agricultural land-uses, largely cropping and grazing. Box/gum woodland communities are the most evident native vegetation throughout the region east to Uranquinty with occasional patches of White Cypress Pine (*Callitris glaucophylla*). Woodlands throughout this section of the disturbance area are largely limited to linear strips of vegetation along roads transecting agricultural lands. While there are a number of threatened species that continue to use these patches where strata complexity is sufficient, such as Superb Parrot and Squirrel Glider, many other threatened species which use box/gum woodlands are absent or very sparsely distributed due to the paucity of cover, general degradation of the communities in terms of plant diversity – particularly understorey strata, dominance of adjacent open country fauna and limited connectivity for establishing territories.

4.9.5 Riverine

These native woodlands are broadly associated with riverine environments. These are dominated by Black Box and River Red Gums. Much of this fauna habitat stratification unit occurs in association with the Great Darling Anabranch, the Darling River and the Murray River. It is highly modified, mostly consisting of a tree canopy layer with generally a highly disturbed understorey and groundcover, owing to the historical agricultural and grazing use for over 140 years. The association with the permanent or semi-permanent rivers still lends this stratification unit regional importance as it is a habitat that provides water within an arid or semi-arid landscape. Tree hollows occur within older River Red Gums and Black Box and these are an important nesting resource for species such as parrots, microchiropteran bats, arboreal fauna and reptiles. The tall trees offer hunting perches and nesting locations for birds of prey and the forests attract a wide variety of birds, and amphibians due to the presence of permanent water and the foraging resources offered by canopy resources and riverside vegetation stands.

4.9.6 Rocky woodlands

East of Uranquinty, the foothills surrounding Wagga Wagga are underlain by rocky geology which influences variation in the vegetation community mix and contains larger areas of retained woodland habitats. While the disturbance area occurs at the edges of woodland patches, the presence of relatively large patches gives opportunities for the smaller threatened woodland birds and the rocky substrates offer niches for small reptile species inhabiting the ranges further east.

4.9.7 Wetlands

This wetland fauna habitat stratification unit is very small and only small areas will be directly impacted by the disturbance area. Although wetland habitats directly associated with the disturbance area are relatively sparse there are wetlands habitats in the regions through which the disturbance area traverses. Wetlands in the study area's localities occur in a range of geographical contexts; within low-lying flood zones at the margins of rivers, as ephemeral depressions on otherwise flat plains, as man-made structures built for agricultural purposes and occasionally as large semi-permanent lower lying basins. Areas near the riverine environment tend to be dominated by Lignum shrubs and be ephemerally wet in nature. These areas can be important within the arid and semi-arid region by providing a water source and important for providing habitat for amphibians, waterfowl and other birds in wet times.

4.10 Native vegetation Mallee Bird assessment

Mallee habitats represent unique community forms, where mallee eucalypts are adapted to growing in semi-arid sandy topographies (Australian National Botanic Gardens 2004). Uniquely, mallee eucalypts are adapted to the harsh conditions defining low rainfall habitats, through a special root structure called a lignotuber (Australian National Botanic Gardens 2004). They provide a eucalypt canopied structural framework that uniquely fosters a niche assemblage for specialised flora and fauna (including many listed threatened species) over large semi-arid regions. A confirmation of this value includes the proposed listing of the Eastern Mallee Bird Community as Endangered under the EPBC Act, which is still under consideration.

In terms of bird potentials, the highest quality mallee habitats exhibit a number of structural characteristics, which separate them from poorer mallee habitat types, including:

- large patch size with no fragmentation
- long periods without fire
- continuous understorey cover of grasses and/or shrubs
- high understorey plant diversity
- high levels of understorey woodland debris and litter
- old-growth habitat features such as abundant hollows.

Although the study area traverses large areas of country dominated by mallee vegetation, the health of associated mallee communities is generally compromised by the lack of the key habitat characteristics which support high quality mallee habitat for mallee dependent fauna. Observed short comings of associated habitats, which constrain its potential to support healthy populations of threatened mallee bird populations occur at all structural levels of the habitat.

Due to the arid nature of lands in which mallee habitats occur they are generally fragile in terms of resilience, particularly during extended dry periods. Therefore, the integrity of their structure and resilience can be easily compromised from impacts that erode their structural form and biodiversity proportions and variation. Due to the low density of resources during hard times, patch size in marginal country needs to be large, to offset the thinning of resources. Fauna that are limited to small home ranges are more susceptible to resource declines. Large areas of habitat or linkages to large areas of habitat are required to allow population to rebuild after stochastic events.

In mallee habitats associated with the disturbance area the continuity of canopy cover is often compromised by fragmentation, which reduces patch size and isolates small patches from extensive areas of high-quality habitats, increasing edge effects, eroding connectivity, introducing weed opportunities and increasing micro-habitat exposure to wind and light. Patch fragmentation, size reduction and isolation are serious hurdles that many small fauna species populations are unable to endure, and different scales of fragmentation affects varying fauna capacities to connect in the landscape.

Understorey degradation from grazing was widespread in lands associated with the disturbance area and was exaggerated by the prevailing extended dry conditions under which surveys were conducted. Grazing appeared to have serious impacts on understorey cover and flora diversity, during the dry, when compared directly with adjacent habitats where grazing was not experienced. The thinning or loss of flora cover appeared to reduce fauna diversity present at many sites, from invertebrates to small and medium sized fauna with limited movement capability. The loss of cover realises an increased risk of predation, reductions in foraging resources, including plants and invertebrates dependent on them, and population resilience.

Old-growth mallee habitat examples were patchy and relatively sparse, with large areas of habitat exhibiting relatively small DBH mallee stems, suggesting fire or clearing in the past. Hollow-bearing mallee trees were infrequent and often associated with degraded understories, suggesting retention for stock shade purposes.

Understorey diversity and structural complexity was occasionally moderate to high, but for the most part sparse or patchy. *Triodia* (Porcupine Grass, known as spinifex) was patchy and nowhere observed to extensive.

5 Threatened species

This chapter assesses the habitat suitability for threatened species in accordance with Chapter 5 of the BAM and has been prepared in accordance with Part 3 of the BAM 2020 Operational Manual – Stage 1 (Department of Planning 2020).

5.1 Nomenclature

For threatened species of flora, the names used in the BioNet Atlas (Environment Energy and Science 2021) and Threatened Biodiversity Data Collection (Environment Energy and Science 2021) were preferenced where these differ from the names used in the PlantNET (Royal Botanic Gardens 2021) and VICFLORA (VicFlora 2020) databases.

Names of vertebrate fauna follow the Australian Faunal Directory maintained by the Department of Agriculture, Water and Environment (Department of Agriculture Water and the Environment 2021).

For threatened species of fauna, the names used in the BioNet Atlas (Environment Energy and Science 2021) and Threatened Biodiversity Data Collection (Environment Energy and Science 2021) and threatened species final determination listing were preferenced over Australian Faunal Directory naming.

5.2 Assessing the habitat suitability for threatened species

In the BAM, threatened species are assessed as either ecosystem credit species, species credit species or a combination of the two (referred to as 'dual credit species'). The BAM defines these threatened species categories as follows:

- **ecosystem credit species** (predicted): are those threatened species where the likelihood of occurrence and/or elements of its habitat can be confidently predicted by vegetation surrogates and landscape features
- **species credit species** (candidate): are those threatened species that cannot be reliably predicted by habitat surrogates
- **dual credit species**: are those threatened species where part of the habitat is assessed as an ecosystem credit (e.g. foraging habitat) and part as a species credit (e.g. breeding habitat). In this report, dual credit species will be included in both ecosystem and species credit assessment.

The BAM sets out six steps for assessing habitat suitability for threatened species (ecosystem credit species and species credit species), these are:

- Ecosystem and species credit species (include dual species)
  - Step 1: Identify threatened species for assessment (BAM s. 5.2.1)
  - Step 2: Assess the habitat constraints and vagrant species on the subject land (BAM s. 5.2.2).
- Species credits species only (includes dual species)
  - Step 3: Further assessment of candidate species credit species (BAM s. 5.2.3)
  - Step 4: Determine the presence of a candidate species credit species (BAM s. 5.2.4)
  - Step 5: Determine the area or count, and location of suitable habitat for a species credit species (a species polygon) (BAM s. 5.2.5)
  - Step 6: Determine the habitat condition within the species polygon for species credit species assessed by area (BAM s. 5.2.6).

5.2.1 Threatened species database searches

As part of Step 1, identifying threatened species for assessment, the BAM requires the assessor to review additional information about threatened species to determining if any predicted or candidate species inclusions are applicable. This involved searches of threatened species databases and likelihood of occurrence assessments. A list of threatened species databases accessed for this report as presented in Table 5-1.

Table 5-1 Threatened species database searches

DATABASE	SEARCH DATE	AREA SEARCHES	REFERENCE
PlantNet Database	16/08/2021	The following Local Government Areas: — Balranald — Edward River — Federation Council — Hay Shire Council — Murray River — Murrumbidgee — Wagga Wagga — Wentworth.	(Royal Botanic Gardens 2020)
EES BioNet Atlas of NSW Wildlife	16/08/2021	The following IBRA subregions: — South Olary Plain — Lachlan — Murrumbidgee — Lower Slopes — Inland Slopes.	
EPBC Protected Matters Search Tool	16/08/2021	25 km buffer of the proposal study area	
Biodiversity Assessment Method (BAM) Calculator (Credit Calculator)	n/a	The following IBRA subregions: — South Olary Plain — Lachlan — Murrumbidgee — Lower Slopes — Inland Slopes.	
NSW Department of Primary Industries (Fishing and Aquaculture) threatened Aquatic Fauna Database	16/08/2021	The following Local Government Areas: — Balranald — Edward River — Federation Council — Hay Shire Council — Murray River — Murrumbidgee — Wagga Wagga — Wentworth.	

5.2.2 Literature review

In addition to threatened species database searches, a range of relevant documents and literature related to threatened biodiversity was considered, including:

- Threatened Biodiversity Data Collection (TBDC) (Environment Energy and Science 2021)
- NSW Sharing and Enabling Environmental Data (SEED) portal (NSW Government 2021)
- DAWE's Directory of Important Wetlands (Department of Agriculture Water and the Environment 2021).

5.2.3 Likelihood of occurrence assessment

Likelihood of occurrence assessments were undertaken for all threatened species, populations and migratory species identified through desktop searches. These assessments were conducted for both BC Act and EPBC Act listed species. Likelihood of occurrence assessments enabled justification for any identification of species inclusions for both ecosystem and species credit species. They also enabled identification of species considered MNES under the EPBC Act for further assessment in Chapter 7 of this report.

Criteria used to determine likelihood of occurrence for threatened flora species in outlined in Table 5-2 with criteria for determining threatened fauna species is outlined in Table 5-3.

Table 5-2 Likelihood of occurrence criteria for threatened flora species

LIKELIHOOD	CRITERIA
Known	The species was observed in the study area either during the current survey or during another survey less than one year prior.
High	A species has a high likelihood of occurrence if: — the proposal study area contains or forms part of a large area of high-quality suitable habitat that has not been subject to recent disturbance (e.g. fire), the species is known to form a persistent soil seedbank and the species has been recorded recently (within 10 years) in the locality — the species is a cryptic flowering species that has been recorded recently (within 10 years) in the locality and has a large area of high-quality potential habitat within the proposal study area that was not seasonally targeted by surveys.
Moderate	A species has a moderate likelihood of occurrence if: — the species has a large area of high-quality suitable habitat in the proposal study area that has not been subject to recent disturbance (e.g. fire) — the species is known to form a persistent soil seedbank — the species has not been recorded recently (within 10 years) in the locality — the species has a small area of high-quality suitable habitat or a large area of marginal habitat in the study area that has not been subject to recent disturbance (e.g. fire) — the species is known to form a persistent soil seedbank — the species has been recorded recently (within 10 years) in the locality — the species is a cryptic flowering species, with a small area of high-quality potential habitat or a large area of marginal habitat within the proposal study area, that was not seasonally targeted by surveys.
Low	A species has a low likelihood of occurrence if: — it is not a cryptic species, nor a species known to have a persistent soil seedbank species and was not detected despite targeted searches — the species is a cryptic flowering species, with a small area of high-quality potential habitat or a large area of marginal habitat within the proposal study area, that was not seasonally targeted by surveys as the species has not been recorded within 50 years in the locality.
None	Suitable habitat is absent from the proposal study area.

Table 5-3 Likelihood of occurrence criteria for threatened fauna species

LIKELIHOOD	CRITERIA
Known	The species was observed in the proposal study area either during the current survey or during another survey less than one year prior.
High	A species has a high likelihood of occurrence if: — the proposal study area contains or forms part of a large area of high-quality suitable habitat — important habitat elements (i.e. for breeding or important life cycle periods such as winter foraging periods) are abundant within the proposal study area — the species has been recorded recently (previous 10 years) in similar habitat in the locality — the proposal study area is likely to support resident populations or to contain habitat that is visited by the species during regular seasonal movements or migration.
Moderate	A species has a moderate likelihood of occurrence if: — the proposal study area contains or forms part of a small area of high-quality suitable habitat — the proposal study area contains or forms part of a large area of marginal habitat — important habitat elements (i.e. for breeding or important life cycle periods such as winter foraging periods) are sparse or absent within the study area — the proposal study area is unlikely to support resident populations or to contain habitat that is visited by the species during regular seasonal movements or migration but is likely to be used occasionally during seasonal movements and/or dispersal.
Low	A species has a low likelihood of occurrence if: — potentially suitable habitat exists but the species has not been recorded recently (previous 10 years) in the locality despite intensive survey (i.e. the species is considered to be locally extinct) — the species is considered to be a rare vagrant, likely only to visit the proposal study area very rarely; e.g. during juvenile dispersal or exceptional climatic conditions (e.g. extreme drought conditions in typical habitat of inland birds).
None	Suitable habitat is absent from the proposal study area.

5.3 Identifying habitat suitability for ecosystem credit species

Ecosystem credit threatened species were assessed using information about site context, PCTs and vegetation integrity attributes collected during the field surveys, and data from the TBDC (Environment Energy and Science 2021) as required by subsections 5.2.1 and 5.2.2 of the BAM and Part 3 of the BAM 2020 Operational Manual – Stage 1 (Department of Planning 2020).

Initial desktop assessment to determine ecosystem (predicted) and species (candidate) credit species involved entering the identified vegetation types and zones into BAM-C. This allowed predicted and candidate species reports to be generated for the associated PCTs within the proposal study area.

5.3.1 Predicted ecosystem credit species generated from BAM-C

A preliminary list of predicted ecosystem credit species was generated from the BAM-C based on associated vegetation types. This preliminary predicted ecosystem credit species list is presented in Table 5-4.

Table 5-4 List of BAM-C generated predicted ecosystem credit species

SCIENTIFIC NAME	COMMON NAME	BC ACT[1]	ASSOCIATED NATIVE VEGETATION AND PCTS	IBRA SUBREGIONS[2]				
				SOP	LAC	MUR	LS	IS
Reptiles								
Aprasia inaurita	Mallee Worm-lizard	E	PCT's 170, 171, 172	✓	–	–	–	–
Ctenotus brooksi	Wedgesnout Ctenotus	V	PCT's 143, 171, 172, 199	✓	–	–	–	–
Cyclodomorphus melanops elongatus	Mallee Slender Blue-tongue Lizard	V	PCT's 171, 172	✓	–	–	–	–
Delma australis	Marble-faced Delma	E	PCT's 170, 171, 172	✓	–	–	–	–
Echiopsis curta	Bardick	E	PCT's 171, 172	✓	–	–	–	–
Lerista xanthura	Yellow-tailed Plain Slider	V	PCT's 58, 143, 170, 171, 199	✓	–	–	–	–
Pseudonaja modesta	Ringed Brown Snake	E	PCT's 58, 143, 170, 171, 172, 199	✓	–	–	–	–
Ramphotyphlops endoterus	Interior Blind Snake	E	PCT's 143, 163, 199	✓	–	–	–	–
Strophurus elderi	Jewelled Gecko	V	PCT's 170, 171, 172	✓	–	–	–	–
Tiliqua occipitalis	Western Blue-tongued Lizard	V	PCT's 170, 171, 172	✓	✓	✓	–	–
Birds								
Anseranas semipalmata	Magpie Goose	V	PCT's 15, 24, 45, 47, 53, 160, 163, 182, 249	–	✓	✓	✓	–
Anthochaera phrygia	Regent Honeyeater	CE	PCT's 5, 7, 74, 75, 267, 277, 319 Riparian and Box woodlands	–	–	✓	✓	✓
Artamus cyanopterus cyanopterus	Dusky Woodswallow	V	PCT's 5, 7, 8, 11, 13, 15, 17, 22, 23, 24, 26, 28, 44, 45, 47, 53, 58, 74, 75, 76, 80, 110, 143, 157, 160, 163, 164, 166, 170, 171, 172, 182, 199, 216, 249, 267, 277, 319	✓	✓	✓	✓	✓
Botaurus poiciloptilus	Australasian Bittern	E	PCT's 8, 11, 13, 17, 24, 53, 160, 182, 249	–	✓	✓	✓	–
Calidris ferruginea	Curlew Sandpiper	E	PCT's 24, 47, 53 Wetlands, lake edges	–	✓	✓	–	–
Callocephalon fimbriatum	Gang-Gang Cockatoo	V	PCT's 5, 74, 75, 267, 277 Grassy woodland	–	–	–	✓	✓
Calyptorhynchus lathami	Glossy Black-Cockatoo	V	PCT's 74, 75, 76, 80, 110 Grassy woodland	–	–	–	✓	✓

SCIENTIFIC NAME	COMMON NAME	BC ACT[1]	ASSOCIATED NATIVE VEGETATION AND PCTS	IBRA SUBREGIONS[2]				
				SOP	LAC	MUR	LS	IS
Certhionyx variegatus	Pied Honeyeater	V	PCT's 8, 11, 13, 15, 22, 23, 24, 26, 28, 58, 80, 143, 163, 170, 171, 172, 199, 249	✓	✓	✓	✓	✓
Chthonicola sagittata	Speckled Warbler	V	PCT's 74, 75, 76, 80, 110, 249, 267, 277, 319	–	–	✓	✓	✓
Cinclosoma castanotum	Chestnut Quail-thrush	V	PCT's 170, 171, 172	✓	✓	–	–	–
Circus assimilis	Spotted Harrier	V	PCT's 5, 7, 8, 11, 13, 15, 17, 22, 23, 24, 26, 28, 44, 45, 46, 47, 53, 58, 74,75, 143, 157, 163, 164, 166, 170, 171, 172, 182, 199, 216, 249, 277	✓	✓	✓	✓	✓
Climacteris picumnus victoriae	Brown Treecreeper (eastern subspecies)	V	PCT's 74, 76, 249, 267, 277	–	–	–	✓	✓
Daphoenositta chrysoptera	Varied Sittella	V	PCT's 5, 7, 8, 11, 13, 15, 22, 23, 26, 28, 58, 74, 75, 76, 80, 110, 170, 171, 172, 249, 267, 277, 319	✓	✓	✓	✓	✓
Drymodes brunneopygia	Southern Scrub-robin	V	PCT's 171	✓	–	–	–	–
Epthianura albifrons	White-fronted Chat	V	PCT's 17, 24, 44, 45, 46, 47, 53, 157, 160, 163, 164, 166, 182, 216	✓	✓	✓	–	–
Falco hypoleucos	Grey Falcon	E	PCT's 8, 11, 13, 15, 17, 22, 23, 24, 26, 28, 44, 45, 46, 47, 53, 58, 76, 80, 143, 157, 160, 163, 164, 166, 170, 171, 172, 182, 199, 216, 249	✓	✓	✓	✓	–
Falco subniger	Black Falcon	V	PCT's 5, 7, 8, 11, 13, 15, 17, 23, 24, 26, 28, 44, 45, 46, 47, 53, 58, 74, 75, 76, 80, 110, 143, 157, 160, 163, 164, 166, 170, 171, 182, 199, 216, 267, 277	✓	✓	✓	✓	✓
Glossopsitta porphyrocephala	Purple-crowned Lorikeet	V	PCT's 5, 74, 170, 171, 172, 249	✓	–	–	✓	✓
Glossopsitta pusilla	Little Lorikeet	V	PCT's 5, 74, 75, 267, 277, 319	–	–	–	✓	✓
Grantiella picta	Painted Honeyeater	V	PCT's 5, 7, 8, 11, 13, 15, 23, 26, 28, 58, 74, 75, 76, 80, 110, 143, 249, 267, 277, 319	✓	✓	✓	✓	✓
Grus rubicunda	Brolga	V	PCT's 7, 8, 11, 13, 15, 17, 24, 26, 45, 47, 53, 160, 163, 166, 182, 249	✓	✓	✓	✓	–

SCIENTIFIC NAME	COMMON NAME	BC ACT[1]	ASSOCIATED NATIVE VEGETATION AND PCTS	IBRA SUBREGIONS[2]				
				SOP	LAC	MUR	LS	IS
Haliaeetus leucogaster	White-bellied Sea-Eagle	V	PCT's 5, 7, 8, 11, 13, 15, 17, 23, 24, 26, 28, 44, 45, 46, 47, 53, 58, 74, 75, 76, 80, 110, 143, 157, 160, 163, 164, 166, 170, 171, 182, 216, 249, 267, 277, 319 Riparian forest – inland lakes and rivers	✓	✓	✓	✓	✓
Hamirostra melanosternon	Black-breasted Buzzard	V	PCT's 15, 23, 24, 28, 58, 143, 163, 170, 171, 172, 199 Semi-arid zone – open country	✓	✓	–	✓	–
Hieraaetus morphnoides	Little Eagle	V	PCT's 5, 7, 8, 11, 13, 15, 17, 22, 23 24, 26, 28, 44, 45, 46, 47, 53, 58, 74, 75, 76, 80, 110,143, 157, 160, 163, 164, 166, 170, 171, 172, 182,199,216, 249, 267, 277, 319 Woodlands with associated grassland	✓	✓	✓	✓	✓
Hirundapus caudacutus	White-throated Needletail	-	PCT's 5, 7, 8, 11, 13, 15, 17, 24, 26, 44, 45, 46, 47, 53, 74, 76, 80, 110, 157, 160, 182, 216, 249, 267, 277, 319	–	✓	✓	✓	✓
Hylacola cautus	Shy Heathwren	V	PCT's 170, 171, 172	✓	–	–	–	–
Lathamus discolor	Swift Parrot	E	PCT's 5, 7, 8, 11, 74, 75, 76, 80, 110, 249, 267, 277 Winter foraging resources – Riparian and lake-side habitats	–	–	✓	✓	✓
Leipoa ocellata	Malleefowl	E	PCT's 110, 170, 171, 172	✓	✓	–	–	✓
Lichenostomus cratitius	Purple-gaped Honeyeater	V	PCT's 170, 171, 172	✓	–	–	–	–
Limosa limosa	Black-tailed Godwit	V	PCT's 53, 166	–	–	✓	–	–
Lophochroa leadbeateri	Major Mitchell's Cockatoo	V	PCT's 7, 8, 11, 13, 15, 22, 23, 26, 28, 58, 74, 76, 80, 110, 143, 163, 166, 170, 171, 172, 199, 249 Callitris and Mallee – arid riverine	✓	✓	✓	✓	✓
Lophoictinia isura	Square-tailed Kite	V	PCT's 5, 7, 8, 11, 13, 15, 22, 23, 26, 28, 45, 58, 74, 76, 110, 249, 267, 277 Woodlands – Mallee, floodplain and riverine	✓	✓	✓	✓	✓

SCIENTIFIC NAME	COMMON NAME	BC ACT[1]	ASSOCIATED NATIVE VEGETATION AND PCTS	IBRA SUBREGIONS[2]				
				SOP	LAC	MUR	LS	IS
Melanodryas cucullata	Hooded Robin (south-eastern form)	V	PCT's 5, 7, 8, 11, 13, 15, 22, 23, 26, 28, 58, 74, 75, 76, 80, 110, 143, 170, 171, 172, 199, 249, 267, 277, 319	✓	✓	✓	✓	✓
Melithreptus gularis gularis	Black-chinned Honeyeater (eastern subspecies)	V	PCT's 5, 7, 8, 11, 74, 80, 110, 249, 267, 277, 319	–	–	✓	✓	✓
Neophema pulchella	Turquoise Parrot	V	PCT's 5, 74, 75, 76, 80, 110, 249, 267, 277, 319	–	–	✓	✓	✓
Neophema splendida	Scarlet-chested Parrot	V	PCT's 170, 171, 172	✓	–	–	–	–
Ninox connivens	Barking Owl	V	PCT's 5, 7, 8, 11, 13, 15, 24, 26, 53, 74, 75, 76, 80, 110, 267, 277, 249, 319 Not mallee – woodlands and riparian	✓	✓	✓	✓	✓
Ninox strenua	Powerful Owl	V	PCT's 5	–	–	–	–	✓
Oxyura australis	Blue-billed Duck	V	PCT 17, 24, 53, 160, 182	–	✓	✓	–	–
Pachycephala inornata	Gilberts Whistler	V	PCT's 5, 11, 13, 17, 22, 28, 58, 80, 110, 170, 171, 172, 267	✓	✓	✓	✓	✓
Pedionomus torquatus	Plains-wanderer	CE	PCT 44, 46	–	–	✓	–	–
Petroica boodang	Scarlet Robin	V	PCT's 5, 7, 11, 23, 26, 74, 75, 76, 80, 110, 249, 267, 277, 319	–	–	✓	✓	✓
Petroica phoenicea	Flame Robin	V	PCT's 5, 7, 74, 76, 80, 110, 249, 277	–	–	✓	✓	✓
Polytelis anthopeplus monarchoides	Regent Parrot (eastern subspecies)	E	PCT's 8, 11, 13, 15, 22, 58, 170, 171 Mallee, floodplain and riparian	✓	✓	✓	–	–
Polytelis swainsonii	Superb Parrot	V	PCT's 5, 7, 11, 13, 23, 26, 28, 45, 46, 74, 75, 76, 80, 110, 249, 267, 277	–	✓	✓	✓	✓
Pomatostomus temporalis temporalis	Grey-crowned Babbler (eastern subspecies)	V	PCT's 13, 15, 22, 23, 26, 28, 58, 74, 75, 76, 80, 110, 143, 249, 267, 277, 319	✓	✓	✓	✓	✓
Pyrrholaemus brunneus	Redthroat	V	PCT's 17, 24, 163	✓	✓	✓	–	–
Rostratula australis	Australian Painted Snipe	E	PCT's 5, 7, 8, 11, 13, 17, 24, 47, 53, 160, 182, 249	–	✓	✓	✓	✓
Stagonopleura guttata	Diamond Firetail	V	PCT's 5, 7, 8, 11, 13, 22, 23, 26, 28, 44, 45, 46, 58, 74, 75, 76, 80, 110, 170, 249, 267, 277, 319	✓	✓	✓	✓	✓
Stictonetta naevosa	Freckled Duck	V	PCT's 5, 7, 8, 11, 13, 17, 24, 53, 74, 160, 182, 249, 267, 277	–	✓	✓	✓	✓

SCIENTIFIC NAME	COMMON NAME	BC ACT[1]	ASSOCIATED NATIVE VEGETATION AND PCTS	IBRA SUBREGIONS[2]				
				SOP	LAC	MUR	LS	IS
Tyto Novaehollandiae	Masked Owl	V	PCT's 7, 11, 13, 24, 26, 53, 74, 76, 80, 110, 249, 267, 277 Open forest and woodlands	–	✓	✓	✓	✓
Mammals								
Antechinomys laniger	Kultarr	E	PCT's 23, 58, 143, 163, 170, 171, 199	✓	–	–	–	–
Cercartetus concinnus	Western Pygmy Possum	E	PCT's 58, 170, 171, 172	✓	–	–	–	–
Chalinolobus picatus	Little Pied Bat	V	PCT's 5, 7, 8, 11, 13, 15, 17, 22, 23, 24, 26, 28, 53, 58, 76, 110, 143, 157, 160 163, 164, 166, 170, 171, 172, 182, 199, 216, 267, 249	✓	✓	✓	✓	✓
Dasyurus maculatus	Spotted-tailed Quoll	V	PCT's 5, 110, 249, 267, 277	–	–	–	✓	✓
Falsistrellus tasmaniensis	Eastern False Pipistrelle	V	PCT's 277	–	–	–	–	✓
Miniopterus orianae oceanensis	Large Bent-winged Bat	V	PCT's 277	–	–	–	–	✓
Ningaui yvonneae	Southern Ningaui	V	PCT's 170, 171, 172 Mallee spinifex	✓	–	–	–	–
Nyctophilus corbeni	Corben's Long-eared Bat	V	PCT's 22, 23, 28, 58, 75, 80, 110, 170, 171, 172, 199, 249, 267 Forests and woodlands	✓	✓	–	✓	✓
Phascolarctos cinereus	Koala	V	PCT's 5, 7, 8, 11, 13, 15, 74, 75, 76, 80, 110, 249, 267, 277 Forests and woodlands	–	–	✓	✓	✓
Pteropus poliocephalus	Grey-headed Flying-fox	V	PCT's 5, 76, 267, 277 Forests and woodlands	–	–	–	✓	✓
Pseudomys bolami	Bolam's Mouse	E	PCT 22, 58, 170, 171, 172 Inland shrubby woodlands and spinifex mallee	✓	–	–	–	–
Pseudomys hermannsburgensis	Sandy Inland Mouse	V	PCT's 23, 58, 143, 171, 199 Inland woodlands and shrublands	✓	–	–	–	–
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	V	PCT's 5, 7, 8, 11, 13, 15, 17, 23, 24, 26, 28, 45, 53, 58, 74, 75, 76, 80, 110, 143, 160, 170, 182, 249, 267, 277 Inland habitats, from open spaces to forests	✓	✓	✓	✓	✓
Sminthopsis macroura	Stripe-faced Dunnart	V	PCT's 58, 143, 163, 171, 172, 199, 249	✓	–	–	✓	–

SCIENTIFIC NAME	COMMON NAME	BC ACT[1]	ASSOCIATED NATIVE VEGETATION AND PCTS	IBRA SUBREGIONS[2]				
				SOP	LAC	MUR	LS	IS
Vespadelus baverstocki	Inland Forest Bat	V	PCT's 13, 15, 22, 28, 58, 143, 170, 171, 172 Inland woodlands and mallee	✓	–	✓	–	–

(1) Threat status under the BC Act: V = vulnerable, E = endangered, CE = critically endangered

(2) IBRA subregions:

SOP – South Olary Plain

LAC – Lachlan

MUR – Murrumbidgee

LS – Lower Slopes

IS – Inland Slopes

5.3.2 Justification for inclusion of any additional predicted ecosystem credit species

In determining the predicted ecosystem credit species list for each IBRA subregion, the following inclusions to the BAM-C preliminary predicted list have been added (refer to Table 5-5).

Table 5-5 Justification for inclusion of any additional predicted ecosystem credit species

SCIENTIFIC NAME	COMMON NAME	BC ACT[1]	JUSTIFICATION FOR INCLUSION	IBRA SUBREGIONS[2]				
				SOP	LAC	MUR	LS	IS
Birds								
Hirundapus caudacutus	White-throated Needletail	–	Listed as vulnerable under the EPBC Act. Included as an ecosystem credit species. PCTs 5, 7, 8, 11, 13, 15, 17, 24, 26, 44, 45, 46, 47, 53, 74, 76, 80, 110, 157, 160, 182, 216, 249, 277, 319	✓	✓	✓	✓	✓

(1) Threat status under the BC Act: V = vulnerable, E = endangered, CE = critically endangered

(2) IBRA subregions:

SOP – South Olary Plain

LAC – Lachlan

MUR – Murrumbidgee

LS – Lower Slopes

IS – Inland Slopes

5.3.3 Justification for exclusion of any predicted ecosystem credit species

In determining the predicted ecosystem credit species list for each IBRA subregion, no exclusions to the BAM-C preliminary predicted list have been considered.

5.4 Identifying habitat suitability for species credit species

5.4.1 Threatened flora species

5.4.1.1 Candidate threatened flora species credit species generated from BAM-C

A preliminary list of candidate threatened flora species was generated from the BAM-C based on associated vegetation types for each IBRA subregion. This preliminary candidate threatened flora species list is presented in Table 5-6.

Table 5-6 List of preliminary BAM-C candidate threatened flora species credit species

SCIENTIFIC NAME	COMMON NAME	BC ACT[1]	SAII	NATIVE VEGETATION TYPE(S), HABITAT CONSTRAINTS AND GEOGRAPHICAL LIMITATIONS	IBRA SUBREGIONS[2]				
					SOP	LAC	MUR	LS	IS
Acacia acanthoclada	Harrow Wattle	E	No	PCT's 170, 171, 172 Habitat constraint: — deep silicious sands.	✓	–	–	–	–
Acacia ausfeldii	Ausfeld's Wattle	V	No	PCT's 267 & 277 Habitat constraint: — footslopes and low rises on sandstone. Geographical limitations: Inland Slopes IBRA subregion — south of Cowra.	–	–	–	–	✓
Acacia carneorum	Purple-wood Wattle	V	Yes	PCT's 58 & 199	✓	–	–	–	–
Ammobium craspedioides	Yass Daisy	V	No	PCT's 277 Geographical limitations: Inland Slopes IBRA subregion — south of Cowra.	–	–	–	–	✓
Amphibromus fluitans	Floating Swamp Wallaby-grass	V	V	PCT's 249 Habitat constraints — semi-permanent/ephemeral wet areas — periodically inundated sites (including table drains and farm dams), notably wetlands on riverine floodplain.	–	–	–	✓	–
Atriplex infrequens	A saltbush	V	No	PCT's 23, 163, 170	✓	–	–	–	–
Austrostipa metatoris	A spear-grass	V	No	PCT's 28, 170	✓	–	–	✓	–

SCIENTIFIC NAME	COMMON NAME	BC ACT[1]	SAII	NATIVE VEGETATION TYPE(S), HABITAT CONSTRAINTS AND GEOGRAPHICAL LIMITATIONS	IBRA SUBREGIONS[2]				
					SOP	LAC	MUR	LS	IS
Austrostipa wakoolica	A spear-grass	E	No	PCT's 17, 26, 28, 74, 76, 80 Habitat constraint: — alluvial plains and plains. Geographical limitations: Murrumbidgee IBRA subregion — south of the Murrumbidgee River. Lower Slopes IBRA subregion — south of Narranderra. Inland Slopes IBRA subregion — west of Cowra.	–	–	✓	✓	✓
Brachyscome muelleroides	Claypan Daisy	V	Yes	PCT's 44, 45, 46, 47 Habitat constraint: — floodplains on grey-brown or red-brown clays and claypans|semi-permanent/ephemeral wet areas — wetland-grassland communities on grey-brown or red-brown clays and claypans. Geographical limitations: Murrumbidgee IBRA subregion — east of the Cobb Highway and south of Griffith.	–	–	✓	–	–
Brachyscome papillosa	Mossgiel Daisy	V	No	PCT's 13, 15, 24, 44, 45, 46, 76, 80, 157, 160, 163, 164, 216	✓	✓	✓	✓	–
Caladenia arenaria	Sand-hill Spider Orchid	E	Yes	PCT's 28, 75, 76, 80 Geographical limitations: Murrumbidgee IBRA subregion — east of Jerilderie. Lower Slopes IBRA subregion — west of Lockhart and north of Rand.	–	–	✓	✓	✓
Calotis moorei	A burr-daisy	E	Yes	PCT's 23, 143, 157, 170, 199	✓	–	✓	–	–
Cratystylis conocephala	Bluebush Daisy	E	No	PCT's 58, 170, 171, 172	✓	–	–	–	–

SCIENTIFIC NAME	COMMON NAME	BC ACT[1]	SAII	NATIVE VEGETATION TYPE(S), HABITAT CONSTRAINTS AND GEOGRAPHICAL LIMITATIONS	IBRA SUBREGIONS[2]				
					SOP	LAC	MUR	LS	IS
Convolvulus tedmoorei	Bindweed	E	Yes	PCT's 17, 24, 26, 44, 45, 46, 157, 160, 163, 216	–	–	✓	–	–
Cullen parvum	Small Scurf-pea	E	No	PCT's 5, 7, 44, 74, 277 Geographical limitations: Murrumbidgee IBRA subregion — Hay Plains and to the east.	–	–	✓	✓	✓
Diuris sp. (Oaklands, D.L. Jones 5380)	Oaklands Diuris	E	Yes	PCT's 75, 80	–	–	✓	✓	–
Diuris tricolor	Pine Donkey Orchid	V	No	PCT's 75, 76, 80, 267	–	–	✓	✓	✓
Dodonaea sinuolata subsp. *acrodentata*	A Hopbush	E	Yes	PCT's 58, 143	–	✓	–	–	–
Dodonaea stenozyga	Desert Hopbush	CE	Yes	PCT's 170, 171, 172	✓	–	–	–	–
Eleocharis obicis	Spike-Rush	V	No	PCT's 11, 12, 13, 17, 24, 47, 53, 74, 76, 160, 164, 216 Habitat constraint: — semi-permanent/ephemeral wet areas — periodically waterlogged sites (including table drains and farm dams).	–	✓	–	✓	–
Erodiophyllum elderi	Koonamore Daisy	E	Yes	PCT's 199	✓	–	–	–	–
Eucalyptus leucoxylon subsp. *pruinosa*	Yellow Gum	V	No	PCT's 11, 13, 15	–	–	✓	–	–
Euphrasia arguta	Euphrasia arguta	CE	Yes	PCT's 267, 277	–	–	–	–	✓
Indigofera efoliata	-	CE	Yes	PCT 76, 267	–	–	–	–	✓
Kippistia suaedifolia	Fleshy Minuria	E	Yes	PCT's 143 Habitat constraint: — saline lakes, depressions and claypans with gypseous or calcareous soils, gypseous dunes, or within 50 m.	✓	–	–	–	–

SCIENTIFIC NAME	COMMON NAME	BC ACT[1]	SAII	NATIVE VEGETATION TYPE(S), HABITAT CONSTRAINTS AND GEOGRAPHICAL LIMITATIONS	IBRA SUBREGIONS[2]				
					SOP	LAC	MUR	LS	IS
Lasiopetalum behrii	Pink Velvet Bush	CE	Yes	PCT's 170, 171, 172 Habitat constraint: — Shallow, sandy soils.	✓	–	–	–	–
Lepidium aschersonii	Spiny Peppercress	V	No	PCT's 26, 53, 74, 76	–	–	–	✓	–
Lepidium monoplocoides	Winged Peppercress	E	No	PCT's 13, 15, 24, 26, 45, 46, 47, 74, 80, 160, 163, 170, 216	✓	✓	✓	✓	–
Leptorhynchos orientalis	Lanky Buttons	E	No	PCT's 24, 26, 44, 45, 46, 47	–	✓	✓	–	–
Leptorhynchos waitzia	Button Immortelle	E	Yes	PCT 170	✓	–	–	–	–
Maireana cheelii	Chariot Wheels	V	No	PCT's 26, 44, 46, 157, 163, 164 Habitat constraint: — heavy grey clay soils and claypans or shallow depressions. Geographical limitations: Murrumbidgee IBRA subregion — west of Darlington Point, west of Jerilderie.	–	–	✓	–	–
Pilularia novae-hollandiae	Austral Pillwort	E	Yes	PCT's 13, 15, 26, 44, 45, 46, 53, 74 & 249 Geographical limitations: Murrumbidgee IBRA subregion — east of Deniliquin.	–	–	✓	✓	✓
Pimelea serpyllifolia subsp. *serpyllifolia*	Thyme Rice-Flower	E	Yes	PCT's 170, 171, 172 Geographical limitations: — within 50 km of the Murray River.	✓	–	–	–	–
Prasophyllum petilum (Syn. *Prasophyllum* sp. Wybong)	Tarengo Leek Orchid	E	No	PCT's 267 & 277 Geographical limitations: Inland Slopes IBRA subregion — east of Binalong, south and east of Boorowa.	–	–	–	–	✓
Prasophyllum sp. Wybong		–	Yes						
Pterostylis cobarensis	Greenhood Orchid	V	No	PCT's 170, 171	✓	–	–	–	–

SCIENTIFIC NAME	COMMON NAME	BC ACT[1]	SAII	NATIVE VEGETATION TYPE(S), HABITAT CONSTRAINTS AND GEOGRAPHICAL LIMITATIONS	IBRA SUBREGIONS[2]				
					SOP	LAC	MUR	LS	IS
Santalum murrayanum	Bitter Quandong	E	No	PCT's 170, 171, 172 Habitat constraint: — Sandy loam or loamy sand.	✓	–	–	–	–
Sclerolaena napiformis	Turnip Copperburr	E	No	PCT's 26, 44, 46 Geographical limitations: — Hay Plain.	–	–	✓	–	–
Solanum karsense	Menindee Nightshade	V	No	PCT's 13, 15, 17, 24, 160 Habitat constraint: — semi-permanent/ephemeral wet areas. Geographical limitations: — west of Maude.	✓	✓	✓	–	–
Swainsona colutoides	Bladder Senna	E	No	PCT's 170, 171, 172	✓	–	–	–	–
Swainsona murrayana	Slender Darling Pea	V	No	PCT's 15, 23, 26, 28, 44, 45, 46, 76, 80, 157, 163, 164, 216	–	✓	✓	✓	–
Swainsona plagiotropis	Red Darling Pea	V	No	PCT's 26, 44, 45, 46 Geographical limitations: — Hay Plain.	–	–	✓	–	–
Swainsona pyrophila	Yellow Swainson-pea	V	No	PCT's 170, 171, 172	✓	–	–	–	–
Swainsona recta	Small Purple-pea	E	No	PCT's 76, 267, 277	–	–	–	✓	✓
Swainsona sericea	Silky Swainson-pea	V	No	PCT's 23, 26, 28, 44, 45, 46, 74, 76, 80	✓	–	✓	✓	✓

(1) Threat status under the BC Act: V = vulnerable, E = endangered, CE = critically endangered

(2) IBRA subregions:

SOP – South Olary Plain

LAC – Lachlan

MUR – Murrumbidgee

LS – Lower Slopes

IS – Inland Slopes

5.4.1.2 Justification for inclusion of any additional threatened flora species credit species

In identifying a candidate threatened flora species list for further assessment, the following inclusions to the BAM-C preliminary candidate list have been considered (refer to Table 5-7). Species inclusions were based on database searches and likelihood of occurrence assessments (refer to Appendix C-1).

Table 5-7 Justification for inclusion of any additional threatened flora species credit species

SCIENTIFIC NAME	COMMON NAME	BC ACT[1]	SAII	JUSTIFICATION FOR INCLUSION	IBRA SUBREGIONS[2]				
					SOP	LAC	MUR	LS	IS
Amphibromus fluitans	Floating Swamp Wallaby-grass	V	V	Suitable habitat in the form of farm dams and roadside drains provides potential habitat for this species	–	–	✓	–	–

(1) Threat status under the BC Act: V = vulnerable, E = endangered, CE = critically endangered

(2) IBRA subregions:

SOP – South Olary Plain

LAC – Lachlan

MUR – Murrumbidgee

LS – Lower Slopes

IS – Inland Slopes

5.4.1.3 Justification for exclusion of any additional threatened flora species credit species

One candidate threatened flora species credit species, being *Prasophyllum petilum* was identified to be excluded from the BAM-C candidate species credit list based on geographical limitations. The justification for exclusion is presented in Table 5-8.

Table 5-8 Justification for exclusion of any additional threatened flora species credit species

SCIENTIFIC NAME	COMMON NAME	BC ACT[1]	SAII	JUSTIFICATION FOR EXCLUSION	IBRA SUBREGIONS[2]				
					SOP	LAC	MUR	LS	IS
Prasophyllum petilum (Syn. *Prasophyllum* sp. Wybong)	Tarengo Leek Orchid	E	No	The proposal study area is located outside the BAM-C geographical limitations for this species which are east of Binalong, south and east of Boorowa	–	–	-	–	✓

(1) Threat status under the BC Act: V = vulnerable, E = endangered, CE = critically endangered

(2) IBRA subregions:

SOP – South Olary Plain

LAC – Lachlan

MUR – Murrumbidgee

LS – Lower Slopes

IS – Inland Slopes

5.4.2 Threatened fauna species

5.4.2.1 Candidate threatened fauna species credit species generated from BAM-C

A preliminary list of candidate threatened fauna species was generated from the BAM-C based on associated vegetation types for each IBRA subregion. This preliminary candidate threatened fauna species list is presented in Table 5-9.

Table 5-9 List of BAM-C candidate threatened fauna species credit species

SPECIES NAME	COMMON NAME	BC ACT[1]	SAII	NATIVE VEGETATION TYPE(S), HABITAT CONSTRAINTS AND GEOGRAPHICAL LIMITATIONS	IBRA SUBREGIONS[2]				
					SOP	LAC	MUR	LS	IS
Insects									
Synemon plana	Golden Sun Moth	E	Yes	PCT's 277 Habitat constraint: — presence of Wallaby grass (*Rytidosperma* sp), Chilean needlegrass (*Nassella nessiana*) or Serrated Tussock (*Nassella trichotoma*).	–	–	–	–	✓
Amphibians									
Crinia sloanei	Sloane's Froglet	V	No	PCT's 5, 74, 76, 80, 249 Habitat constraint: — semi-permanent/ephemeral wet areas — containing relatively shallow sections with submergent and emergent vegetation, or within 500 m of wet areas and swamps — within 500 m of waterbodies.	–	–	✓	✓	✓
Litoria booroolongensis	Booroolong Frog	E	No	PCT's 277	–	–	–	–	✓
Litoria raniformis	Southern Bell Frog	E	No	PCT's 7, 8, 11, 13, 15, 17, 24, 47, 53, 249 Lakes, swamps and rivers	–	✓	✓	✓	–
Neobatrachus pictus	Painted Burrowing Frog	E	No	PCT's 15, 58, 163, 170, 171, 172 Floodplain – grasslands and swamps	✓	–	–	–	–
Reptiles									
Aprasia parapulchella	Pink-tailed Legless Lizard	V	No	PCT's 267, 277, 319 Habitat constraint: — rocky areas — or within 50 m of rocky areas.	–	–	–	–	✓

SPECIES NAME	COMMON NAME	BC ACT[1]	SAII	NATIVE VEGETATION TYPE(S), HABITAT CONSTRAINTS AND GEOGRAPHICAL LIMITATIONS	IBRA SUBREGIONS[2]				
					SOP	LAC	MUR	LS	IS
Delma impar	Striped Legless Lizard	V	No	PCT's 277 Grassy woodland on rocky substrates	–	–	–	–	✓
Lucasium stenodactylum	Crowned Gecko	V	No	PCT's 143, 170, 199 Sand hill habitats	✓	–	–	–	–
Birds									
Amytornis striatus	Striated Grasswren	V	Yes	PCT's 171, 172 Spinifex Mallee	✓	–	–	–	–
Anthochaera phrygia	Regent Honeyeater	CE	Yes	As per mapped areas	–	–	–	✓	✓
Ardeotis australis	Australian Bustard	E	No	PCT's 11, 15, 22, 23, 24, 26, 28, 44, 45, 46, 47, 53, 58, 143, 157, 160, 163, 164, 166, 199, 216 Chenopod shrublands and grassy plains	✓	✓	✓	–	–
Burhinus grallarius	Bush Stone-curlew	V	No	PCT's 5, 7, 8, 11, 13, 15, 22, 23, 26, 28, 58, 74, 75, 76, 80, 249, 267, 277 Grassy woodland Habitat constraint: — fallen/standing dead timber including logs.	✓	✓	✓	✓	✓
Calidris ferruginea	Curlew Sandpiper	E	Yes	As per mapped areas	–	✓	✓	–	–
Callocephalon fimbriatum	Gang-gang Cockatoo	V	No	PCT's 5, 74, 75, 267, 277	–	–	–	✓	✓
Calyptorhynchus lathami	Glossy Black-Cockatoo	V	No	PCT's 74, 75, 76, 80, 110 Grassy woodland	–	–	–	✓	✓
Calyptorhynchus lathami	Glossy Black-Cockatoo, Riverina population – endangered population	E	No	PCT's 74, 75, 76, 80, 110 Geographical limitations: Endangered population in Carrathool, Griffith, Leeton and Narrandera LGAs	–	–	✓	✓	–
Climacteris affinis	White-browed Treecreeper – endangered populations	E	No	PCT's 58, 80 Endangered population in Carrathool local government area south of the Lachlan River and Griffith local government area	–	✓	✓	✓	–

SPECIES NAME	COMMON NAME	BC ACT[1]	SAII	NATIVE VEGETATION TYPE(S), HABITAT CONSTRAINTS AND GEOGRAPHICAL LIMITATIONS	IBRA SUBREGIONS[2]				
					SOP	LAC	MUR	LS	IS
Haliaeetus leucogaster	White-bellied Sea-Eagle	V	No	PCT's 5, 7, 8, 11, 13, 15, 17, 23, 24, 26, 28, 44, 45, 46, 47, 53, 58, 74, 75, 76, 80, 110, 143, 157, 160, 163, 164, 166, 170, 171, 182, 216, 249, 267, 277, 319 Riparian forest – inland lakes and rivers Habitat constraint: — living or dead mature trees within suitable vegetation within 1km of a rivers, lakes, large dams or creeks, wetlands and coastlines.	✓	✓	✓	✓	✓
Hamirostra melanosternon	Black-breasted Buzzard	V	No	PCT's 15, 23, 24, 58, 143, 163, 170, 171, 172, 199 Semi-arid zone – open country Habitat constraint: — waterbodies — land within 40 m of riparian woodland on inland watercourses/waterholes containing dead or dying eucalypts.	✓	✓	–	✓	–
Hieraaetus morphnoides	Little Eagle	V	No	PCT's 5, 7, 8, 11, 13, 15, 17, 22, 23, 24, 26, 28, 44, 45, 46, 47, 53, 58, 74, 75, 76, 80, 110, 143, 157, 160, 163, 164, 166, 170, 171, 172, 182, 199, 216, 249, 267, 277, 319 Woodlands with associated grassland Habitat constraint: — nest trees – live (occasionally dead) large old trees within vegetation).	✓	✓	✓	✓	✓
Lathamus discolor	Swift Parrot	E	Yes	As per mapped areas Winter foraging resources – Riparian and lake-side habitats	–	–	✓	✓	✓
Limosa limosa	Black-tailed Godwit	V	No	PCT 53, 166 Wetlands, lake edges	–	–	✓	–	–

SPECIES NAME	COMMON NAME	BC ACT[1]	SAII	NATIVE VEGETATION TYPE(S), HABITAT CONSTRAINTS AND GEOGRAPHICAL LIMITATIONS	IBRA SUBREGIONS[2]				
					SOP	LAC	MUR	LS	IS
Lophochroa leadbeateri	Major Mitchell's Cockatoo	V	No	PCT's, 7, 8, 11, 13, 15, 22, 23, 26, 28, 58, 74, 76, 80, 110, 143, 163, 166, 170, 171, 172, 199, 249 Callitris and mallee – arid riverine Habitat constraint: — hollow bearing trees — living or dead tree with hollows greater than 10 cm diameter.	✓	✓	✓	✓	✓
Lophoictinia isura	Square-tailed Kite	V	No	PCT's 5, 7, 8, 11, 13, 15, 22, 23, 26, 28, 45, 58, 74, 76, 80, 110, 143, 163, 166, 170, 171, 172, 249, 267, 277 Woodlands – Mallee, floodplain and riverine	✓	✓	✓	✓	✓
Manorina melanotis	Black-eared Miner	CE	Yes	PCT's 170, 171, 172 Mallee	✓	–	–	–	–
Ninox connivens	Barking Owl	V	No	PCT's 5, 7, 8, 11, 13, 15, 24, 26, 53, 74, 75, 76, 80, 110, 267, 277, 249, 319 Not mallee – woodlands and riparian	✓	✓	✓	✓	✓
Ninox strenua	Powerful Owl	V	No	PCT 5 Habitat constraints (breeding): — living or dead trees with hollow greater than 20 cm diameter.	–	–	–	–	✓
Pachycephala rufogularis	Red-lored Whistler	CE	Yes	PCT's 171, 172 Mallee	✓	–	–	–	–
Pedionomus torquatus	Plains-wanderer	E	Yes	PCT's 44, 46 Habitat constraint: — as per mapped areas.	–	–	✓	–	–

SPECIES NAME	COMMON NAME	BC ACT[1]	SAII	NATIVE VEGETATION TYPE(S), HABITAT CONSTRAINTS AND GEOGRAPHICAL LIMITATIONS	IBRA SUBREGIONS[2]				
					SOP	LAC	MUR	LS	IS
Polytelis anthopeplus monarchoides	Regent Parrot (eastern subspecies)	E	No	PCT's 8, 11, 13, 15, 22, 58, 170, 171, 172 Mallee, floodplain and riparian Habitat constraint: — hollow bearing trees — living or dead *E. camaldulensis* with hollows greater than 5 cm diameter, greater than 5 m above the ground OR trees with DBH of greater than 40 cm, within 1 km of watercourses or billabongs. Trees can be isolated but within 20 km of mallee. Geographical limitations: — within 30 km of the Murray and Murrumbidgee Rivers.	✓	✓	✓	–	–
Polytelis swainsonii	Superb Parrot	V	No	PCT's 5, 7, 11, 13, 23, 26, 28, 45, 46, 74, 75, 76, 80, 110, 249, 267, 277 Habitat constraint: — hollow bearing trees — living or dead *E. blakelyi, E. melliodora, E. albens, E. camaldulensis, E. microcarpa, E. polyanthemos, E. mannifera, E. intertexta* with hollows greater than 5 cm diameter — greater than 4 m above ground or trees with a DBH of greater than 30 cm.	–	✓	✓	✓	✓
Tyto novaehollandiae	Masked Owl	V	No	PCT's 7, 11, 13, 24, 26, 53, 74, 76, 80, 110, 249, 267, 277 Not mallee – woodlands and riparian Habitat constraint: — hollow bearing trees — living or dead trees with hollows greater than 20 cm diameter.	–	✓	✓	✓	✓

SPECIES NAME	COMMON NAME	BC ACT[1]	SAII	NATIVE VEGETATION TYPE(S), HABITAT CONSTRAINTS AND GEOGRAPHICAL LIMITATIONS	IBRA SUBREGIONS[2]				
					SOP	LAC	MUR	LS	IS
Mammals									
Cercartetus nanus	Eastern Pygmy-possum	V	No	PCT's 74, 80, 110 Forests and woodlands	–	–	–	✓	✓
Chalinolobus dwyeri	Large-eared Pied Bat	V	Yes	PCT 267 & 277 Forests and woodlands with escarpments Habitat constraint: — cliffs — within two kilometres of rocky areas containing caves, overhangs, escarpments, outcrops, or crevices, or within two kilometres of old mines or tunnels	–	–	–	–	✓
Lasiorhinus latifrons	Southern Hairy-nosed Wombat	E	No	PCT's 58, 170, 171, 172 Suitable semi-arid to arid grassy woodlands with suitable burrowing substrates	✓	–	–	–	–
Miniopterus orianae oceanensis	Large Bent-winged Bat	V	Yes (breeding)	PCT 277 Habitat constraints (breeding): — cave, tunnel, mine, culvert or other structure known or suspected to be used for breeding including species records with microhabitat code "IC - in cave;" observation type code "E nest-roost;" with numbers of individuals >500.	–	–	–	–	✓

SPECIES NAME	COMMON NAME	BC ACT[1]	SAII	NATIVE VEGETATION TYPE(S), HABITAT CONSTRAINTS AND GEOGRAPHICAL LIMITATIONS	IBRA SUBREGIONS[2]				
					SOP	LAC	MUR	LS	IS
Myotis macropus	Southern Myotis	V	No	PCT's 5, 7, 8, 11, 74, 182, 249 Forests, woodlands, water Habitat constraint: — hollow bearing trees — within 200 m of riparian zone | other — bridges, caves or artificial structures within 200 m of riparian zone | waterbodies — this includes rivers, creeks, billabongs, lagoons, dams and other waterbodies on or within 200 m of the site.	–	–	✓	✓	✓
Petaurus norfolcensis	Squirrel Glider	V	No	PCT's 5, 74, 75, 76, 80, 110, 249, 267, 277 Forests and woodlands	–	–	–	✓	✓
Petaurus norfolcensis	Squirrel Glider in the Wagga Wagga Local Government Area	E	No	PCT's 5, 74, 75, 76, 80, 110, 249, 267, 277 Forests and woodlands Geographical limitations: — Wagga Wagga Local Government Area	–	–	–	✓	✓
Petrogale penicillata	Brush-tailed Rock-wallaby	E	Yes	PCT's 267 & 277 Forests and woodlands Habitat constraint: — land within 1 km of rocky escarpments, gorges, steep slopes, boulder piles, rock outcrops or cliff lines.	–	–	–	–	✓
Phascogale tapoatafa	Brush-tailed Phascogale	V	No	PCT's 5, 74, 80, 267 & 277 Forests and woodlands	–	–	–	–	✓
Phascolarctos cinereus	Koala	V	No	PCT's 5, 7, 8, 11, 13, 15, 74, 75, 76, 80, 110, 249, 267 & 277 Forests and Woodlands Areas identified via survey as important habitat	–	–	✓	✓	✓
Pseudomys desertor	Desert Mouse	CE	Yes	PCT's 24, 163, 171 & 172 Spinifex mallee	✓	–	–	–	–

SPECIES NAME	COMMON NAME	BC ACT[1]	SAII	NATIVE VEGETATION TYPE(S), HABITAT CONSTRAINTS AND GEOGRAPHICAL LIMITATIONS	IBRA SUBREGIONS[2]				
					SOP	LAC	MUR	LS	IS
Pteropus poliocephalus	Grey-headed Flying-fox	V	No	PCT's 5, 76 & 267 Habitat constraint: — breeding camps.	–	–	–	✓	✓

(1) Threat status under the BC Act: V = vulnerable, E = endangered, CE = critically endangered

(2) IBRA subregions:

SOP – South Olary Plain

LAC – Lachlan

MUR – Murrumbidgee

LS – Lower Slopes

IS – Inland Slopes

5.4.2.2 Justification for inclusion of any additional threatened fauna species credit species

In identifying a candidate threatened fauna species list for further assessment, no additional threatened fauna species credit species are required to be included.

5.4.2.3 Justification for exclusion of any additional threatened fauna species credit species

In identifying a candidate threatened fauna species list for further assessment, no additional threatened fauna species credit species are required to be excluded.

5.5 Species credit species survey methods

In accordance with Part 3 of the BAM 2020 Operational Manual – Stage 1 (Department of Planning 2020), further assessment of candidate species credit species (Step 3) includes assessing microhabitats and targeted surveys to determine if a species is absent, or if present, whether a species and/or its habitats are degraded to the point that the species is unlikely to utilise the study area (or specific vegetation zones).

Details of threatened species surveys methods employed for this report are presented below. The survey method outlined below should be read in conjunction with the candidate threatened flora species survey effort table (refer to Appendix C-3), the candidate threatened fauna survey effort table (refer to Appendix C-4) and the threatened flora and fauna field survey effort map (refer to Appendix C-5).

5.5.1 Survey dates and weather observations

5.5.1.1 Rainfall

Preceding and during the earliest survey periods (i.e. 2019 and early 2020) much of the study area and NSW was in a period of extended drought. By mid-2020 drought conditions had been relieved and above average rainfall conditions were experienced in winter/spring 2020. Data recorded in post-drought conditions was preferentially used over data recorded in drought conditions. Below is an analysis of monthly rainfall for 2020 and 2021 compared the historical mean. Locations are as follows:

- Paringi, NSW (Kerribee Station) – located approximately 5 kms south-west of the nearest point on the alignment and 10 kms south-west of the Buronga substation.
- Euston, NSW (Sunnyside Station) – located within 5 kms of the nearest point on the alignment.
- Balranald, NSW – located approximately 10 kms north-east of the nearest point on the alignment.
- Moulamein, NSW (Tchelery Station) – located within 5 kms of the nearest point on the alignment.
- Jerilderie, NSW (Pooginook Station) – located within 5 kms of the nearest point on the alignment.
- Urana, NSW – located approximately 10 kms south-west of the nearest point on the alignment.
- Baylfrayden, NSW – located approximately 10 kms north of the nearest point on the alignment.
- Wagga Wagga, NSW – located within 5 kms of the nearest point on the alignment and within 5 kms of the Wagga Wagga substation.

Rainfall data, along with relevant threatened species profile advice from BAM-C and Bionet atlas database, was used to assist in species likelihood analysis and microhabitat searches (refer to Section 5.5.2).

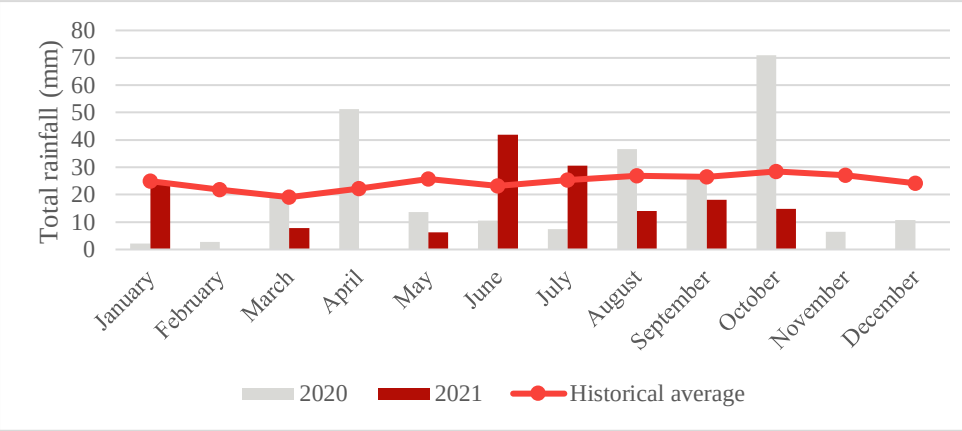


Figure 5-1 Total monthly rainfall for Paringi (Kerribee Station), NSW (weather station 047107) vs. historic average

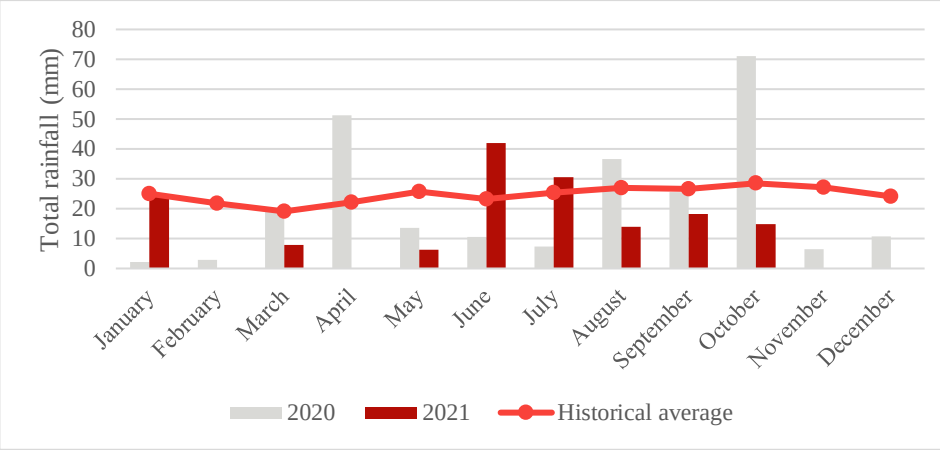


Figure 5-2 Total monthly rainfall for Euston (Sunnyside Station), NSW (weather station 049045) vs historic average

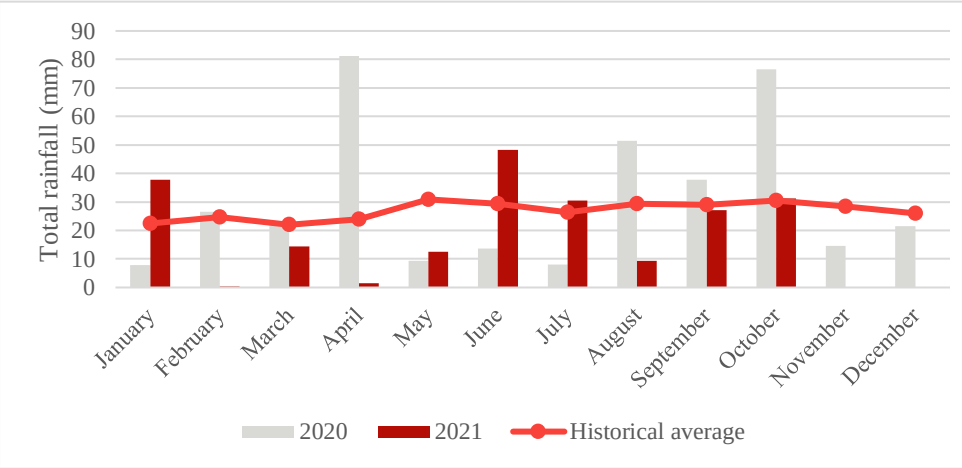


Figure 5-3 Total monthly rainfall for Balranald, NSW (weather station 049002) vs historical average

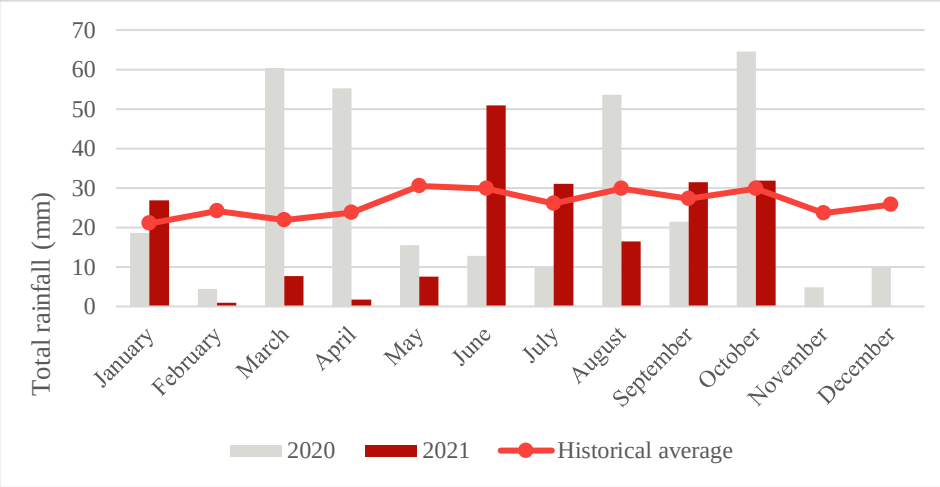


Figure 5-4 Total monthly rainfall for Moulamein (Tchelery station), NSW (weather station 075062) vs historical average

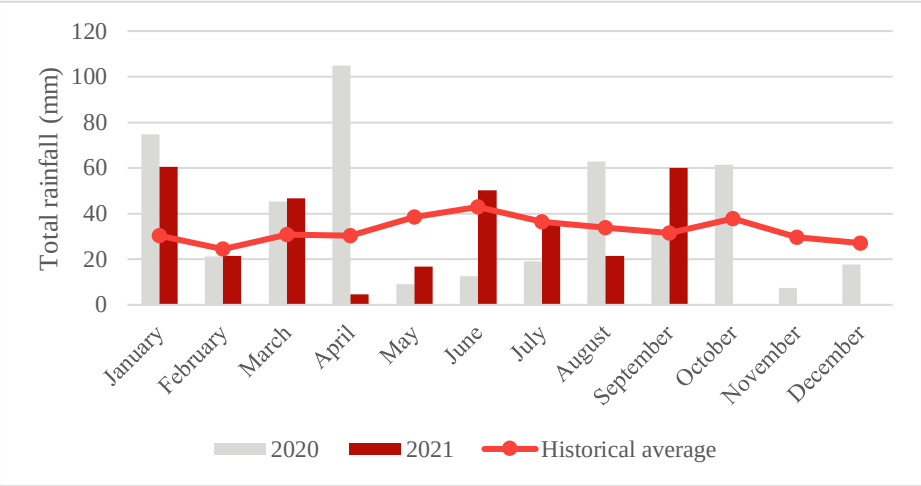


Figure 5-5 Total monthly rainfall for Jerilderie (Pooginook Station), NSW (weather station 074040) vs historic average

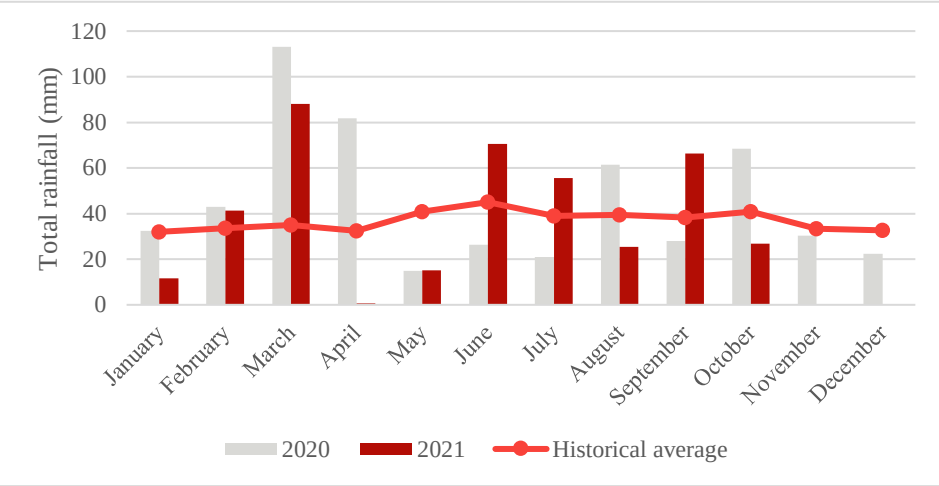


Figure 5-6 Total monthly rainfall for Urana, NSW (weather station 074110) vs historic average

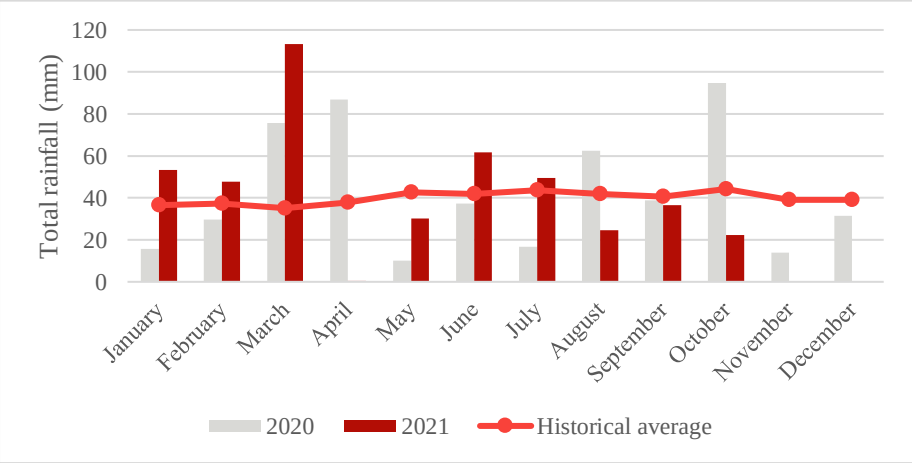


Figure 5-7 Total monthly rainfall for Balfrayden, NSW (weather station 074205) vs historic average

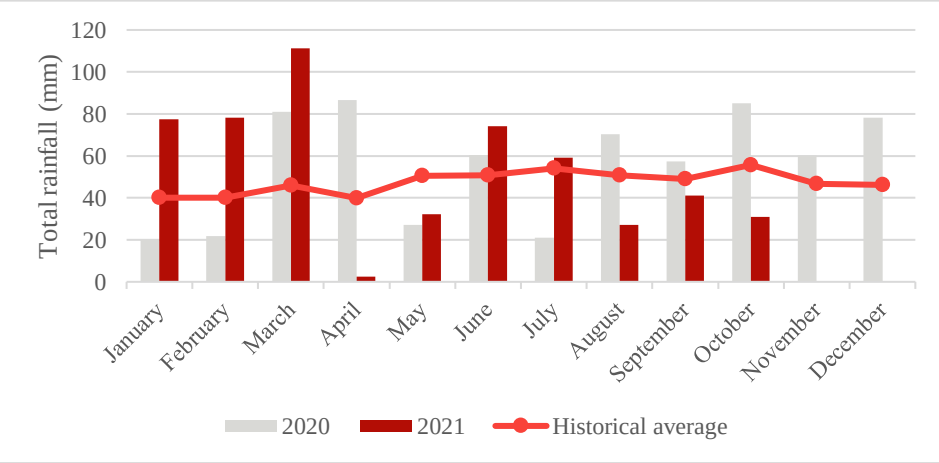


Figure 5-8 Total monthly rainfall for Wagga Wagga, NSW (weather station 074127) vs historic average

5.5.1.2 Daily weather observations during field survey

Daily weather observations during survey dates were recorded from several locations across the alignment. Weather stations, and associated survey locations, were as follows:

- Balranald, NSW (weather station 049002): location used for Buronga substation to Maude road
- Hay, NSW (weather station 075019): location used for Maude road to Coleambally, NSW
- Narrandera, NSW (weather station 074148): location used for Coleambally, NSW to Lockhart, NSW
- Wagga Wagga, NSW (Kapooka – weather station 074272): location used for Lockhart, NSW to Wagga Wagga substation.

Weather stations were chosen based on location in relation to the alignment and comprehensiveness of climate data available.

Table 5-10 Weather conditions observed at Balranald during survey dates (weather station 049002)

DATE	TEMPERATURE		RAIN (MILLIMETERS)	WIND DIRECTION/SPEED (KPH)	
	Minimum	Maximum		9 am	3 pm
10/02/2020	18.5	29.8	0	S 17	S 19
11/02/2020	18.8	34	0	SW 11	SSW 19
12/02/2020	18.7	33.5	0	SSE 24	SSW 13
13/02/2020	21.3	38	0	SE 17	E 11
14/02/2020	25.9	37.2	0	N 7	W 15
15/02/2020	19.5	32	0	SSW 17	SSW 13
16/02/2020	15.5	31.5	0	S 13	W 15
17/02/2020	15	34.1	0	SW 11	SSW 13
18/02/2020	18.2	27.5	0	WSW 28	WSW 28
18/03/2020	18.3	34.4	0	NNE 13	NW 13
19/03/2020	21	36.8	0	N 15	N 22
20/03/2020	13	27.6	0	WSW 17	SW 19
21/03/2020	12.1	26.6	0	SE 11	WSW 9
22/03/2020	18.4	25.2	0	Data deficient	
23/03/2020	17.4	23.9	0		
24/03/2020	16.8	21.1	0		
26/10/2020	9.4	16.1	1.6	SE 6	E 15
27/10/2020	11.6	20.6	1.4	E 6	SE 13
23/03/2021	17.4	23	5.4	S 7	S 15
24/03/2021	16.8	23.1	0	W 6	WSW 35
25/03/2021	15	24.5	0	WSW 24[1]	WSW 31
26/03/2021	9.9	24.4	0	Calm	WNW 26
27/03/2021	11.4	25.5	0	W 4	W 31

DATE	TEMPERATURE		RAIN (MILLIMETERS)	WIND DIRECTION/SPEED (KPH)	
	Minimum	Maximum		9 am	3 pm
28/03/2021	10	23.6	0	S 6	SW 17
29/03/2021	10.1	26.4	0	S 4	SW 24
30/03/2021	8.4	26.1	0	S 4	SSW 17
31/03/2021	7.7	30	0	S 4	ESE 13
8/04/2021	9.4	31.9	0	Calm	NW 19
9/04/2021	15.5	23	0	SW 6	SSW 19
7/06/2021	7.5	19	0	N 4	N 30
8/06/2021	8.5	11.9	4.2	NNW 6	WSW 11
5/09/2021	5.4	15.6	0	SW 6	SW 28
6/09/2021	6.4	18.2	0	S 6	WSW 17
7/09/2021	5.5	17.6	0	SW 6	WSW 24
8/09/2021	2.4	22.2	0	Calm	NW 17
9/09/2021	8.4	27.4	0	N 7	NW 33
4/10/2021	7.4	19.6	0.6	WSW 7	WSW 39
5/10/2021	6.9	21.4	1.4	SW 7	WSW 31
6/10/2021	5.6	25.4	0	NNW 6	N 26
7/10/2021	8.8	19.4	0	S 7	SW 24
8/10/2021	5.2	24.4	0	SE 4	N 20
11/10/2021	4.2	18.6	0	S 7	SE 15
12/10/2021	6.8	22.4	0	E 4	NNE 17
13/10/2021	11.8	24	0	N 13	N 28
18/10/2021	9.9	27	0	N 6	WNW 24
19/10/2021	7.4	22.1	0	S 6	SSE 19
20/10/2021	8.5	26.4	0	E 4	NNE 24
21/10/2021	14.9	29.4	0	NE 7	NE 17
22/10/2021	13.4	32.2	0	NE 6	NNE 22

(1) Data taken from Swan Hill, Victoria (Swan Hill Aerodrome station number 077094) due to lack of data for Balranald.

Source: Climate data online (Bureau of Meteorology 2021)

Table 5-11 Weather conditions observed at Hay airport during survey dates (weather station 075019)

DATE	TEMPERATURE		RAIN (MILLIMETERES)	WIND	
	Minimum	Maximum		9 am	3 pm
24/05/2019	11.6	23.6	0	Data deficient	
25/05/2019	11.2	22.8	0		
4/09/2020	6.5	19.6	0	ESE 6	WNW 17
5/09/2020	3.2	19.7	0	SW 26	SW 13
6/09/2020	1.6	21.9	0	NE 17	NE 7
7/09/2020	8.4	25.7	0	NNE 24	N 26
8/09/2020	13.8	31.2	0	N 30	W 22
9/09/2020	10.4	20.3	0.4	S 20	SW 19
10/09/2020	3	23	0	ENE 24	ENE 19
22/10/2020	7.7	31.5	0	NE 9	WNW 9
23/10/2020	16	28.2	0	N 26	NNE 9
28/10/2020	9.7	25.8	0.4	SSE 15	WNW 7
27/03/2021	14.2	26.6	0	NW 22	WSW 31
28/03/2021	7.9	24.4	0	WSW 13	SSW 19
29/03/2021	8.5	26.4	0	SSW 13	S 28
30/03/2021	6.1	26.3	0	SSW 20	SSW 20
31/03/2021	6	29.3	0	SSE 15	SE 11
9/04/2021	14.1	24.3	0	SW 30	SW 26
10/04/2021	9.8	22.3	0	SW 24	WSW 31
11/04/2021	8	18.6	0	WSW 33	SW 31
12/04/2021	3.8	20.5	0	SSW 20	SE 13
14/04/2021	15.9	24.7	0	NNW 22	W 26
10/09/2021	4.7	26.8	0	N 19	WNW 20
11/09/2021	9.3	30	0	N 28	NW 39
12/09/2021	9.3	18	0	WSW 22	WSW 20

Source: Climate data online (Bureau of Meteorology 2021)

Table 5-12 Weather conditions observed at Narrandera during survey dates (weather station 074148)

DATE	TEMPERATURE		RAIN (MILLIMETERES)	WIND	
	Minimum	Maximum		9 am	3 pm
26/05/2019	8	15.8	2.2	Data deficient	
10/09/2020	7.6	20.5	0	ENE 35	E 28
12/04/2021	3.8	19	0	SW 17	SW 11
13/04/2021	3	22.9	0	NE 11	N 11
14/04/2021	13.8	25.4	0	NNW 19	W 19
23/05/2021	3.1	21.2	0	E 7	S 9
24/05/2021	4.4	22.6	0	ENE 15	NE 19
25/05/2021	7.2	24.3	0	NNE 35	N 33
26/05/2021	6.4	15.8	19.2	NW 20	W 20
27/05/2021	2.9	16.2	0.2	NW 9	WSW 20
24/08/2021	5.1	14	7.2	SSW 24	SW 28
25/08/2021	1.9	15.3	0	SW 15	SW 24
26/08/2021	-1	16.1	0	Calm	W 6
31/08/2021	4.3	21.3	0	NNE 4	N 22
13/09/2021	6.2	14.6	1	SSW 13	WSW 13
14/09/2021	0.3	17.6	0.2	NE 7	WSW 11
15/09/2021	0.7	17.4	0.2	E 9	Calm
16/09/2021	1.6	19	0	ENE 15	S 6

Source: Climate data online (Bureau of Meteorology 2021)

Table 5-13 Weather conditions observed at Kapooka (Wagga Wagga) during survey dates (station number 074272)

DATE	MIN TEMP	MAX TEMP	RAIN (MM)	MAX WIND (DIRECTION / SPEED (KM/H))	WIND 9AM	WIND 3PM
20/10/2020	4.5	23.8	0	NNE 19	NNE 6	NW 7
21/10/2020	6.5	24.6	0	WSW 19	WSW 2	SW 7
15/04/2021	3.3	19.8	0	SW 28	NNW 2	WSW 13
25/04/2021	0	20	0	SW 26	N 2	SW 11
26/04/2021	-0.9	20.2	0	SW17	N 4	WSW 7
27/04/2021	0.2	22.8	0	NNE 13	WNW 2	WSW 2
28/04/2021	3.8	23	0	NE 20	NE 4	S 6
29/04/2021	2.9	24	0	N 13	Calm	SW 4
30/04/2021	4.6	24.4	0	ENE 17	ESE 2	ENE 4
1/05/2021	7.3	24.3	0	E 31	E 19	E 7
2/05/2021	10.1	24.6	0	ENE 35	ENE 17	ENE 11
27/08/2021	0.2	16	0	NW 31	N 4	W 15
28/08/2021	-2.2	17.3	0	ENE 31	Calm	N 15
30/08/2021	1	17.1	2.2	N 20	Calm	N 11
2/09/2021	7.5	23.6	0	NE 37	ENE 15	NE 24
3/09/2021	16.1	22.6	0	NNE 43	N22	NNE19
30/10/2021	1.1	19.4	0	SSW 39	SSW 11	SSW 19
31/10/2021	-1.5	23	0	NW 19	N 4	WSW 4
1/11/2021	3.3	27.3	0	N 30	E 7	NNW 6

Source: Climate data online (Bureau of Meteorology 2021)

5.5.2 Threatened flora surveys methods

Targeted threatened flora surveys were planned with a phased approach:

- Survey was designed to maximise the likelihood of detection of targeted threatened plant species by grouping those species considered likely to be reliably detected through survey according to optimal months of survey and their specific associated habitat.
- Field survey techniques were assigned to areas of associated habitat based on number of associated candidate species, likelihood to support candidate species, condition and presence of associated microhabitats. The likelihood of potential habitat for each threatened flora species in the western section between Buronga substation and Yanga National Park were further reviewed by the local mallee flora expert Dr Ian Sluiter.

The following field survey techniques were used to undertake targeted seasonal surveys in general accordance with the NSW Guide to Surveying Threatened Plants (Office of Environment & Heritage 2016) and Surveying threatened plants and their habitats; NSW guide for the BAM (Department for Planning Industry and Environment 2020):

- parallel field traverses
- representative parallel field traverses (one kilometre sections)
- two-phase grid-based systematic survey
- parallel field traverses of microhabitats
- rapid data point assessment of threatened flora habitats by local mallee expert Dr Ian Sluiter
- driving transects for large and medium tree and shrub forms of plants (driving slowly) along the entire disturbance area.

It is acknowledged that the later field survey guidelines published by the Department of Planning, Industry and Environment were released during and following completion of part of the surveys for this proposal. It is considered that the method of representative parallel field traverses for one kilometre distances is not strictly in accordance with the recently released guideline Surveying threatened plants and their habitats; NSW guide for the BAM (Department for Planning Industry and Environment 2020), which provides a preferred method of surveying large areas using a systematic grid based sampling methodology.

The adopted systematic parallel transect and two-phase grid-based systematic survey methods applied to this proposal were considered more suitable for the extensive linear nature of the proposal than a systematic plot-based approach for the following reasons:

- it more comprehensively samples the disturbance area within each sample section and
- the relatively homogeneous nature of the PCT and condition for large sections provide relatively consistent habitat potential.

A summary of targeted threatened flora survey effort of each method and the proportion of effort undertaken on native vegetation within the study area is presented in Table 5-14 and shown in Figure 5-9.

Table 5-14 Summary of targeted threatened flora survey effort of each method

SURVEY METHOD	AREA (HA)	% OF TOTAL
Two-phase grid-based systematic survey	4446.88	56.64
Representative parallel field traverses survey	1356.90	17.28
Opportunistic survey	616.65	7.85
Areas not subject to targeted survey	550.37	7.01
No Access	879.95	11.21
Total Native vegetation	**7850.75**	**100.00**

Detailed locations and effort of targeted surveys within the proposal study area are presented in Appendix C-3 and Appendix C-5 and the methods outlined below should be read in conjunction with these appendices.

5.5.2.1 Parallel field traverses

Parallel field traverses were used in vegetation types which were considered the most suitable habitat for candidate threatened flora species. This involved two botanists walking on a fixed bearing at distances according to the life form of the candidate threatened species in accordance with Table 1 (section 4.2) in Surveying threatened plants and their habitats; NSW survey guide for the BAM (Department for Planning Industry and Environment 2020).

5.5.2.2 Representative parallel field traverses (one kilometre sections)

Representative sampling of one kilometre sections of the centreline of the disturbance area was undertaken in vegetation types which habitat considered suitable for numerous candidate flora species. This approach involved two senior botanists walking on a fixed bearing at 20 metres apart over one kilometre sections. These surveys were designed to cover the disturbance area being 60 metres each side of the centreline of the disturbance area that allowed for a total coverage of a 120 metre corridor.

This systematic survey approach was considered appropriate given it provides a more comprehensive sample of the disturbance area within each sample section and due to the relatively homogeneous nature of the PCT and condition for large sections providing relatively consistent habitat potential. This technique was used in vegetation communities with less floristic diversity in the shrub and ground stratum.

It should be noted that this method was only employed for surveys conducted during spring 2020. After further consultation with the NSW Biodiversity Conservation Division, this method was replaced by adopting the two-phase grid systematic survey as outlined in Surveying threatened plants and their habitats; NSW guide for the BAM (Department for Planning Industry and Environment 2020).

Where threatened species were recorded using this method, species polygons were applied to suitable habitats within areas not subject to targeted surveys to ensuring a conservative approach to species occurrence was taken.

Detailed locations and effort of representative parallel field traverses survey method within the proposal study area is presented in Appendix C-3 and Appendix C-5.

5.5.2.3 Two-phase grid-based systematic survey

It is recognised that the parallel field traverses survey method is impractical for large scale project, particularly the current proposal, which spans a linear distance of 540 kilometres (Department for Planning Industry and Environment 2020). The two-phase grid-based systematic survey methods has been developed for large areas of suitable potential threatened species habitat that generally exceed 50 hectares in area. The method involves phase-one establishing a grid spaced at 100 square metres that is nested within a one-square-kilometre grid. Surveys are then conducted at each survey location (100 metre grid intersect or greater if open woodland structure occurred), where a 40-metre diameter search area is undertaken (1256-square-metre circular area). If a target threatened species is located, finer-scale grid surveys (phase-two) is used to locate population extent, which allows a species polygon to be defined. This subsequent phase ensures a greater intensity of survey effort in locations where the target threatened species occurs (Department for Planning Industry and Environment 2020).

Given the linear nature of the proposal study area, an alternate two-phase grid-based systematic survey method was adopted. This involved a liner 100 meter survey effort where a 40-metre diameter search area is undertaken (1256-square-metre circular area) at each 100 metre survey location along the proposal study area. Survey locations were pre-loaded onto a handheld GPS to enable a systematic approach to the survey effort (refer to Photo 5-1). If a target threatened species was located, a finer-scale grid survey (phase-two) was undertaken to locate population extent and allow a species polygon to be defined.

For mallee vegetation types (open woodland structure), a two-phased grid survey was conducted by local mallee flora experts, Dr Ian Sluiter and Geoffrey Allen.

Detailed locations and effort of two-phase grid-based systematic survey method within the proposal study area is presented in Appendix C-3 and Appendix C-5.

5.5.2.4 Parallel field traverses of microhabitats

Parallel field traverses of microhabitats were undertaken for candidate flora species associated with specific microhabitats or habitat attributes. A five metre distance between parallel field traverses was considered appropriate to adequately survey for candidate grass and forb species based on the open nature of associated habitat. This approach was carried out in microhabitats (i.e. wetland complexes) known to support candidate threatened flora.

This approach was applied to microhabitats such as:

- Red clay scalds (i.e. PCT 44 where red clays scalds occur)
- Inundated grey, grey brown and red brown clays (i.e. PCT 17, 47, 160 following rainfall)
- Table drains (i.e. road verges)
- Farm dams
- Sandhills associated with *Callitris* sp. (i.e. PCT 28)
- Gilgai clay depressions (i.e. PCT 17, 24, 47, 53, 76, 160)
- Triodia sandhills (i.e. PCT 171, 172).

5.5.2.5 BAM vegetation integrity surveys

Vegetation integrity plot surveys were carried out in accordance with the BAM. At each vegetation integrity plot survey location, dedicated 20 minute searches were conducted for threatened species assessed as candidate species within each vegetation zone sampled. The number of plots completed for each identified PCT and vegetation zone is provided in Table 4-2 to Table 4-6 with the location of each vegetation integrity plot identified in Appendix B-3 and shown in Appendix B-5.

5.5.2.6 Rapid data point assessment of threatened flora habitats

Rapid data point assessment (RDP) were undertaken to sample patches to vegetation to determine micro habitat suitability for threatened species. Typically, an area of about 10 by 10 meters (100 square metres) is searched at rapid data point for a period of about 10 minutes. RDP assessment was used supplementary to field traverses to allow an overall better detection for threatened flora species and their habitat within the subject land. If a threatened flora species was detected, parallel field traverses were undertaken at the appropriate distance apart based on growth form to determine the extent of the population.

5.5.2.7 Opportunistic threatened flora surveys

Opportunistic sightings of threatened flora species were recorded during field surveys whilst completing other field surveys such as undertaking BAM vegetation integrity plots, vegetation type/condition validation etc. During these surveys, a hand-held GPS was used to record the locations of any threatened or important flora species observed. If a threatened flora species was detected, parallel field traverses were undertaken at the appropriate distance apart based on growth form to determine the extent of the population.

5.5.2.8 Herbarium sampling and vouchering

Threatened flora species located during surveys were tentatively identified in the field to enable finer-scale grid surveys to locate population extent and allows species polygons to be defined. Plant samples of each threatened species were collected and placed in a field plant press for further analysis and herbarium sampling. Each sample was located with GPS coordinates and field notes were recorded including unique code, date of recording, genus and tentative species name, associated plant species, PCT, soils, landform, and any other relevant information to assist with herbarium vouchering. Collected plant samples were examined under a microscope before being processed and forwarded to the National Herbarium of NSW for positive verification. All plant samples were collected under NSW scientific licence number 100630. An example to collected plant material for herbarium verification is presented in Photo 5-2.

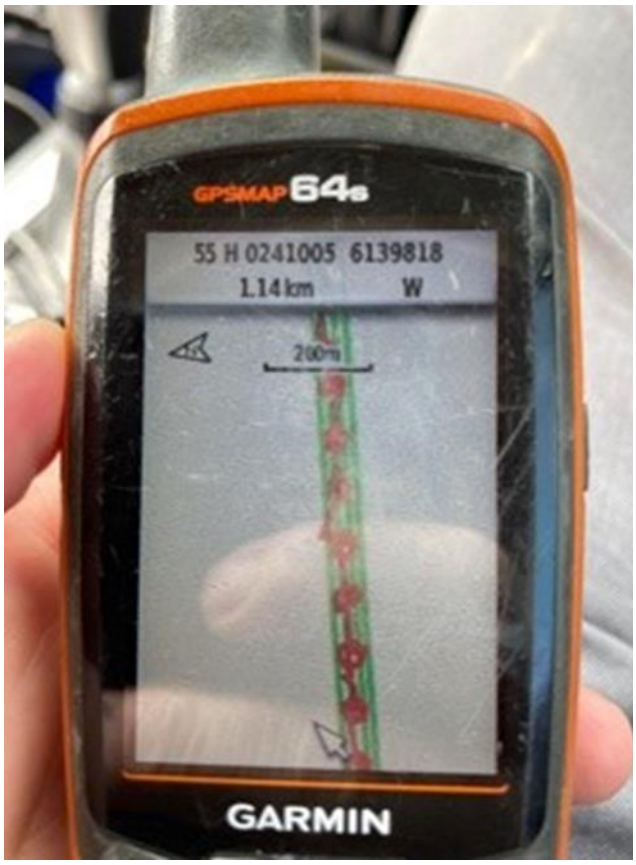
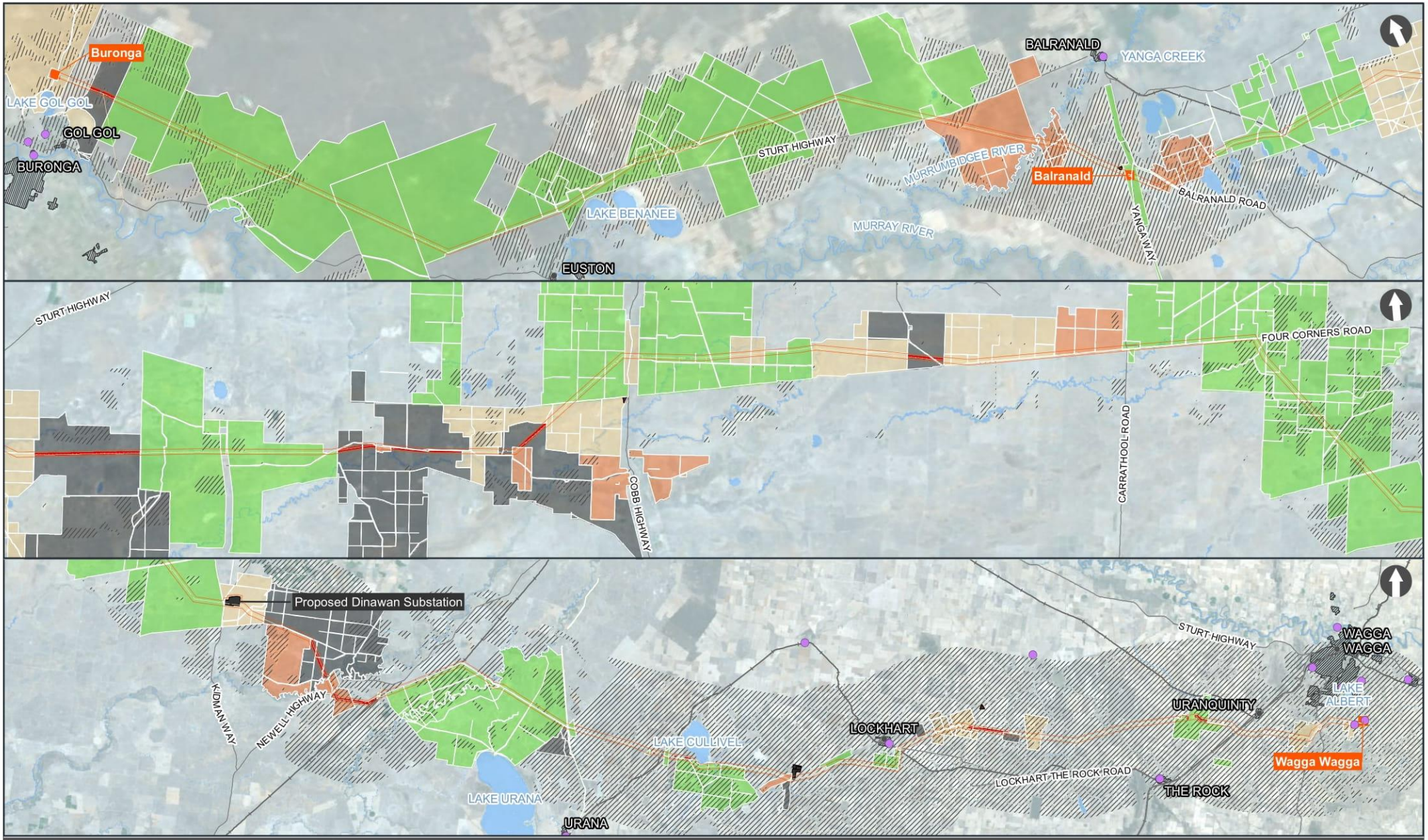


Photo 5-1 Example of two-phase grid-based systematic survey methods using a pre-loaded handheld GPS

Photo 5-2 Collected plant sample of *Leptorhynchos* sp. possible *L. orientalis* for herbarium verification



BDAR - Figure 5-9

Summary of Targeted Threatened Flora Survey Effort Map

C:\Users\autw500241\WSP O365\EnergyConnect - General\5_Shared\54_Production\Maps\003_PEC_East\02_SpecialistReports\01_Ecology\06_BDAR\PS117658_BDAR_F0509_OverviewTargetedThreatenedFloraSurveyEffort_r1v4.mxd

Source: NSWSS, ESRI, Transgrid, WSP

5.5.3 *Threatened fauna survey methods*

This section outlines the fauna survey effort completed for candidate species which were predicted to have a moderate to high likelihood of occurrence within the disturbance area based on the BAM-C, database searches and habitat assessments outlined in Section 5.2.1.

Threatened fauna surveys completed within the proposal study area and were carried out as described below and where applicable, considering the methodology detailed in:

- NSW Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities (Working Draft) (Department of Environment and Conservation 2004)
- Survey Guidelines for Australia's Threatened Birds (Department of Environment Water Heritage and the Arts 2010)
- Threatened Species survey and assessment guidelines: field survey and methods for fauna-Amphibians (Department of Environment and Climate Change 2009)
- Survey guidelines for Australia's threatened frogs (Department of the Environment Water Heritage and the Arts 2010)
- Survey guidelines for Australia's threatened reptiles (Department of Environment Water Heritage and the Arts 2011).
- 'Species credit' threatened bats and their habitats (Office of Environment & Heritage 2018)
- NSW Survey Guidelines for threatened frogs (Department of Planning Industry and Environment 2020)
- Threatened Species Profile Database (Science 2021).

5.5.3.1 Fauna habitat stratification

There are 39 PCTs that contain various types of habitats for fauna within the proposal study area and disturbance area. These can broadly be categorised into the following similar fauna habitat stratification units, being:

- Arid woodland/shrublands: Native woodland and shrublands broadly associated with arid interior areas (880.39 hectares in disturbance area)
- Chenopod shrublands: Low shrublands in arid and semi-arid interior areas (305.22 hectares in disturbance area)
- Grasslands: Native grasslands of the Riverina (150.67 hectares in disturbance area)
- Grassy Woodlands: Woodlands with a grassy understorey on plains and slopes (67.22 hectares in disturbance area)
- Riverine: Native woodland broadly associated with riverine environments (67.23 hectares in disturbance area)
- Rocky Woodlands: Woodlands on foothills surrounding Wagga Wagga underlain by rocky geology (21.88 hectares in disturbance area)
- Wetlands: Various forms of inundated wetland habitats (62.43 hectares in disturbance area).

These fauna habitat stratification units were identified to ensure that fauna surveys were undertaken within each representative habitat type for the target threatened fauna species. The fauna habitat stratification units are as outlined below in Table 5-15.

Table 5-15 Vegetation zone and PCT types as they correspond to fauna habitat stratification types

FAUNA STRATIFICATION UNITS AND RELATED PCTS	DISTURBANCE AREA (HA)[1]
Arid woodland/shrublands	
PCT 22 – Semi-arid shrubby Buloke - Slender Cypress Pine woodland, far south-western NSW	2.93
PCT 23 – Yarran tall open shrubland of the sandplains and plains of the semi-arid (warm) and arid climate zones	18.51
PCT 26 – Weeping Myall open woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion	313.54

FAUNA STRATIFICATION UNITS AND RELATED PCTS	DISTURBANCE AREA (HA)[1]
PCT 28 – White Cypress Pine open woodland of sand plains, prior streams and dunes mainly of the semi-arid (warm) climate zones	31.99
PCT 58 – Black Oak – Western Rosewood open woodland on deep sandy loams mainly in the Murray Darling Depression Bioregion	120.35
PCT 143 – Narrow-leaved Hopbush – Scrub Turpentine – Senna shrubland on semi-arid and arid sandplains and dunes	2.25
PCT 170 – Chenopod sandplain mallee woodland/shrubland of the arid and semi-arid (warm) zones	299.57
PCT 171 – Spinifex linear dune mallee mainly of the Murray Darling Depression Bioregion	44.47
PCT 172 – Deep sand mallee of irregular dunefields of the semi-arid (warm) zone	45.31
PCT 199 – Hooked Needlewood – Needlewood – Mulga – Turpentine Bush open shrubland of the semi-arid and arid plains	1.31
Subtotal	880.23
Chenopod shrublands	
PCT 157 – Bladder Saltbush shrubland on alluvial plains in the semi-arid (warm) zone including Riverina Bioregion	47.60
PCT 163 – Dillon Bush (Nitre Bush) shrubland of the semi-arid and arid zones	109.36
PCT 164 – Cotton Bush open shrubland of the semi-arid (warm) zone	132.35
PCT 166 – Disturbed annual saltbush forbland on clay plains and inundation zones mainly of south-western NSW	0.95
PCT 216 – Black Roly Poly low open shrubland of the Riverina	14.96
Subtotal	305.22
Grasslands	
PCT 44 – Forb-rich Speargrass – Windmill Grass – White Top grassland of the Riverina Bioregion	45.15
PCT 45 – Plains Grass grassland on alluvial mainly clay soils in the Riverina Bioregion and NSW South Western Slopes Bioregion	37.26
PCT 46 – Curly Windmill Grass – speargrass – wallaby grass grassland on alluvial clay and loam on the Hay plain, Riverina Bioregion	68.26
Subtotal	150.67

FAUNA STRATIFICATION UNITS AND RELATED PCTS	DISTURBANCE AREA (HA)[1]
Grassy Woodlands	
PCT 74 – Yellow Box – River Red Gum tall grassy riverine woodland of NSW South Western Slopes Bioregion and Riverina Bioregion	2.07
PCT 75 – Yellow Box – White Cypress Pine grassy woodland on deep sandy-loam alluvial soils of the eastern Riverina Bioregion and western NSW South Western Slopes Bioregion	35.62
PCT 76 – Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions	1.34
PCT 80 – Western Grey Box – White Cypress Pine tall woodland on loam soil on alluvial plains of NSW South Western Slopes Bioregion and Riverina Bioregion	24.44
PCT 267 – White Box – White Cypress Pine – Western Grey Box shrub/grass/forb woodland in the NSW South Western Slopes Bioregion	0.26
PCT 277 – Blakely's Red Gum – Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion	3.49
Subtotal	67.22
Riverine	
PCT 5 – River Red Gum herbaceous-grassy very tall open forest wetland on inner floodplains in the lower slopes sub-region of the NSW South Western Slopes Bioregion and the eastern Riverina Bioregion	8.44
PCT 7 – River Red Gum – Warrego Grass – herbaceous riparian tall open forest wetland mainly in the Riverina Bioregion	0.78
PCT 8 – River Red Gum - Warrego Grass - Couch Grass riparian tall woodland wetland of the semi-arid (warm) climate zone (Riverina Bioregion and Murray Darling Depression Bioregion)	4.77
PCT 11 – River Red Gum – Lignum very tall open forest or woodland wetland on floodplains of semi-arid (warm) climate zone (mainly Riverina Bioregion and Murray Darling Depression Bioregion)	13.86
PCT 13 – Black Box – Lignum woodland wetland of the inner floodplains in the semi-arid (warm) climate zone (mainly Riverina Bioregion and Murray Darling Depression Bioregion)	10.0
PCT 15 – Black Box open woodland wetland with chenopod understorey mainly on the outer floodplains in south-western NSW (mainly Riverina Bioregion and Murray Darling Depression Bioregion)	23.25
PCT 249 – River Red Gum swampy woodland wetland on cowals (lakes) and associated flood channels in central NSW	6.13
Subtotal	67.23

FAUNA STRATIFICATION UNITS AND RELATED PCTS	DISTURBANCE AREA (HA)[1]
Rocky Woodlands	
PCT 110 – Western Grey Box – Cypress Pine shrubby woodland on stony footslopes in the NSW South Western Slopes Bioregion and Riverina Bioregion	2.67
PCT 319 – Tumbledown Red Gum – White Cypress Pine hill woodland in the southern part of the NSW South Western Slopes Bioregion	19.21
Subtotal	21.88
Wetlands	
PCT 17 – Lignum shrubland wetland of the semi-arid (warm) plains (mainly Riverina Bioregion and Murray Darling Depression Bioregion)	17.20
PCT 24 – Canegrass swamp tall grassland wetland of drainage depressions, lakes and pans of the inland plains	12.23
PCT 47 – Swamp grassland wetland of the Riverine Plain	3.01
PCT 53 – Shallow freshwater wetland sedgeland in depressions on floodplains on inland alluvial plains and floodplains	1.73
PCT 160 – Nitre Goosefoot shrubland wetland on clays of the inland floodplains	28.19
PCT 182 – Cumbungi rushland wetland of shallow semi-permanent water bodies and inland watercourses	0.07
Subtotal	62.43
Total	**1,554.88**

5.5.3.2 Fauna habitat assessment

Fauna habitat assessments were undertaken to assess the likelihood of threatened species of animal (those species known or predicted to occur within the locality from the literature and database review) occurring within the proposal study area. Fauna habitat assessments were the primary assessment tool in assessing whether threatened species were likely to occur within the proposal study area.

Fauna habitat characteristics assessed included:

- structure and floristics of the canopy, understorey and ground vegetation, including the presence of flowering and fruiting trees providing potential foraging resources
- presence of hollow-bearing trees providing roosting and breeding habitat for arboreal mammals, Forest Owls, birds and reptiles
- presence of the ground cover vegetation, leaf litter, rock outcrops and fallen timber and potential to provide protection for ground-dwelling mammals, reptiles and amphibians
- presence of waterways (ephemeral or permanent) and water bodies
- presence of man-made structures (e.g. culverts) for roosting/breeding microchiropteran bats.

The criteria were used to evaluate the condition of habitat values is outlined in Table 5-16.

Table 5-16 Fauna habitat assessment evaluation criteria

HABITAT VALUE	EVALUATION CRITERIA
Good	A full range of fauna habitat components are usually present (for example, old growth trees, fallen timber, feeding and roosting resources) and habitat linkages to other remnant ecosystems in the landscape are intact.
Moderate	Some fauna habitat components are missing or greatly reduced (for example, old-growth trees and fallen timber), although linkages with other remnant habitats in the landscape are usually intact, but sometimes degraded.
Poor	Many fauna habitat elements in low quality remnants have been lost, including old growth trees (for example, due to past timber harvesting or land clearing) and fallen timber, and tree canopies are often highly fragmented. Habitat linkages with other remnant ecosystems in the landscape have usually been severely compromised by extensive clearing in the past.

5.5.3.3 Opportunistic and anecdotal recording of fauna species and evidence of fauna activity

Opportunistic sightings of animals were recorded during all field surveys. Evidence of animal activity, such as scats, diggings, scratch marks, nests/dreys, burrows, mounds etc., was also noted. This provided indirect information on animal presence and activity.

During these field surveys, a hand-held GPS was used to record the locations of:

- hollow-bearing trees
- aquatic habitat
- rock outcrops
- any other important habitat features of note.

Anecdotal records from landholders were also recorded if provided.

5.5.3.4 Diurnal bird surveys

Formal 20-minute diurnal bird searches were completed by two ecologists. Bird surveys were completed by actively walking through the nominated site (transect) over a period of 20 minutes. All birds were identified to the species level, either through direct observation or identification of calls.

Targeted survey effort for each bird group (waterbirds, etc) is outlined in the summary table (Table 5-17) at the end of this Section.

Bird surveys were completed during different times of the day, but generally occurred during morning hours or evening. Birds were also recorded opportunistically during all other surveys.

Wherever threatened bird species were absent from the site, habitat assessments were conducted to determine the likelihood that the disturbance area might support those species that are known to occur in the region.

5.5.3.5 Call playback

Call playback was used to survey for threatened owls (Powerful, Masked, Barking and Sooty Owl), Bush Stone-curlew and arboreal mammals (predominantly Koala and Gliders) using the methods of Kavanagh (Kavanagh and Peake 1993) and Debus (Debus 1995). Call playback was conducted after dusk each night, within suitable habitat in the study area. An initial listening period of 10 minutes was undertaken, followed by a spotlight search for 10 minutes to detect any animals in the immediate vicinity.

The calls of the target species were then played intermittently for five minutes followed by a 10-minute listening period. After the calls were played, another 10 minutes of spotlighting was carried out in the vicinity to check for animals attracted by the calls without vocalising. Calls were broadcast using a portable call playing device and amplified through a megaphone or Bluetooth speaker. Wherever threatened bird species were absent from the site, habitat assessments were conducted to determine the likelihood that the disturbance area might support those species that are known to occur in the region.

5.5.3.6 Koala spot assessments

In addition to habitat assessments, the Spot Assessment Technique (SAT) was undertaken within the study area to detect potential Koala presence. In areas where Koalas are present, the SAT also measures Koala feed-tree species preferences by measuring the rate at which individual trees are utilised by Koalas.

The SAT samples Koala activity by selecting a prominent tree, usually a known Koala feed-tree species, and surveying its trunk and surrounding leaf litter for signs of Koala activity. A minimum of 29 surrounding trees are sampled systematically for Koala faecal pellets for 1 metre around the base of each tree. The activity of Koala usage for each SAT is then expressed as the percentage equivalent of the proportion of the surveyed trees within each SAT. The percentage is then compared to prescribed ranges for activity levels for Koalas within NSW (Phillips and Callaghan 2011).

5.5.3.7 Anabat detection

Passive Ultrasonic Anabat Bat detection (Anabat SD1/SD2 or Anabat Express unit – Titley Scientific, Brendale QLD) was used to record and identify the echolocation calls of microchiropteran bats foraging at each survey site. Passive monitoring of survey sites was achieved by setting Anabat bat detectors to record throughout the night.

Anabat Bat detectors recorded bat vocalisations throughout the full night, with the recording starting before dusk. Bat activity throughout the night does vary (Taylor and Oneill 1988, Department of Environment and Conservation 2004), but the peak in activity is usually within a few hours of dusk. For this study the sampled population was defined as those active up to two hours after last light. Bat activity is used as a substitute for abundance, and is based on the number of microchiropteran bat calls recorded during the survey period, including those calls assigned to a species complex (i.e. not positively attributable to an individual species). Calls were analysed by Rob Gration using Analook (Version 4.7) software with reference to 'Bat Calls of NSW: Region Based Guide to the Echolocation Calls of Microchiropteran Bats' (Pennay, Law et al. 2004).

Targeted survey effort for each fauna group is outlined in the summary table (Table 5-17) at the end of this Section.

5.5.3.8 Harp trapping

Like other Long-eared Bat species Corben's Long-eared Bat (*Nyctophilus corbeni*) uses understorey strata for foraging and they roost in hollow-bearing trees. Although many microchiropteran bat species are detectable through use of Anabat call detection methodologies, the vocal differences between *Nyctophilus* spp. are too subtle to reliably differentiate between the various species occurring in the locality of the proposal study area. Therefore, surveys for Corben's Long-eared Bat needed to be conducted with a methodology that enabled bats to be identified in the hand.

Harp traps are excellent for capture and release of microchiropteran bats and they are well suited to the capture of *Nyctophilus* spp. due to their propensity to use lower forest strata for their foraging habits. Site selection for the setting of harp traps included a number of rationale, such as targeting of those areas where *Nyctophilus* spp. had been previously detected during previous monitoring programs, woodland habitats in areas where hollow-bearing trees provide potential roosting sites and where suitable flyways were detected in forest and woodland settings.

Harp traps were set at each location over a single night period. Captured bats were identified to species level, sexed, measured and weighed. Bats were released immediately after processing during dark conditions. Targeted survey effort for each fauna group is outlined in the summary table (Table 5-17) at the end of this Section.

5.5.3.9 Spotlighting

Spotlighting surveys were completed on foot or vehicle by pairs of two ecologists, targeting arboreal, flying and large ground-dwelling mammals, as well as nocturnal birds, reptiles and amphibians. At least one person hour of survey effort was completed per site.

The spotlighting methodology also included the use of a thermal imaging monocular to assist in nocturnal species identification, including target Western Pygmy Possum. The FLIR Thermal Imaging Monocular Scout II was used for this purpose. Targeted survey effort for each fauna group is outlined in the summary table (Table 5-17) at the end of this Section.

5.5.3.10 Pitfall and funnel trapping

Pitfall traps, supplemented with funnel traps were used in conjunction with drift fences to target amphibians, reptiles and small ground-dwelling mammals. Pitfall traps consisted of 20 litre buckets, buried in the ground with the lip flush to the ground's surface. Funnel traps consisted of a fabric mesh with both ends forming an inward-directed cone. Buckets were supplemented with a small amount of leaf litter, soil and damp cloth. Funnel traps were covered with ground cover debris to afford captured specimens some protection from weather variables.

As pitfall and funnel trapping was used specifically to target a range of mallee reptiles and terrestrial fauna, four pitfall traps and six funnel traps were used to sample six locations, including spinifex dune and chenopod understory habitats with an overstorey of mallee canopy species. Surveys are generally completed over a four-night period. However, weather forecasts are monitored for very cool conditions or high rainfall events, which might place small animals at risk of drowning or freezing. Targeted survey effort for each fauna group is outlined in the summary table (Table 5-17) at the end of this Section.

All live trapping followed guidelines and policies for wildlife research as set by the Animal Research Review (Australian Government 2004). Trap lines were checked during early morning and late afternoon hours with trapped specimens recorded to species level. All animals were released at the site of capture, immediately following processing.

5.5.3.11 Elliott-A and Elliott-E traps

Elliott traps, in two sizes, were used to target small mammals. The standard terrestrial Elliott A traps were set in transects of 25 with a minimum spacing of five metres. The smaller Elliott E traps were set in lines of six to target Western Pygmy Possum. Both traps were set with bait containing peanut butter, honey and oats and positioned so that they are sheltered from strong sunshine, to prevent heat exposure for captured animals.

Squirrel Glider (*Petaurus norfolcensis*) were surveyed using arboreal set Elliott Type B trapping methods. Live capture and release Elliott Type B traps were set. Each trap was baited with a mixture of oats, honey and vanilla essence and the immediate location was sprayed with an attractant of honey/vanilla essence water mix. Traps were checked at dawn each morning and captured animals were identified to species level before being released. All live trapping followed guidelines and policies for wildlife research in accordance with animal ethics protocols. Such survey technique also targeted Brush-tailed Phascogale.

Targeted survey effort for each fauna group is outlined in the summary table (Table 5-17) at the end of this Section.

5.5.3.12 Remote cameras

Remote cameras were employed for long-term observations of fauna using the habitats associated with the study area. Three cameras were used with each trapline as part of each trapping station suite. Cameras were baited with chicken necks and peanut butter, honey and oats in the western Mallee areas.

78 cameras were also employed for longer periods of time to target species that occur more sparsely within the environment, particularly Squirrel Gliders and potentially Brush-tailed Phascogale and Koala closer to Wagga Wagga. Peanut butter, honey and oats plus a honey water spray mix were used as an attractant. Targeted survey effort for each fauna group is outlined in the summary table (Table 5-17) at the end of this Section.

5.5.3.13 Roof tile surveys

Roofing tiles placed on the ground for long periods of time become part of the landscape for small fauna and offer excellent shelter in habitats where protection is sparse. Setting them for long periods of time, in suitable numbers, provides another method to target animals that are sparsely distributed in habitats. Grids of 49 tiles, placed in a 10x5 setting, at five metre intervals, were set and checked after 3 months. Species targeted included Pink-tailed Legless Lizard and Striped Legless Lizard. Targeted survey effort for each fauna group is outlined in the summary table (Table 5-17) at the end of this Section.

5.5.3.14 Nest box surveys

Nest boxes were placed for long periods of time become part of the landscape for small fauna and offer excellent shelter in habitats where protection is sparse. Setting them for long periods of time, in suitable numbers, provides another method to target animals that are sparsely distributed in habitats. Nest boxes (suitable for Western Pygmy Possum but also other hollow-dependent fauna species) were set in the mallee PCT's (Arid Woodlands/Shrublands habitat).

A total of 34 boxes, in groups of four to five, were set. Targeted survey effort for each fauna group is outlined in the summary table (Table 5-17) at the end of this Section.

5.5.3.15 Herpetological searches

Searches for reptiles and frogs were undertaken constantly during field surveys wherever suitable habitat occurred.

For reptiles this mostly consisted of targeted searches of areas containing suitable substrate such as leaf litter, logs, hollows, rocky substrates, grasses and *Triodia*.

For frogs, the available habitat was very limited in terms of aquatic resources, though when opportunities occurred, targeted surveys occurred. Frog call surveys included call playback and spotlighting transects in optimal conditions (e.g. after moderate rainfall events). For Sloane's Froglet (*Crinia sloanei*) the reference site at Charles Sturt University at Thurgoona, was visited before and during the survey period (August 2021) to check activity level of the target species. Activity level at the reference sites was high after rainfall and appeared higher in the 2 hours after dusk. Targeted survey effort for each fauna group is outlined in the summary table (Table 5-17) at the end of this Section.

Spotlighting activities also targeted nocturnal reptiles such as geckos.

5.5.3.16 Plains-wanderer surveys

Although the Plains-wanderer is a diurnally (daytime) active species they are not easily observable during those times. Their strategy for survival in an open environment is reliant on their cryptic plumage, while remaining motionless, and they do not readily flush as other grassland birds do, unless an observer almost steps on them. Therefore, surveys are conducted during nocturnal hours when the birds are roosting and more easily observed. Traditionally, Plains-wanderers are detected at night with the use of a spotlight while moving through potential habitat.

High-powered head-torches were used for spotlighting surveys as well as an infra-red scope (FLIR Thermal Imaging Monocular Scout II) that picks up the heat signature of fauna in the landscape at night. The scope proved to be useful for checking over areas where spotlighting techniques were compromised by the bird's ability to remain hidden due to camouflage and where distance reduced the detection of fauna by eyesight alone. The scope is able to pick up very small animals at considerable distance.

To determine the locations of areas most likely to support Plains-wanderer, particularly during nocturnal hours, aerial maps were consulted to identify areas where red coloured substrates were distributed. On the ground verification of the demarcation between soil areas and then assessment of habitat suitability was based on specific habitat criteria. Generally, the areas outside of red soil patches were too densely vegetated for Plains-wanderer to access, but where structure approached suitability those areas were also surveyed. Comparison to NSW Plains-wanderer habitat mapping and discussions with Plains-wanderer expert David Parker from BCD were also made to guide field works.

5.5.3.17 Golden Sun Moth surveys

Targeted surveys for Golden Sun Moths were undertaken with consideration of the *Significant impact guidelines for the critically endangered Golden Sun Moth* (Department of Environment Water Heritage and the Arts 2009). These guidelines recommend surveys for the Golden Sun Moth be conducted at any location containing habitat likely to support the species, which includes all areas which have, or once had, native grasslands (including derived grasslands) or grassy woodlands that occur within the historical range of the species including sites dominated by the exotic weed *Nassella neesiana** (Chilean Needle grass). Specifically, the guidelines outline that surveys should occur:

- during the local flying season (generally late October-January)
- of reference sites (sites of known occurrence) to guide survey timing
- over at least four suitable days (at weekly intervals):
  - warm to hot day (above 20°C by 10 am)
  - clear or mostly cloudless sky
  - still or relatively still wind conditions
  - at least two days since rain.

Surveys were completed in the small areas of suitable habitat (PCT 277) located in the eastern end of the proposal study area. They consisted of two ecologists walking 10m transects across the potential habitat during the appropriate weather. Note that a single day of survey across each patch was considered to be adequate as:

- this species has not previously been recorded west of Tumut and the record near Tumut was in the year 2000. This record is over 80 km from the proposal study area
- conditions were sunny and warm and mostly cloudless sky with relatively still conditions, where other species of moth and butterfly were observed flying around
- the habitat within the proposal study area was generally considered to be sub-optimal for this species as it mostly contained only sporadic wallaby grass or Chilean needlegrass, its preferred habitat.

5.5.3.18 Fauna survey summary

Fauna surveys as described above were undertaken in a stratified manner to ensure that all habitat types were sampled (refer to Section 4.9 for detail).

Table 5-17 summarises the fauna surveys completed within each fauna habitat stratification unit. For more survey detail including on targeted surveys for candidate species refer to the tables in Appendix C-4 and survey locations in Appendix C-6.

Table 5-17 Fauna survey summary

FAUNA GROUP	SURVEY TECHNIQUE	OPTIMUM SURVEY PERIOD	SURVEY EFFORT	DATES SURVEYED
Arid Woodlands/Shrublands –PCT22, PCT23, PCT26, PCT28, PCT58, PCT143, PCT170, PCT171, PCT172, PCT199				
Aerial bird species (Swifts)	Seasonal opportunistic surveys	Nov – Mar	11 x 20 min/2 ha formal bird surveys 352 person hours of opportunistic surveys	2-5 Dec 2019 11-19 Feb 2020 18-21; 23-31 Mar 2020 19-23 July 2020 8-15 Apr 2021 25-30 Apr 2021 24-27 May 2021 2-9 Sep 2021
Amphibians	Targeted surveys Call playback Spotlighting during suitable conditions	All year after significant rainfall	160 x Pitfall trap nights 96 x Funnel trap nights 6 person hours spotlighting	18-21 Mar 2020 2-9 Sep 2021
Birds of Prey	Targeted opportunistic surveys Targeted formal surveys in suitable habitat	All year	24 x 20 min/2 ha Formal Bird surveys 768 Person hours of opportunistic surveys across all habitats	2-5 Dec 2019 11-19 Feb 2020 18-21; 23-31 Mar 2020 19-23 July 2020 8-15 Apr 2021 25-30 Apr 2021 24-27 May 2021 2-9 Sep 2021

FAUNA GROUP	SURVEY TECHNIQUE	OPTIMUM SURVEY PERIOD	SURVEY EFFORT	DATES SURVEYED
Blossom Nomads	Favoured habitat surveys and assessment	Associated with strong blossoming events	24 x 20 min/2 ha Formal Bird surveys 572 Person hours of opportunistic surveys across all habitats	2-5 Dec 2019 11-19 Feb 2020 18-21; 23-31 Mar 2020 19-23 July 2020 8-15 Apr 2021 25-30 Apr 2021 24-27 May 2021 2-9 Sep 2021
Mallee Spinifex birds	Targeted habitat searches and assessments	All year	32 x 20 min/2 ha formal bird surveys 302 person hours of opportunistic surveys	2-5 Dec 2019 11-14, 16-19 Feb 2020 18-21; 23-31 Mar 2020 19-23 July 2020 2-9 Sep 2021
Mallee, Woodlands and Shrubland birds	Formal 20 min/2 ha surveys Opportunistic surveys Habitat assessments	All year & during breeding seasons for certain species (Aug–Jan)	33 x 20 min/2 ha Formal Bird surveys 339 person hours of opportunistic surveys	3-5 Dec 2019 11-19 Feb 2020 18-21; 23-31 Mar 2020 19 & 20 July 2020 2-9 Sep 2021

FAUNA GROUP	SURVEY TECHNIQUE	OPTIMUM SURVEY PERIOD	SURVEY EFFORT	DATES SURVEYED
Microchiropteran bats	Harp trap and Anabat surveys	All year	23 x Harp trap locations 24 x Anabat nights	2-4 Dec 2019 11-14, 16-17 Feb 2020 18 – 21 Mar 2020 23 - 31 Mar 2021
Reptiles	Habitat searches Nocturnal surveys Pitfall/Funnel survey Spotlighting In situ tile surveys Opportunistic reptile searches	All year & certain species Oct–Mar	242 x Pitfall trap nights 272 x Funnel trap nights 88 person hours spotlighting	2-5 Dec 2019 11-19 Feb 2020 18 – 21 Mar 2020 19 July 2020 23 - 31 Mar 2021 2-9 Sep 2021 3 & 6 Sep 2021
Woodland Mammals	Habitat searches and assessments Pitfall/Funnel surveys Elliott A and Elliott E surveys Remote Cameras (traplines) Remote Camera surveys Nest boxes for Western Pygmy Possum and other arboreal fauna Spotlighting/Infrared Scope Spotlighting	All year & certain species March – Jun & Aug – Dec	242 x Pitfall trap nights 272 x Funnel trap nights 700 x Elliot A trap nights 120 x Elliot E trap nights 30 x Remote camera trap nights 2,070 x Remote camera trap nights 10,560 x nest box nights 72 person hours spotlighting/Infrared scope	2-5 Dec 2019 11-19 Feb 2020 18 – 21 Mar 2020 18 – 21 Mar 2020 (cameras) 19-23 July 2020 23 - 31 Mar 2021 Mar - Dec 2021(cameras) 8-15 Apr 2021 25-30 Apr 2021 24-27 May 2021 2-9 Sep 2021

FAUNA GROUP	SURVEY TECHNIQUE	OPTIMUM SURVEY PERIOD	SURVEY EFFORT	DATES SURVEYED
Chenopod Shrublands – PCT157, PCT 163, PCT 164, PCT166, PCT216				
Aerial bird species (Swifts)	Seasonal opportunistic surveys	Nov – Mar	No person hours of opportunistic surveys in the indicative disturbance area in this habitat type during the seasonal periods when swifts are likely to occur. However, regional opportunistic surveys conducted in this habitat type while travelling to other PCT surveys during the likely seasons of occurrence.	2-5 Dec 2019 11-19 Feb 2020 18-21Mar 2020 23-31 Mar 2020
Birds of Prey	Opportunistic surveys in suitable habitat Targeted opportunistic surveys	All year	116 person hours of opportunistic surveys 2 x 20min/2 ha formal bird surveys	19-23 July 2020 7-15 Apr 2021 7 – 16 Sep 2021
Ground Birds	Opportunistic surveys in suitable habitat Targeted opportunistic surveys	All year	2 x 20min/2 ha formal bird surveys 116 person hours of opportunistic survey 18 person hours of spotlighting/Infrared surveys	19-23 July 2020 7-15 Apr 2021 7 – 16 Sep 2021
Reptiles	Opportunistic surveys in suitable habitat	All year	36 person hours of opportunistic surveys	19-23 July 2020 8-15 Apr 2021
Shrubland Birds	Targeted surveys Opportunistic surveys in suitable habitat	All year	2 x 20min/2 ha formal bird surveys 112 person hours of opportunistic surveys	19-23 July 2020 8-15 Apr 2021 7 – 16 Sep 2021
Grassland Mammals	Spotlighting/Infrared scope	All year	8 person hours of spotlighting/Infrared surveys	14 April 2021

FAUNA GROUP	SURVEY TECHNIQUE	OPTIMUM SURVEY PERIOD	SURVEY EFFORT	DATES SURVEYED
Grasslands – PCT44, PCT 45, PCT 46				
Aerial bird species (Swifts)	Seasonal targeted surveys Opportunistic surveys	Nov – Mar	No person hours of opportunistic surveys in the indicative disturbance area in this habitat type during the seasonal periods when swifts are likely to occur. However, regional opportunistic surveys conducted in this habitat type while travelling to other PCT surveys during the likely seasons of occurrence.	2-5 Dec 2019 11-19 Feb 2020 18-21; 23-31 Mar 2020
Amphibians	Seasonal opportunistic surveys	All year after significant rainfall	10 x call playback locations (*C. sloanei, L. raniformis*)	19-23 July 2020
Birds of Prey	Opportunistic surveys in suitable habitat	All year	156 person hours of opportunistic surveys 6 x formal 20-minute bird survey	8-15 Apr 2021 24-27 May 2021 7 – 16 Sep 2021
Ground Birds	Opportunistic surveys Nocturnal call playback Spotlight/Infrared scope	All year & during breeding Sept – Dec	146 person hours of targeted opportunistic surveys 6 x formal 20-minute bird survey hours nocturnal call playback 9/4 6 hours spotlight/infrared scope	8-15 Apr 2021 24-27 May 2021 7 – 16 Sep 2021
Reptiles	Opportunistic surveys in suitable habitat	All year	156 person hours of opportunistic surveys	8-15 Apr 2021 24-27 May 2021
Shrubland Birds	Opportunistic surveys Call playback survey	All year	64 person hours of opportunistic surveys 6 x formal 20-minute bird survey	7 – 14 Apr 2021 7 – 16 Sep 2021
Grassland Mammals	Spotlighting/Infrared scope	All year	8 person hours of spotlighting/Infrared surveys	14 April 2021

FAUNA GROUP	SURVEY TECHNIQUE	OPTIMUM SURVEY PERIOD	SURVEY EFFORT	DATES SURVEYED
Grassy Woodlands – PCT74, PCT75, PCT76, PCT80, PCT267, PCT277				
Aerial bird species (Swifts)	Opportunistic surveys	Nov – Mar	No person hours of opportunistic surveys in the indicative disturbance area in this habitat type during the seasonal periods when swifts are likely to occur. However, regional opportunistic surveys conducted in this habitat type while travelling to other PCT surveys during the likely seasons of occurrence.	2-5 Dec 2019 11-19 Feb 2020 18-21; 23-31 Mar 2020
Amphibians	Assessment of wetland habitats. Frog call playback Spotlighting/ targeted survey	July - August	Assessment of wetland habitat. (4 person hrs) Frog call playback (6 person hrs) Spotlighting (8 person hrs) Sloane's froglet -Reference site at Charles Sturt University visited to ensure reference population was calling.	20-22 July 2020 23 & 24 Aug 2021 (after rainfall)
Birds of Prey	Targeted opportunistic surveys in suitable habitat	Nov – Mar	65 person hours of opportunistic surveys	3-5 Dec 2019 23 Jul 2020 14 Apr 2021 25, 27-30 Apr 2021 27 May 2021 7 – 16 Sep 2021

FAUNA GROUP	SURVEY TECHNIQUE	OPTIMUM SURVEY PERIOD	SURVEY EFFORT	DATES SURVEYED
Blossom Nomads	Favoured habitat surveys and assessment	Associated with strong blossoming events	65 person hours of opportunistic surveys	3-5 Dec 2019 23 Jul 2020 14 Apr 2021 25, 27-30 Apr 2021 27 May 2021 16 Sep 2021
Invertebrates	Habitat Assessment Targeted surveys	Oct-Dec	12 person hours of habitat assessment and targeted surveys	8-9 Dec 2021
Microchiropteran bats	Harp trap and Anabat surveys	All year	2 x Harp trap locations 2 x Anabat nights	4 Dec 2019
Nocturnal birds of prey	Owl call playback and spotlighting. Searches for owl pellets in suitable habitat.	May- Dec	11 x call playback sessions and spotlighting (33 person hrs) 12 person hours of pellet searches (diurnal)	25 - 31 Aug 2021
Reptiles	Opportunistic surveys conducted during the undertaking of other survey effort.	May- Dec	23 x 20 min/2 ha opportunistic surveys 211 person hours of opportunistic surveys	3-5 Dec 2019 11-19 Feb 2020 19-20 July 2020 2-9 Sep 2021 16 Sep 2021

FAUNA GROUP	SURVEY TECHNIQUE	OPTIMUM SURVEY PERIOD	SURVEY EFFORT	DATES SURVEYED
Woodland and Shrubland birds	Formal 20 min/2 ha surveys Opportunistic surveys and habitat assessments	All year & during breeding seasons for certain species (Aug–Jan)	23 x 20 min/2 ha Formal Bird surveys 211 person hours of opportunistic surveys	3-5 Dec 2019 11-19 Feb 2020 19 & 20 July 2020 2-9 Sep 2021 16 Sep 2021
Woodland Mammals	Habitat searches and assessments Spotlighting Arboreal traps Remote camera traps Koala SAT surveys	All year	6 Person hours of nocturnal surveys 241 arboreal trap nights 8912 Camera nights 16 person hours of SAT surveys	11 Feb 2020 20 Jul 2020 26 Apr – 3 May 2021 26 Apr – 7 Aug 2021 (cameras) 26 May – 8 Nov 2021 (cameras) 6-8 Dec 2021
Riverine – PCT5, PCT7, PCT8, PCT11, PCT13, PCT15, PCT249				
Aerial bird species (Swifts)	Opportunistic surveys	Nov – Mar	11 person hours of opportunistic surveys	3 Dec 2019 11 Feb 2020
Amphibians	Targeted surveys Call playback during suitable conditions Assessment of wetland habitats. Spotlighting	Oct – Feb or during significant rainfall events	7 Person hours of targeted surveys 60 hrs of opportunistic surveys and habitat assessments Frog call playback (4 sites – 6 person hrs) Spotlighting (5 sites – 8 person hrs)	19-23 July 2020 25 August (after rainfall)

FAUNA GROUP	SURVEY TECHNIQUE	OPTIMUM SURVEY PERIOD	SURVEY EFFORT	DATES SURVEYED
Birds of Prey	Targeted opportunistic surveys Targeted formal surveys in suitable habitat	All year	2 x 20 min/2 ha formal bird surveys 68 person hours of opportunistic surveys	3 Dec 2019 11 Feb 2020 12 & 14 Apr 2020 20-22 Jul 2020 28 Apr 2021 7 – 16 Sep 2021
Blossom Nomads	Favoured habitat surveys and assessment	Nov – Feb – Mistletoe fruiting OR Associated with strong winter blossoming events Apr – Sep	2 x 20 min/2 ha formal bird surveys 68 person hours of opportunistic surveys	3 Dec 2019 11 Feb 2020 12 & 14 Apr 2020 20-22 Jul 2020 28 Apr 2021 7 – 16 Sep 2021
Ground Birds	Opportunistic surveys in suitable habitats	All year & breeding cycle Sep – Dec	2 x 20 min/2 ha formal bird surveys 68 person hours of opportunistic surveys	3 Dec 2019 11 Feb 2020 12 & 14 Apr 2020 20-22 Jul 2020 28 Apr 2021 7 – 16 Sep 2021
Microchiropteran bats	Harp trap and Anabat surveys Active Anabat Walkabout survey	All year	2 x Harp site locations 1 x Anabat locations (2 person hours) 1 person hour active Anabat walkabout survey	3 Dec 2019 11 Feb 2020 27 Mar 2021

FAUNA GROUP	SURVEY TECHNIQUE	OPTIMUM SURVEY PERIOD	SURVEY EFFORT	DATES SURVEYED
Nocturnal birds of prey	Owl call playback and spotlighting. Searches for pellets in suitable habitat.	May- Dec	2 x call playback sessions and spotlighting (6 person hrs) 4 person hours of pellet searches (diurnal)	24 & 25 Aug 2021
Reptiles	Habitat searches	May- Dec	36 person hours of opportunistic surveys	3 Dec 2019 11 Feb 2020 12 & 14 Apr 2020 20-22 Jul 2020 28 Apr 2021
Shrubland Birds	Favoured habitat surveys and assessment	All year	2 x 20 min/2 ha formal bird surveys 68 person hours of opportunistic surveys	3 Dec 2019 11 Feb 2020 12 & 14 Apr 2020 20- 22 Jul 2020 28 Apr 2021 7 – 16 Sep 2021
Wetland Birds	Targeted wetland surveys Habitat assessments	All year	32 person hours of opportunistic surveys 8 x 20 min/2 ha formal bird surveys	21-22 Jul 2020

FAUNA GROUP	SURVEY TECHNIQUE	OPTIMUM SURVEY PERIOD	SURVEY EFFORT	DATES SURVEYED
Woodland Birds	Habitat searches Formal 20 min/2 ha surveys Opportunistic surveys Habitat assessments	All year & during breeding Sep – Jan	2 x 20 min/2 ha formal bird surveys 68 person hours of opportunistic surveys	3 Dec 2019 11 Feb 2020 12 & 14 Apr 2020 20-22 Jul 2020 28 Apr 2021 7 – 16 Sep 2021
Woodland Mammals	Habitat searches and assessments Koala SAT surveys	May- Dec or all year depending on species	2 x spotlighting sessions (6 person hrs) 4 person hours of SAT searches (diurnal) 16 person hours of SAT surveys	24 & 25 Aug 2021 6-8 Dec 2021
Rocky Woodlands – PCT110, PCT319				
Aerial bird species (Swifts)	Opportunistic surveys	Nov – Mar	No person hours of opportunistic surveys in the indicative disturbance area in this habitat type during the seasonal periods when swifts are likely to occur. However, regional opportunistic surveys conducted in this habitat type while travelling to other PCT surveys during the likely seasons of occurrence.	2-5 Dec 2019 11-19 Feb 2020 18-21; 23-31 Mar 2020
Amphibians	Habitat assessments Opportunistic survey Spotlighting/nocturnal searches	Oct – Feb or during significant rainfall events	8 person hours opportunistic surveys and habitat assessment 3 person hours nocturnal searches/spotlighting	26 Apr 2021 2 Sep 2021
Birds of Prey	Habitat assessments Opportunistic surveys	All year	8 person hours opportunistic surveys and habitat assessment	26 Apr 2021 2 Sep 2021

FAUNA GROUP	SURVEY TECHNIQUE	OPTIMUM SURVEY PERIOD	SURVEY EFFORT	DATES SURVEYED
Blossom Nomads	Habitat assessments Opportunistic surveys	Associated with strong blossoming events	8 person hours opportunistic surveys and habitat assessment	26 Apr 2021 2 Sep 2021
Microchiropteran bats	Anabat surveys	All year	2 x Anabat nights	2 Sep 2021
Nocturnal birds of prey	Owl call playback Spotlighting. Searches for pellets in suitable habitat.	May- Dec	2 x call playback sessions and spotlighting (6 person hrs) 4 person hours of pellet searches (diurnal)	30 Aug 2021
Reptiles	Habitat assessments Opportunistic surveys	All year & certain species Oct–Mar	8 person hours opportunistic surveys and habitat assessment 14,406 tile days (98 tile days)	26 Apr 2021 2 Sep – 9 Dec 2021
Woodland Mammals	Spotlighting Remote camera traps Koala SAT surveys	All year	3 person hours of nocturnal surveys 600 camera trap nights 4 person hours of SAT surveys	2 Sep 2021 26 Apr – 4 Aug 2021 (cameras) 9 Dec 2021
Wetlands – PCT17, PCT24, PCT47, PCT53, PCT160, PCT182				
Aerial bird species (Swifts)	Targeted opportunistic surveys	Nov – Mar	No person hours of opportunistic surveys in the indicative disturbance area in this habitat type during the seasonal periods when swifts are likely to occur. However, regional opportunistic surveys conducted in this habitat type while travelling to other PCT surveys during the likely seasons of occurrence.	2-5 Dec 2019 11-19 Feb 2020 18-21; 23-31 Mar 2020

FAUNA GROUP	SURVEY TECHNIQUE	OPTIMUM SURVEY PERIOD	SURVEY EFFORT	DATES SURVEYED
Amphibians	Targeted surveys Frog call playback Habitat assessment	Oct – Feb or suitable periods for target species	Nocturnal surveys and call playback at 7 locations 32 Person hours opportunistic surveys in wetland habitats (*C. sloanei, L. raniformis*)	21 & 22 Jul 2020
Birds of prey	Habitat assessments Opportunistic surveys	All year	56 person hours of opportunistic surveys and habitat assessment	21, 22 Jul 2020 7 – 16 Sep 2021
Microchiropteran bats	Active Anabat Walkabout survey	All year	1 person hours Anabat walkabout	24 Aug 2021
Migratory Birds	Habitat assessment	Sep – Mar	32 person hours of opportunistic surveys and habitat assessment	21-22 Jul 2020
Threatened Migratory and Nomadic resident Shorebirds	Habitat assessments Opportunistic surveys	Sep – Mar & where suitable conditions occur	32 person hours of opportunistic surveys and habitat assessment	21-22 Jul 2020
Waterfowl	Habitat assessments Opportunistic surveys	All year – where suitable conditions occur	32 person hours of opportunistic surveys and habitat assessment	21-22 Jul 2020
Wading Birds	Habitat assessments Opportunistic surveys	All year – where suitable conditions occur	32 person hours of opportunistic surveys and habitat assessment	21-22 Jul 2020

5.6 Species credit species survey results

In accordance with Part 3 section 4.4.4 of the BAM 2020 Operational Manual – Stage 1 (Department of Planning 2020), determine the presence of candidate species credit species (Step 4) includes the methods undertaken to determine if a species is absent, or if present, whether a species and/or its habitats are degraded to the point that the species is unlikely to utilise the proposal site (or specific vegetation zones).

5.6.1 Threatened flora species credit species survey results

A total of 45 candidate threatened flora species were considered to have potential associated habitat within the proposal study area and were the subject of targeted surveys. Of these, nine threatened flora species have been recorded. These are:

- *Brachyscome papillosa* (Mossgiel Daisy) – Vulnerable
- *Lepidium monoplocoides* (Winged Peppercress) – Endangered
- *Leptorhynchos orientalis* (Lanky Buttons) – Endangered
- *Maireana cheelii* (Chariot Wheels) – Vulnerable
- *Pilularia novae-hollandiae* (Austral Pillwort) – Endangered (SAII)
- *Pimelea serpyllifolia* subsp. *serpyllifolia* (Thyme Rice-Flower) – Endangered (SAII)
- *Santalum murrayanum* (Bitter Quandong) – Endangered
- *Swainsona murrayana* (Slender Darling Pea) – Vulnerable
- *Swainsona sericea* (Silky Swainson-pea) – Vulnerable.

Of the nine recorded threatened flora species, eight are considered affected by the proposal. Impacts to *Santalum murrayanum* (Bitter Quandong) have been avoided and the species will not be impacted by the proposal.

Based on seasonal survey limitation an additional one species has been considered affected by the proposal and assumed present in associated suitable habitat. This species is:

- *Cullen parvum* (Small Scurf-pea) – Endangered.

Of the nine affected species, eight recorded and one assumed present, four are listed under the EPBC act and discussed further in Section 7.1.2.

A summary of survey results for all candidate threatened flora species, to determine those species that are considered affected by the proposal, are presented in Table 5-18. It should be noted that Table 5-18 should be read in conjunction with the candidate threatened flora survey effort table (refer to Appendix C-3), threatened flora survey methods (refer to Section 5.5.2) and threatened flora field survey effort map (refer to Appendix C-5). A discussion of each recorded threatened flora species is also provided below.

Table 5-18 Assessment of candidate threatened flora to determine affected species

SCIENTIFIC NAME	COMMON NAME	BC ACT[1]	SAII	IBRA SUBREGIONS[2]					HABITAT REQUIREMENTS	SPECIES PRESENCE	AFFECTED SPECIES?	OUTCOME
				SOP	LAC	MUR	LS	IS				
Acacia acanthoclada	Harrow Wattle	E	No	✓	–	–	–	–	PCT's 170, 171, 172	No (surveyed)	No This species was previously recorded from the western section of EnergyConnect west of Pine Camp Road. Targeted surveys focused on deep sand mallee vegetation between Buronga and Balranald. Existing records in the local area all occur to the north of Mallee Cliffs National Park towards Pooncarie. There are no records of this species within 100km of the proposal. Targeted surveys within the disturbance area did not record any specimens of *Acacia acanthoclada*. *Acacia acanthoclada* is not considered an affected species.	Not an affected species
Acacia ausfeldii	Ausfeld's Wattle	V	No	–	–	–	✓	✓	PCT's 267 & 277	No (surveyed)	No Targeted surveys were conducted for Ausfeld's Wattle and no specimens were recorded. During field surveys, no similar *Acacia* spp. were observed within the proposal study area (no specimens of the similar looking species *Acacia verniciflua* (Varnish Wattle) were recorded). The main distribution of this species in NSW is from the Mudgee/Gulgong region in the Central Tablelands. Given targeted surveys did not locate this species and that the proposal is located to the west and south of any known population, *Acacia ausfeldii* (Ausfeld's Wattle) is unlikely to be affected by the proposal and as such this species is not considered further. *Acacia ausfeldii* is not considered an affected species.	Not an affected species

SCIENTIFIC NAME	COMMON NAME	BC ACT[1]	SAII	IBRA SUBREGIONS[2]					HABITAT REQUIREMENTS	SPECIES PRESENCE	AFFECTED SPECIES?	OUTCOME
				SOP	LAC	MUR	LS	IS				
Acacia carneorum	Purple-wood Wattle	V	Yes	✓	–	–	–	–	PCT's 58, 199	No (surveyed)	No Targeted surveys within the disturbance area did not record any specimens of *Acacia carneorum.* *Acacia carneorum* is not considered an affected species.	Not an affected species
Ammobium craspedioides	Yass Daisy	V	No	–	–	–	–	✓	PCT's 277	No (surveyed)	No Targeted surveys were conducted during appropriate seasonal requirements and no specimens were recorded. There are no records of this species in the locality with most records of this species occur east of a line from near Crookwell in the north to Gundagai in the south with an outlier population about 30km to the south of Wagga Wagga in Livingstone National Park. Given targeted surveys did not locate this species and that the proposal is located to the west of any known population, *Ammobium craspedioides* (Yass Daisy) is unlikely to be affected by the proposal and as such this species is not considered further. *Ammobium craspedioides* is not considered an affected species.	Not an affected species

SCIENTIFIC NAME	COMMON NAME	BC ACT[1]	SAII	IBRA SUBREGIONS[2]					HABITAT REQUIREMENTS	SPECIES PRESENCE	AFFECTED SPECIES?	OUTCOME
				SOP	LAC	MUR	LS	IS				
Amphibromus fluitans	Floating Swamp Wallaby-grass	V	V	–	–	–	✓	-	PCT 249	No (surveyed)	No Whilst surveys were conducted outside optimal seasonal timing, no *Amphibromus* species were recorded from the target vegetation types (PCT 249). PCT 249 was only recorded from one property. PCT 249 occurred in mod-good and derived condition class. Microhabitat searches within these vegetation zones did not record the specific habitat constraints listed in BAM-C (i.e. Semi-permanent/ ephemeral wet areas and periodically inundated sites despite above average rainfall prior to surveys – refer to Figure 5-6). Species typically associated with *Amphibromis fluitans, Potamogeton* sp. and *Chamaeraphis* sp., were not recorded. Optimal survey conditions likely to have extended beyond March into April due to above average rainfall in preceding winter and spring (refer to Figure 5-6). Evidence of the species would be expected to persist in the landscape into the month of April, as this species is listed to flower later than other grasses with which it grows. Despite being described to occur as occasional to common in populations with potential to cover several hectares, no evidence of this species was found. Searches of man-made periodically inundated sites, i.e. table drains and farm dams, occurred during all relevant survey periods following above average rainfall (refer to section 5.5.1). The expected disturbance caused by the proposal makes direct impact or table drains and farm dams unlikely. *Amphibromus fluitans* is not considered an affected species.	Not an affected species

SCIENTIFIC NAME	COMMON NAME	BC ACT[1]	SAII	IBRA SUBREGIONS[2]					HABITAT REQUIREMENTS	SPECIES PRESENCE	AFFECTED SPECIES?	OUTCOME
				SOP	LAC	MUR	LS	IS				
Atriplex infrequens	A saltbush	V	No	✓	–	–	–	–	PCT's 17, 23, 24, 157, 160, 163, 170, 216	No (surveyed)	No Targeted surveys within the disturbance area did not record any specimens of *Atriplex infrequens*. *Atriplex infrequens* is not considered an affected species.	Not an affected species
Austrostipa metatoris	A spear-grass	V	No	✓	–	–	✓	–	PCT's 8, 28, 170	No (surveyed)	No The closest records of this species to the proposal are from the edges of Dry Lake and Lake Benanee in the west near Euston and a single record from Yanco Creek in the east. Targeted surveys within the disturbance area did not record any specimens of *Austrostipa metatoris*. *Austrostipa metatoris* is not considered an affected species.	Not an affected species
Austrostipa wakoolica	A spear-grass	E	No	–	–	✓	✓	✓	PCT's 17, 26, 28, 74, 76, 80	No (surveyed)	No Surveys were undertaken after above average rainfall (refer to section 5.5.1). Regular checks of any *Austrostipa* spp. found were undertaken. Targeted surveys within the disturbance area did not record any specimens of *Austrostipa wakoolica*. *Austrostipa wakoolica* is not considered an affected species.	Not an affected species

SCIENTIFIC NAME	COMMON NAME	BC ACT[1]	SAII	IBRA SUBREGIONS[2]					HABITAT REQUIREMENTS	SPECIES PRESENCE	AFFECTED SPECIES?	OUTCOME
				SOP	LAC	MUR	LS	IS				
Brachyscome muelleroides	Claypan Daisy	V	Yes	–	–	✓	–	–	PCT's 44, 45, 46, 47	No (surveyed)	No Surveys were undertaken after above average rainfall (refer to Figure 5-5 and Figure 5-6). Regular checks of any *Brachyscome* spp. found were undertaken. Targeted surveys within the disturbance area did not record any specimens of *Brachyscome muelleroides*. *Brachyscome muelleroides* is not considered an affected species.	Not an affected species
Brachyscome papillosa	Mossgiel Daisy	V	No	✓	✓	✓	✓	–	PCT's 13, 15, 17, 24, 44, 45, 46, 76, 80, 157, 160, 163, 164, 216	Yes (surveyed)	Yes- *Brachyscome papillosa* found at multiple locations during survey period. Further details on this species within the proposal study area is provided in section 5.6.2.1. *Brachyscome papillosa* is considered an affected species.	Affected species offsets required
Caladenia arenaria	Sand-hill Spider Orchid	E	Yes	–	–	✓	✓	✓	PCT's 28, 75, 76, 80	No (surveyed)	No A reference population of *Caladenia arenaria* at Buckingbong State Forest was inspected on 15 September 2021 where the species was observed in flower. Habitat within the disturbance area located on private lands is mostly highly disturbed from historical and ongoing agricultural land uses. Targeted surveys did not record *Caladenia arenaria* and potential habitats were observed to have high annual exotic weed cover at the time of surveys. Targeted surveys within better quality public lands including Cullivel and Brookong State Forest also did not record any specimens of *Caladenia arenaria.* *Caladenia arenaria* is not considered an affected species.	Not an affected species

SCIENTIFIC NAME	COMMON NAME	BC ACT[1]	SAII	IBRA SUBREGIONS[2]					HABITAT REQUIREMENTS	SPECIES PRESENCE	AFFECTED SPECIES?	OUTCOME
				SOP	LAC	MUR	LS	IS				
Calotis moorei	A burr-daisy	E	Yes	✓	–	✓	–	–	PCT's 23, 143, 157, 170, 199	No (surveyed)	No Targeted surveys within the disturbance area did not record any specimens of *Calotis moorei*. *Calotis moorei* is not considered an affected species.	Not an affected species
Cratystylis conocephala	Bluebush Daisy	E	No	✓	–	–	–	–	PCT's 58, 170, 171, 172	No (surveyed)	No Targeted surveys within the disturbance area did not record any specimens of *Cratystylis conocephala.* *Cratystylis conocephala* is not considered an affected species.	Not an affected species
Convolvulus tedmoorei	Bindweed	E	Yes	–	–	✓	–	–	PCT's 17, 24, 26, 44, 45, 46, 157, 160, 163, 216	No (surveyed)	No Targeted surveys within the disturbance area did not record any specimens of *Convolvulus tedmoorei*. *Convolvulus tedmoorei* is not considered an affected species.	Not an affected species
Cullen parvum	Small Scurf-pea	E	No	–	–	✓	✓	✓	PCT's 5, 7, 44, 74, 277	Yes (assumed)	Yes Cullen parvum was not recorded during floristic plot sampling and no targeted surveys were undertaken due to time constraints. Surveys are not considered sufficient to dismiss presence of this species within the proposal study area. Assumed habitat has been assigned to PCT 5, 7, 44, 74 and 277 for *Cullen parvum.* *Cullen parvum* is considered an affected species.	Affected species offsets required

SCIENTIFIC NAME	COMMON NAME	BC ACT[1]	SAII	IBRA SUBREGIONS[2]					HABITAT REQUIREMENTS	SPECIES PRESENCE	AFFECTED SPECIES?	OUTCOME
				SOP	LAC	MUR	LS	IS				
Diuris tricolor	Pine Donkey Orchid	V	No	–	–	✓	✓	✓	PCT's 75, 76, 80, 267	No (surveyed)	No A reference population of *Diuris tricolor* at Buckingbong State Forest was inspected on 15 September 2021 where the species was observed in flower. Targeted surveys within the disturbance area did not record any specimens of *Diuris tricolor*. *Diuris tricolor* is not considered an affected species.	Not an affected species
Diuris sp. (Oaklands, D.L. Jones 5380)	Oaklands Diuris	E	Yes	–	–	✓	✓	-	PCT's 75, 80	No (surveyed)	No Targeted surveys within the disturbance area did not record any specimens of *Diuris* sp. (Oaklands, D.L. Jones 5380). *Diuris* sp. (Oaklands, D.L. Jones 5380) is not considered an affected species.	Not an affected species
Dodonaea sinuolata subsp. *acrodentata*	A Hopbush	E	Yes	–	✓	–	–	–	PCT's 170, 171, 172	No (surveyed)	No Targeted surveys within the disturbance area did not record any specimens of *Dodonaea sinuolata* subsp. *acrodentata*. *Dodonaea sinuolata* subsp. *acrodentata* is not considered an affected species.	Not an affected species
Dodonaea stenozyga	Desert Hopbush	CE	Yes	✓	–	–	–	–	PCT's 170,171,172	No (surveyed)	No This species can be easily confused with the foliage of *Eremophila sturtii* and *Senna artemisioides* subsp. *filifolia* when fruiting bodies not present. Regular checks of *Eremophila sturtii* and *Senna artemisioides* subsp. *filifolia* were undertaken. Targeted surveys within the disturbance area did not record any specimens of *Dodonaea stenozyga*. *Dodonaea stenozyga* is not considered an affected species.	Not an affected species

SCIENTIFIC NAME	COMMON NAME	BC ACT[1]	SAII	IBRA SUBREGIONS[2]					HABITAT REQUIREMENTS	SPECIES PRESENCE	AFFECTED SPECIES?	OUTCOME
				SOP	LAC	MUR	LS	IS				
Eleocharis obicis	Spike-Rush	V	No	–	✓	–	✓	–	PCT's 11, 12, 13, 17, 24, 47, 53, 74, 76, 160, 164, 216,	No (surveyed)	No Targeted surveys within the disturbance area did not record any specimens of *Eleocharis obicis*. *Eleocharis obicis* is not considered an affected species.	Not an affected species
Erodiophyllum elderi	Koonamore Daisy	E	Yes	✓	–	–	–	–	PCT's 199	No (surveyed)	No Targeted surveys within the disturbance area did not record any specimens of *Erodiophyllum elderi*. *Erodiophyllum elderi* is not considered an affected species.	Not an affected species
Eucalyptus leucoxylon subsp. *pruinosa*	Yellow Gum	V	No	–	–	✓	–	–	PCT 11, 13, 15	No (surveyed)	No Targeted surveys within the disturbance area did not record any specimens of *Eucalyptus leucoxylon* subsp. *pruinosa*. *Eucalyptus leucoxylon* subsp. *pruinosa* is not considered an affected species.	Not an affected species
Euphrasia arguta	Euphrasia arguta	CE	Yes	–	–	–	–	✓	PCT's 267 & 277	No (surveyed)	No Targeted survey for this species were conducted outside of optimal seasonal survey period. *Euphrasia arguta* was rediscovered in the Nundle area of the NSW north western slopes and tablelands in 2008. Prior to this, it had not been collected for 100 years. Historically, *Euphrasia arguta* has only been recorded from relatively few places within an area extending from Sydney to Bathurst and north to Walcha. This species has not been recorded from the NSW South Western Slopes Bioregion.	Not an affected species

SCIENTIFIC NAME	COMMON NAME	BC ACT[1]	SAII	IBRA SUBREGIONS[2]					HABITAT REQUIREMENTS	SPECIES PRESENCE	AFFECTED SPECIES?	OUTCOME
				SOP	LAC	MUR	LS	IS				
											Given targeted surveys did not locate this species and it is not known from the bioregion, *Euphrasia arguta* is unlikely to be affected by the proposal and as such this species is not considered further. *Euphrasia arguta* is not considered an affected species.	
Indigofera efoliata	–	CE	Yes	–	–	–	–	✓	PCT 76, 267	No (surveyed)	No Targeted surveys within the disturbance area did not record any specimens of *Indigofera efoliata*. *Indigofera efoliata* is not considered an affected species.	Not an affected species
Kippistia suaedifolia	Fleshy Minuria	E	Yes	✓	–	–	–	–	PCT 143	No (surveyed)	No Targeted surveys within the disturbance area did not record any specimens of *Kippistia suaedifolia*. *Kippistia suaedifolia* is not considered an affected species.	Not an affected species
Lasiopetalum behrii	Pink Velvet Bush	CE	Yes	✓	–	–	–	–	PCT 170, 171, 172	No (surveyed)	No Targeted surveys within the proposal study area did not record any specimens of *Lasiopetalum behrii*. *Lasiopetalum behrii* is not considered an affected species.	Not an affected species

SCIENTIFIC NAME	COMMON NAME	BC ACT[1]	SAII	IBRA SUBREGIONS[2]					HABITAT REQUIREMENTS	SPECIES PRESENCE	AFFECTED SPECIES?	OUTCOME
				SOP	LAC	MUR	LS	IS				
Lepidium aschersonii	Spiny Peppercress	V	No	–	–	–	✓	–	PCT 76	No (surveyed)	No Conditions for Lepidium flowering and fruit set were good in April 2021 due to above average rainfall in the months preceding the survey period (Figure 5-7). Regular checks of any *Lepidium* spp. found were undertaken. *Lepidium papillosum, L. phlebopetalum,* and *L. fasciculatum* were examined closely. Targeted surveys within the disturbance area did not record any specimens of *Lepidium aschersonii.* *Lepidium aschersonii* is not considered an affected species.	Not an affected species
Lepidium monoplocoides	Winged Peppercress	E	No	✓	✓	✓	✓	–	PCT's 13, 15, 24, 26, 45, 46, 47, 74, 80, 160, 163, 170, 216	Yes (surveyed)	Yes *Lepidium monoplocoides* was tentatively recorded from PCT 44_mod-good on property H104. Plant material collected, including fruit, for positive identification. Further details on this species within the proposal study area is provided in section 5.6.2.2. *Lepidium monoplocoides* is considered an affected species.	Affected species offsets required
Leptorhynchos orientalis	Lanky Buttons	E	No	–	✓	✓	–	–	PCT's 24, 26, 44, 45, 46, 47	Yes (surveyed)	Yes *Leptorhynchos orientalis* was tentatively recorded from PCT 44_mod-good on property H090. Plant material collected, including flower, for positive identification. 28 Sept 2021 plant material forwarded to the National Herbarium of NSW. Further details on this species within the proposal study area is provided in section 5.6.2.2. *Leptorhynchos orientalis* is considered an affected species.	Affected species offsets required

SCIENTIFIC NAME	COMMON NAME	BC ACT[1]	SAII	IBRA SUBREGIONS[2]					HABITAT REQUIREMENTS	SPECIES PRESENCE	AFFECTED SPECIES?	OUTCOME
				SOP	LAC	MUR	LS	IS				
Leptorhynchos waitzia	Button Immortelle	E	Yes	✓	–	–	–	–	PCT 170	No (surveyed)	No Surveys were undertaken after above average rainfall (refer to Figure 5-1, Figure 5-2 and Figure 5-3). Regular checks of any *Leptorhynchos* spp. found were undertaken. Targeted surveys within the disturbance area did not record any specimens of *Leptorhynchos waitzia.* *Leptorhynchos waitzia* is not considered an affected species.	Not an affected species
Maireana cheelii	Chariot Wheels	V	No	–	–	✓	–	–	PCT's 26, 44, 46, 157, 163, 164	Yes (surveyed)	Yes *Maireana cheelii* found at multiple locations during survey period, most with the distinct 5-winged chariot wheel fruiting body. Further details on this species within the proposal study area is provided in Section 5.6.2.4. *Maireana cheelii* is considered an affected species.	Affected species offsets required
Pilularia novae-hollandiae	Austral Pillwort	E	Yes	–	–	✓	✓	✓	PCT's 9, 12, 13, 15, 44, 45, 46, 74	Yes (surveyed)	Yes Species recorded from property H081 & H081A in PCT 17_mod-good & PCT 160_mod-good. Small population of approximately 50 plants was identified. Plant material, including fruiting capsules, collected for positive identification. 28 Sept 2021 plant material forwarded to National Herbarium of NSW. Further details on this species within the proposal study area is provided in Section 5.6.2.5. *Pilularia novae-hollandiae* is considered an affected species.	Affected species offsets required

SCIENTIFIC NAME	COMMON NAME	BC ACT[1]	SAII	IBRA SUBREGIONS[2]					HABITAT REQUIREMENTS	SPECIES PRESENCE	AFFECTED SPECIES?	OUTCOME
				SOP	LAC	MUR	LS	IS				
Pimelea serpyllifolia subsp. *serpyllifolia*	Thyme Rice-Flower	E	Yes	✓	–	–	–	–	PCT's 170, 171, 172	Yes (surveyed)	Yes Species recorded on property H035 by Dr Ian Sluiter. Population was estimated at about 40 plants. Further details on this species within the proposal study area is provided in Section 5.6.2.6. *Pimelea serpyllifolia* subsp. *serpyllifolia* is considered an affected species.	Affected species offsets required
Prasophyllum petilum (Syn. *Prasophyllum* sp. Wybong)	Tarengo Leek Orchid	E	No	–	–	–	–	✓	PCT's 267 & 277	No (surveyed)	No Targeted surveys were conducted during appropriate seasonal requirements and no specimens were recorded. The main distribution of this species in NSW extends between the South-East, Central Tablelands and Hunter regions. The closest known records to the proposal site are located near Boorowa (1995–2016), >100km to the northeast. Given targeted surveys did not locate this species and that the proposal site is located to the west of any known or likely habitat, *Prasophyllum petilum* (Tarengo Leek Orchid) is unlikely to be affected by the proposal and as such this species is not considered further. *Prasophyllum petilum* is not considered an affected species.	Not an affected species
Prasophyllum sp. Wybong		–	Yes									

SCIENTIFIC NAME	COMMON NAME	BC ACT[1]	SAII	IBRA SUBREGIONS[2]					HABITAT REQUIREMENTS	SPECIES PRESENCE	AFFECTED SPECIES?	OUTCOME
				SOP	LAC	MUR	LS	IS				
Pterostylis cobarensis	Greenhood Orchid	V	No	✓	–	–	–	–	PCT's 170, 171	No (surveyed)	No Surveys were undertaken after above average rainfall (refer to Figure 5-1, Figure 5-2 and Figure 5-3). Regular checks of any *Pterostylis* spp. found were undertaken. Targeted surveys within the disturbance area did not record any specimens of *Pterostylis cobarensis.* *Pterostylis cobarensis* is not considered an affected species.	Not an affected species
Santalum murrayanum	Bitter Quandong	E	No	✓	–	–	–	–	PCT's 170, 171, 172	Yes (surveyed)	No A total of 4 individuals of *Santalum murrayanum* were recorded within or adjacent to the proposal study area during targeted surveys (refer to Figure 5-10). The disturbance area will not impact on *Santalum murrayanum* and as such the species is not considered affected and is not subject to further assessment in Stage 2 of this BDAR.	Not an affected species
Sclerolaena napiformis	Turnip Copperburr	E	No	–	–	✓	–	–	PCT's 26, 44, 46	No (surveyed)	No Surveys were undertaken after above average rainfall (refer to Figure 5-6). Regular checks of any *Sclerolaena* spp. found were undertaken. Targeted surveys within the disturbance area did not record any specimens of *Sclerolaena napiformis.* *Sclerolaena napiformis* is not considered an affected species.	Not an affected species

SCIENTIFIC NAME	COMMON NAME	BC ACT[1]	SAII	IBRA SUBREGIONS[2]					HABITAT REQUIREMENTS	SPECIES PRESENCE	AFFECTED SPECIES?	OUTCOME
				SOP	LAC	MUR	LS	IS				
Solanum karsense	Menindee Nightshade	V	No	✓	✓	✓	–	–	PCT's 12, 13, 15, 17, 24, 160	No (surveyed)	No Surveys were undertaken after above average rainfall (refer to Section 5.5.1 for further analysis). Regular checks of any *Solanum* spp. found were undertaken. Targeted surveys within the disturbance area did not record any specimens of *Solanum karsense.* *Solanum karsense* is not considered an affected species.	Not an affected species
Swainsona colutoides	Bladder Senna	E	No	✓	–	–	–	–	PCT's 170, 171, 172	No (surveyed)	No All *Swainsona* spp. located in the field were checked. Only *Swainsona microphylla* and *S. phacoides* were found in mallee vegetation. Targeted surveys within the disturbance area did not record any specimens of *Swainsona colutoides*. *Swainsona colutoides* is not considered an affected species.	Not an affected species
Swainsona murrayana	Slender Darling Pea	V	No	–	✓	✓	✓	–	PCT's 15, 23, 26, 28, 44, 45, 46, 76, 80, 157, 163, 164, 216	Yes (surveyed)	Yes *Swainsona murrayana* recorded at multiple locations during survey period. Further details on this species within the proposal study area is provided in Section 5.6.2.8.	Affected species offsets required

SCIENTIFIC NAME	COMMON NAME	BC ACT[1]	SAII	IBRA SUBREGIONS[2]					HABITAT REQUIREMENTS	SPECIES PRESENCE	AFFECTED SPECIES?	OUTCOME
				SOP	LAC	MUR	LS	IS				
Swainsona plagiotropis	Red Darling Pea	V	No	–	–	✓	–	–	PCT's 26, 44, 45, 46	No (surveyed)	No Surveys were undertaken after above average rainfall (refer to Figure 5-5 and Figure 5-6). Four *Swainsona* sp. that were regularly recoded during targeted surveys being *S. procumbens, S. murrayana, S. sericea* and *S. swainsonioides.* were regularly inspected to ensure *Swainsona plagiotropis* was not overlooked. Tentative field identification of a bright pinkish *Swainsona* sp. was thought to be a possible specimen of *Swainsona plagiotropis.* Samples examined under a microscope confirmed this to be a pinkish variant of *S. sericea*. All examined material was identified to have medifixed hairs and leaflets being less than 13 in number. Samples were also forwarded to the Nation Herbarium of NSW for further verification. Targeted surveys within the disturbance area did not record any specimens of *Swainsona plagiotropis*. *Swainsona plagiotropis* is not considered an affected species.	Not an affected species
Swainsona pyrophila	Yellow Swainson-pea	V	No	✓	–	–	–	–	PCT's 170, 171, 172	No (surveyed)	No Surveys were undertaken after above average rainfall (refer to Figure 5-1,Figure 5-2 and Figure 5-3). Much of PCT 172 was in post fire recovery (+2 years). Disturbed edges and areas of recent mallee clearing were targeted. All *Swainsona* spp. located in the field were checked. Only *Swainsona microphylla* and *S. phacoides* were found in mallee vegetation. Targeted surveys within the disturbance area did not record any specimens of *Swainsona pyrophila*. *Swainsona pyrophila* is not considered an affected species.	Not an affected species

SCIENTIFIC NAME	COMMON NAME	BC ACT[1]	SAII	IBRA SUBREGIONS[2]					HABITAT REQUIREMENTS	SPECIES PRESENCE	AFFECTED SPECIES?	OUTCOME
				SOP	LAC	MUR	LS	IS				
Swainsona recta	Small Purple-pea	E	No	–	–	–	✓	✓	PCT's 76, 267, 277	No (surveyed)	No Targeted surveys were conducted during appropriate seasonal requirements and no specimens were recorded. The closest known record to the study area is historic (1900) and is located near Wagga Wagga, (1930) near Culcairn and (1887) near Wodonga. A more recent record (2000) is located near Mandurama, about 130km to the north-east. During field surveys, suitable habitat was mostly restricted to small patches of PCT 76, 267 and 277. Larger areas of poor condition PCT 277 were considered generally unsuitable to support a population of this species due to the highly modified nature of the ground stratum. Given targeted surveys did not locate this species and that the study area is not located near any current known or likely habitat, Swainsona recta (Small Purple Pea) is unlikely to be affected by the proposal and as such this species is not considered further.	Not an affected species
Swainsona sericea	Silky Swainson-pea	V	No	✓	–	✓	✓	✓	PCT's 23, 26, 28, 44, 45, 46, 74, 76, 80	Yes (surveyed)	Yes- *Swainsona sericea* recorded at multiple locations during survey period. Further details on this species within the proposal study area is provided in Section 5.6.2.9.	Affected species offsets required

(1) Threat status under the BC Act: V = vulnerable, E = endangered, CE = critically endangered

5.6.2 Recorded threatened flora species

A total of nine threatened flora species listed under the BC Act were recorded within the proposal study area. These species are:

- *Brachyscome papillosa* (Mossgiel Daisy) – Vulnerable
- *Lepidium monoplocoides* (Winged Peppercress) – Endangered
- *Leptorhynchos orientalis* (Lanky Buttons) – Endangered
- *Maireana cheelii* (Chariot Wheels) – Vulnerable
- *Pilularia novae-hollandiae* (Austral Pillwort) – Endangered (SAII)
- *Pimelea serpyllifolia* subsp. *serpyllifolia* (Thyme Rice-Flower) – Endangered (SAII)
- *Santalum murrayanum* (Bitter Quandong) – Endangered
- *Swainsona murrayana* (Slender Darling Pea) – Vulnerable
- *Swainsona sericea* (Silky Swainson-pea) – Vulnerable.

Of these nine species, five are listed as Endangered (with two being listed as SAII species) and four are listed as Vulnerable. A brief overview and description of each species is provided below with recorded location shown in Figure 5-10.

5.6.2.1 *Brachyscome papillosa* (Mossgiel Daisy)

Brachyscome papillosa is a threatened perennial herb daisy listed as Vulnerable under both the BC Act and EPBC Act. The plant is generally multi-stemmed up to 40 centimetres in height with mauve or white flowers and distinct broad obovate winged seeds (achenes) with densely flattened papillae (refer to Photo 5-3 and Photo 5-4).

Brachyscome papillosa is only known from NSW where it is generally restricted to the Riverina bioregion with most records occurring chiefly from the Mossgiel to Urana districts with records from Jerilderie, Hay Plain, Darlington Point, Willandra Lakes and north to Ivanhoe. The population size of *Brachyscome papillosa* is currently unknown and the species is not considered adequately reserved in conservation area.

Within the proposal study area, a large population of *Brachyscome papillosa* has been recorded from heavy clay soils on land east of Yanga National Park on Keri Keri Station (+500 plants). A population was also recorded on land east of the Cobb Highway associated with PCT 24 (+100 plants) with a third population recorded from PCT 160 on land adjacent to Coonong Road to the west of the Federation Way (+100 plants).

Herbarium samples were collected (collected under SL 100630) from plants on the Keri Keri and Coonong Road populations and forwarded to the National Herbarium of NSW for positive verification (samples sent by post 28/09/2021).

The unit of measure under BAM-C for *Brachyscome papillosa* is area. Area calculations for species polygons have been established by applying a 30-metre buffer area around the outside of the individual or group of plants as outlined in section 5.2.5 of the BAM (refer to Appendix C-7). Associated habitat for this species has also been recorded from State vegetation mapping for properties where access for surveys was not granted. For these properties, habitat has been assumed for associated PCTs and used for calculation impact purpose in BAM-C.

The total area of occupancy (recorded) of *Brachyscome papillosa* within the disturbance area is 18.69 hectares with an additional 52.48 hectares of assumed habitat. A summary of *Brachyscome papillosa* species polygon area is provided in Table 5-19.

Table 5-19 *Brachyscome papillosa* species polygon area within the disturbance area

VEGETATION TYPE	IBRA SUBREGION	VEGETATION ZONE	DISTURBANCE AREA (HA)
Recorded			
PCT 17 – Lignum shrubland wetland of the semi-arid (warm) plains (mainly Riverina Bioregion and Murray Darling Depression Bioregion)	Murrumbidgee	VZ #8 17_Mod-good	1.64
PCT 24 – Canegrass swamp tall grassland wetland of drainage depressions, lakes and pans of the inland plains		VZ #11 24_Mod-good	0.74
PCT 160 – Nitre Goosefoot shrubland wetland on clays of the inland floodplains		VZ #24 160_Mod-good	5.11
PCT 163 – Dillon Bush (Nitre Bush) shrubland of the semi-arid and arid zones		VZ #25 163_Mod-good	8.79
PCT 164 – Cotton Bush open shrubland of the semi-arid (warm) zone		VZ #26 164_Mod-good	2.41
		Sub-total - recorded	18.69
Assumed presence			
PCT 17 – Lignum shrubland wetland of the semi-arid (warm) plains (mainly Riverina Bioregion and Murray Darling Depression Bioregion)	Murrumbidgee	VZ #8 17_Mod-good	2.10
		VZ #35 17_SVM_Bench	4.10
PCT 24 – Canegrass swamp tall grassland wetland of drainage depressions, lakes and pans of the inland plains		VZ #11 24_Mod-good	0.77
		VZ #36 24_SVM_Bench	0.01
PCT 160 – Nitre Goosefoot shrubland wetland on clays of the inland floodplains		VZ #24 160_Mod-good	1.21
		VZ #44 160_SVM_Bench	1.17
PCT 164 – Cotton Bush open shrubland of the semi-arid (warm) zone		VZ #45 164_SVM_Bench	43.12
		Sub-total - assumed	52.48
Total			**71.17**

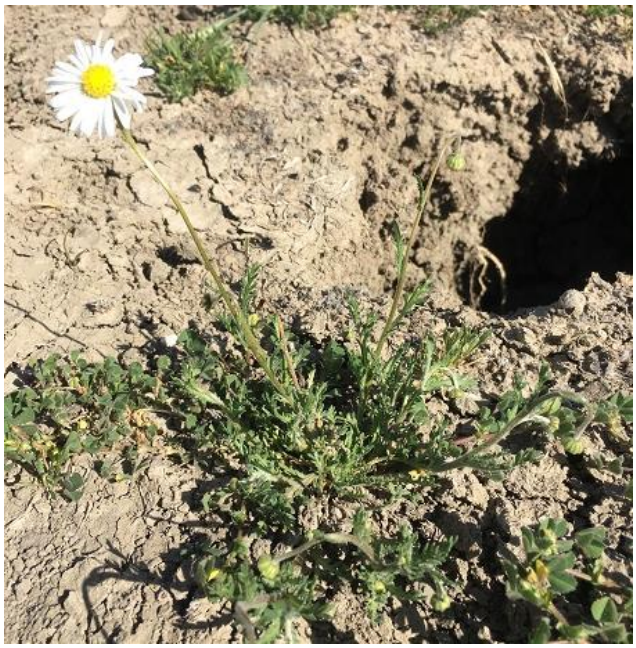


Photo 5-3 *Brachyscome papillosa* with white flowers growing on heavy grey clay within PCT 24

Photo 5-4 *Brachyscome papillosa* seed (achene) with distinct broad obovate wings and densely flattened papillae

5.6.2.2 *Lepidium monoplocoides* (Winged Peppercress)

Lepidium monoplocoides is a threatened annual herb listed as Endangered under the BC Act and EPBC act. The plant occurs as a 15-20 cm high, erect herb with angular and striped stems roughened with smart worts. Fruit occurs as a circular pod about 5 mm long and 44 mm wide with pointed wings extending to narrow notch at the tip.

Lepidium monoplocoides was historically widespread with a large number of records across semi-arid NSW and Victoria but has few recent collections. This species has previously been recorded from localities including Bourke, Cobar, Urana, Balranald and Deniliquin with more recent samples collected from the Hay Plain, south-eastern Riverina and from near Pooncarie.

Within the proposal study area a tentative recording of this species has been made on H104 from natural grassland vegetation (PCT 44) where the specimen was growing on the upper edge of a red clay scald. Herbarium samples were collected (collected under SL 100630) and forwarded to the National Herbarium of NSW for positive verification.

The unit of measure under BAM-C for *Lepidium monoplocoides* is area. Area calculations for species polygons have been established by applying a 30-metre buffer area around the outside of the individual or group of plants as outlined in section 5.2.5 of the BAM (refer to Appendix C-6). Associated habitat for this species has also been recorded from State vegetation mapping for properties where access for surveys was not granted. For these properties, habitat has been assumed for associated PCTs and used for calculation impact purpose in BAM-C.

The total area of occupancy (recorded) of *Lepidium monoplocoides* within the disturbance area is 0.20 hectares with an additional 8.65 hectares of assumed habitat. A summary of *Lepidium monoplocoides* species polygon area is provided in Table 5-20.

Table 5-20 *Lepidium monoplocoides* species polygon area within the disturbance area

VEGETATION TYPE	IBRA SUBREGION	VEGETATION ZONE	DISTURBANCE AREA (HA)
Recorded			
PCT 44 – Forb-rich Speargrass – Windmill Grass – White Top grassland of the Riverina Bioregion	Murrumbidgee	VZ #16 44_Mod-good	0.20
		Sub-total - recorded	0.20
Assumed presence			
PCT 44 – Forb-rich Speargrass – Windmill Grass – White Top grassland of the Riverina Bioregion	Murrumbidgee	VZ #39 44_SVM_Bench	6.55
PCT 160 – Nitre Goosefoot shrubland wetland on clays of the inland floodplains		VZ #24 160_Mod-good	0.25
		Sub-total - assumed	6.80
Total			**7.00**

Photo 5-5 Tentative *Lepidium monoplocoides* located in PCT 44

Photo 5-6 Tentative *Lepidium monoplocoides* located in PCT 44

5.6.2.3 *Leptorhynchos orientalis* (Lanky Buttons)

Leptorhynchos orientalis is a threatened button daisy listed as Endangered under the BC Act. This species is not listed under the EPBC Act. The plant occurs as an erect annual herb to 30 centimetres in height with yellow button flowers occurring at the end of slender stalks.

Leptorhynchos orientalis is known from a small number of areas within Hay Plain and southern Riverina districts in NSW. The species is also known to occur in Victoria and southern Eyre Peninsular of South Australia. In NSW, the species has been recorded near Hillston, Hay and land to the west of Buckingbong State Forest.

Within the proposal study area a tentative recording of this species has been made from two locations on the Riverina Plain from natural grassland vegetation (PCT 44). One tentative recording is from Pooginook Station where about 50+ plants were recorded from PCT 44 (Photo 5-7). The second tentative record is from Gum Road TSR where about 20 plants were observed from again a patch of PCT 44 (Photo 5-8).

Herbarium samples were collected (collected under SL 100630) from plants at both locations and forwarded to the National Herbarium of NSW for positive verification (samples sent by post 28/09/2021). Positive verification of these specimens has not been received at the time of report preparation and as such a precautionary approach has been taken and the species is assumed to be *Leptorhynchos orientalis.*

The unit of measure under BAM-C for *Leptorhynchos orientalis* is area. Area calculations for species polygons have been established by applying a 30-metre buffer area around the outside of the individual or group of plants as outlined in section 5.2.5 of the BAM (refer to Appendix C-7). Associated habitat for this species has also been recorded from State vegetation mapping for properties where access for surveys was not granted. For these properties, habitat has been assumed for associated PCTs and used for calculation impact purpose in BAM-C.

The total area of occupancy (recorded) of *Leptorhynchos orientalis* within the disturbance area is 0.63 hectares with an additional 14.69 hectares of assumed habitat. A summary of *Leptorhynchos orientalis* species polygon area is provided in Table 5-21.

Table 5-21 *Leptorhynchos orientalis* species polygon area within the disturbance area

VEGETATION TYPE	IBRA SUBREGION	VEGETATION ZONE	DISTURBANCE AREA (HA)
Recorded			
PCT 44 – Forb-rich Speargrass – Windmill Grass – White Top grassland of the Riverina Bioregion	Murrumbidgee	VZ #16 44_Mod-good	0.63
		Sub-total - recorded	0.63
Assumed presence			
PCT 44 – Forb-rich Speargrass – Windmill Grass – White Top grassland of the Riverina Bioregion	Murrumbidgee	VZ #16 44_Mod-good	8.06
		VZ #39 44_SVM_Bench	6.38
PCT 160 – Nitre Goosefoot shrubland wetland on clays of the inland floodplains		VZ #24 160_Mod-good	0.25
		Sub-total - assumed	14.69
Total			**15.32**

Photo 5-7 Tentative *Leptorhynchos orientalis* located in PCT 44

Photo 5-8 Tentative *Leptorhynchos orientalis* flowering at Gum Road TSR

5.6.2.4 *Maireana cheelii* (Chariot Wheels)

Maireana cheelii is a threatened perennial forb listed as Vulnerable under both the BC Act and EPBC Act. This species grows to a height of about 20 centimetres and has narrow-cylindrical hairless leaved and is easily identified by its distinctly wheel-like fan shaped fruits (refer to Photo 5-9).

Maireana cheelii has a restricted distribution in the southern Riverina region of NSW, mainly in the area between Deniliquin and Hay. The species is also known to have a limited distribution in Victoria where it is considered very rare.

The species appears to occupy niche habitat in the form of shallow depressions, often on scalded surfaces or edges of bare, windswept claypans, in shallow depressions of eroded surfaces where rainwater collects. *Maireana cheelii* has been documented to favour heavy brown to red-brown clay-loams, hard cracking red clay, other heavy texture-contrast soils (Department of Planning Industry and Environment 2021).

Within the proposal study area, *Maireana cheelii* has been recorded from Keri Keri Road in the west to the intersection of Jerilderie / North Boundary Road and Bullewah Road in the east. Large populations of this species were recorded from property H062 Keri Keri Station, H064 Tchelery Station and H075 Mungadal Station.

Maireana cheelii was consistently observed to be growing in larger populations on hard cracking red clay soils associated with scalds (refer to Photo 5-9) particular following heavy rains where the scalds became temporarily flooded (refer to Photo 5-10).

The unit of measure under BAM-C for *Maireana cheelii* is area. Area calculations for species polygons have been established by applying a 30-metre buffer area around the outside of the individual or group of plants as outlined in section 5.2.5 of the BAM (refer to Appendix C-7). Associated habitat for this species has also been recorded from State vegetation mapping for properties where access for surveys was not granted. For these properties, habitat has been assumed for associated PCTs and used for calculation impact purpose in BAM-C.

The total area of occupancy (recorded) of *Maireana cheelii* within the disturbance area is 7.01 hectares with an additional 102.67 hectares of assumed habitat. A summary of *Maireana cheelii* species polygon area is provided in Table 5-22.

Table 5-22 *Maireana cheelii* species polygon area within the disturbance area

VEGETATION TYPE	IBRA SUBREGION	VEGETATION ZONE	DISTURBANCE AREA (HA)
Recorded			
PCT 17 – Lignum shrubland wetland of the semi-arid (warm) plains (mainly Riverina Bioregion and Murray Darling Depression Bioregion)	Murrumbidgee	VZ #8 17_Mod-good	0.09
PCT 44 – Forb-rich Speargrass – Windmill Grass – White Top grassland of the Riverina Bioregion		VZ #16 44_Mod-good	0.14
PCT 46 – Curly Windmill Grass – speargrass – wallaby grass grassland on alluvial clay and loam on the Hay plain, Riverina Bioregion		VZ #18 46_Mod-good	0.11
PCT 58 – Black Oak – Western Rosewood open woodland on deep sandy loams mainly in the Murray Darling Depression Bioregion		VZ #21 58_Mod-good	0.01
PCT 157 – Bladder Saltbush shrubland on alluvial plains in the semi-arid (warm) zone including Riverina Bioregion		VZ #23 157_Mod-good	0.37
PCT 163 – Dillon Bush (Nitre Bush) shrubland of the semi-arid and arid zones		VZ #25 163_Mod-good	4.78
PCT 164 – Cotton Bush open shrubland of the semi-arid (warm) zone		VZ #26 164_Mod-good	1.34
PCT 216 – Black Roly Poly low open shrubland of the Riverina		VZ #29 216_Mod-good	0.17
		Sub-total - recorded	7.01
Assumed presence			
PCT 17 – Lignum shrubland wetland of the semi-arid (warm) plains (mainly Riverina Bioregion and Murray Darling Depression Bioregion)	Murrumbidgee	VZ #8 17_Mod-good	2.10
		VZ #35 17_SVM_Bench	3.48
PCT 28 – White Cypress Pine open woodland of sand plains, prior streams and dunes mainly of the semi-arid (warm) climate zones		VZ #38 28_SVM_Bench	1.30
PCT 44 – Forb-rich Speargrass – Windmill Grass – White Top grassland of the Riverina Bioregion		VZ #16 44_Mod-good	8.06
PCT 46 – Curly Windmill Grass – speargrass – wallaby grass grassland on alluvial clay and loam on the Hay plain, Riverina Bioregion		VZ #18 46_Mod-good	4.94
		VZ #42 46_SVM_Bench	23.08

VEGETATION TYPE	IBRA SUBREGION	VEGETATION ZONE	DISTURBANCE AREA (HA)
PCT 157 – Bladder Saltbush shrubland on alluvial plains in the semi-arid (warm) zone including Riverina Bioregion		VZ #23 157_Mod-good	5.77
		VZ #43 157_SVM_Bench	10.70
PCT 163 – Dillon Bush (Nitre Bush) shrubland of the semi-arid and arid zones		VZ #25 163_Mod-good	0.12
PCT 164 – Cotton Bush open shrubland of the semi-arid (warm) zone		VZ #45 164_SVM_Bench	43.12
		Sub-total - assumed	102.67
Total			**109.68**

Photo 5-9 *Maireana cheelii* with mature fruiting bodies

Photo 5-10 *Maireana cheelii* recorded from a flooded scald on Tchelery Station (H064)

5.6.2.5 *Pilularia novae-hollandiae* (Austral Pillwort)

Pilularia novae-hollandiae is a threatened semi-aquatic fern listed as Endangered under the BC Act. This species is not listed under the EPBC Act. *Pilularia novae-hollandiae* superficially resembles a small fine grass like plant with tread like fronds to 8 centimetres in height occurring in tuffs arising from underground stems (rhizomes). Fruiting bodies are distinct small hairy pills that occur at the base of the fronds generally underground.

Pilularia novae-hollandiae is widely distributed throughout southern Australia with known occurrences in New South Wales, the Australian Capital Territory, Victoria, Tasmania, South Australia and Western Australia (Department of Planning Industry and Environment 2021) . Although widely distributed the species is rare in New South Wales and has been recorded from suburban Sydney, Khancoban, the Riverina between Albury and Urana (including Henty, Walbundrie, Balldale and Howlong), Oolambeyan National Park near Carathool and at Lake Cowal near West Wyalong (Department of Planning Industry and Environment 2021).

Within the study area a small population was recorded from property H081 at the eastern end of West Burrabogie Road where it was growing in flooded gilgais within lignum swamp vegetation (PCT 17). Herbarium samples were collected (collected under SL 100630) and forwarded to the National Herbarium of NSW for positive verification (samples sent by post 28/09/2021).

The unit of measure under BAM-C for *Pilularia novae-hollandiae* is area. Area calculations for species polygons have been established by applying a 30-metre buffer area around the outside of the individual or group of plants as outlined in section 5.2.5 of the BAM (refer to Appendix C-7). Associated habitat for this species has also been recorded from State vegetation mapping for properties where access for surveys was not granted. For these properties, habitat has been assumed for associated PCTs and used for calculation impact purpose in BAM-C.

The total area of occupancy (recorded) of *Pilularia novae-hollandiae* within the disturbance area is 0.32 hectares with an additional 8.30 hectares of assumed habitat. A summary of *Pilularia novae-hollandiae* species polygon area is provided in Table 5-23.

Table 5-23 *Pilularia novae-hollandiae* species polygon area within the disturbance area

VEGETATION TYPE	IBRA SUBREGION	VEGETATION ZONE	DISTURBANCE AREA (HA)
Recorded			
PCT 17 – Lignum shrubland wetland of the semi-arid (warm) plains (mainly Riverina Bioregion and Murray Darling Depression Bioregion)	Murrumbidgee	VZ #8 17_Mod-good	0.26
PCT 160 – Nitre Goosefoot shrubland wetland on clays of the inland floodplains		VZ #24 160_Mod-good	0.06
		Sub-total - recorded	0.32
Assumed presence			
PCT 17 – Lignum shrubland wetland of the semi-arid (warm) plains (mainly Riverina Bioregion and Murray Darling Depression Bioregion)	Murrumbidgee	VZ #8 17_Mod-good	2.10
		VZ #35 17_SVM_Bench	4.10
PCT 44 – Forb-rich Speargrass – Windmill Grass – White Top grassland of the Riverina Bioregion		VZ #39 44_SVM_Bench	0.01
PCT 160 – Nitre Goosefoot shrubland wetland on clays of the inland floodplains		VZ #24 160_Mod-good	0.92
		VZ #44 160_SVM_Bench	1.17
		Sub-total - assumed	8.30
Total			**8.62**

Photo 5-11 *Pilularia novae-hollandiae* with fronds and fruiting bodies are distinct small hairy pills

Photo 5-12 *Pilularia novae-hollandiae* with grass like fronds

Photo 5-13 *Pilularia novae-hollandiae* herbarium samples

5.6.2.6 *Pimelea serpyllifolia* subsp. *serpyllifolia* (Thyme Rice-Flower)

Pimelea serpyllifolia subsp. *serpyllifolia* is a threatened shrub listed as endangered under the BC Act. This species is not listed under the EPBC Act. The plant occurs as an erect shrub that ranges in height from 0.1 to 1.5 metres. It is characterised by having glabrous stems, crowded leaves with hairless yellow terminal flowers.

Pimelea serpyllifolia subsp. *serpyllifolia* is not common in NSW and is only known from mallee vegetation in the Euston district in the far southwest of the State. Whilst uncommon in NSW the species is more abundant in coastal areas of Victoria and South Australia.

In NSW, *Pimelea serpyllifolia* subsp. *serpyllifolia* is currently only known from a single population west of Euston that has been recorded on the northern side of the Sturt Highway near the Tapalin Mail Road. At this location it has been identified to occur on calcareous sandy red soils, growing in mallee woodland scrub (Department of Planning Industry and Environment 2021) . The population size and extent are currently unknown.

Within the proposal study area, *Pimelea serpyllifolia* subsp. *serpyllifolia* has been recorded to the north of Euston on property H035 from PCT 172 - Deep sand mallee of irregular dunefields of the semi-arid (warm) zone (refer to Photo 5-14 and Photo 5-15). A total of 40 plants were recorded from a single discrete population. The plants were recorded by Dr Ian Sluiter and Mr Geoffrey Allen on the 12 October 2021 and are considered a range extension to the Sturt Highway Euston West population. Plant material was collected for further positive identification and expert verification from Mr Neville Walsh from the Royal Botanical Garden, Victoria.

The unit of measure under BAM-C for *Pimelea serpyllifolia* subsp. *serpyllifolia* is area. Area calculations for species polygons have been established by applying a 30 metre buffer area around the outside of the individual or group of plants as outlined in section 5.2.5 of the BAM (refer to Appendix C-7).

The total area of occupancy (recorded) of *Pimelea serpyllifolia* subsp. *serpyllifolia* within the disturbance area is 1.70 hectares. A summary of *Pimelea serpyllifolia subsp. serpyllifolia* species polygon area is provided in Table 5-24.

Table 5-24 *Pimelea serpyllifolia* subsp. *serpyllifolia* species polygon area within the disturbance area

VEGETATION TYPE	IBRA SUBREGION	VEGETATION ZONE	DISTURBANCE AREA (HA)
PCT 172 – Deep sand mallee of irregular dunefields of the semi-arid (warm) zone	South Olary Plain	#10 172_Mod-good_whip	1.70
Total			**1.70**

Photo 5-14 *Pimelea serpyllifolia* subsp. *serpyllifolia* shrub habit growing in PCT 172 on property H035 north of Euston

Photo 5-15 *Pimelea serpyllifolia* subsp. *serpyllifolia* showing crowded leaf arrangement and terminal yellow flowers

5.6.2.7 *Santalum murrayanum* (Bitter Quandong)

Santalum murrayanum is a threatened flora species listed as endangered under the BC Act. This species is not listed under the EPBC Act.

Santalum murrayanum is a tall shrub or small tree to five metres tall. The growth habit is pendulous with leaves grey-green or silver-green being opposite or sometimes whorled. The bark is smooth when young and becomes dark, hardened and furrowed with age.

The species is widely distributed across Australia occurring from inland southern Western Australia, through SA with the eastern extent being north-western Victoria and south-western New South Wales (Department of Planning Industry and Environment 2021) . *Santalum murrayanum* is rare in NSW with most records occurring near the Sturt Highway between Dareton and Balranald. Other more widely distributed records occur between Kyalite and Moulamein in the east, Lake Victoria in the west and in mallee vegetation to the south-east of Menindee (Department of Planning Industry and Environment 2021) .

A total of 4 individuals of this species were recorded within the proposal study area or on adjoin lands during targeted surveys. All specimens were recorded from the following vegetation types:

- PCT 171 – Spinifex linear dune mallee mainly of the Murray Darling Depression Bioregion (moderate to good whip)
- PCT 172 – Deep sand mallee of irregular dunefields of the semi-arid (warm) zone (moderate to good whip).

During targeted surveys, regular inspections of *Myoporum platycarpum* subsp. *platycarpum* (Sugarwood) and *Pittosporum angustfolium* (Weeping pittosporum) were undertaken due to the superficial similarities in habit and form between the species observed at a distance.

The unit of measure under BAM-C for *Santalum murrayanum* is count of individuals. The total count of *Santalum murrayanum* within the proposal study area and surrounds is 4 individuals. No individuals will be impacted within the disturbance area and as such *Santalum murrayanum* is not considered affected by the proposal.

Photo 5-16 Santalum murrayanum growing in PCT 172

Photo 5-17 *Santalum murrayanum* with weeping pendulous habit

Photo 5-18 Old fallen fruit berries accumulated at the base of a tree

Photo 5-19 *Santalum murrayanum* mature bark

5.6.2.8 *Swainsona murrayana* (Slender Darling Pea)

Swainsona murrayana is a threatened small prostrate forb listed as Vulnerable under both the BC Act and EPBC Act. The species has narrow linear leaves and is sparsely downy forb. The pea-like flowers are pink or purple with red stripes on densely and darkly hairy slender stalks (Department of Planning Industry and Environment 2021) .

Swainsona murrayana is known to occur as scattered populations throughout NSW although within the vicinity of the proposal it has been recorded in the Jerilderie and Deniliquin areas of the southern riverine plain, the Hay plain as far north as Willandra National Park (Department of Planning Industry and Environment 2021) .

Within the proposal study area *Swainsona murrayana* was recorded from the following dates and locations:

- 7 Sept 2020 in PCT 157_mod-good in the Cobb Highway TSR. Small population within TSR, but larger population in neighbouring property H075 could be seen
- 8 Sept 2020 in PCT 163_mod-good on property H064. This population was recorded in conjunction with known records occurring along Boorooban-Tchelery Road
- 9 Sept 2020 in PCT 163_mod-good and PCT 17_mod-good on property H081/H081A. Multiple populations found
- 10 Sept 2020 PCT 24_mod-good, PCT 44_mod-good & PCT 46_mod-good. Multiple populations found including one large population associated with PCT 44_mod-good and one population found in conjunction with *Swainsona sericea* population
- 7-8 Sept 2021 in PCT163_mod-good on property H064. Multiple populations found
- 9-11 Sept 2021 in PCT 46_mod-good, 164_mod-good & PCT 163_mod-good on property H075. Multiple populations found; some large in size. Recorded to grow with *Maireana cheelii*. Population recorded in the Cobb Highway TSR (borders property boundary) was re-visited and plants were observed to be flowering. 10 Sept 2021 plant material, including flower, was collected for positive identification. 28 Sept 2021 plant material was forwarded to National Herbarium of NSW
- 9 Sept 2021 in PCT 26_moderate, PCT 26_mod-good & PCT 164_ mod-good on property H087. Multiple populations found including one large population associated with PCT 26_moderate. Due to time constraints, every second circle was surveyed in PCT 26_moderate. Results indicate species presence across all patches of PCT 26_mod-good & PCT 26-moderate
- 13-14 Sept 2021 in PCT 46 mod-good in Bundure Siding TSR. Population found to be growing alongside *Swainsona sericea*

- 13-14 Sept 2021 in PCT 44_mod-good, PCT 45_mod-good, PCT 46_mod-good, PCT 164_mod-good & lands mapped as Category 1 on H104. Very large population (>1,000 plants) recorded. Found to be growing in areas subject to modification including two paddocks that have been classified as Category 1 exempt lands. Species recorded to be growing alongside *Swainsona sericea*
- 14 Sept 2021 in PCT 44_mod-good & PCT 45_mod-good in The Gums TSR. Population recorded with a high density of *Swainsona murrayana* plants growing in conjunction with *Swainsona sericea*.

The unit of measure under BAM-C for *Swainsona murrayana* is area. Area calculations for species polygons have been established by applying a 30-metre buffer area around the outside of the individual or group of plants as outlined in section 5.2.5 of the BAM (refer to Appendix C-7). Associated habitat for this species has also been recorded from State vegetation mapping for properties where access for surveys was not granted. For these properties, habitat has been assumed for associated PCTs and used for calculation impact purpose in BAM-C.

The total area of occupancy (recorded) of *Swainsona murrayana* within the disturbance area is 80.67 hectares with an additional 151.68 hectares of assumed habitat. A summary of *Swainsona murrayana* species polygon area is provided in Table 5-25.

Table 5-25 *Swainsona murrayana* species polygon area within the disturbance area

VEGETATION TYPE	IBRA SUBREGION	VEGETATION ZONE	DISTURBANCE AREA (HA)
Recorded			
PCT 17 – Lignum shrubland wetland of the semi-arid (warm) plains (mainly Riverina Bioregion and Murray Darling Depression Bioregion)	Murrumbidgee	VZ #8 17_Mod-good	2.85
PCT 24 – Canegrass swamp tall grassland wetland of drainage depressions, lakes and pans of the inland plains		VZ #11 24_Mod-good	2.56
PCT 26 – Weeping Myall open woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion		VZ #12 26_Mod-good	1.69
		VZ #13 26_Moderate	14.50
		VZ #14 26_Derived	0.08
PCT 44 – Forb-rich Speargrass – Windmill Grass – White Top grassland of the Riverina Bioregion		VZ #16 44_Mod-good	8.66
		VZ #39 44_SVM_Bench	0.01
PCT 45 – Plains Grass grassland on alluvial mainly clay soils in the Riverina Bioregion and NSW South Western Slopes Bioregion		VZ #17 45_Mod-good	13.07
PCT 46 – Curly Windmill Grass – speargrass – wallaby grass grassland on alluvial clay and loam on the Hay plain, Riverina Bioregion		VZ #18 46_Mod-good	20.98

VEGETATION TYPE	IBRA SUBREGION	VEGETATION ZONE	DISTURBANCE AREA (HA)
PCT 47 – Swamp grassland wetland of the Riverine Plain		VZ #19 47_Mod-good	0.17
PCT 53 – Shallow freshwater wetland sedgeland in depressions on floodplains on inland alluvial plains and floodplains		VZ #20 53_Mod-good	1.73
PCT 157 – Bladder Saltbush shrubland on alluvial plains in the semi-arid (warm) zone including Riverina Bioregion		VZ #23 157_Mod-good	0.02
PCT 160 – Nitre Goosefoot shrubland wetland on clays of the inland floodplains		VZ #24 160_Mod-good	0.19
PCT 163 – Dillon Bush (Nitre Bush) shrubland of the semi-arid and arid zones		VZ #25 163_Mod-good	10.86
PCT 164 – Cotton Bush open shrubland of the semi-arid (warm) zone		VZ #26 164_Mod-good	3.27
		VZ #45 164_SVM_Bench	0.02
PCT 216 – Black Roly Poly low open shrubland of the Riverina		VZ #29 216_Mod-good	0.01
		Sub-total - recorded	80.67
Assumed presence			
PCT 17 – Lignum shrubland wetland of the semi-arid (warm) plains (mainly Riverina Bioregion and Murray Darling Depression Bioregion)	Murrumbidgee	VZ #8 17_Mod-good	2.10
		VZ #35 17_SVM_Bench	4.10
PCT 24 – Canegrass swamp tall grassland wetland of drainage depressions, lakes and pans of the inland plains		VZ #11 24_Mod-good	0.77
		VZ #36 24_SVM_Bench	0.01
PCT 26 – Weeping Myall open woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion		VZ #12 26_Mod-good	1.18
		VZ #13 26_Moderate	4.42
		VZ #14 26_Derived	23.65
		VZ #37 26_SVM_Bench	0.04

VEGETATION TYPE	IBRA SUBREGION	VEGETATION ZONE	DISTURBANCE AREA (HA)
PCT 44 – Forb-rich Speargrass – Windmill Grass – White Top grassland of the Riverina Bioregion		VZ #16 44_Mod-good	8.06
		VZ #39 44_SVM_Bench	6.37
PCT 45 – Plains Grass grassland on alluvial mainly clay soils in the Riverina Bioregion and NSW South Western Slopes Bioregion		VZ #41 45_SVM_Bench	10.01
PCT 46 – Curly Windmill Grass – speargrass – wallaby grass grassland on alluvial clay and loam on the Hay plain, Riverina Bioregion		VZ #18 46_Mod-good	4.94
		VZ #41 46_SVM_Bench	23.08
PCT 47 – Swamp grassland wetland of the Riverine Plain		VZ #42 47_SVM_Bench	0.88
PCT 157 – Bladder Saltbush shrubland on alluvial plains in the semi-arid (warm) zone including Riverina Bioregion		VZ #23 157_Mod-good	5.77
		VZ #43 157_SVM_Bench	10.70
PCT 160 – Nitre Goosefoot shrubland wetland on clays of the inland floodplains		VZ #24 160_Mod-good	1.21
		VZ #44 160_SVM_Bench	1.17
PCT 163 – Dillon Bush (Nitre Bush) shrubland of the semi-arid and arid zones		VZ #25 163_Mod-good	0.12
PCT 164 – Cotton Bush open shrubland of the semi-arid (warm) zone		VZ #45 164_SVM_Bench	43.10
		Sub-total - assumed	151.68
Total			**232.35**

Photo 5-20 *Swainsona murrayana* flowering at Coonong Station, September 2021

Photo 5-21 *Swainsona murrayana* flowering at Gums TSR, September 2021

5.6.2.9 *Swainsona sericea* (Silky Swainson-pea)

Swainsona sericea is a threatened small prostrate forb listed as Vulnerable the BC Act. This species is not listed under the EPBC Act. The plant grows to a height of about 10 centimetres with densely hairy stems and leaves, with 5–13 narrow pointed leaflets. The pea shaped flowers range from mauve to pink and are followed by a hairy seed pod up to 17 millimetres long (Department of Planning Industry and Environment 2021).

Swainsona sericea is known from the Northern Tablelands to the Southern Tablelands and further inland on the slopes and plains of NSW. It is also known to occur in South Australia, Victoria and Queensland (Department of Planning Industry and Environment 2021).

Within the proposal study area scattered occurrences of this species were recorded from properties along the North Boundary Road, on property H091 south of McLennons Boree Road, Bundure Siding TSR, Coonong Station, along Coonong Road and Gum TSR. Details on survey effort and dates recorded are provided in Appendix C-3.

The unit of measure under BAM-C for *Swainsona sericea* is area. Area calculations for species polygons have been established by applying a 30-metre buffer area around the outside of the individual or group of plants as outlined in section 5.2.5 of the BAM (refer to Appendix C-7). Associated habitat for this species has also been recorded from State vegetation mapping for properties where access for surveys was not granted. For these properties, habitat has been assumed for associated PCTs and used for calculation impact purpose in BAM-C.

The total area of occupancy (recorded) of *Swainsona sericea* within the disturbance area is 10.32 hectares with an additional 98.85 hectares of assumed habitat. A summary of *Swainsona sericea* species polygon area is provided in Table 5-26.

Table 5-26 *Swainsona sericea* species polygon area within the disturbance area

VEGETATION TYPE	IBRA SUBREGION	VEGETATION ZONE	DISTURBANCE AREA (HA)
Recorded			
PCT 44 – Forb-rich Speargrass – Windmill Grass – White Top grassland of the Riverina Bioregion	Murrumbidgee	VZ #16 44_Mod-good	5.15
		VZ #39 44_SVM_Bench	0.01
PCT 45 – Plains Grass grassland on alluvial mainly clay soils in the Riverina Bioregion and NSW South Western Slopes Bioregion		VZ #17 45_Mod-good	3.94
PCT 46 – Curly Windmill Grass – speargrass – wallaby grass grassland on alluvial clay and loam on the Hay plain, Riverina Bioregion		VZ #18 46_Mod-good	1.00
PCT 47 – Swamp grassland wetland of the Riverine Plain		VZ #19 47_Mod-good	0.17
PCT 160 – Nitre Goosefoot shrubland wetland on clays of the inland floodplains		VZ #24 160_Mod-good	0.01
PCT 164 – Cotton Bush open shrubland of the semi-arid (warm) zone		VZ #26 164_Mod-good	0.04
		Sub-total - recorded	10.32

Assumed presence			
PCT 44 – Forb-rich Speargrass – Windmill Grass – White Top grassland of the Riverina Bioregion		VZ #16 44_Mod-good	8.06
	Murrumbidgee	VZ #39 44_SVM_Bench	6.38
PCT 45 – Plains Grass grassland on alluvial mainly clay soils in the Riverina Bioregion and NSW South Western Slopes Bioregion		VZ #40 45_SVM_Bench	10.01
PCT 46 – Curly Windmill Grass – speargrass – wallaby grass grassland on alluvial clay and loam on the Hay plain, Riverina Bioregion		VZ #18 46_Mod-good	4.94
		VZ #41 46_SVM_Bench	23.08
PCT 47 – Swamp grassland wetland of the Riverine Plain		VZ #42 47_SVM_Bench	0.88
PCT 160 – Nitre Goosefoot shrubland wetland on clays of the inland floodplains		VZ #24 160_Mod-good	1.21
		VZ #44 160_SVM_Bench	1.17
PCT 164 – Cotton Bush open shrubland of the semi-arid (warm) zone		VZ #47 164_SVM_Bench	43.12
		Sub-total - assumed	98.85
Total			**109.17**

Photo 5-22 *Swainsona sericea* with mauve pink flowers recorded in PCT 44

0 1 2 KM

Project Components
- Proposed Alignment
- Access Tracks
- Main Construction Compounds and Accomodation Sites
- Water Supply Point
- Existing Substation
- Built Up Areas
- Waterbody
- Biodiversity Study Area

Threatened Flora Species
- *Brachyscome papillosa*
- *Maeriana cheelii*

Threatened Flora Species Polygons
- *Brachyscome papillosa*
- *Maeriana cheelii*

Assumed Species Presence Polygon
- *Brachyscome papillosa*
- *Maireana cheelii*
- *Pilularia novae-hollandiae*
- *Swainsona murrayana*
- *Swainsona sericea*

BDAR - Figure 5-10a

Overview of Threatened Flora Species Individual and Species Polygons

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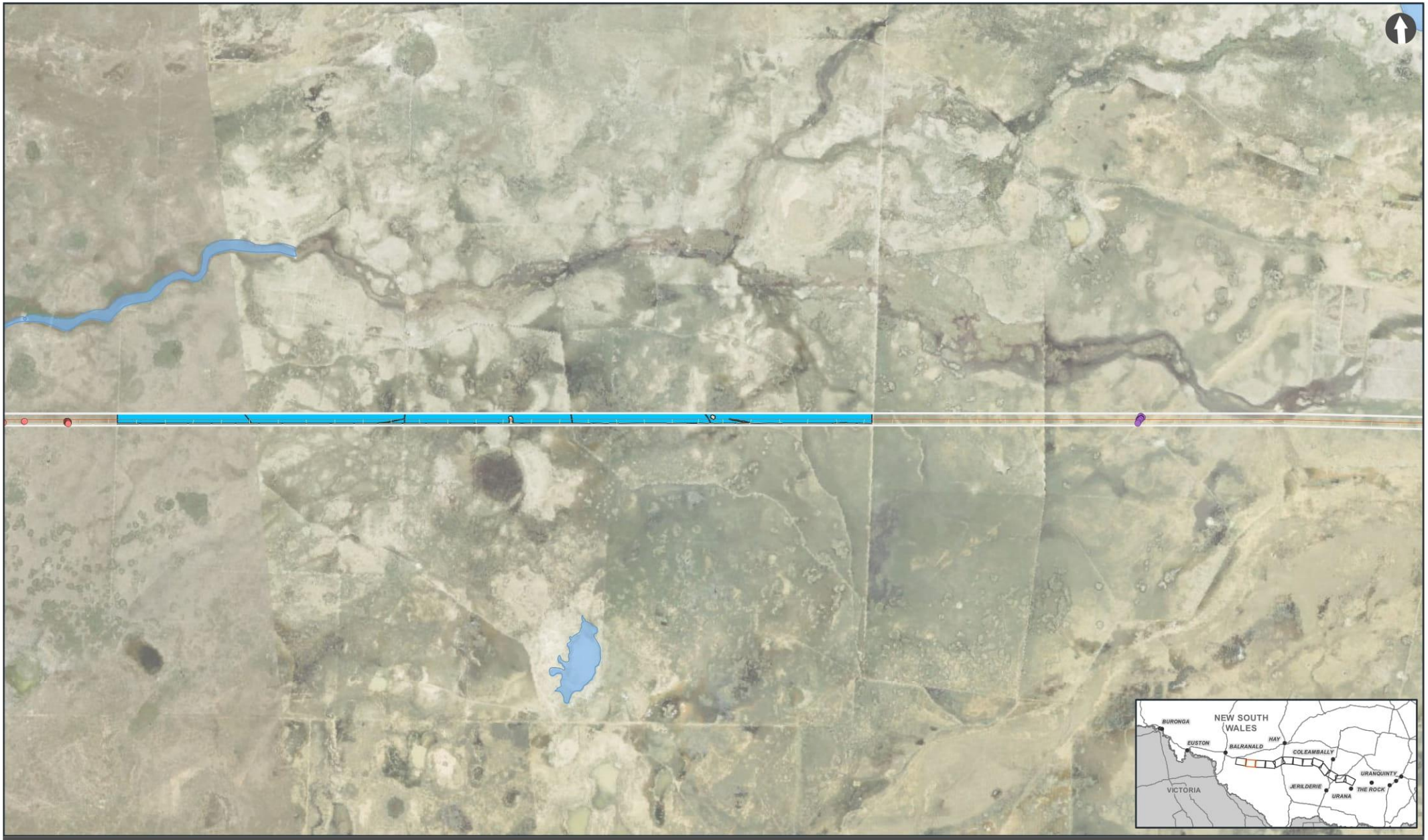
Source: NSWSS, ESRI, Transgrid, WSP



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BDAR - Figure 5-10b

Overview of Threatened Flora Species Individual and Species Polygons

Project Components
- Proposed Alignment
- Access Tracks
- Main Construction Compounds and Accomodation Sites
- Water Supply Point
- Existing Substation
- Built Up Areas
- Waterbody
- Biodiversity Study Area

Threatened Flora Species
- *Brachyscome papillosa*
- *Maeriana cheelii*

Threatened Flora Species Polygons
- *Brachyscome papillosa*
- *Maeriana cheelii*

Assumed Species Presence Polygon
- *Brachyscome papillosa*
- *Maireana cheelii*
- *Pilularia novae-hollandiae*
- *Swainsona murrayana*
- *Swainsona sericea*

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Source: NSWSS, ESRI, Transgrid, WSP

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BDAR - Figure 5-10c

Overview of Threatened Flora Species Individual and Species Polygons

Project Components
- Proposed Alignment
- Access Tracks
- Main Construction Compounds and Accomodation Sites
- Water Supply Point
- Existing Substation
- Built Up Areas
- Waterbody
- Biodiversity Study Area

Threatened Flora Species
- *Maeriana cheelii*
- *Swainsona murrayana*

Threatened Flora Species Polygons
- *Maeriana cheelii*
- *Swainsona murrayana*
- *Swainsona sericea*

Assumed Species Presence Polygon
- *Brachyscome papillosa*
- *Maireana cheelii*
- *Swainsona murrayana*
- *Swainsona sericea*

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Source: NSWSS, ESRI, Transgrid, WSP

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BDAR - Figure 5-10d

Overview of Threatened Flora Species Individual and Species Polygons

Project Components
- Proposed Alignment
- Access Tracks
- Main Construction Compounds and Accomodation Sites
- Water Supply Point
- Existing Substation
- Built Up Areas
- Waterbody
- Biodiversity Study Area

Threatened Flora Species
- *Maeriana cheelii*
- *Swainsona murrayana*

Threatened Flora Species Polygons
- *Maeriana cheelii*
- *Swainsona murrayana*
- *Swainsona sericea*

Assumed Species Presence Polygon
- *Brachyscome papillosa*
- *Maireana cheelii*
- *Pilularia novae-hollandiae*
- *Swainsona murrayana*
- *Swainsona sericea*

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Source: NSWSS, ESRI, Transgrid, WSP

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BDAR - Figure 5-10e

Overview of Threatened Flora Species Individual and Species Polygons

Project Components
- Proposed Alignment
- Access Tracks
- Main Construction Compounds and Accomodation Sites
- Water Supply Point
- Existing Substation
- Built Up Areas
- Waterbody
- Biodiversity Study Area

Threatened Flora Species
- *Brachyscome papillosa*
- *Maeriana cheelii*
- *Swainsona murrayana*

Threatened Flora Species Polygons
- *Brachyscome papillosa*
- *Maeriana cheelii*
- *Swainsona murrayana*
- *Swainsona sericea*

Assumed Species Presence Polygon
- *Brachyscome papillosa*
- *Maireana cheelii*
- *Swainsona murrayana*
- *Swainsona sericea*

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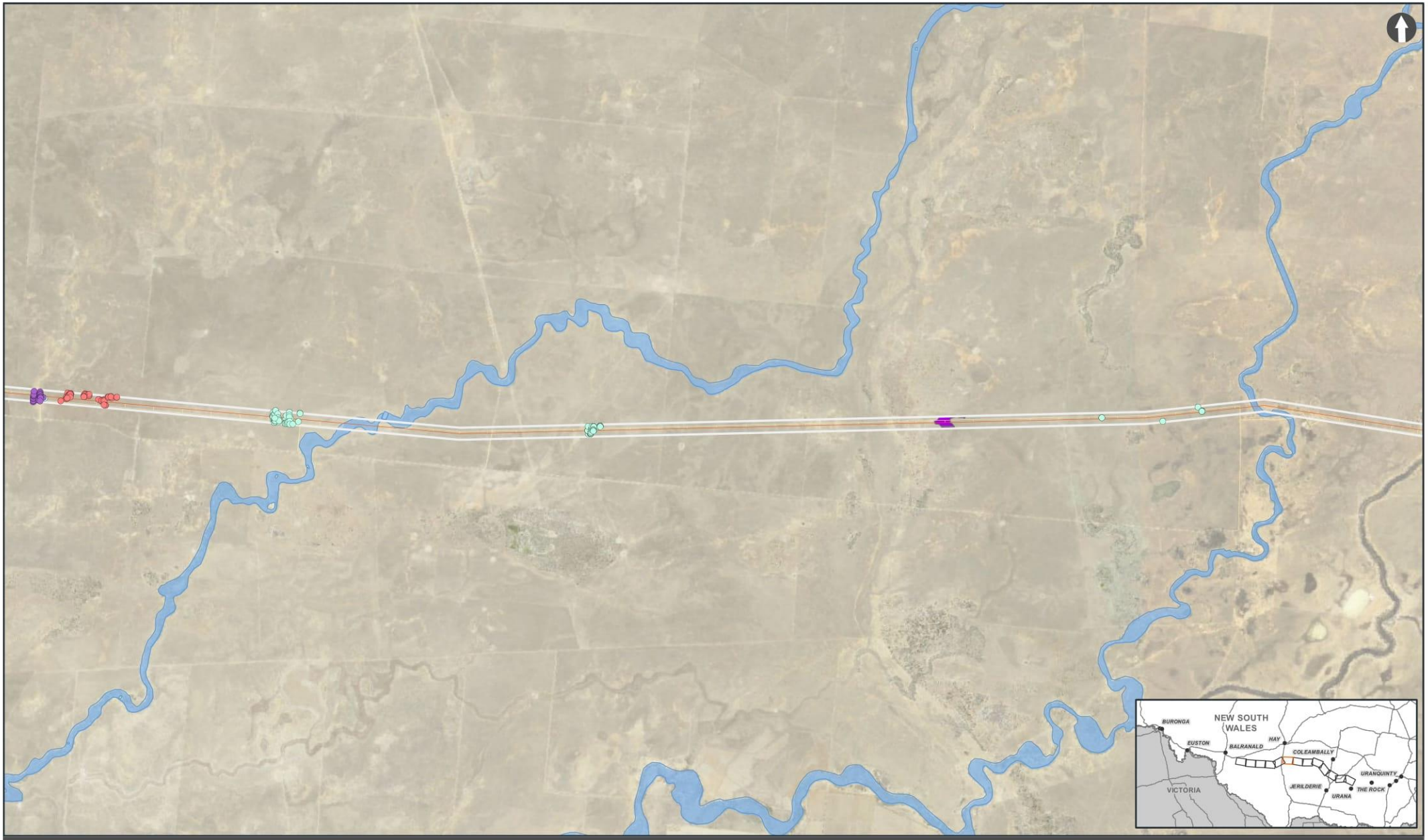
Source: NSWSS, ESRI, Transgrid, WSP



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BDAR - Figure 5-10f

Overview of Threatened Flora Species Individual and Species Polygons

Project Components
- Proposed Alignment
- Access Tracks
- Main Construction Compounds and Accomodation Sites
- Water Supply Point
- Existing Substation
- Built Up Areas
- Waterbody
- Biodiversity Study Area

Threatened Flora Species
- *Brachyscome papillosa*
- *Maeriana cheelii*
- *Swainsona murrayana*

Threatened Flora Species Polygons
- *Brachyscome papillosa*
- *Maeriana cheelii*
- *Swainsona murrayana*
- *Swainsona sericea*

Assumed Species Presence Polygon
- *Cullen parvum*

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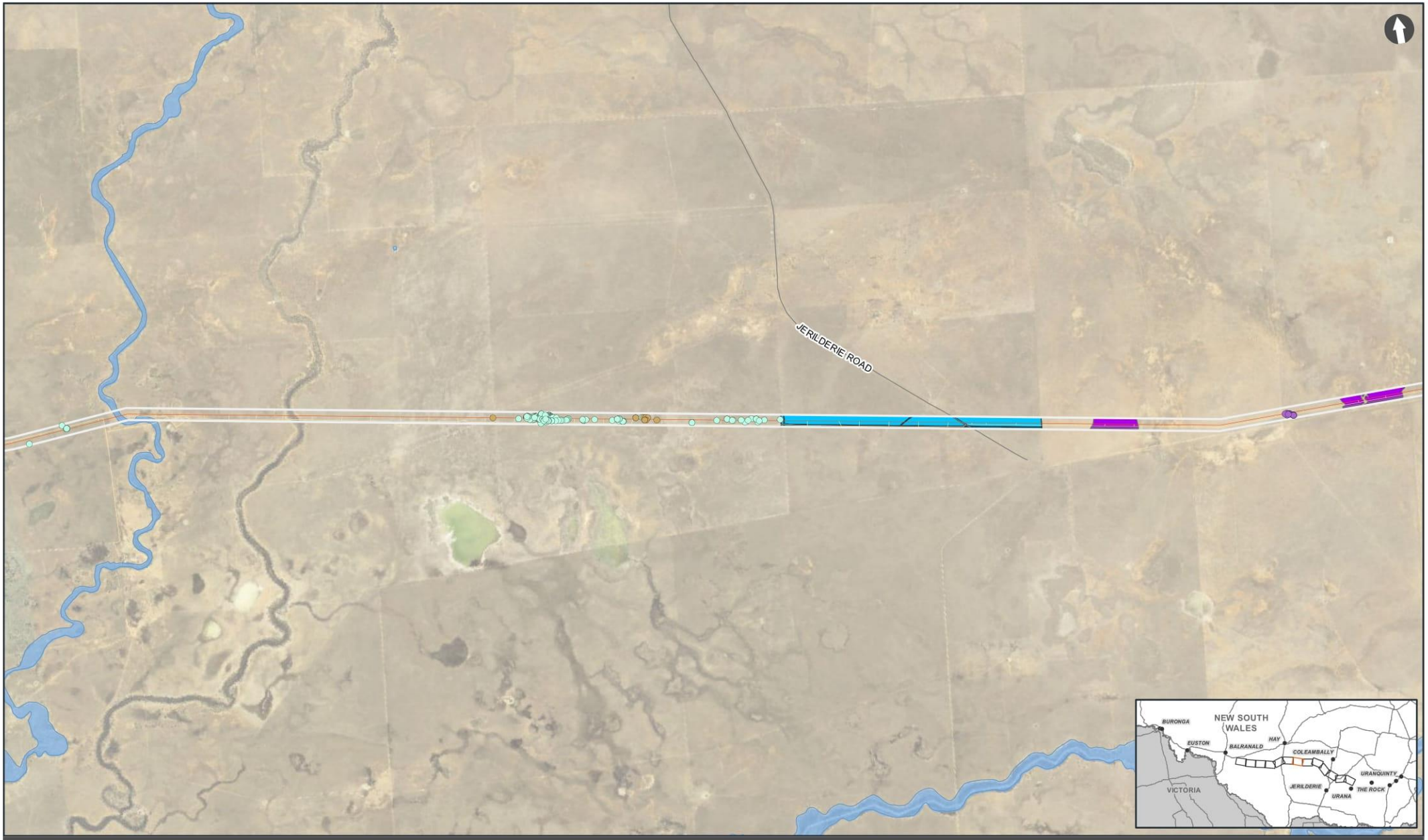
Source: NSWSS, ESRI, Transgrid, WSP



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BDAR - Figure 5-10g

Overview of Threatened Flora Species Individual and Species Polygons

Project Components
- Proposed Alignment
- Access Tracks
- Main Construction Compounds and Accomodation Sites
- Water Supply Point
- Existing Substation
- Built Up Areas
- Waterbody
- Biodiversity Study Area

Threatened Flora Species
- *Maeriana cheelii*
- *Pilularia novae-hollandiae*
- *Swainsona murrayana*

Threatened Flora Species Polygons
- *Maeriana cheelii*
- *Pilularia novae-hollandiae*
- *Swainsona murrayana*
- *Swainsona sericea*

Assumed Species Presence Polygon
- *Brachyscome papillosa*
- *Cullen parvum*
- *Maireana cheelii*
- *Swainsona murrayana*
- *Swainsona sericea*

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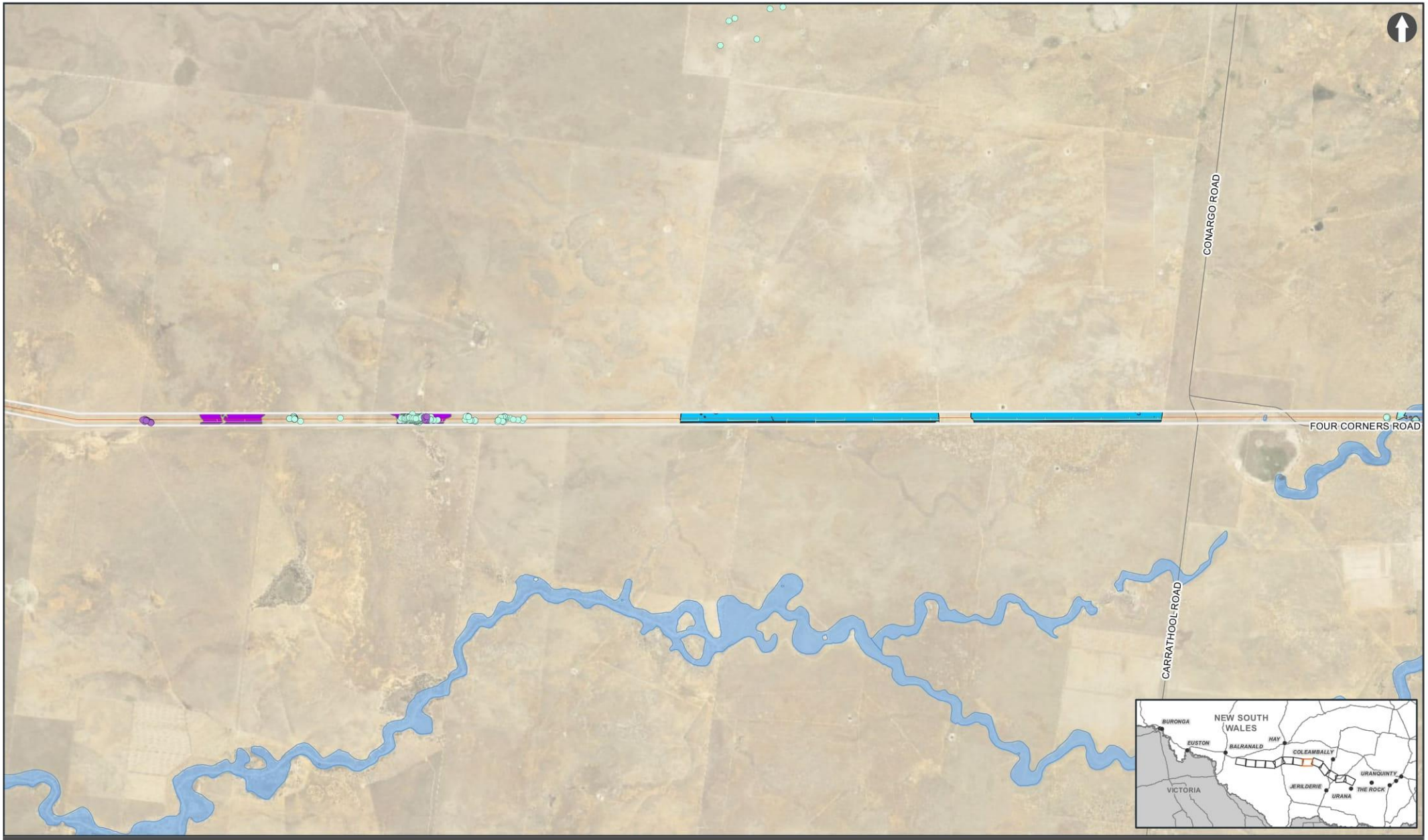
Source: NSWSS, ESRI, Transgrid, WSP



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BDAR - Figure 5-10h

Overview of Threatened Flora Species Individual and Species Polygons

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Project Components
- Proposed Alignment
- Access Tracks
- Main Construction Compounds and Accomodation Sites
- Water Supply Point
- Existing Substation
- Built Up Areas
- Waterbody
- Biodiversity Study Area

Threatened Flora Species
- *Maeriana cheelii*
- *Swainsona murrayana*
- *Swainsona sericea*

Threatened Flora Species Polygons
- *Maeriana cheelii*
- *Swainsona murrayana*
- *Swainsona sericea*

Assumed Species Presence Polygon
- *Brachyscome papillosa*
- *Cullen parvum*
- *Maireana cheelii*
- *Pilularia novae-hollandiae*
- *Swainsona murrayana*
- *Swainsona sericea*

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Source: NSWSS, ESRI, Transgrid, WSP

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BDAR - Figure 5-10i

Overview of Threatened Flora Species Individual and Species Polygons

Project Components
- Proposed Alignment
- Access Tracks
- Main Construction Compounds and Accomodation Sites
- Water Supply Point
- Existing Substation
- Built Up Areas
- Waterbody
- Biodiversity Study Area

Threatened Flora Species
- *Swainsona murrayana*

Threatened Flora Species Polygons
- *Swainsona murrayana*
- *Swainsona sericea*

Assumed Species Presence Polygon
- *Maireana cheelii*
- *Swainsona murrayana*
- *Swainsona sericea*

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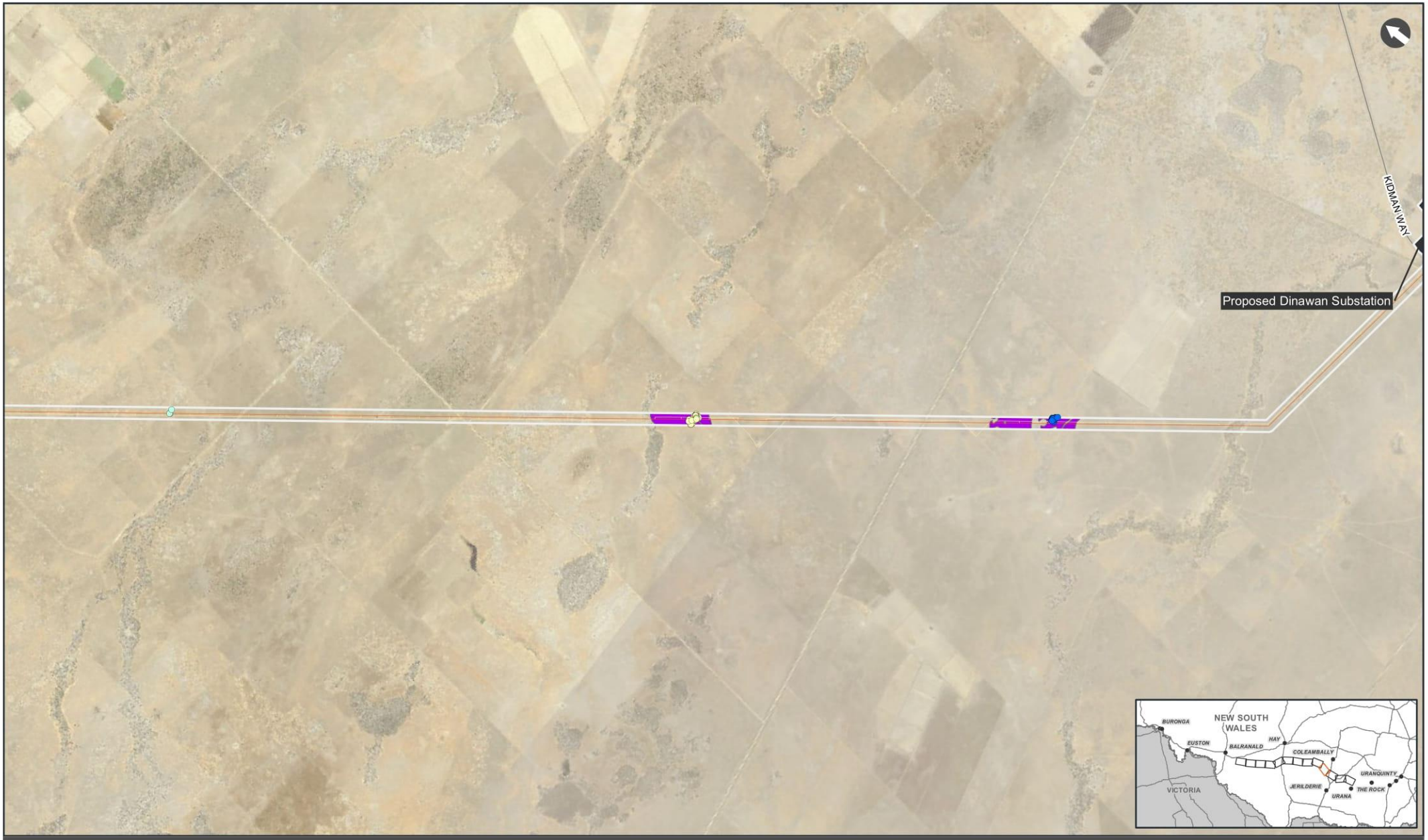
Source: NSWSS, ESRI, Transgrid, WSP



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BDAR - Figure 5-10j

Overview of Threatened Flora Species Individual and Species Polygons

Project Components
- Proposed Alignment
- Access Tracks
- Main Construction Compounds and Accomodation Sites
- Water Supply Point
- Existing Substation
- Built Up Areas
- Waterbody
- Biodiversity Study Area

Threatened Flora Species
- *Leptorhynchos orientalis*
- *Swainsona murrayana*
- *Swainsona sericea*

Threatened Flora Species Polygons
- *Leptorhynchos orientalis*
- *Swainsona murrayana*
- *Swainsona sericea*

Assumed Species Presence Polygon
- *Cullen parvum*

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Source: NSWSS, ESRI, Transgrid, WSP

Project Components

- Proposed Alignment
- Access Tracks
- Main Construction Compounds and Accomodation Sites
- Water Supply Point
- Existing Substation
- Built Up Areas
- Waterbody
- Biodiversity Study Area

Assumed Species Presence Polygon

- *Brachyscome papillosa*
- *Cullen parvum*
- *Leptorhynchos orientalis*
- *Maireana cheelii*
- *Pilularia novae-hollandiae*
- *Swainsona murrayana*
- *Swainsona sericea*

BDAR - Figure 5-10k

Overview of Threatened Flora Species Individual and Species Polygons

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Source: NSWSS, ESRI, Transgrid, WSP

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BDAR - Figure 5-10l

Overview of Threatened Flora Species Individual and Species Polygons

Project Components
- Proposed Alignment
- Access Tracks
- Main Construction Compounds and Accomodation Sites
- Water Supply Point
- Existing Substation
- Built Up Areas
- Waterbody
- Biodiversity Study Area

Threatened Flora Species
- *Swainsona murrayana*

Threatened Flora Species Polygons
- *Swainsona murrayana*
- *Swainsona sericea*

Assumed Species Presence Polygon
- *Brachyscome papillosa*
- *Cullen parvum*
- *Leptorhynchos orientalis*
- *Maireana cheelii*
- *Pilularia novae-hollandiae*
- *Swainsona murrayana*
- *Swainsona sericea*

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Source: NSWSS, ESRI, Transgrid, WSP

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BDAR - Figure 5-10m

Overview of Threatened Flora Species Individual and Species Polygons

Project Components
- Proposed Alignment
- Access Tracks
- Main Construction Compounds and Accomodation Sites
- Water Supply Point
- Existing Substation
- Built Up Areas
- Waterbody
- Biodiversity Study Area

Threatened Flora Species
- *Brachyscome papillosa*
- *Leptorhynchos orientalis*
- *Swainsona murrayana*
- *Swainsona sericea*

Threatened Flora Species Polygons
- *Brachyscome papillosa*
- *Leptorhynchos orientalis*
- *Swainsona murrayana*
- *Swainsona sericea*

Assumed Species Presence Polygon
- *Cullen parvum*

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Source: NSWSS, ESRI, Transgrid, WSP

5.6.3 Threatened fauna species credit species

A total of 43 threatened fauna species were considered to have potential associated habitat within the proposal study area and were the subject of targeted surveys. Of these 20 threatened fauna species have been recorded. These are listed in Section 5.6.4.

A summary of survey results for all candidate threatened fauna species, to determine those species that are considered affected by the proposal, are presented in Table 5-27. It should be noted that Table 5-27 should be read in conjunction with the candidate threatened fauna survey effort table (refer to Appendix C-4), threatened fauna survey methods (refer to Section 5.5.3) and threatened fauna field survey effort map (refer to Appendix C-4). A discussion of each potential threatened fauna species is provided below.

Table 5-27 Assessment of candidate threatened fauna to determine affected species

SCIENTIFIC NAME	COMMON NAME	BC ACT[1]	SAII	IBRA SUBREGIONS[2]					HABITAT REQUIREMENTS	SPECIES PRESENCE	AFFECTED SPECIES?	OUTCOME
				SOP	LAC	MUR	LS	IS				
Invertebrates												
Synemon plana	Golden Sun Moth	E	Yes	–	–	–	–	✓	PCT's 277 Grassy plains	No (surveyed)	No. This species was not recorded. Surveys conducted in December 2021.	Not an affected species
Amphibians												
Crinia sloanei	Sloane's Froglet	V	No	–	–	✓	✓	✓	PCT's 5, 74, 76, 80, 249	No (surveyed)	No. This species was not recorded Surveys conducted in July 2021 during wet conditions while other frog species were vocal with no presence detected.	Not an affected species
Litoria booroolongensis	Booroolong Frog	E	No	–	–	–	–	✓	PCT's 277	No (surveyed)	No. This species was not recorded. Unlikely to occur, due to a lack of suitable habitat and generally outside species known range.	Not an affected species
Litoria raniformis	Southern Bell Frog	E	No	–	✓	✓	✓	–	PCT's 7, 8, 11, 13, 15, 17, 24, 47, 53, 249 Lakes, swamps and rivers	No (surveyed)	No. This species was not recorded. The proposal is considered unlikely to impact upon habitats in which this species is most likely to occur in. Some marginal opportunities for this species at the Murrumbidgee crossing and Colombo Creek	Not an affected species

SCIENTIFIC NAME	COMMON NAME	BC ACT[1]	SAII	IBRA SUBREGIONS[2]					HABITAT REQUIREMENTS	SPECIES PRESENCE	AFFECTED SPECIES?	OUTCOME
				SOP	LAC	MUR	LS	IS				
Neobatrachus pictus	Painted Burrowing Frog	E	No	✓	–	–	–	–	PCT's 15, 58, 163, 170, 171, 172 Floodplain – grasslands and swamps	No (surveyed)	No. This species was not recorded, all regional records are associated with the most westerly sections of the Murray River floodplain well to the project's south.	Not an affected species
Reptiles												
Aprasia parapulchella	Pink-tailed Legless Lizard	V	No	–	–	–	–	✓	PCT's 267, 277, 319 Grassy woodland on rocky substrates	No (surveyed)	No. This species was not recorded. Surveys conducted September – December 2021.	Not an affected species
Delma impar	Striped Legless Lizard	V	No	–	–	–	–	✓	PCT's 277 Grassy woodland on rocky substrates	No (surveyed)	No. This species was not recorded.	Not an affected species
Lucasium stenodactylum	Crowned Gecko	V	No	✓	–	–	–	–	PCT's 143, 170, 199 Sand hill habitats	No (surveyed).	No. This species was not recorded.	Not an affected species
Birds												
Amytornis striatus	Striated Grasswren	V	Yes	✓	–	–	–	–	PCT's 171, 172 Spinifex Mallee	No (surveyed)	No. This species was not recorded. Mallee spinifex understories of insufficient quality and extent to support this species.	Not an affected species

SCIENTIFIC NAME	COMMON NAME	BC ACT[1]	SAII	IBRA SUBREGIONS[2]					HABITAT REQUIREMENTS	SPECIES PRESENCE	AFFECTED SPECIES?	OUTCOME
				SOP	LAC	MUR	LS	IS				
Anthochaera phrygia	Regent Honeyeater	CE	Yes	–	–	–	✓	✓	As per important habitat maps	No (surveyed), not in important mapped areas	No. This species was not recorded and no important habitat mapped areas will be impacted.	Not an affected species
Ardeotis australis	Australian Bustard	E	No	✓	✓	✓	–	–	PCT's 11, 15, 22, 23, 24, 26, 28, 44, 45, 46, 47, 53, 58, 143, 157, 160, 163, 164, 166, 199, 216 Chenopod and grassy plains	No (surveyed). Not observed, rare in the region.	No. This species was not recorded.	Not an affected species
Burhinus grallarius	Bush Stone-curlew	V	No	✓	✓	✓	✓	✓	PCT's 5, 7, 8, 11, 13, 15, 22, 23, 26, 28, 58, 74, 75, 76, 80, 249, 267, 277 Grassy woodland	No (surveyed)	No. This species was not recorded.	Not an affected species
Calidris ferruginea	Curlew Sandpiper	E	Yes	–	✓	✓	–	–	PCT's 24, 47, 53 Wetlands, lake edges	No (surveyed), not in important mapped areas. Suitable habitat is scant and may occur at Lake Cullivel under the right conditions.	No. This species was not recorded and no important habitat mapped areas will be impacted.	Not an affected species

SCIENTIFIC NAME	COMMON NAME	BC ACT[1]	SAII	IBRA SUBREGIONS[2]					HABITAT REQUIREMENTS	SPECIES PRESENCE	AFFECTED SPECIES?	OUTCOME
				SOP	LAC	MUR	LS	IS				
Callocephalon fimbriatum	Gang-gang Cockatoo	V	No	–	–	–	✓	✓	PCT's 5, 74, 75, 267, 277 Grassy woodland	No (surveyed). While not recorded, Wagga Wagga is at the western limit of their range with recent records locally and woodlands associated with the disturbance area represent foraging habitat for this species.	No. This species was not recorded.	Not an affected species
Calyptorhynchus lathami	Glossy Black-Cockatoo	V	No	–	–	–	✓	✓	PCT's 74, 75, 76, 80, 110 Grassy woodland	No (surveyed) species is limited to retained woodland reserves not associated with the project footprint.	No. This species was not recorded. The woodlands associated with the disturbance area do not contain preferred foraging plants to attract or support this species.	Not an affected species
Calyptorhynchus lathami endangered population	Glossy Black-Cockatoo, Riverina population	E	No	–	–	✓	✓	–	PCT's 74, 75, 76, 80, 110 Grassy woodland	No (surveyed) species is limited to retained woodland reserves not associated with the project footprint.	No. The woodlands associated with the disturbance area do not contain preferred foraging plants to attract or support this species.	Not an affected species

SCIENTIFIC NAME	COMMON NAME	BC ACT[1]	SAII	IBRA SUBREGIONS[2]					HABITAT REQUIREMENTS	SPECIES PRESENCE	AFFECTED SPECIES?	OUTCOME
				SOP	LAC	MUR	LS	IS				
Climacteris affinis - endangered population	White-browed Treecreeper	E	No	–	✓	✓	✓	–	PCT's 58, 80 Grassy woodland	Species records to the west of the Carrathool LGA near Euston and not of the endangered population. Not recorded in the project areas.	No, the range of this population is well outside (>50km) the disturbance area with no suitable habitat in the intervening lands.	Not an affected species
Haliaeetus leucogaster	White-bellied Sea-Eagle	V	No	✓	✓	✓	✓	✓	PCT's 5, 7, 8, 11, 13, 15, 17, 23, 24, 26, 28, 44, 45, 46, 47, 53, 58, 74, 75, 76, 80, 110, 143, 157, 160, 163, 164, 166, 170, 171, 182, 216, 249, 267, 277, 319 Riparian forest – inland lakes and rivers	No (surveyed)	No. This species was not recorded. The project footprint largely traverses habitats where this species does not occur. However, there is opportunity for it to occur at the crossing of the Murrumbidgee River south of Balranald.	Not an affected species

SCIENTIFIC NAME	COMMON NAME	BC ACT[1]	SAII	IBRA SUBREGIONS[2]					HABITAT REQUIREMENTS	SPECIES PRESENCE	AFFECTED SPECIES?	OUTCOME
				SOP	LAC	MUR	LS	IS				
Hamirostra melanosternon	Black-breasted Buzzard	V	No	✓	✓	–	✓	–	PCT's 15, 23, 24, 58, 143, 163, 170, 171, 172, 199 Semi-arid zone – open country	No (surveyed) This species has been observed west of the Darling, during previous survey works, but has not been observed in habitats associated with this project footprint. May occur intermittently in the west of the project area.	No. This species was not recorded either nesting or within the proposal study area, despite extensive surveys over multiple years. Therefore classified as a predicted ecosystem credit species.	Not an affected species
Hieraaetus morphnoides	Little Eagle	V	No	✓	✓	✓	✓	✓	PCT's 5, 7, 8, 11, 13, 15, 17, 22, 23, 24, 26, 28, 44, 45, 46, 47, 53, 58, 74, 75, 76, 80, 110, 143, 157, 160, 163, 164, 166, 170, 171, 172, 182, 199, 216, 249, 267, 277, 319 Woodlands with associated grassland	Yes (surveyed) Recorded flying near Bundure Road (Bundure) and also east of the Cobb Highway near Curtains Creek (Boororban).	No. This species was not recorded either nesting or within the proposal study area, despite extensive surveys over multiple years. Therefore it has been classified as a predicted ecosystem credit species as it has not been recorded nesting, nor has there been evidence of previous nests etc.	Not an affected species

SCIENTIFIC NAME	COMMON NAME	BC ACT[1]	SAII	IBRA SUBREGIONS[2]					HABITAT REQUIREMENTS	SPECIES PRESENCE	AFFECTED SPECIES?	OUTCOME
				SOP	LAC	MUR	LS	IS				
Lathamus discolor	Swift Parrot	E	Yes	–	–	✓	✓	✓	As per mapped areas Winter foraging resources – Riparian and lake-side habitats	No (surveyed). The species was not observed this season. Wagga Wagga appears to be the western limit of this species and while important habitat is mapped around Wagga Wagga, none is within the proposal study area.	No. This species was not recorded and no important habitat mapped areas will be impacted.	Not an affected species
Limosa limosa	Black-tailed Godwit	V	No	–	–	✓	–	–	PCT 53, 166 Wetlands, lake edges	No (surveyed), not in important mapped areas. Suitable habitat is scant and may occur at Lake Cullivel under the right conditions.	No. This species was not recorded and no important habitat mapped areas will be impacted.	Not an affected species

SCIENTIFIC NAME	COMMON NAME	BC ACT[1]	SAII	IBRA SUBREGIONS[2]					HABITAT REQUIREMENTS	SPECIES PRESENCE	AFFECTED SPECIES?	OUTCOME
				SOP	LAC	MUR	LS	IS				
Lophochroa leadbeateri	Major Mitchell's Cockatoo	V	No	✓	✓	✓	✓	✓	PCT's, 7, 8, 11, 13, 15, 22, 23, 26, 28, 58, 74, 76, 80, 110, 143, 163, 166, 170, 171, 172, 199, 249 Callitris and mallee – arid riverine	Yes (surveyed) A group of five birds observed roosting in *A. pauper* stand near the Yanga Way Substation south of Balranald. Two birds foraging in Sunshine mallee west of Balranald.	No. Not recorded breeding or nesting so therefore classified as a predicted ecosystem credit species.	Not an affected species
Lophoictinia isura	Square-tailed Kite	V	No	✓	✓	✓	✓	✓	PCT's 5, 7, 8, 11, 13, 15, 22, 23, 26, 28, 45, 58, 74, 76, 80, 110, 143, 163, 166, 170, 171, 172, 249, 267, 277 Woodlands – Mallee, floodplain and riverine	No (surveyed) No records during fieldwork for the eastern BDAR.	No. This species was not recorded.	Not an affected species

SCIENTIFIC NAME	COMMON NAME	BC ACT[1]	SAII	IBRA SUBREGIONS[2]					HABITAT REQUIREMENTS	SPECIES PRESENCE	AFFECTED SPECIES?	OUTCOME
				SOP	LAC	MUR	LS	IS				
Manorina melanotis	Black-eared Miner	CE	Yes	✓	–	–	–	–	PCT's 170, 171, 172 Mallee	No (surveyed) No habitat of sufficient quality to support this species within the project footprint.	No. This species does not occur locally.	Not an affected species
Ninox connivens	Barking Owl	V	No	✓	✓	✓	✓	✓	PCT's 5, 7, 8, 11, 13, 15, 24, 26, 53, 74, 75, 76, 80, 110, 267, 277, 249, 319 Not mallee – woodlands and riparian	No (surveyed) not recorded in call play back/spotlight surveys. May be in vegetation along Murrumbidgee River, Colombo Creek and Yanco Creek but no response to calls.	No. This species was not recorded.	Not an affected species
Ninox strenua	Powerful Owl	V	No	–	–	–	–	✓	PCT 5	No (surveyed) No records during fieldwork for the eastern BDAR.	No. This species was not recorded.	Not an affected species
Pachycephala rufogularis	Red-lored Whistler	CE	Yes	✓	–	–	–	–	PCT's 171, 172 Mallee	No (surveyed). Mallee habitats associated with the project are of insufficient quality to support this species.	No. This species was not recorded. No records for this species in south-western NSW, including Mallee Cliffs NP and local mallee habitats.	Not an affected species

SCIENTIFIC NAME	COMMON NAME	BC ACT[1]	SAII	IBRA SUBREGIONS[2]					HABITAT REQUIREMENTS	SPECIES PRESENCE	AFFECTED SPECIES?	OUTCOME
				SOP	LAC	MUR	LS	IS				
Pedionomus torquatus	Plains-wanderer	E	Yes	–	–	✓	–	–	PCT's 44, 46 Habitat constraint: As per important mapped areas	Yes, at Bundure Travelling Stock Route.	Yes. The project traverses areas of habitat for this species, including mapped important areas for this species.	Affected species, offsets required
Polytelis anthopeplus monarchoides	Regent Parrot (eastern subspecies)	E	No	✓	✓	✓	–	–	PCT's 8, 11, 13, 15, 22, 58, 170, 171, 172 Mallee, floodplain and riparian	Yes (surveyed). Observed traversing the project footprint in mallee and riparian habitats.	Yes. Numerous birds in groups observed within the proposal study area flying through riverine woodland on the Murrumbidgee IBRA subregion. Also recorded travelling in two locations in the arid woodland/shrublands however these are not considered likely to form breeding habitat for the species, they were flying fast overhead and did not land. Not observed in the Lachlan, Lower Slopes or Inland Slopes IBRA subregions. The species is considered affected by the proposal for the Murrumbidgee IBRA subregion with associated habitat recorded for PCT 8 and PCT 11 (in moderate or moderate to high condition).	Affected species, offsets required

SCIENTIFIC NAME	COMMON NAME	BC ACT[1]	SAII	IBRA SUBREGIONS[2]					HABITAT REQUIREMENTS	SPECIES PRESENCE	AFFECTED SPECIES?	OUTCOME
				SOP	LAC	MUR	LS	IS				
Polytelis swainsonii	Superb Parrot	V	No	–	✓	✓	✓	✓	PCT's 5, 7, 11, 13, 23, 26, 28, 45, 46, 74, 75, 76, 80, 110, 249, 267, 277 Grassy and riparian woodlands	Yes (surveyed). Observed in a number of wooded locations throughout the eastern sections of the proposal study area from Four Corners eastwards.	Yes. Numerous birds in groups observed within the proposal study area. The species is considered affected by the proposal for the Murrumbidgee IBRA from Four Corners eastwards through Lower Slopes and Inland Slopes subregions with associated habitat recorded for the listed PCTs (in moderate or moderate to high condition). Not observed in the South Olary Plain or Lachlan IBRA subregions.	Affected species, offsets required
Tyto novaehollandiae	Masked Owl	V	No	–	✓	✓	✓	✓	PCT's 7, 11, 13, 24, 26, 53, 74, 76, 80, 110, 249, 267, 277 Open forest and woodlands	No (surveyed) Limited woodland habitat and no responses to call play back. No recent records for this species in the region.	No. This species was not recorded. Limited opportunities for this species to occur in the west and poor quality habitat in the east.	Not an affected species
Mammals												
Cercartetus nanus	Eastern Pygmy-possum	V	No	–	–	–	✓	✓	PCT's 74, 80, 110 Forests and woodlands	No (surveyed). Camera traps in most likely habitats, which were not generally of sufficient quality for this species.	No. This species was not recorded. Limited opportunities for this species to occur.	Not an affected species

SCIENTIFIC NAME	COMMON NAME	BC ACT[1]	SAII	IBRA SUBREGIONS[2]					HABITAT REQUIREMENTS	SPECIES PRESENCE	AFFECTED SPECIES?	OUTCOME
				SOP	LAC	MUR	LS	IS				
Chalinolobus dwyeri	Large-eared Pied Bat	V	Yes	–	–	–	–	✓	PCT 267, 277 Forests and woodlands with escarpments	No (surveyed) No roosting habitats for this species use proximate to the project area.	No. This species was not recorded. Limited opportunities for this species to occur.	Not an affected species
Lasiorhinus latifrons	Southern Hairy-nosed Wombat	E	No	✓	–	–	–	–	PCT's 58, 170, 171, 172 Suitable semi-arid to arid grassy woodlands with suitable burrowing substrates	No (surveyed). Project footprint outside of the known range of this species.	No. This species was not recorded.	Not an affected species
Miniopterus orianae oceanensis	Large Bent-winged Bat			–	–	–	–	✓	PCT 277	No (surveyed) No records during fieldwork for the eastern BDAR.	No. This species was not recorded.	Not an affected species

SCIENTIFIC NAME	COMMON NAME	BC ACT[1]	SAII	IBRA SUBREGIONS[2]					HABITAT REQUIREMENTS	SPECIES PRESENCE	AFFECTED SPECIES?	OUTCOME
				SOP	LAC	MUR	LS	IS				
Myotis macropus	Southern Myotis	V	No	–	–	✓	✓	✓	PCT's 5, 7, 8, 11, 74, 182, 249 Forests and woodlands	Yes (surveyed). Recorded during targeted surveys on Murrumbidgee River.	Yes. Recorded during targeted surveys on Murrumbidgee River. All habitat on the subject land where the subject land is within 200 m of a waterbody with pools/ stretches 3 m or wider including rivers, creeks, billabongs, lagoons, dams and other waterbodies on the subject land must be mapped. The species is considered affected by the proposal in the Murrumbidgee subregion in PCT 8 (in moderate to good condition). Not recorded in the South Olary Plain, Lachlan Murrumbidgee IBRA subregions.	Affected species, offsets required
Petaurus norfolcensis	Squirrel Glider	V	No	–	–	–	✓	✓	PCT's 5, 74, 75, 76, 80, 110, 249, 267, 277 Forests and woodlands	Yes (surveyed). Individuals captured in linear roadside vegetation east of Lockhart.	Yes. Recorded during targeted surveys east of Lockhart. The species is considered affected by the proposal in the Inland Slopes and Lower Slopes subregions in PCT's 5, 74, 75, 76, 80, 110, 249, 267, 277 (in moderate to high condition). Not recorded in the South Olary Plain, Lachlan or Murrumbidgee IBRA subregions.	Affected species, offsets required

SCIENTIFIC NAME	COMMON NAME	BC ACT[1]	SAII	IBRA SUBREGIONS[2]					HABITAT REQUIREMENTS	SPECIES PRESENCE	AFFECTED SPECIES?	OUTCOME
				SOP	LAC	MUR	LS	IS				
Petaurus norfolcensis - endangered population	Squirrel Glider in the Wagga Wagga Local Government Area	E	No	–	–	–	✓	✓	PCT's 5, 74, 75, 76, 80, 110, 249, 267, 277 Forests and woodlands	Yes (surveyed). Individuals captured in linear roadside vegetation east of Lockhart.	Yes. Recorded during targeted surveys east of Lockhart. The species is considered affected by the proposal in the Inland Slopes and Lower Slopes subregions in PCT's 5, 74, 75, 76, 80, 110, 249, 267, 277 (in moderate to high condition). Not recorded in the South Olary Plain, Lachlan or Murrumbidgee IBRA subregions.	Affected species, offsets required
Petrogale penicillata	Brush-tailed Rock-wallaby	E	Yes	–	–	–	–	✓	PCT's 267, 277 Forests and woodlands	No (surveyed). No suitable habitat occurs.	No. This species was not recorded. There is no suitable habitat associated with the project footprint.	Not an affected species
Phascogale tapoatafa	Brush-tailed Phascogale	V	No	–	–	–	–	✓	PCT's 74 Forests and woodlands	No (surveyed).	No. This species was not recorded.	Not an affected species
Phascolarctos cinereus	Koala	V	No	–	–	✓	✓	✓	PCT's 5, 7, 8, 11, 13, 15, 74, 75, 76, 80, 110, 249, 267, 277 Forests and Woodlands	No (surveyed).	No. This species was not recorded.	Not an affected species
Pseudomys desertor	Desert Mouse	CE	Yes	✓	–	–	–	–	PCT's 24, 163, 171, 172 Spinifex mallee	No (surveyed). Unlikely due to known range and reduced habitat quality.	No. This species was not recorded.	Not an affected species

SCIENTIFIC NAME	COMMON NAME	BC ACT[1]	SAII	IBRA SUBREGIONS[2]					HABITAT REQUIREMENTS	SPECIES PRESENCE	AFFECTED SPECIES?	OUTCOME
				SOP	LAC	MUR	LS	IS				
Pteropus poliocephalus	Grey-headed Flying-fox	V	No	–	–	–	✓	✓	PCT's 5, 76, 267 Habitat constraint: Breeding camps	No (surveyed).	No. This species was not recorded.	Not an affected species

5.6.4 Recorded threatened fauna species

A total of 20 threatened fauna species listed under the BC Act were recorded within the proposal study area. These species are:

- Black Falcon (*Falco subniger*) – Vulnerable
- Brolga (*Grus rubicunda*) – Vulnerable
- Bolam's Mouse (*Pseudomys bolami*) – Endangered
- Chestnut Quail-thrush (*Cinclosoma castanotum*) – Vulnerable
- Corbens's Long-eared Bat (*Nyctophilus corbeni*) – Vulnerable
- Diamond Firetail (*Stagonopleura guttata*) – Vulnerable
- Dusky Woodswallow (*Artamus cyanopterus*) – Vulnerable
- Gilbert's Whistler (*Pachycephala inornata*) – Vulnerable
- Hooded Robin (*Melanodryas cucullata cucullata*) – Vulnerable
- Inland Forest Bat (*Vespadelus baverstocki*) – Vulnerable
- Little Eagle (*Hieraaetus morphnoides*) – Vulnerable
- Major Mitchell's Cockatoo (*Lophochroa leadbeateri*) – Vulnerable
- Mallee Worm-lizard (*Aprasia inaurita*) – Endangered
- Plains Wanderer (*Pedionomus torquatus*) – Endangered (SAII)
- Purple-crowned Lorikeet (*Glossopsitta porphyrocephala*) – Vulnerable
- Regent Parrot (eastern subspecies) (*Polytelis anthopeplus monarchoides*) – Endangered
- Spotted Harrier (*Circus assimilis*) – Vulnerable
- Southern Myotis (*Myotis macropus*) – Vulnerable
- Squirrel Glider (*Petaurus norfolcensis*) – Vulnerable
- Superb Parrot (*Polytelis swainsonii*) – Vulnerable.

Of these 20 species, four are listed as Endangered (with one being listed as SAII species) and 16 are listed as Vulnerable. A brief overview and description of each species is provided below.

5.6.4.1 Black falcon

The Black Falcon (*Falco subniger*) is listed as Vulnerable (Ecosystem Credit) in NSW under the BC Act and is not listed as threatened under the Commonwealth EPBC Act.

Widely, but sparsely, distributed in New South Wales, mostly occurring in woodland, shrubland and grassland in the arid and semi-arid zones, especially wooded watercourses and agricultural land with scattered remnant trees. It is usually associated with streams or wetlands, visiting them in search of prey and often using standing dead trees as lookout posts. Habitat selection is generally influenced more by prey densities than by specific aspects of habitat floristics or condition, although in agricultural landscapes it tends to nest in healthy, riparian woodland remnants, especially in arid areas with a concentration of avi-fauna diversity (Marchant and Higgins 1993). An open country specialist taking prey from the air, ground and sometimes from the water (Marchant and Higgins 1993).

Black Falcons were observed in open country at Bundure Road North West of Yanco Creek and at the Ski Club on Colombo Creek on Coonong Road.

Powerline infrastructure may represent a possible collision risk for this species, but most of its flight patterns are not at high elevations. They occasionally use the nest of other birds, such as ravens and crows, on power poles and will use power lines and poles as roosting sites and hunting vantage points (Marchant and Higgins 1993).

Photo 5-23 Black Falcon Bundure Road, Bundure

5.6.4.2 Bolam's Mouse

Bolam's Mouse (*Pseudomys bolami*) is listed as Endangered (Ecosystem Credit) in NSW under the BC Act and is not listed as threatened under the Commonwealth EPBC Act. Bolam's Mouse is a nocturnal species known to widely inhabit chenopod dominated communities across southern South Australia and the arid southeast corner of Western Australia. It's range only extends into NSW in the far southwestern corner (Van Dyck and Strahan 2008). It feeds on seeds, including plant material and invertebrates in its diet and the species is known to quickly increase in numbers after periods of high rainfall (Van Dyck and Strahan 2008). In previous surveys it was captured in a pitfall trap in floodplain habitat dominated by Black Box with an understorey dominated by chenopod shrubs. During this survey a single individual was captured in spinifex mallee northeast of Euston. The disturbance area will remove habitats used by this species in the western areas of the project.

5.6.4.3 Brolga

The Brolga (*Grus rubicunda*) is listed as Vulnerable (Ecosystem Credit) in NSW under the BC Act and is not listed as threatened under the Commonwealth EPBC Act.

The Brolga was formerly found across Australia, except for the south-east corner, Tasmania and the south-western third of the country. It is still abundant in the northern tropics, but sparse across much of the southern part of its range. The species is only very rarely encountered in coastal NSW, although number of records increase northward from about the Manning River floodplain into the mid-north coastal region. In NSW records suggest there is a north to south flyway that is used by brolgas on the western plains with a cohort of the population moving south to western Victoria and breeding, although such movements appear to be dependent on rainfall filling ephemeral wetlands. Often feed in dry grassland or ploughed paddocks or even desert claypans, they are dependent on wetlands too, especially shallow swamps, where they will forage with their head entirely submerged.

A pair of Brolgas were observed breeding in an ephemeral dam about 2.5 km from the disturbance area on Federation Way, south of the Gums TSR.

The Brolga, like many crane species, often fly at very high elevations, especially during long distance movements, and are at risk of power line collision. Brolgas, particularly young birds, appear to be at a greater risk of strike while descending and ascending through powerlines to terrestrial habitats they frequent for foraging and/or breeding.

Photo 5-24 Male Brolga foraging in field near nest dam

Photo 5-25 Female Brolga sitting on nest south of the Gums TSR

5.6.4.4 Chestnut Quail-thrush

The Chestnut Quail-thrush (*Cinclosoma castanotum*) is listed as Vulnerable (Ecosystem Credit) in NSW under the BC Act and not listed as threatened under the EPBC Act.

The Chestnut Quail-thrush is a medium-sized bird, which spends much of its time foraging on the ground for invertebrates and prefers canopy cover and open shrubby habitats containing ground layers with suitable foraging niches. Although its habitat preferences extend to a range of woodland types in the semi-arid zone (Higgins and Peter 2002), within the alignment's habitats it was only encountered within mallee on sandy substrates. The species nests at ground level at the base of a mallee tree, shrub, fallen branch or grass tuft (Pizzey and Knight 2012), so is not dependent on old-growth trees for breeding purposes. They can tolerate more open understories provided there is sufficient overhead cover from mallee, or shrub canopies, and understory complexity/litter for foraging. Birds were observed at two locations in mallee east of the Buronga substation; within the Sunny-side reserve west of Balranald and in spinifex covered mallee dunes to north of Euston. It is expected to occur widely in mallee habitat associated with the study area where there is sufficient canopy cover and at least moderate understorey cover and woodland floor debris.

The Chestnut Quail-thrush was observed in the alignment during the 2019/2021 survey periods at two locations in spinifex mallee and shrubby mallee woodlands north of Euston.

The disturbance area will clear and maintain cleared linear strips of mallee inhabited by this species reducing its area of available habitat. Clearing works have the potential to fragment habitats and exaggerate breaks between patches of occupied habitat where clearing is associated with existing infrastructure easements. Although this species is capable of crossing easement breaks in canopy vegetation, the reduced cover in newly managed easements will place quail-thrush at a greater risk of predation from birds of prey.

Photo 5-26 Male Chestnut Quail-thrush in spinifex mallee habitat northeast of Euston

5.6.4.5 Corben's Long-eared Bat

Corben's Long-eared Bat (*Nyctophilus corbeni*) is listed as Vulnerable under the NSW BC Act and listed as Vulnerable under the Commonwealth EPBC Act..

Corben's Long-eared Bat are known to inhabit a range of vegetation types including mallee, bulloke *Allocasuarina luehmannii* and box Eucalypt forest across large portions of central and western NSW (Department of Planning Industry and Environment 2021). Typically, this species utilizes understorey vegetation to hunt non-flying prey, including caterpillars and beetles, and has even been known to hunt on the ground (Department of Planning Industry and Environment 2021). This species utilizes tree hollows, crevices and loose bark for roosting habitats (Department of Planning Industry and Environment 2021).

Two Corben's Long-eared Bats were captured during harp trapping surveys in PCT 170 and PCT 171 or ecotones of both PCTs on a property north-east of Balranald. The proposal would represent an incremental loss of woodland habitat for this species in the form of roosting, hunting and mating habitats.

Photo 5-27 Corben's Long-eared bat captured in old-growth mallee habitat north-east of Balranald

5.6.4.6 Diamond Firetail

The Diamond Firetail (*Stagonopleura guttata*) is listed as Vulnerable (Ecosystem Credit) in NSW under the BC Act and is not listed as threatened under the Commonwealth EPBC Act.

Distributed through central and eastern NSW, extending north into southern and central Queensland and south through Victoria to the Eyre Peninsula, South Australia. In NSW, the species occurs predominantly west of the Great Dividing Range, although populations are known from drier coastal areas (Blakers, Davies et al. 1984, Schodde and Mason 1999). Occurs in a range of eucalypt dominated communities with a grassy understorey including woodland, forest and mallee. Most populations occur on the inland slopes of the dividing range (Garnett and Crowley 2000). Firetails nest in trees and bushes, and forage on the ground, largely for grass seeds and other plant material, but also for insects (Blakers, Davies et al. 1984, Read 1994).

The Diamond Firetail was observed in association with the proposal study area within open woodland west of Holbrook Road to the southwest of Wagga Wagga.

The Diamond Firetail may be impacted by the disturbance area by the incremental loss of woodland habitats.

Photo 5-28 Diamond Firetail in open grassy woodland southwest of Wagga Wagga

5.6.4.7 Dusky Woodswallow

The Dusky Woodswallow (*Artamus cyanopterus*) is listed as Vulnerable (Ecosystem Credit) in NSW under the BC Act and not listed as threatened under the EPBC Act.

Dusky woodswallows are widespread in eastern, southern and south-western Australia. The species occurs throughout most of New South Wales, but is sparsely scattered in, or largely absent from, much of the upper western region. Most breeding activity occurs on the western slopes of the Great Dividing Range. It primarily inhabits dry, open eucalypt forests and woodlands, including mallee associations, with an open or sparse understorey of eucalypt saplings, acacias and other shrubs, and a ground-cover of grasses or sedges and fallen woody debris. It has also been recorded in shrublands, heathlands and very occasionally in moist forest or rainforest. Also found in farmland, usually at the edges of forest or woodland.

Dusky Woodswallows were observed at the crossing of the Murrumbidgee River south of Balranald and in woodland west of Holbrook Road to the southwest of Wagga Wagga.

The Dusky Woodswallow will be impacted by the disturbance area by an incremental loss of woodland habitat.

Photo 5-29 Dusky Woodswallows are reliant for woodland habitats for foraging and breeding

5.6.4.8 Gilbert's Whistler

Gilbert's Whistler (*Pachycephala inornata*) is listed as Vulnerable (Ecosystem Credit) in NSW under the BC Act and is not listed as threatened under the Commonwealth EPBC Act.

The Gilbert's Whistler occurs in the ranges, plains and foothills of arid and semi-arid timbered habitats. In NSW it occurs mostly in mallee shrubland, but also in box-ironbark woodlands, Cypress Pine and Belah woodlands, and River Red Gum forests. Within the mallee the species is often found in association with an understorey of spinifex and low shrubs including acacias, hakeas, sennas and grevilleas. In woodland habitats, the understorey comprises dense patches of shrubs.

Four Gilbert's Whistlers were recorded in Mallee habitats within the Sunshine conservation lands west of Balranald. The habitat was dominated by adolescent regrowth mallee with an open shrubby understorey. Birds were recorded a considerable distance away from the edges of mallee woodland where the existing powerline easement occurs at the mallee's boundary with cropping lands.

Gilbert's Whistlers are likely to be impacted by the disturbance area due to an incremental loss of suitable foraging and potential breeding habitat.

Photo 5-30 Male Gilbert's Whistler Sunshine conservation lands west of Balranald

5.6.4.9 Hooded Robin

The Eastern subspecies of the Hooded Robin (*Melanodryas cucullata cucullata*) is listed as Vulnerable (Ecosystem Credit) in NSW under the BC Act and is not listed as threatened under the Commonwealth EPBC Act.

Found across Australia, except for the driest deserts and the wetter coastal areas – northern and eastern coastal Queensland and Tasmania. However, 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 (subspecies cucullata) is found from Brisbane to Adelaide and throughout much of inland NSW, with the exception of the extreme north-west, where it is replaced by subspecies picata. Two other subspecies occur outside NSW. Prefers lightly wooded country, usually open eucalypt woodland, acacia scrub and mallee, often in or near clearings or open areas. Requires structurally diverse habitats featuring mature eucalypts, saplings, some small shrubs and a ground layer of moderately tall native grasses. This is one of a suite of species that has declined in woodland areas in south-eastern Australia (Garnett and Crowley 2000, Traill and Duncan 2000).

Hooded Robins were recorded at two locations in mallee habitats west of Balranald. At each location multiple birds were observed some showing immature plumage.

Hooded Robins are likely to be impacted by the disturbance area by an incremental loss of suitable foraging and potential breeding habitat.

Photo 5-31 Hooded Robin family group in mallee west of Balranald

Photo 5-32 Male Hooded Robin in mallee west of Balranald

5.6.4.10 Inland Forest Bat

The Inland Forest Bat (*Vespadelus baverstocki*) is listed as Vulnerable under the NSW BC Act and is not listed under the Commonwealth EPBC Act.

The distribution of the Inland Forest Bat is not well known due to similarities with some species that occur within the same distribution. However, records indicate that it is present in south-western NSW with records as far east as Balranald area (Department of Planning Industry and Environment 2021). This species is known to roost in very small tree hollows in stunted trees only a few meters high (Department of Planning Industry and Environment 2021). Other habitat requirements for this species ae poorly known but this species has been recorded from a range of vegetation types including Mallee, Mulga and River Red Gum communities (Department of Planning Industry and Environment 2021).

The Inland Forest Bat was captured along the bank of the Murrumbidgee River in River Red Gum Forest with adjacent Black Box open woodland. The proposal has the potential to impact on the Inland Forest Bat through an incremental loss of habitat represented by the removal of hollow bearing trees in River Red gum and Black Box communities, most notably along the Murrumbidgee River where the Inland Forest Bat was recorded.

Photo 5-33 Inland Forest Bat captured along the Murrumbidgee Creek west of Balranald

5.6.4.11 Little Eagle

The Little Eagle (*Hieraaetus morphnoides*) is listed as Vulnerable under the NSW BC Act and is not listed as threatened under Commonwealth legislation.

The Little Eagle is found throughout the Australian mainland except the most densely forested parts of the Dividing Range escarpment and occurs as a single population throughout NSW. It occupies open eucalypt forests, woodlands or open woodlands. Sheoak or Acacia woodlands and riparian woodlands of interior NSW are also used. Little Eagles build their nests in tall living trees within a remnant patch, where pairs build a large stick nest in winter. They prey on a range of small birds, reptiles and mammals including introduced species such as rabbits, occasionally adding large insects and carrion. A Little Eagle was observed flying over the proposal study area, south of Hay and east of the Cobb Highway near Curtains Creek. A second record for Little Eagle was made flying over a location at Bundure Rd, Bundure.

The proposal has the potential to impact on the Little Eagle through the loss of nesting opportunities represented by cleared canopy vegetation and it is likely at risk of powerline impact due to its habits of soaring at relatively high elevations. Despite this, no nests or previous nest that could be attributable to this species were recorded within the proposal study area.

Photo 5-34 Little Eagle, Low Darling Road (western section)

Photo 5-35 Little Eagle, Rufus (western section), at the common soaring elevation

5.6.4.12 Major Mitchell's Cockatoo

This species is listed as Vulnerable (Species/Ecosystem Credit) in NSW under the BC Act and not listed under the EPBC Act. This species is a dual Species/Ecosystem Credit Species and requires surveys to determine if breeding is associated with the proposal; its presence can be assumed.

Found across the arid and semi-arid inland, from south-western Queensland south to north-west Victoria, through most of South Australia, north into the south-west Northern Territory and across to the west coast between Shark Bay and about Jurien. In NSW it is found regularly as far east as about Bourke and Griffith, and sporadically further east than that. Inhabits a wide range of treed and treeless inland habitats, always within easy reach of water. Feeds mostly on the ground, especially on the seeds of native and exotic melons and on the seeds of species of saltbush, wattles and cypress pines. Nesting, in tree hollows, occurs throughout the second half of the year; nests are at least 1 km apart, with no more than one pair every 30 square kilometres (Garnett and Crowley 2000).

Major Mitchell's Cockatoos were recorded close to the proposal alignment south of Balranald adjacent to the Balranald Substation on Yanga Way, and in Mallee habitats south (<1 km) of the alignment and Sunnyside Conservation Land west of Balranald during targeted seasonal surveys. Five birds observed at Yanga Way Substation were observed going to roost in a stand of *Casuarina pauper*. No trees of sufficient size to represent breeding opportunities for Major Mitchell's Cockatoo were observed at this location. Mallee habitats associated with the second sighting west of Balranald are largely composed of recovering communities with insufficient age to develop hollows of the size required by this species for breeding purposes. It is considered most likely that hollows of sufficient size for breeding Major Mitchell's Cockatoo are very sparsely distributed through the mallee country in the western sections of the alignment and therefore birds may often resort to either Black Box and/or River Red Gum communities associated with the flood plain and riparian habitats of the Murray and Murrumbidgee Rivers for breeding purposes.

The proposal traverses such habitats in association with the Murrumbidgee crossing south of Balranald. Impacts to this species will most likely be limited to the potential loss of breeding trees. Although they are capable of flying at considerable heights, most movements are within or just above canopy heights, so they are considered likely to have limited risk of collision with powerline infrastructure.

Photo 5-36 Major Mitchell's Cockatoos at roost Yanga Way substation

5.6.4.13 Mallee Worm-lizard

The Mallee Worm-lizard (*Apraisia inaurita*) is listed as Endangered (Species Credit) under the NSW BC Act and is not listed as threatened under the Commonwealth EPBC Act. The species is reported to occur in semi-arid mallee woodlands on red sand (Wilson 2021). Its distribution extends across the most southerly arid and semi-arid lands of South Australia, extending west into south-eastern Western Australia and east into southwest NSW (Cogger 2014). In the east of its range it is known to burrow into sandy substrates and shelters under mallee roots, surface litter, in its ant prey nests and may be dependent on *Triodia scariosa*, a species of arid grass colloquially called Spinifex (Heritage 2021). A single individual was unearthed by the accidental dislocation of a mallee root along the edge of the existing transmission line easement northwest of Euston, the location is shown below in Photo 5-37.

Photo 5-37 Mallee Worm-lizard habitat northwest of Euston NSW

5.6.4.14 Painted Honeyeater

The Painted Honeyeater is listed as Vulnerable (Ecosystem Credit) under the NSW BC Act and is listed as Vulnerable under the Commonwealth EPBC Act.

The Painted Honeyeater is dependent on mistletoes, including species that parasitise eucalypts, casuarinas and allocasuarinas, but foremostly mistletoes parasitising acacias. Its distribution occurs within the dry inland areas of Victoria NSW and Qld, extending into the gulf country sections of the eastern Northern Territory, which overlies the belts of inland acacia communities including mulga and brigalow in the north and weeping myall in the south. The species is nomadic in response to the intermittent distribution of fruiting resources produced by mistletoes throughout its range and is sometimes absent from seasonal areas, even when resources are present, due to an abundance of resources elsewhere in its range. The distribution of Painted Honeyeaters in the study area most likely occurs through those areas, roughly from Wagga Wagga in the east and Balranald in the west, where Weeping Myall occurs in remnant stands across open plains, with notable stands along Four Corners Road, associated with the Dinawan Substation and as remnants in TSR blocks at Four Corners TSR, Fernbark TSR, and the plains associated with the Silesian Downs property, along the McLennans Bore Road.

Photo 5-38 Painted Honeyeater in Weeping Myall (*Acacia pendula*)

5.6.4.15 Plains Wanderer

The Plains Wanderer is listed as Endangered (Species Credit) under the NSW BC Act and listed as Critically Endangered under the Commonwealth EPBC Act. The Plains-wanderer is a relatively small grassland bird that exists as a single species in its monotypic family. It is most closely related to the shorebirds; its closest genetic associations with the seedsnipes of South America.

Although the Plains-wanderer's range extends through northern Victoria, South Australia, the lower Northern Territory and through western NSW to south-western Queensland, their stronghold is in the NSW Riverina district and the northern Victoria grasslands. The proposal traverses the most important area for the species in NSW which roughly extends from Griffith in the north to Deniliquin in the south and from west of the Cobb Highway to the Urana area in the east.

From comparisons of genetic material, between the Victorian and NSW Riverina populations, there is evidence that the two areas share individuals, although movements haven't been confirmed through banding (David Parker pers. comm.). There is at least some hard evidence that Plains Wanderers move relatively large distances, with a bird being recorded over 140 km from a banding location with significant barriers (river and woodland) between the two locations (David Parker pers comm.).

Although it is superficially similar in habitat choice to quail, it is unable to negotiate dense grassland types like quail do and it is far less likely to flush when approached. They avoid woodland habitats by a significant margin, which is thought to be due to the potential haunt for predators that woodlands represent. Their difficulty in negotiating dense grassland types and preference for high grassland plant diversity has limited the availability of preferred habitat types due to widespread pasture improvement and grazing pressures throughout its natural range. Their habitat preference is for substrates denuded of the "A" horizon where grasses can only grow sparsely, leaving soil substrates open and providing opportunities for short native herbs and tufted native grasses to offer forage and cover. Their highly specific requirements for habitat quality and structure is further dependant on land use and grazing regimes; sheep often being employed as a means of reducing grass densities during periods of strong growth returning preferred habitat areas to structural condition preferred by the bird.

The Plains Wanderer is diurnal in its habits, but almost impossible to see during daylight hours. All surveys conducted for the species are therefore undertaken at night. Currently, the species is experiencing a low population ebb because of a prevailing dry period extending back twenty years and this weather pattern has contributed to a population reduction from an estimated 3,000 individuals down to approximately 700 birds during that period (David Parker pers. comm.). There is strong evidence that they move in response to changes in habitat quality, with birds present in locations when habitat is of high quality and absent when habitat quality wanes (David Parker pers. comm.). This tendency to move in

response to habitat quality, which is widely recorded in many other bird species, has important implications for results returned from Plains Wanderer survey works.

Plains Wanderer surveys were conducted during nocturnal hours through the use of both spotlighting and the use of a thermal imaging scope. Habitat assessments were made during daylight hours and habitats within Oolambeyan National Park were surveyed for reference site comparisons to the habitats traversed by the disturbance area. No Plains Wanderers were observed at Oolambeyan National Park.

Surveys for Plains-wanderers were conducted wherever property access was made available, with the properties along North Boundary Road showing patchy areas of promise, and other areas such as the Dinawan Substation site, Coonong Station and Silesian Downs also provided potential habitat. Reasonable quality habitat, but past its best condition, was surveyed at The Gums TSR, without success, but three Plains Wanderers were observed in the best available habitat observed during the survey periods at Bundure TSR. The birds were observed under very wet conditions on 25 May 2021 as the plumage of the male in the photo below shows. The two mature birds were located with spotlighting methodology, the immature female located more distantly with a thermal imaging scope.

Most of the surveys for the proposal were conducted on lands of marginal condition, although reasonable quality habitat, but past its best condition, was surveyed at The Gums TSR. The best available habitat was observed at Bundure TSR, and despite heavy rain and strong wind, three Plains Wanderers were located at this location. An adult female and male were found together and some distance away an immature female was discovered. Surveys for Plains-wanderers were conducted wherever property access was made available. Furthermore, the lambing status of many properties prevented access to a number of land holdings, or surveys were restricted to diurnal periods, when the birds are nigh on impossible to find. Therefore, as a consequence of a combination of low habitat condition and both limited access and timings of survey effort, Plains-wanderer were not observed in a number of locations where they might otherwise occur during times of better habitat condition.

Impacts to Plains-wanderers are largely limited to impacts of substrates supporting preferred habitat and the loss of preferred habitat by the maintaining of access tracks and powerline construction support, laydown, park-up, management facilities and pads.

Photo 5-39 Mature female Plains-wanderer Bundure TSR

Photo 5-40 Mature male Plains-wanderer Bundure TSR

Photo 5-41 Immature female Plains-wanderer Bundure TSR

Photo 5-42 Plains-wanderer thermal image Bundure TSR

5.6.4.16 Purple-crowned Lorikeet

The Purple-crowned Lorikeet (*Glossopsitta porphyrocephala*) is listed as Vulnerable (Ecosystem Credit) under the NSW BC Act and is not listed as threatened under the Commonwealth EPBC Act. The Purple-crowned Lorikeet's distribution is predominantly southern and extends from Canberra in the east to the western coasts of south Western Australia. In the east the species occurs largely in Victoria with a relatively small spattering of records through NSW (eBird, Birdata). Outlying records in NSW occur in Canberra, and Deniliquin, with older records prior to the turn of the century in the western mallee habitats as far north as Mungo National Park and Tarawari Nature Reserve (Birdata). The extremely low numbers of records in western NSW is likely exaggerated by a low number of surveys, due to the predominance of land under private ownership, although the species appears to be very sparsely distributed in NSW habitats, with no records from Mallee Cliffs National Park and a very own number of records from the Mildura/Wentworth region. During surveys for the disturbance area, and the previous more westerly component of the project, as conducted through the period from spring 2019 to spring 2021, the species has only been recorded once. Although small and difficult to see, lorikeets in general are relatively easy birds to detect as they regularly move between foraging locations and are usually vocal when flying. The record associated with the disturbance area, was in mallee habitat to the west of Balranald and was a heard only record of at least one bird flying though. The only possible confusion species, Little Lorikeet, was eliminated as a possibility, due to the complete lack of records in the locality of the observation. The disturbance area will remove potential foraging habitat for this species, with the loss of breeding habitat considered generally unlikely, due to the paucity of mallee habitats with sufficient age to carry an abundance of hollows.

5.6.4.17 Regent Parrot (eastern subspecies)

This species is listed as Endangered (Species Credit) in NSW under the BC Act and Vulnerable under the EPBC Act. It was observed during the targeted seasonal surveys. Birds were observed within the disturbance area at six locations and observed regionally at five other locations during the survey period.

The range of the eastern Regent Parrot is restricted to a single population occurring within semi-arid catchment areas of the lower Murray Darling basin in south-eastern Australia, and extending across inland areas of south-eastern South Australia, north-western Victoria and south-western NSW (Menkhorst, Rogers et al. 2019). During the last 100 years the eastern subspecies has declined in both abundance and distribution (Baker-Gabb and Hurley 2011). Favoured breeding habitats are reported as large trees with suitable hollows, generally in riparian forests, but occasionally in stands of tall forest near patches of mallee. There seems to be a general preference for River Red Gum over Black Box for breeding purposes although the latter is occasionally used for breeding (Higgins 1999). The species is dependent on the relatively close juxtaposition of key habitat requirements, being; tall mature riparian forest for breeding and roosting sites (mallee used for roosting in the non-breeding season in some areas), suitable mallee and/or cereal crop foraging areas, and corridors of vegetation for movements between key habitat types (Baker-Gabb and Hurley 2011).

The current distribution encompasses the study area, although the most likely Murray River associated breeding areas (Baker-Gabb and Hurley 2011) do not extend to the disturbance area. However, the disturbance area traverses potential breeding habitat in the River Red Gum communities associated with the Murrumbidgee River south of Balranald.

Regent Parrots were observed in association with the disturbance area on six occasions during surveys conducted between spring 2019 and spring 2021. In five of those observations the birds were observed from mallee woodlands in locations along the disturbance area between Balranald and Euston. Eighty-five birds, flying over mallee woodland from south to north in small groups, were observed to the north of Euston during the dusk period while ecologists were preparing for nocturnal surveys in February 2020. The birds were all flying strongly in the same direction, and appeared to be heading to roost, suggesting that the roosting location would be in mallee woodlands, as no alternative vegetation communities occur to the north of the location. Eighteen birds were observed flying over ecotonal habitat composed of mallee and black oak, approximately 4 km east of the above location on the previous day, although the birds were observed in mid-morning. Three other mallee habitat observations were made in habitats to the west of Balranald, consisting of two sightings in early 2021 of seventeen birds and 2 birds respectively, and a third observation made of about a dozen birds just to the west of the Sunnyside conservation area in April 2020. The sixth observation of Regent Parrots in association with the disturbance area was of around 20 birds flying north across the proposal alignment in River Red Gum woodland on the eastern side of the Murrumbidgee River crossing.

Regional observations of Regent Parrots during the combined survey period between Spring 2019 and Spring 2021 consisted of five observations: 2 birds along the Sturt Highway 17 km west of Balranald in March 2021, several flocks of birds flying through riparian habitats at Robinvale prior to sunset in February 2020, from 2 to 10 birds on separate days along the Murray River at Euston in September 2021, two birds along the Sturt Highway nine kilometres west of Euston in May 2020 and two birds in Black Box Woodland at Trentham Cliffs in May 2020.

The disturbance area will remove potential foraging and roosting habitat for the Regent Parrot in mallee habitats and potential roosting and breeding habitat in riparian habitats associated with the Murrumbidgee crossing.

5.6.4.18 Spotted Harrier

The Spotted Harrier (*Circus assimilis*) is listed as Vulnerable (Ecosystem Credit) in NSW under the BC Act and not listed as threatened under the EPBC Act. The Spotted Harrier was observed in the alignment during the 2019/2021 survey periods at three locations. Bundure Road grasslands, the Gums TSR and north of the alignment along the Yamma Road.

Occurs throughout the Australian mainland, except in densely forested or wooded habitats of the coast, escarpment and ranges, and rarely in Tasmania. Individuals disperse widely in NSW and comprise a single population. Occurs in grassy open woodland including Acacia and mallee remnants, inland riparian woodland, grassland and shrub steppe. It is found most commonly in native grassland, but also occurs in agricultural land, foraging over open habitats including edges of inland wetlands. Preys on terrestrial mammals (e.g. bandicoots, bettongs, and rodents), birds and reptile, occasionally insects and rarely carrion.

This species is likely to occur anywhere within the disturbance area where it traverses open plain habitats dominated by grassy or chenopod lands. Areas containing occasional stands of canopy trees in open habitats are also likely to represent potential breeding sites.

The Spotted Harrier is not considered to be directly disadvantaged by clearing in the disturbance area, apart from the possible loss of nesting sites in otherwise open country. It is most likely to be impacted by the potential management of open country habitats in regard to impacts on its prey species' densities. Otherwise an increase in open habitats would increase its area of potential foraging habitat.

Photo 5-43 Immature Spotted Harrier Bundure Road Bundure

5.6.4.19 Southern Myotis

The Southern Myotis is listed as Vulnerable under the NSW BC Act and is not listed as threatened under the Commonwealth EPBC Act.

The Southern Myotis is found in the coastal band from the north-west of Australia, across the top-end and south to western Victoria. It is rarely found more than 100 km inland, except along major rivers. They generally roost in groups of 10–15 close to water in caves, mine shafts, hollow-bearing trees, storm water channels, buildings, under bridges and in dense foliage. The species forages over streams and pools catching insects and small fish by raking their feet across the water surface.

A single Southern Myotis was observed foraging for aquatic invertebrates from the surface of the Murrumbidgee River south of Balranald and adjacent to the existing powerline easement's crossing of the Murrumbidgee River. The proposal may remove riparian vegetation containing roosting hollows for this species where it crosses creeks and rivers.

Photo 5-44 Southern Myotis often use man-made structures for roosting and breeding nurseries

5.6.4.20 Squirrel Glider

The Squirrel Glider is listed as Vulnerable (Species Credit) under the NSW BC Act and it is not listed as threatened under the EPBC Act. It is also listed under the NSW BC Act as an Endangered Population (Species Credit) in the Wagga Wagga Local Government Area.

The species is widely, though sparsely, distributed in eastern Australia, from northern Queensland to western Victoria. It inhabits a range of woodland/forest types from coastal swamp forests and Blackbutt-Bloodwood forest with heath understorey in coastal areas, to mature or old growth Box, Box-Ironbark woodlands and River Red Gum forests west of the Great Dividing Range. Prefers mixed species stands with a shrub or Acacia midstorey. 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.

This species was recorded in linear stands of woodland east of Lockhart to Wagga Wagga. Acacia understoreys were generally present in the locations individuals were trapped or photographed by remote camera. While much of this region of the proposal study area has scant patches of extensive woodland, the linear patches of woodland along road edges and watercourses are often considerable in length and without significant breaks. Construction works and ongoing maintenance of canopy vegetation within the disturbance area have the potential to introduce and maintain (respectively) breaks in occupied vegetation which would fragment and isolated areas of occupied habitat for this species; placing existing populations at risk of isolation from each other with the added potential to remove occupied hollow trees.

Photo 5-45 Squirrel Glider Bullenbung to The Rock Road – The Rock

Photo 5-46 Squirrel Glider Bullenbung to The Rock Road – The Rock

5.6.4.21 Superb Parrot

This species is listed as Vulnerable (Ecosystem species) in NSW under the BC Act and Vulnerable under the EPBC Act.

In relation to the proposal, in online records (eBird as of 23-09-2021), the species' current range extends west to at least Hay, with literature reporting the western limit to Balranald (Pizzey and Knight 2012). Its range encompasses all lands containing woodland habitats north and south of the proposal alignment to, and beyond, Wagga Wagga in the east.

Although records occur as far west as Hay, open plain habitats largely dominate the alignment footprint west of wooded habitats along Four Corners Road and provide unsuitable habitat for this species. No birds have been observed in the vicinity of Balranald during onsite surveys and site access movements through the region for the project. During onsite fauna surveys, and travel between survey locations, Superb Parrots were observed in association with wooded vegetation from Four Corners Road west of Kidman Way, in the west, to woodland vegetation in the wider vicinity of the project's eastern termination at the Boiling Down Road Substation in Wagga Wagga.

Superb Parrots were observed in a range of woodland types including melaleuca canopies at Four Corners Road, mallee canopies and understories along McLennons Bore Road, Weeping Myall at the Dinawan substation site, narrow road-side box/gum vegetation strips between Lockhart and The Rock and similar habitats at Lake Albert north of the project's termination point. The birds are expected to use roadside strips of woodland throughout intervening country between the most easterly and westerly sightings. It is a highly mobile species foraging both on canopy resources and seeding grasslands, including crops. They are capable of crossing open country between patches of woodland, which they require for roosting and breeding purposes, and are comfortable in adjacent open country where they often forage for seeds, including seeding crops. They have been observed to fly at a range of elevations during onsite survey works, from below canopy height to relatively high elevations over 50m (WSP Ecologist pers. obs.).

Their distribution and status is hampered by clearing of box woodlands and reduced numbers of trees with sufficient age to produce hollows for nesting purposes (Higgins 1999).

Their greatest risk of impact, in relation to the proposal will be the loss of native woodland vegetation and potential impact with powerlines, although most movements are made just over or under the top of the canopy heights of frequented vegetation, so impact risks are considered to be relatively low.

Photo 5-47 Immature Superb Parrots and Galah Mclennons Bore Road

5.6.4.22 White-fronted Chat

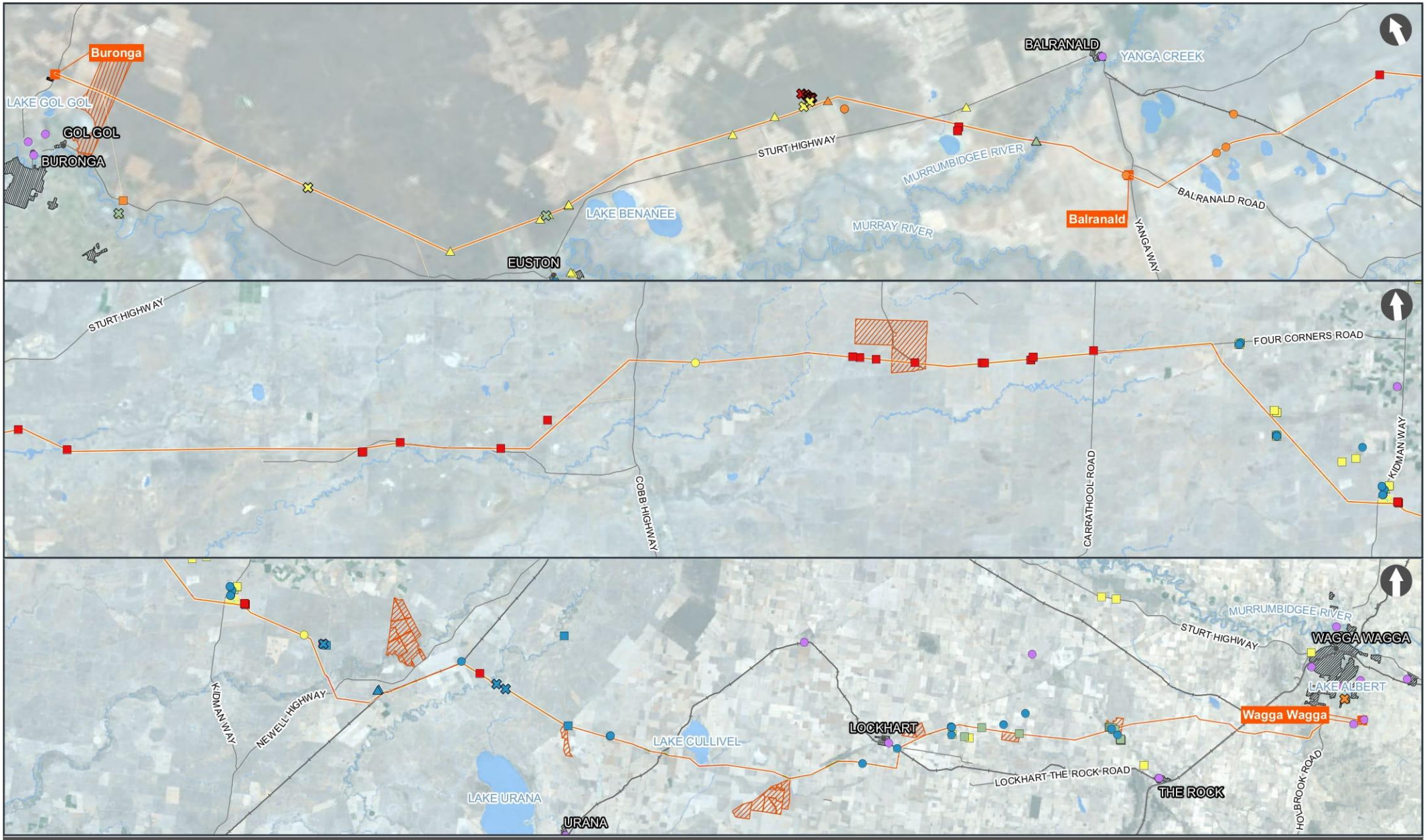
The White-fronted Chat (*Epthianura albifrons*) is listed as Vulnerable (Ecosystem Credit) in NSW under the BC Act and is not listed as threatened under the Commonwealth EPBC Act. Two isolated sub-populations of White-fronted Chats are currently known from the Sydney Metropolitan Catchment Management Authority (CMA) area; one at Newington Nature Reserve on the Parramatta River and one at Towra Point Nature Reserve in Botany Bay. These sub-populations are separated from each other by 25 km of urbanised land, across which the Chats are unlikely to fly, but are listed together as an Endangered Population in the Sydney Metropolitan Catchment Management Area. The nearest extant populations outside Sydney Metropolitan CMA are at Ash Island north of Newcastle and Lake Illawarra, south of Wollongong. White-fronted Chats were previously recorded at Penrith Lakes (2001), Hawkesbury Swamps (2002), Tuggerah Lake (1997) and Lake Macquarie (1998).

The White-fronted Chat occurs across southern Australia, largely no further north than -27º latitude from the south of Queensland, across most of the southern two thirds of South Australia (absent from the western arid zone about the South Australia and Western Australia border) and across Western Australia where its range swings north above the -27º latitude beyond the Shark Bay Region as far north as Exmouth (Schodde and Mason 1999). It is absent from sub-tropical southeast Queensland and northeast NSW, including the New England Tablelands, preferring temperate, semi-arid and arid regions. In coastal NSW it occurs on the floodplains of major rivers using saltmarsh and adjacent open communities, breeding in low shrubs and dense grasses. Inland it uses grassy and chenopod plains with movements somewhat dictated by the condition of habitat dictated by rainfall.

White-fronted Chats were observed from large open areas cleared of mallee west of Balranald, across the Hay plain and in open habitats along Bundure Road. An active nest was found a long North Boundary Road at the edge of an ephemeral wetland which was holding water and waterfowl in July 2020. The species is somewhat irruptive with numbers increasing when good conditions are promoted by rainfall.

White-fronted Chats are considered unlikely to be significantly impacted by the disturbance area, due to their preference for open habitats and the lack of ongoing vegetation management required for the ground-cover vegetation communities it prefers.

Photo 5-48 Male White-fronted Chat with food for nestlings, North Boundary Road, Steam Plains



BDAR - Figure 5-11

Overview of Identified Threatened Fauna Species and Fauna Stratification

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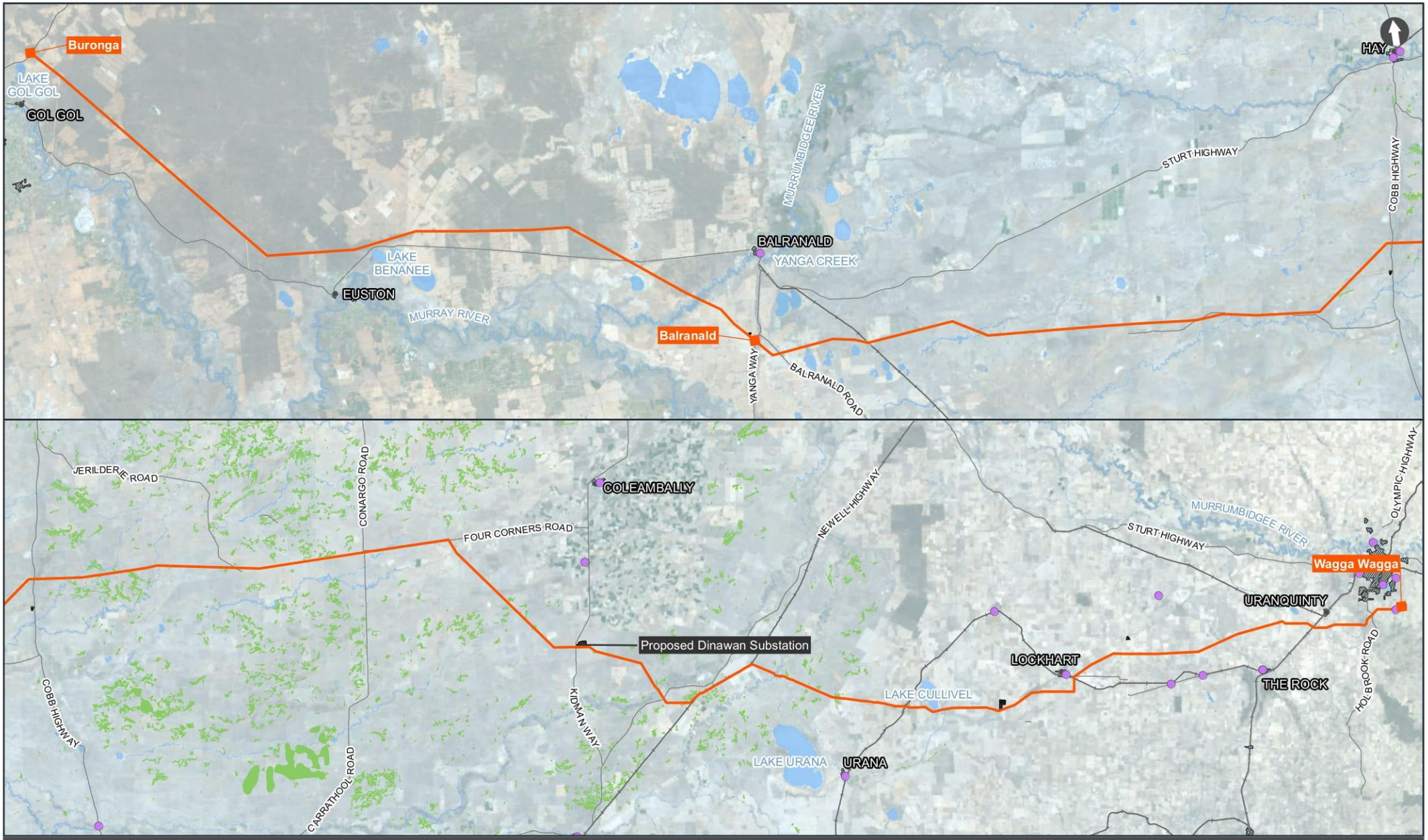
Source: NSWSS, ESRI, Transgrid, WSP



BDAR - Figure 5-12

Plains Wanderer Habitat Mapping

Project Components

- Proposed Alignment
- Access Tracks
- Main Construction Compounds and Accomodation Sites
- Water Supply Point
- Existing Substation
- Existing Railway
- Built Up Areas
- Waterbody
- Plains Wanderer Important Habitat

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Source: NSWSS, ESRI, Transgrid, WSP

5.7 Threatened aquatic species

5.7.1 FM Act listed threatened species

Within the proposal study area threatened aquatic habitat occurs in the form of fresh and saline wetlands, rivers and creeks that contain mapped key fish habitats (Strahler 4/5th Order streams) and other open water bodies such as agricultural dams, irrigation canals, road table drains and low depressions that periodically pond water.

Areas of mapped key fish habitat have been considered to provide moderate likelihood of occurrence for four threatened species listed under the FM Act. These species are:

- Murray Hardyhead (*Craterocephalus fluviatilis*) listed as critically endangered under the FM Act
- Silver Perch (*Bidyanus bidyanus*) listed as vulnerable under the FM Act.
- Flathead Galaxias (*Galaxias rostratus*) listed as critically endangered under the FM Act
- Macquarie Perch (*Macquaria australasica*) listed as endangered under the FM Act.

Further assessment of these threatened aquatic species is provided in Stage 2 of this report.

5.7.2 FM Act listed endangered ecological communities

The following Endangered ecological communities listed under the FM Act have potential to occur within the proposal study area:

- Aquatic Ecological Community in the Natural Drainage System of the Lowland Catchment of the Murray River Lowland.

A brief overview of the endangered ecological community and its relevance to the proposal study area is provided below.

5.7.2.1 Aquatic Ecological Community in the Natural Drainage System of the Lowland Catchment of the Murray River Lowland

The Aquatic Ecological Community in the Natural Drainage System of the Lowland Catchment of the Murray River (Lowland Catchment of the Murray River) is listed as an Endangered ecological community under the FM Act.

The lowland catchment of the Murray River ecological community includes all native fish and aquatic invertebrates within all natural creeks, rivers, and associated lagoons, billabongs and lakes of the regulated portions of the Murray River (also known as the River Murray) downstream of Hume Weir, the Murrumbidgee River downstream of Burrinjuck Dam, the Tumut River downstream of Blowering Dam and all their tributaries anabranches and effluents including Billabong Creek, Yanco Creek, Colombo Creek, and their tributaries, the Edward River and the Wakool River and their tributaries, anabranches and effluents, Frenchmans Creek, the Rufus River and Lake Victoria (NSW Fisheries Scientific Committee 2003b).

Riparian native vegetation recorded within the proposal study area is considered to comprise of the following native vegetation types:

- PCT 5 – River Red Gum herbaceous-grassy very tall open forest wetland on inner floodplains in the lower slopes sub-region of the NSW South Western Slopes Bioregion and the eastern Riverina Bioregion
- PCT 7 – River Red Gum – Warrego Grass – herbaceous riparian tall open forest wetland mainly in the Riverina Bioregion
- PCT 8 – River Red Gum – Warrego Grass – Couch Grass riparian tall woodland wetland of the semi-arid (warm) climate zone (Riverina Bioregion and Murray Darling Depression Bioregion)
- PCT 11 – River Red Gum – Lignum very tall open forest or woodland wetland on floodplains of semi-arid (warm) climate zone (mainly Riverina Bioregion and Murray Darling Depression Bioregion)
- PCT 13 – Black Box – Lignum woodland wetland of the inner floodplains in the semi-arid (warm) climate zone (mainly Riverina Bioregion and Murray Darling Depression Bioregion)

- PCT 15 – Black Box open woodland wetland with chenopod understorey mainly on the outer floodplains in south-western NSW (mainly Riverina Bioregion and Murray Darling Depression Bioregion)
- PCT 249 – River Red Gum swampy woodland wetland on cowals (lakes) and associated flood channels in central NSW.

Lowland Catchment of the Murray River ecological community is considered affected by the proposal based on clearing of riparian vegetation. Assessment of impacts on this ecological community, including an assessment of significance in accordance with Section 221ZV of the FM Act, are addressed in Section 9.4 of Stage 2 of this report.

6 Prescribed impacts

This chapter identifies potential prescribed biodiversity impacts on threatened entities in accordance with Chapter 6 of the BAM and has been prepared in accordance with Part 4 of the BAM 2020 Operational Manual – Stage 1 (Department of Planning 2020).

6.1 Identifying prescribed impacts on threatened entities

Prescribed impacts are those that may affect biodiversity values in addition to, or instead of, impacts from clearing vegetation. These impacts may be difficult to quantify or offset as they often affect biodiversity values that are irreplaceable. Prescribed impacts associated with the proposal and the threatened species or communities which have the potential to utilise these features within the proposal study area are presented in Table 6-1.

Table 6-1 Prescribed biodiversity impacts relevant to the proposal

PRESCRIBED BIODIVERSITY IMPACTS	DESCRIPTION OF FEATURE CHARACTERISTICS AND LOCATION	POTENTIAL IMPACT	THREATENED SPECIES OR COMMUNITY USING OR DEPENDANT ON FEATURE	IMPACT ASSESSED
Karst, caves, crevices, cliffs, rocks and other geological features of significance	No karst, caves, crevices or cliffs considered to be relevant to prescribed impacts are present. An area with rocky substrate occurs near the eastern end of the proposal and the habitat stratification unit has been mapped as "Rocky Woodlands"	Negligible, the vast majority of rocky substrate will not be impacted as it will be spanned by the powerlines.	Pink-tailed Worm Lizard potential habitat	Sections 8.1.2 and 9.3 of Stage 2 assessment of this BDAR
Occurrences of human-made structures	No human made structures considered to be relevant to prescribed impacts are present.	N/A	N/A	N/A
Occurrences of non-native vegetation	No non-native vegetation considered to be relevant to prescribed impacts is present.	N/A	N/A	N/A
Corridors or other areas of connectivity linking habitat for threatened entities	Yes, throughout the landscape there are habitat and aerial connections for terrestrial, aquatic and aerial species.	The proposal has the potential to impact on connectivity for habitat of threatened species that facilitates movement across species' ranges. The nature of the potential impacts to connectivity primarily relate to impacts to aerial species such as birds or bats through interaction with the proposed towers or associated lines. Terrestrial movement (either on the ground and/or below the upper stratum of vegetation) is unlikely to be substantially altered given the majority of native vegetation under 4 m and, in some sections, under 10 m growth height would be retained within the easement of the proposal.	— Raptors — Brolga — Major Mitchell's Cockatoo — Regent Parrot — Migratory shorebirds — Waterfowl — Microbats — Squirrel glider	Sections 8.1.2 and 9.3 of Stage 2 assessment of this BDAR

PRESCRIBED BIODIVERSITY IMPACTS	DESCRIPTION OF FEATURE CHARACTERISTICS AND LOCATION	POTENTIAL IMPACT	THREATENED SPECIES OR COMMUNITY USING OR DEPENDANT ON FEATURE	IMPACT ASSESSED
Water bodies or any hydrological processes that sustain threatened entities	Yes the proposal occurs nearby to Lake Gol Gol, Lake Benanee and Lake Cullivel. It also crosses the Murrumbidgee River and other more minor watercourses and low lying wet areas.	Substantial impacts to water quality to these and other water bodies are not expected to occur, with all permanent disturbance areas located outside core riparian zone areas. All construction and operation impacts will be managed to ensure ground disturbance is minimised and managed and direct impacts to the waterbodies themselves and related hydrological processes are not expected to occur.	— Amphibians — Terrestrial Species — Aerial species — Aquatic Species	Sections 8.1.2 and 9.3 of Stage 2 assessment of this BDAR
Protected animals that may use the proposed wind farm development site as a flyway or migration route	This proposal is not a wind farm.	N/A	N/A	N/A
Proposed development may result in vehicle strike on threatened fauna or on animals that are part of a threatened ecological community	It is located adjoining to or crosses regional roads such as the Sturt Highway, Cobb Highway, Kidman Way and Newell Highway.	The proposal is likely to generate additional vehicular movements, particularly during construction but also during operation.	— Amphibians — Terrestrial Species	Sections 8.1.2 and 9.3 of Stage 2 assessment of this BDAR

7 Matters of national environmental significance

This chapter describes Matters of National Environmental Significance (MNES) relating to Commonwealth legislation under the EPBC Act.

7.1 Threatened species and ecological communities

7.1.1 Threatened ecological communities

Based on broad scale state vegetation mapping and database searches a total of seven candidate threatened ecological communities listed under the EPBC Act were considered likely to occur. These are:

- Buloke Woodlands of the Riverina and Murray-Darling Depression Bioregions – Endangered
- Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia – Endangered
- Natural Grasslands of the Murray Valley Plains – Critically Endangered
- Plains mallee box woodland of the Murray Darling Depression, Riverina and Naracoorte Coastal Plains bioregions
- Seasonal Herbaceous Wetlands (Freshwater) of the Temperate Lowland Plains – Critically Endangered
- Weeping Myall Woodlands – Endangered
- White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland – Critically Endangered.

7.1.1.1 Buloke Woodlands of the Riverina and Murray-Darling Depression Bioregions - Endangered

The Buloke Woodlands of the Riverina and Murray-Darling Depression Bioregions is an ecological community where Buloke (*Allocasuarina luehmannii*) is usually the dominant or co-dominant tree. This community occurs from north-western and northern central Victoria into south central New South Wales within the in the Riverina and Murray-Darling Depression bioregions.

Within the proposal study area one vegetation type was considered likely to associate with this threatened ecological community, PCT 22 – Semi-arid shrubby Buloke – Slender Cypress Pine Woodland, far south-western NSW.

A comparison of the listing advice for Buloke Woodlands threatened ecological community and candidate PCT is provided in Table 7-1. Each element of the listing advice including locality, species composition, characteristic species and resilience is compared to each condition class for the candidate PCT to determine if vegetation recorded is consistent with the listing criteria.

The location of Buloke Woodlands threatened ecological community in relation to the proposal study area is provided in Table 7-2. A summary of Buloke Woodlands threatened ecological community, associated PCT and extent within the disturbance area for each IBRA subregion is summarized in Table 7-2.

Table 7-1 Assessment of EPBC Act – listed Buloke Woodlands and associated PCT

SCIENTIFIC DETERMINATION	PCT 22
Does the PCT occur within the Riverina and/or Murray-Darling Depression IBRA bioregions?	Yes PCT was recorded to occur within the South Olary Plain IBRA subregion which falls in the Murray-Darling Depression Bioregion.
Does the PCT contain occurrences of Buloke (*Allocasuarina luehmanii*)? Buloke does not have to be the structurally dominant species.	Yes PCT contained living *Allocasuarina luehmanii* at varying levels of dominance/co-dominance.
Does the PCT structure comprise of woodland or open woodland that lacks a well-developed tall shrub layer and has a highly variable well-developed ground stratum that is usually grassy, but also includes many subshrubs and herbs or have and understory that is predominantly shrubby or herbaceous	Yes PCT structure varied from woodland to open woodland with several discrete locations recording a decreased projected foliar canopy cover due to historical logging practices. Ground stratum varied from the grassy dominate to predominantly shrubby and herbaceous.
Contain any of the following native species for grasses – *Austrostipa spp.* or *Rytidosperma spp*. for subshrubs – *Convolvulus remotus, Einadia nutans, Maireana enchylaenoides, Senecio pinnatifolius, Sida corrugata,* and *Vittadinia* spp.	Yes Species recorded includes: For grasses – *Austrostipa elegantissima, A. nitida, A. scabra* subsp. *falcata* and *Rytidosperma caespitosum* For subshrubs – *Einadia nutans,*
There is no condition threshold described for this community in the determination.	Any vegetation in which characteristic native species dominate any structural layer present is considered to constitute the community.
Outcome	**Meets key characteristics - forms part of the ecological community**

Table 7-2 Summary of Buloke Woodland within the disturbance area

THREATENED ECOLOGICAL COMMUNITY	VEGETATION TYPE	IBRA SUBREGION	VEG ZONE NAME (BAM-C)	IMPACT (HA)
Buloke Woodlands of the Riverina and Murray Darling Depression bioregions	PCT 22 – Semi-arid shrubby Buloke – Slender Cypress Pine woodland, far south-western NSW	South Olary Plain	VZ #2 22_Mod-good	2.93
Total				**2.93**

7.1.1.2 Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia – Endangered

Grey Box (*Eucalyptus microcarpa*) grassy woodlands and derived native grasslands of south-eastern Australia is a grass woodland that occurs on mostly flat to undulating plains, low slopes and rises on the drier edges of the temperate grassy eucalypt woodland belt and ranges from central New South Wales through northern and central Victoria into South Australia (Department of Sustainability Environment Water Population and Communities 2012).

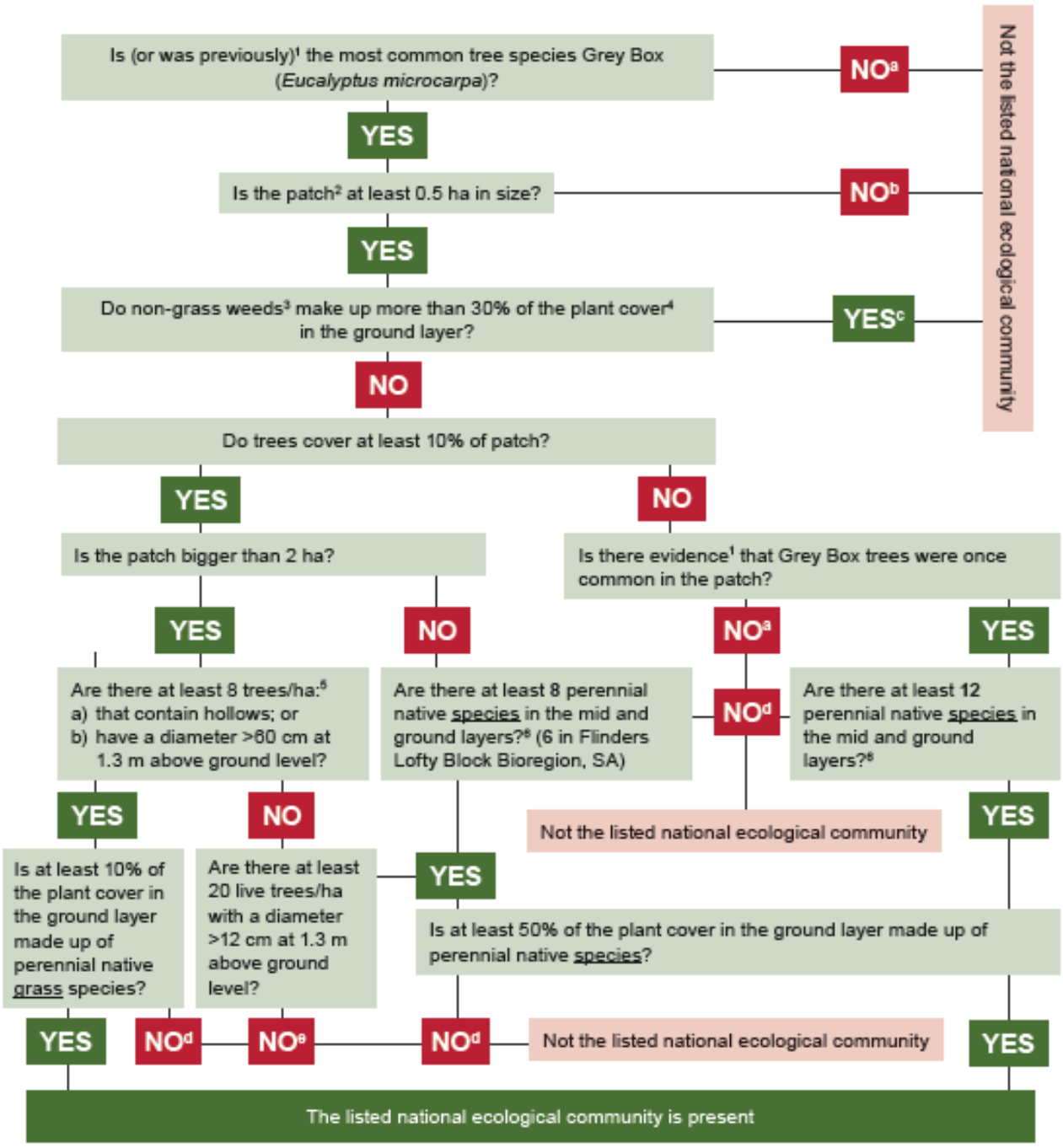
Within the proposal study area four vegetation types were considered likely to associate with this threatened ecological community, these are:

- PCT 76 – Western Grey Box tall grassy woodland on alluvial loan and clay soils in the NSW South Western Slopes and Riverina Bioregion
- PCT 80 – Western Grey Box – White Cypress Pine tall woodland on loam soil on alluvial plains of NSW South Western Slopes Bioregion and Riverina Bioregion
- PCT 110 – Western Grey Box – Cypress Pine shrubby woodland on stony footslopes in the NSW South Western Slopes Bioregion and Riverina Bioregion.

For a vegetation patch to meet the threatened ecological listing of Grey Box (*Eucalyptus microcarpa*) grassy woodlands and derived native grasslands of south-eastern Australia it must meet specific listing advice key characteristics and condition threshold criteria as outlined in Figure 7-1. An assessment of this key diagnostic characteristics and condition threshold criteria against recorded plot data is presented in Table 7-3.

Vegetation analysis against listing advice identified that select patches of PCT 110 do not meet the key characteristics and condition thresholds and such do not meet the Endangered listing under the EPBC act.

A summary of Grey Box grassy woodlands threatened ecological community, associated PCT and extent within the disturbance area for each IBRA subregion is presented in Table 7-4.



1 Evidence that Grey Box was originally present might include stumps, historical records or presence in nearby vegetation.
2 When considering a patch it is important to note that a patch may extend beyond a property or development site boundary. For the purposes of determining whether or not a patch meets the minimum patch size of the condition thresholds for the ecological community, the entire patch should be considered, not just the area occurring on a property or development site.
3 A weed is defined here as a plant species that is not native to Australia and the species has established viable self-sustaining populations in a region.
4 Plant cover excludes mosses and lichens. Patches of bare ground or leaf litter are also not included.
5 Dead trees are included if present, up to 50% of the total tree count.
6 Relevant growth-forms to include are: grasses, other graminoids, forbs and shrubs less than 4 metres tall. Shrubs that are 4 metres or more in height and non-vascular plants (mosses and lichens) are not included.

Figure 7-1 Listing advice key characteristic and condition thresholds for Grey Box (*Eucalyptus microcarpa*) grassy woodlands and derived native grasslands of south-eastern Australia

Table 7-3 Assessment against Grey Box (*Eucalyptus microcarpa*) grassy woodlands and derived native grasslands of south-eastern Australia EPBC Act listing advice criteria

KEY DIAGNOSTIC CHARACTERISTICS AND CONDITION THRESHOLD	**PCT 76**	**PCT 80**								**PCT 110**	
	Q231E	**Q34E – Moderate condition**	**Q184E – Mod-good condition**	**Q203E – Moderate condition**	**Q207E – Mod-good condition**	**Q227E – Mod-good condition**	**Q228E – Derived condition**	**Q230E – Mod-good condition**	**Q233E – Poor condition**	**Q113E – Mod-good condition**	**Q245E – Mod-good condition**
The ecological community occurs on low slopes and plains from central NSW, through northern and central Victoria into South Australia.	Yes This PCT was recorded to occur in the NSW South Western Slopes (Lower Slopes subregion) IBRA Bioregion.	Yes This PCT was recorded to occur in the NSW South Western Slopes (Lower Slopes subregion) IBRA Bioregion.	Yes This PCT was recorded to occur in the NSW South Western Slopes (Lower Slopes subregion) IBRA Bioregion.	Yes This PCT was recorded to occur in the NSW South Western Slopes (Lower Slopes subregion) IBRA Bioregion.	Yes This PCT was recorded to occur in the NSW South Western Slopes (Lower Slopes subregion) IBRA Bioregion.	Yes This PCT was recorded to occur in the NSW South Western Slopes (Lower Slopes subregion) IBRA Bioregion.	Yes This PCT was recorded to occur in the NSW South Western Slopes (Lower Slopes subregion) IBRA Bioregion.	Yes This PCT was recorded to occur in the NSW South Western Slopes (Lower Slopes subregion) IBRA Bioregion.	Yes This PCT was recorded to occur in the NSW South Western Slopes (Inland Slopes subregion) IBRA Bioregion.	Yes This PCT was recorded to occur in the NSW South Western Slopes (Inland Slopes subregion) IBRA Bioregion.	Yes This PCT was recorded to occur in the NSW South Western Slopes (Inland Slopes subregion) IBRA Bioregion.
The tree canopy is dominated (greater than 50% canopy crown cover) by *Eucalyptus microcarpa* (Grey Box). Other tree species may be present in the canopy and, in certain circumstances may be co-dominate with Grey Box but are never dominant on their own. These associated species are listed in Appendix A of the listing advice.	Yes *Eucalyptus microcarpa* was the only tree species recorded.	Yes *Eucalyptus microcarpa* was 67% of the canopy crown cover. Two other tree species were present, *Allocasuarina luehmannii* which made up the remaining 33% of the canopy crown cover, and *Callitris glaucophylla*, which made up the sub-canopy layer, with projected cover of 22%.	Yes *Eucalyptus microcarpa* was the only canopy species recorded. *Callitris glaucophylla* was recorded within the plot but formed a sub canopy with a cover of 22%.	Yes *Eucalyptus melliodora* was the only species recorded, which is listed in Appendix A as an associated species, but *Eucalyptus microcarpa* was dominant within the patch.	Yes *Eucalyptus microcarpa* was the only canopy species recorded. *Callitris glaucophylla* was recorded within the plot but formed the sub-canopy.	Yes *Eucalyptus microcarpa* was the only canopy species recorded. *Callitris glaucophylla* was recorded within the plot but formed the sub-canopy.	Yes *Eucalyptus microcarpa* was previously the dominate tree species but historic land use has reduced canopy cover and patch now exists in derived condition. In direct vicinity of patches of PCT 80 with an intact canopy.	Yes *Eucalyptus microcarpa* was the dominate tree species. One other trees species was recorded, *Brachychiton populneus* subsp. *populneus*. *E. microcarpa* recorded 99% of the total canopy cover.	Yes *Eucalyptus microcarpa* accounted for 80% of canopy cover. One other tree species was recorded, *Callitris glaucophylla*	Yes *Eucalyptus microcarpa* accounted for 91% of canopy cover. One other tree species was recorded, *Callitris glaucophylla*	Yes *Eucalyptus microcarpa* was the only canopy species recorded.

KEY DIAGNOSTIC CHARACTERISTICS AND CONDITION THRESHOLD	PCT 76	PCT 80								PCT 110	
	Q231E	Q34E – Moderate condition	Q184E – Mod-good condition	Q203E – Moderate condition	Q207E – Mod-good condition	Q227E – Mod-good condition	Q228E – Derived condition	Q230E – Mod-good condition	Q233E – Poor condition	Q113E – Mod-good condition	Q245E – Mod-good condition
Broad criteria 1a. The minimum patch size is 0.5 ha; AND 1b. The canopy layer contains Grey Box (*Eucalyptus microcarpa)* as the dominant or co-dominant tree species; AND 1c. The vegetative cover of non-grass weed species in the ground layer is less than 30% at any time of the year AND Meets criteria in either section 2., 3., 4. or 5. (see below)	1a. Meets threshold with patch size >0.5 ha (patch size about 0.6 ha) 1b. Meets threshold. *Eucalyptus microcarpa* is the only tree species recorded. 1c. Meets threshold with <30% vegetative cover of non-grass weed species in the ground layer (cover recorded at 0.009% of total ground cover)	1a. Meets threshold with patch size >0.5 ha (patch size about 3 ha). 1b. Meets threshold. *Eucalyptus microcarpa* and *Allocasuarina luehmannii* form the canopy with 10% and 5% projected foliar cover respectively. *Callitris glaucophylla* forms a sub-canopy with a cover of 22%. 1c. Does not meet threshold with >30% non-grass weed species. Non-grass weed species recorded at 44% of exotic cover.	1a. Meets threshold with patch size >0.5 ha (patch size about 13 ha) 1b. Meets threshold. *Eucalyptus microcarpa* was the only canopy species recorded. *Callitris glaucophylla* was recorded in the plot but formed a sub-canopy. 1c. Meets threshold with <30% vegetative cover of non-grass weed species in the ground layer (cover recorded at 0.017% of total ground cover)	1a. Meets threshold with patch size >0.5 ha (patch size about 6 ha) 1b. Meets threshold with *E. microcarpa* being the dominant tree species at the site despite, *E. melliodora* being dominant within the sample plot. 1c. Meets threshold with <30% vegetative cover of non-grass weed species in the ground layer (cover recorded at 0.016% of total ground cover)	1a. Meets threshold with patch size >0.5 ha (patch size about 10 ha) 1b. Meets threshold. *Eucalyptus microcarpa* was the only canopy species recorded. *Callitris glaucophylla* was recorded in the plot but formed a sub-canopy 1c. Meets threshold with <30% vegetative cover of non-grass weed species in the ground layer (cover recorded at 0.06% of total ground cover)	1a. Meets threshold with patch size >0.5 ha (patch size about 10 ha) 1b. Meets threshold. *Eucalyptus microcarpa* was the only canopy species recorded. *Callitris glaucophylla* was recorded in the plot but formed a sub-canopy 1c. Meets threshold with <30% vegetative cover of non-grass weed species in the ground layer (cover recorded at 0.025% of total ground cover)	1a. Meets threshold with patch size >0.5 ha (broader patch size about 6 ha – sampling location of derived condition about 0.6 ha) 1b. Meets threshold. *Eucalyptus microcarpa* is the dominate tree species in the broader patch. At the sampling location historic land use practices have reduced canopy cover and the sampling location now exists in a derived state with clear evidence of sample location being a subset of the broader patch (i.e. similar suite of species in the ground layer). 1c. Meets threshold with <30% vegetative cover of non-grass weed species in the ground layer (cover recorded at 0.07% of total ground cover)	1a. Meets threshold with patch size >0.5 ha (patch size about 6 ha) 1b. Meets threshold. *Eucalyptus microcarpa* was the dominant tree species. 1c. Meets threshold with <30% vegetative cover of non-grass weed species in the ground layer (cover recorded at 0.01% of total ground cover)	1a. Meets threshold with patch size >0.5 ha (patch size about 2.5 ha) 1b. Meets threshold. Two tree species, *Eucalyptus microcarpa* and *Callitris glaucophylla,* were recorded in the sample plot. *E. microcarpa* comprised 80% of the canopy. 1c. Meets threshold with <30% vegetative cover of non-grass weed species in the ground layer (cover recorded at 20% of total ground cover)	1a. Meets threshold with patch size >0.5 ha (Patch size about 4 ha) 1b. Meets threshold. Two tree species, *Eucalyptus microcarpa* and *Callitris glaucophylla,* were recorded in the sample plot. *E. microcarpa* comprised 80% of the canopy. 1c. Meets threshold with <30% vegetative cover of non-grass weed species in the ground layer (cover recorded at 0.08% of total ground cover)	1a. Meets threshold with patch size >0.5 ha (Patch size about 0.6 ha) 1b. Meets threshold. *Eucalyptus microcarpa* was the dominant tree species. 1c. Meets threshold with <30% vegetative cover of non-grass weed species in the ground layer (cover recorded at 0.03% of total ground cover)
Smaller woodland patches – 0.5 to <2 ha in area with tree crown cover >10% 2a. At least 50% of the vegetative cover in the ground layer comprises perennial native species at any time of the year AND 2b. 8 or more perennial native species are present in the mid and ground layers at any time of the year.	Patch size 0.6 ha. 2a. Meets threshold. Native species recorded to comprise 78% of the total vegetative cover in the ground layer. 2b. Meets threshold. 20 native species recorded in the mid and ground layers.	Does not meet above criteria	Patch size >2 ha	Patch size >2 ha	Patch size >2 ha	Patch size >2 ha	Patch occurs in derived state.	Patch size >2 ha	Patch size >2 ha	Patch size >2 ha	Patch size 0.6 ha. 2a. Does not meet threshold as <50% of the vegetative cover in the ground layer comprises perennial native species. 2b. Does not meet above criteria.

KEY DIAGNOSTIC CHARACTERISTICS AND CONDITION THRESHOLD	PCT 76	PCT 80								PCT 110	
	Q231E	Q34E – Moderate condition	Q184E – Mod-good condition	Q203E – Moderate condition	Q207E – Mod-good condition	Q227E – Mod-good condition	Q228E – Derived condition	Q230E – Mod-good condition	Q233E – Poor condition	Q113E – Mod-good condition	Q245E – Mod-good condition
Larger woodland patches – 2 ha or more in area 3a. At least 8 trees/ha are hollow bearing or have a diameter at breast height of 60 cm or more AND 3b. at least 10% of the vegetative ground cover comprises perennial native grasses at any time of the year; OR 4a. At least 20 trees/ha have a diameter at breast height of 12 cm or more; AND 4b. at least 50% of vegetative cover in the ground layer comprises perennial native species	Meets above criteria	Does not meet above criteria	Patch size about 13 ha 3a. Meets threshold. Two trees >60 cm diameter at breast height and three trees with hollows were recorded in the sample. At a per hectare rate this would equate to 10 trees >60 cm and 15 hollows in the patch. 3b. Meets threshold with >10% of the vegetative ground cover comprising perennial native grasses (perennial native grasses recorded as 70% of total ground cover). 4a. Meets threshold above 4b. Meets threshold above	Patch size about 6 ha 3a. Meets threshold. Two trees >60 cm diameter at breast height and two trees with hollows were recorded in the sample. At a per hectare rate this would equate to 10 trees >60 cm and 10 hollows in the patch. 3b. Meets threshold with >10% of the vegetative ground cover comprising perennial native grasses (perennial native grasses recorded as 18% of total ground cover). 4a. Meets threshold above 4b. Meets threshold above	Patch size is about 10 ha 3a. Does not meet threshold. One tree was recorded to have a diameter at breast height >60 cm, meaning on a per hectare scale five trees would have a diameter >60 cm at breast height. No hollows were recorded. 3b. Not meet threshold for 3a. 4a. Meets threshold. Three *Eucalyptus microcarpa* trees >12cm in diameter at breast height were recorded in the plot. Extrapolated to trees per hectare this equates to 75 trees >12 cm in diameter at breast height. 4b. Meets threshold with >50% of vegetative cover in the ground layer comprises perennial native species (perennial native species recorded to be 93% of the ground layer).	Patch size is about 10 ha 3a. Meets threshold. Three trees >60 m diameter at breast height and three hollow bearing trees were recorded in the sample. At a per hectare rate this would equate to 15 trees >60 cm and 15 hollows in the patch. 3b. Meets threshold with >10% of the vegetative ground cover comprising perennial native grasses (perennial native grasses recorded as 70% of total ground cover). 4a. Meets threshold above 4b. Meets threshold above	Patch occurs in derived state.	Patch size about 6 ha 3a. Meets threshold. Four trees >60 cm diameter at breast height and 1 hollow bearing tree were recorded in the sample. At a per hectare rate this would equate to 20 trees >60 cm and 5 hollows in the patch. 3b. Meets threshold with >10% of the vegetative ground cover comprising perennial native grasses (perennial native grasses recorded as 65% of total ground cover). 4a. Meets threshold above 4b. Meets threshold above	Patch size about 2.5 ha 3a. Meets threshold. Two trees >60 cm diameter at breast height and two hollow bearing trees were recorded in the sample. At a per hectare rate this would equate to 10 trees >60 cm and 10 hollows in the patch. 3b. Does not meet threshold. No perennial native grasses were recorded. 4a. Does not meet threshold. Two trees >12 cm at breast height were recorded in the sample. At a per hectare rate this would equate to 10 trees within the patch. 4b. Does not meet above conditions.	Patch size about 4 ha 3a. Meets threshold. Two trees >60 cm diameter at breast height and two hollow bearing trees were recorded in the sample. At a per hectare rate this would equate to 10 trees >60 cm and 10 hollows in the patch. 3b. Meets threshold with >10% of the vegetative ground cover comprising perennial native grasses (perennial native grasses recorded as 74% of total ground cover). 4a. Meets threshold above 4b. Meets threshold above	Patch <2 ha

KEY DIAGNOSTIC CHARACTERISTICS AND CONDITION THRESHOLD	PCT 76	PCT 80								PCT 110	
	Q231E	Q34E – Moderate condition	Q184E – Mod-good condition	Q203E – Moderate condition	Q207E – Mod-good condition	Q227E – Mod-good condition	Q228E – Derived condition	Q230E – Mod-good condition	Q233E – Poor condition	Q113E – Mod-good condition	Q245E – Mod-good condition
Derived Native grasslands – the canopy is less developed or absent (at least 0.5 ha in area) 5a. Woodland density does not meet criteria 3a or 4a, or is derived grassland with clear evidence that the site formerly was a woodland with a tree canopy dominated or co-dominated by *E. microcarpa;* AND 5b. At least 50% of the vegetative cover in the ground layer is made up of perennial native species at any time of the year; AND 5c. 12 or more native species are present in the ground layer at any time of the year	Is not a derived native grassland.	Does not meet above criteria	Is not a derived native grassland.	Is not a derived native grassland.	Is not a derived native grassland.	Is not a derived native grassland.	Sampling location patch size is 0.6 ha. 5a. Meets threshold. Patch clearly evident to previously be dominated by *Eucalyptus microcarpa*. 5b. Does not meet threshold as <50% of the vegetative cover in the ground layer is made up of perennial native species (perennial native ground cover comprises 44% of total ground cover). 5c. Does not meet above conditions.	Is not a derived native grassland.	Is not a derived native grassland.	Is not a derived native grassland.	Is not a derived native grassland.
Outcome	**Meets key characteristics and condition threshold – forms part of the ecological community**	**Does not meet condition criteria – does not form part of the ecological community**	**Meets key characteristics and condition threshold - forms part of the ecological community**	**Meets key characteristics and condition threshold - forms part of the ecological community**	**Meets key characteristics and condition threshold - forms part of the ecological community**	**Meets key characteristics and condition threshold - forms part of the ecological community**	**Does not meet condition criteria – does not form part of the ecological community**	**Meets key characteristics and condition threshold - forms part of the ecological community**	**Does not meet condition criteria – does not form part of the ecological community**	**Meets key characteristics and condition threshold - forms part of the ecological community**	**Does not meet condition criteria – does not form part of the ecological community**

Table 7-4 Summary of Grey Box grassy woodland within the disturbance area

THREATENED ECOLOGICAL COMMUNITY	VEGETATION TYPE	IBRA SUBREGION	VEG ZONE NAME (BAM-C)	IMPACT (HA)
Grey Box (*Eucalyptus microcarpa*) grassy woodlands and derived native grasslands of south-eastern Australia	PCT 76 – Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions	Lower Slopes	VZ #3 76_Mod-good	1.31
	PCT 80 – Western Grey Box – White Cypress Pine tall woodland on loam soil on alluvial plains of NSW South Western Slopes Bioregion and Riverina Bioregion		VZ #5 80_Mod-good	11.85
			VZ #4 80_Moderate	1.10
			VZ #12 80_SVM_Bench	0.50
	PCT 110 - – Western Grey Box – Cypress Pine shrubby woodland on stony footslopes in the NSW South Western Slopes Bioregion and Riverina Bioregion	Inland Slopes	VZ# 3 110_mod-good	0.65
Total				**15.41**

7.1.1.3 Natural Grasslands of the Murray Valley Plains – Critically Endangered

The Natural Grasslands of the Murray Valley Plains is a critically endangered naturally treeless grassland vegetation community that occurs on the plains of western and northern Victoria and extends into the southern parts of the Riverina bioregion in New South Wales.

Within the proposal study area three vegetation types were considered likely to associate with this threatened ecological community, these are:

- PCT 44 – Forb-rich Speargrass – Windmill Grass – White Top grassland of the Riverina Bioregion
- PCT 45 – Plains Grass grassland on alluvial mainly clay soils in the Riverina Bioregion and NSW South Western Slopes Bioregion
- PCT 46 – Curly Windmill Grass – speargrass – wallaby grass grassland on alluvial clay and loam on the Hay plain, Riverina Bioregion.

For a vegetation patch to meet the threatened ecological listing of Natural Grasslands of the Murray Valley Plains it must meet specific listing advice key characteristics and condition threshold criteria as outlined in Figure 7-2. An initial analysis, using the indicative distribution map, occurred to define the northern boundary of the ecological community. Areas of mapped vegetation types associated with the ecological community recorded outside of the defined distribution area were deemed to not be a part of the ecological community and excluded from analysis. An assessment of the two-step key diagnostic characteristics and condition threshold criteria for this ecological community against recorded PCTs and associated plot data is presented in Table 7-5 to Table 7-10.

A summary of Natural Grasslands threatened ecological community, associated PCT and extent within the disturbance area for each IBRA subregion is summarized in Table 7-11.

The nationally listed ecological community is limited to patches that meet a two step identification process to identify if the ecological community it present.

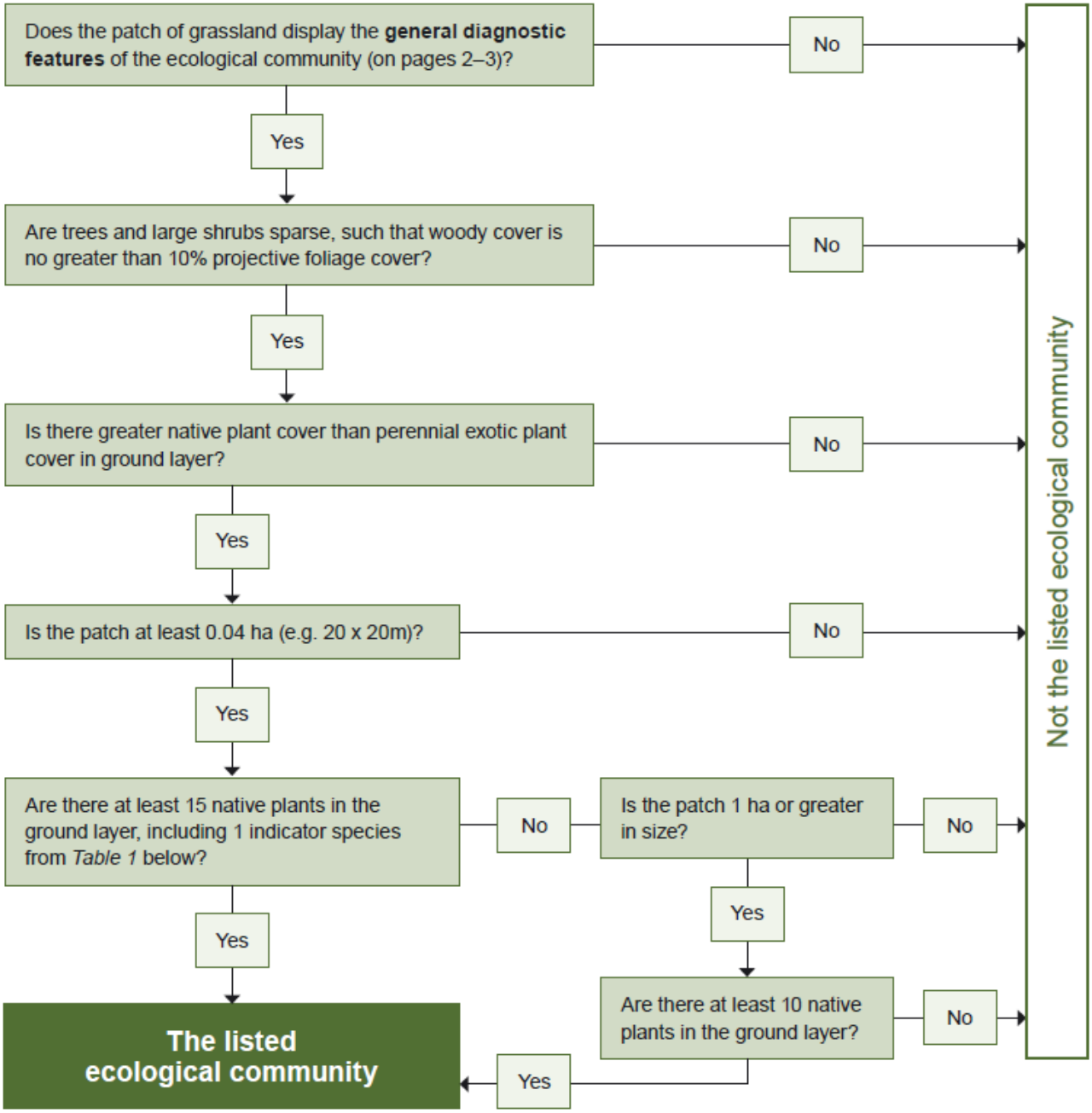


Figure 7-2 Listing advice key characteristic and condition thresholds for Natural Grasslands of the Murray Valley Plains

Table 7-5 Assessment Step 1: use key diagnostic characteristics to identify if the ecological community is present for representative patches assigned to PCT 44 – Forb-rich speargrass – Windmill Grass – White Top grassland of the Riverina Bioregion

KEY DIAGNOSTIC CHARACTERISTICS	Q189E	Q213E
Distribution is primarily in the Riverina Bioregion and the Wimmera plains of the Murray Darling Depression Bioregion. Other outlying occurrences are also in the Murray Darling Depression Bioregion and the NSW South Western Slopes Bioregion. The approximate northern limit of the ecological community is in the Murrumbidgee subregion (IBRA RIV2), approximately near the northern boundary of the Murray Catchment Management Authority (CMA) in NSW.	Occurs in the Murrumbidgee subregion (IBRA RIV2) of the Riverina Bioregion	Occurs in the Murrumbidgee subregion (IBRA RIV2) of the Riverina Bioregion
It typically occurs on a landscape of flat alluvial lowland plains with heavy-textured grey, brown and red clays.	Occurs on red-brown clay.	Occurs on red-brown clay
The ecological community is typically dominated by a range of perennial grasses and/or forbs or co-dominated by small shrubs. Sites are not necessarily dominated by any particular plant species. Characteristic genera present typically include: for grasses – *Rytidosperma, Austrostipa, Chloris* and *Enteropogon,* for forbs – *Arthropodium, Bulbine, Calotis, Chrysocephalum, Leptorhynchos, Minuria, Ptilotus, Rhodanthe, Sida* and *Swainsona,* for small shrubs – *Atriplex* and *Maireana.*	For grasses – *Austrostipa, Enteropogon* and *Rytidosperma* were recorded For forbs – *Chrysocephalum, Rhodanthe, Sida* and *Swainsona* were recorded For shrubs – *Atriplex* and *Maireana* were recorded.	For grasses – *Austrostipa, Enteropogon* and *Rytidosperma.* were recorded For forbs – *Arthropodium, Bulbine, Calotis, Chrysocephalum, Sida* and *Swainsona* were recorded For shrubs – *Maireana* was recorded
Trees and large shrubs (>1m tall) are generally absent to sparse, amounting to less than 10% projective foliage cover. Where woodlands overlap or adjoin with the ecological community an outer boundary of two times the canopy width of the dominant tree species is applied.	Trees and large shrubs were absent.	Trees and large shrubs were absent.
The patch should contain at least as many, preferably more, of the species in Table 1(A) than in Table 1(B) of the listing advice, when assessed at an appropriate time (e.g. late winter-spring and not soon after disturbance such as grazing). The species in Table 1(A) are characteristic of the natural grassland ecological community and not derived grasslands, and the opposite applies to Table 1(B). Note this generally only applies to grasslands occurring in the Lachlan (RIV 1) and Murrumbidgee (RIV 2) IBRA subregions.	Of the 21 native species recorded 6 occur in Table 1 (A) and 4 occur in Table 1 (B).	Of the 31 native species recorded 9 occur in Table 1 (A) and 4 occur in Table 1 (B).

KEY DIAGNOSTIC CHARACTERISTICS	Q189E	Q213E
If there is reliable evidence (e.g. historical records, photographs) that a patch was once woodland or shrubland with >10% cover (of trees, shrubs >1 m), then the patch is not considered to be part of the ecological community.	There is no evidence that the patch was once a woodland or shrubland	There is no evidence that the patch was once a woodland or shrubland
Soil type and landscape position (e.g. Alluvial soils, plains) that correspond with the ecological community and not other vegetation types may also assist in identifying the likely occurrence of natural grasslands ecological community.	The patch occurs on alluvial soils associated with a broad plain.	The patch occurs on alluvial soils associated with a broad plain.
Outcome	**Meets Step 1 – key diagnostic characteristics**	**Meets Step 1 – key diagnostic characteristics**

Table 7-6 Assessment Step 2: Determine condition of the ecological community for representative patches assigned to PCT 44 Forb-rich Speargrass – Windmill Grass – White Top grasslands of the Riverina Bioregion that meet Step 1 key diagnostic characteristics

CONDITION THRESHOLDS	Q189E	Q213E
For all patches of the ecological community. The percentage cover of native vascular plants (annual and perennial) in the patch is greater than the percentage cover of perennial exotic species. AND Either category A or category B thresholds are met as below	Meets threshold. Native vascular cover was recorded at 58.2% with exotic cover recorded at 2.4%.	Meets threshold. Native vascular cover was recorded at 75.5% with exotic cover recorded at 12.9%.
Category A. For patches with high diversity or that are relatively undisturbed. This recognises that many patches of the ecological community can maintain their diversity despite the highly fragmented nature of the community or small patch sizes: A1. 15 or more vascular plant species are present in the patch. AND A2. The patch contains one or more indicator species in Table 2, characteristic of sites that are relatively undisturbed (e.g. have little to no history of cultivation). AND Patch size: A3. The size of the grassland patch is at least 0.04 ha or more in size (i.e. at least 400 m^2 or a 20m x 20 m square or equivalent area in any shape.	A1. Meets condition threshold with 21 native vascular plant species recorded. A2. Meets condition threshold with five indicator species recorded being: *Maireana excavata, Maireana pentagona, Microseris lanceolata, Rhodanthe pygmaea* and *Swainsona procumbens.* A3. Meets condition threshold with patch size exceeding 0.04 ha (patch size about 6 ha).	A1. Meets condition threshold with 31 native vascular plant species recorded. A2. Meets condition threshold with 13 indicator species recorded being: *Arthropodium minus, Asperula conferta, Bulbine bulbosa, Calotis scabiosifolia, Goodenia pusilliflora, Hyalosperma semisterile, Isoetopsis graminifolia, Maireana aphylla, Maireana excavata, Maireana humillima, Maireana pentagona, Rhodanthe pygmaea* and *Swainsona murrayana.* Meets condition threshold with patch size exceeding 0.04 ha (patch size about 13 ha)

CONDITION THRESHOLDS	Q189E	Q213E
Category B. For larger patches that have good ground layer diversity: This applies where patches of the ecological community do not meet the high diversity or lack or disturbance criteria in Category A, but still retain sufficient elements of their natural diversity. Ground layer diversity: B1. 10 or more native vascular plant species are present in the patch. AND Patch size: B2. The size of the grassland patch is at least 1 ha or more in size (i.e. at least 10 000 m^2 or a 100 m x 100 m square or equivalent area in any shape).	Already meets ecological community.	Already meets ecological community
Outcome	**Meets Step 2 (Category A) – condition threshold and forms part of the ecological community.**	**Meets Step 2 (Category A) – condition threshold and forms part of the ecological community.**

Table 7-7 Assessment Step 1: use key diagnostic characteristics to identify if the ecological community is present for patches assigned to PCT 45 – Plains Grass grassland on alluvial mainly clay soils in the Riverina Bioregion and NSW South Western Slopes Bioregion

KEY DIAGNOSTIC CHARACTERISTICS	Q190E	Q218E	Q219E	Q220E	Q221E
Distribution is primarily in the Riverina Bioregion and the Wimmera plains of the Murray Darling Depression Bioregion. Other outlying occurrences are also in the Murray Darling Depression Bioregion and the NSW South Western Slopes Bioregion. The approximate northern limit of the ecological community is in the Murrumbidgee subregion (IBRA RIV2), approximately near the northern boundary of the Murray Catchment Management Authority (CMA) in NSW.	Occurs in the Murrumbidgee subregion (IBRA RIV2) of the Riverina Bioregion	Occurs in the Murrumbidgee subregion (IBRA RIV2) of the Riverina Bioregion	Occurs in the Murrumbidgee subregion (IBRA RIV2) of the Riverina Bioregion	Occurs in the Murrumbidgee subregion (IBRA RIV2) of the Riverina Bioregion	Occurs in the Murrumbidgee subregion (IBRA RIV2) of the Riverina Bioregion
It typically occurs on a landscape of flat alluvial lowland plains with heavy-textured grey, brown and red clays.	Occurs on heavy-textured grey clays	Occurs on heavy-textured grey clays	Occurs on heavy-textured grey clays	Occurs on heavy-textured grey clays	Occurs on heavy-textured grey clays
The ecological community is typically dominated by a range of perennial grasses and/or forbs or co-dominated by small shrubs. Sites are not necessarily dominated by any particular plant species. Characteristic genera present typically include: for grasses – *Rytidosperma, Austrostipa, Chloris* and *Enteropogon,* for forbs – *Arthropodium, Bulbine, Calotis, Chrysocephalum, Leptorhynchos, Minuria, Ptilotus, Rhodanthe, Sida* and *Swainsona,* for small shrubs – *Atriplex* and *Maireana*.	For grasses – *Austrostipa, Enteropogon* and *Rytidosperma* were recorded. For forbs – *Bulbine* and *Calotis* were recorded No shrubs were recorded.	For grasses – *Austrostipa* was recorded. For forbs – *Calotis, Rhodanthe, Sida* and *Swainsona* were recorded For shrubs – *Atriplex* and *Maireana* were recorded	For grasses – *Austrostipa, Chloris* and *Rytidosperma* were recorded For forbs – *Rhodanthe* was recorded For shrubs – *Atriplex* and *Maireana* were recorded	For grasses – *Austrostipa* and *Rytidosperma* were recorded. For forbs – *Calotis, Rhodanthe* and *Sida* were recorded. No shrubs were recorded.	For grasses – *Austrostipa* and *Rytidosperma* were recorded. For forbs – *Calotis, Rhodanthe* and *Sida* were recorded. No shrubs were recorded.

KEY DIAGNOSTIC CHARACTERISTICS	Q190E	Q218E	Q219E	Q220E	Q221E
Trees and large shrubs (>1m tall) are generally absent to sparse, amounting to less than 10% projective foliage cover. Where woodlands overlap or adjoin with the ecological community an outer boundary of two times the canopy width of the dominant tree species is applied.	Trees and large shrubs are absent.	Trees and large shrubs are absent.	Trees and large shrubs are absent.	Trees and large shrubs are absent.	Trees and large shrubs are absent.
The patch should contain at least as many, preferably more, of the species in Table 1(A) than in Table 1(B) of the listing advice, when assessed at an appropriate time (e.g. late winter-spring and not soon after disturbance such as grazing). The species in Table 1(A) are characteristic of the natural grassland ecological community and not derived grasslands, and the opposite applies to Table 1(B). Note this generally only applies to grasslands occurring in the Lachlan (RIV 1) and Murrumbidgee (RIV 2) IBRA subregions.	Of the 16 native species recorded 3 occur in Table 1 (A) and 2 occur in Table 1 (B)	Of the 19 native species recorded 7 occur in Table 1 (A) and 2 occur in Table 1 (B)	Of the 26 native species recorded 7 occur in Table 1 (A) and 2 occur in Table 1 (B)	Of the 14 native species recorded 4 occur in Table 1 (A) and 1 occurs in Table 1 (B)	Of the 15 native species recorded 4 occur in Table 1 (A) and none occur in Table 1 (B)
If there is reliable evidence (e.g. historical records, photographs) that a patch was once woodland or shrubland with >10% cover (of trees, shrubs >1 m), then the patch is not considered to be part of the ecological community.	There is no evidence that the patch was once a woodland or shrubland	There is no evidence that the patch was once a woodland or shrubland	There is no evidence that the patch was once a woodland or shrubland	There is no evidence that the patch was once a woodland or shrubland	There is no evidence that the patch was once a woodland or shrubland
Soil type and landscape position (e.g. Alluvial soils, plains) that correspond with the ecological community and not other vegetation types may also assist in identifying the likely occurrence of natural grasslands ecological community.	The patch occurs on alluvial soils associated with a broad plain.	The patch occurs on alluvial soils associated with a broad plain.	The patch occurs on alluvial soils associated with a broad plain.	The patch occurs on alluvial soils associated with a broad plain.	The patch occurs on alluvial soils associated with a broad plain.
Outcome	**Meets Step 1 – key diagnostic characteristics**	**Meets Step 1 – key diagnostic characteristics**	**Meets Step 1 – key diagnostic characteristics**	**Meets Step 1 – key diagnostic characteristics**	**Meets Step 1 – key diagnostic characteristics**

Table 7-8 Assessment Step 2: Determine condition of the ecological community for representative patches assigned to PCT 45 – Plans Grass grassland on alluvial mainly clay soils in the Riverina Bioregion and NSW South Western Slopes Bioregion

CONDITION THRESHOLDS	Q190E	Q218E	Q219E	Q220E	Q221E
For all patches of the ecological community. The percentage cover of native vascular plants (annual and perennial) in the patch is greater than the percentage cover of perennial exotic species. AND Either category A or category B thresholds are met as below	Meets threshold. Native vascular cove was recorded at 62.8% with exotic cover recorded at 31.74%.	Meets threshold. Native vascular cover was recorded at 51.8% with exotic cover recorded at 44.8%	Meets threshold. Native vascular cover was recorded at 84.8% with exotic cover recorded at 25.1%.	Meets threshold. Native vascular cover was recorded at 69.4% with exotic cover recorded at 37.3%	Meets threshold. Native vascular cover was recorded at 74.9% with exotic cover recorded at 42.9%

CONDITION THRESHOLDS	Q190E	Q218E	Q219E	Q220E	Q221E
Category A. For patches with high diversity or that are relatively undisturbed. This recognises that many patches of the ecological community can maintain their diversity despite the highly fragmented nature of the community or small patch sizes: A1. 15 or more vascular plant species are present in the patch. AND A2. The patch contains one or more indicator species in Table2, characteristic of sites that are relatively undisturbed (e.g. have little to no history of cultivation). AND Patch size: A3. The size of the grassland patch is at least 0.04 ha or more in size (i.e. at least 400 m^2 or a 20 m x 20 m square or equivalent area in any shape.	A1. Meets condition threshold with 16 native vascular plant species recorded. A2. Meets condition threshold with four indicator species recorded being: *Bulbine bulbosa, Calotis scabiosifolia, Microseris lanceolata* and *Pycnosorus globosus* (formerly a *Craspedia spp.*) A3. Meets condition threshold with patch size exceeding 0.04 ha (patch size is about 1.5 ha)	A1. Meets condition threshold with 19 native vascular plant species recorded. A2. Meets condition threshold with eight indicator species recorded being: *Calocephalus citreus, Calotis scabiosifolia, Daucus glochidiatus, Leiocarpa panaetioides, Maireana aphylla, Maireana excavata, Swainsona murrayana* and *Swainsona procumbens.* A3. Meets condition threshold with patch size exceeding 0.04 ha (patch size is about 14 ha).	A1. Meets condition threshold with 26 native vascular plant recorded. A2. Meets condition threshold with six indicator species recorded being: *Asperula conferta, Daucus glochidiatus, Leiocarpa panaetioides, Maireana excavata, Maireana humillima* and *Triptilodiscus pygmaeus* A3. Meets condition threshold with patch size exceeding 0.04 ha (patch size is about 20 ha)	A1. Does not meet condition threshold as <15 native vascular plants were recorded from the patch (14 native vascular plant species)	A1. Meets condition threshold with 15 native vascular plant species recorded A2. Meets condition threshold with four indicator species recorded being: *Asperula conferta, Calotis anthemoides, Crassula decumbens* and *Daucus glochidiatus* A3. Meets condition threshold with patch size exceeding 0.04 ha (patch size about 7 ha)

CONDITION THRESHOLDS	Q190E	Q218E	Q219E	Q220E	Q221E
Category B. For larger patches that have good ground layer diversity: This applies where patches of the ecological community do not meet the high diversity or lack or disturbance criteria in Category A, but still retain sufficient elements of their natural diversity. Ground layer diversity: B1. 10 or more native vascular plant species are present in the patch. AND Patch size: B2. The size of the grassland patch is at least 1 ha or more in size (i.e. at least 10 000 m^2 or a 100 m x 100 m square or equivalent area in any shape).	Already meets ecological community.	Already meets ecological community.	Already meets ecological community.	B1. Meets condition threshold with 14 native vascular plant species recorded B2. Meets condition threshold with patch size exceeding 1 ha (patch size about 20 ha)	Already meets ecological community
Outcome	**Meets Step 2 (Category A) – condition threshold and forms part of the ecological community.**	**Meets Step 2 (Category A) – condition threshold and forms part of the ecological community.**	**Meets Step 2 (Category A) – condition threshold and forms part of the ecological community.**	**Meets Step 2 (Category B) – condition threshold and forms part of the ecological community.**	**Meets Step 2 (Category A) – condition threshold and forms part of the ecological community.**

Table 7-9 Assessment Step 1: use key diagnostic characteristics to identify if the ecological community is present for patches assigned to PCT 46 – Curly Windmill Grass – speargrass – wallaby grass grassland on alluvial clay and loan on the Hay Plain, Riverina Bioregion

KEY DIAGNOSTIC CHARACTERISTICS	Q191E	Q216E	Q217E
Distribution is primarily in the Riverina Bioregion and the Wimmera plains of the Murray Darling Depression Bioregion. Other outlying occurrences are also in the Murray Darling Depression Bioregion and the NSW South Western Slopes Bioregion. The approximate northern limit of the ecological community is in the Murrumbidgee subregion (IBRA RIV2), approximately near the northern boundary of the Murray Catchment Management Authority (CMA) in NSW.	Occurs in the Murrumbidgee subregion (IBRA RIV2) of the Riverina Bioregion	Occurs in the Murrumbidgee subregion (IBRA RIV2) of the Riverina Bioregion	Occurs in the Murrumbidgee subregion (IBRA RIV2) of the Riverina Bioregion
It typically occurs on a landscape of flat alluvial lowland plains with heavy-textured grey, brown and red clays.	Occurs on brown – grey clays.	Occurs on brown – grey clays.	Occurs on brown – grey clays.
The ecological community is typically dominated by a range of perennial grasses and/or forbs or co-dominated by small shrubs. Sites are not necessarily dominated by any particular plant species. Characteristic genera present typically include: for grasses – *Rytidosperma, Austrostipa, Chloris* and *Enteropogon*, for forbs – *Arthropodium, Bulbine, Calotis, Chrysocephalum, Leptorhynchos, Minuria, Ptilotus, Rhodanthe, Sida* and *Swainsona*, for small shrubs – *Atriplex* and *Maireana*.	For grasses – *Enteropogon* and *Rytidosperma* were recorded For forbs – *Calotis, Chrysocephalum,* and *Swainsona* were recorded For shrubs – *Atriplex* and *Maireana* were recorded	For grasses – *Austrostipa, Enteropogon, Chloris* and *Rytidosperma* were recorded For forbs – *Calotis, Chrysocephalum, Ptilotus* and *Rhodanthe* were recorded For shrubs – *Atriplex* and *Maireana* were recorded	For grasses – *Austrostipa, Enteropogon* and *Rytidosperma* were recorded For forbs – *Calotis, Chrysocephalum, Sida* and *Swainsona* were recorded For shrubs – *Atriplex* and *Maireana* were recorded
Trees and large shrubs (>1 m tall) are generally absent to sparse, amounting to less than 10% projective foliage cover. Where woodlands overlap or adjoin with the ecological community an outer boundary of two times the canopy width of the dominant tree species is applied.	Trees and large shrubs were absent.	Trees and large shrubs were absent.	Trees and large shrubs were absent.

KEY DIAGNOSTIC CHARACTERISTICS	Q191E	Q216E	Q217E
The patch should contain at least as many, preferably more, of the species in Table 1(A) than in Table 1(B) of the listing advice, when assessed at an appropriate time (e.g. late winter-spring and not soon after disturbance such as grazing). The species in Table 1(A) are characteristic of the natural grassland ecological community and not derived grasslands, and the opposite applies to Table 1(B). Note this generally only applies to grasslands occurring in the Lachlan (RIV 1) and Murrumbidgee (RIV 2) IBRA subregions.	Of the 25 native species recorded 7 occur in Table 1(A) and 3 occur in Table 1(B)	Of the 26 native species recorded 6 occur in Table 1 (A) and 2 occur in Table 1 (B)	Of the 29 native species recorded 8 occur in Table 1(A) and 2 occur in Table 1 (B)
If there is reliable evidence (e.g. historical records, photographs) that a patch was once woodland or shrubland with >10% cover (of trees, shrubs >1 m), then the patch is not considered to be part of the ecological community.	There is no evidence that the patch was once a woodland or shrubland	There is no evidence that the patch was once a woodland or shrubland	There is no evidence that the patch was once a woodland or shrubland
Soil type and landscape position (e.g. Alluvial soils, plains) that correspond with the ecological community and not other vegetation types may also assist in identifying the likely occurrence of natural grasslands ecological community.	The patch occurs on alluvial soils associated with a broad plain.	The patch occurs on alluvial soils associated with a broad plain.	The patch occurs on alluvial soils associated with a broad plain.
Outcome	**Meets Step 1 – key diagnostic characteristics**	**Meets Step 1 – key diagnostic characteristics**	**Meets Step 1 – key diagnostic characteristics**

Table 7-10 Assessment Step 2: Determine condition of the ecological community for representative patches assigned to PCT 46 – Curly Windmill Grass – speargrass – wallaby grass grassland on alluvial clay and loam on the Hay Plain, Riverina Bioregion

CONDITION THRESHOLDS	Q191E	Q216E	Q217E
For all patches of the ecological community. The percentage cover of native vascular plants (annual and perennial) in the patch is greater than the percentage cover of perennial exotic species. AND Either category A or category B thresholds are met as below	Meets threshold. Native vascular cover was recorded at 69.3% with exotic cover recorded at 26.8%	Meets threshold. Native vascular cover was recorded at 84.3% with exotic cover recorded at 43%	Meets threshold. Native vascular cover was recorded at 59.7% with exotic cover recorded at 17.7%. A high percentage of annual exotic cover was recorded and cover for *Lolium ridgidum** was removed for purpose of calculation.
Category A. For patches with high diversity or that are relatively undisturbed. This recognises that many patches of the ecological community can maintain their diversity despite the highly fragmented nature of the community or small patch sizes: A1. 15 or more vascular plant species are present in the patch. AND A2. The patch contains one or more indicator species in Table 2, characteristic of sites that are relatively undisturbed (e.g. have little to no history of cultivation). AND Patch size: A3. The size of the grassland patch is at least 0.04 ha or more in size (i.e. at least 400 m^2 or a 20 m x 20 m square or equivalent area in any shape.	A1. Meets condition threshold with 25 native vascular plant species recorded A2. Meets condition threshold with five indicator species recorded being: *Asperula conferta, Calotis scabiosifolia, Craspedia variabilis, Leiocarpa panaetioides* and *Linum marginale* A3. Meets condition threshold with patch size exceeding 0.04 ha (patch size is about 1 ha)	A1. Meets condition threshold with 26 native vascular plant species recorded. A2. Meets condition threshold with 10 indicator species recorded being: *Asperula conferta, Calotis scabiosifolia, Daucus glochidiatus, Goodenia pusilliflora, Leiocarpa panaetioides, Maireana humillima, Microseris lanceolata, Plantago drummondii, Ptilotus exaltatus* and *Swainsona murrayana* A3. Meets condition threshold with patch size exceeding 0.04 ha (patch size is about 1 ha)	A1. Meets condition threshold with 29 native vascular plant species recorded. A2. Meets condition threshold with seven indicator species recorded being: *Calocephalus citreus, Calotis scabiosifolia, Isoetopsis graminifolia, Leiocarpa panaetioides, Microseris lanceolata, Swainsona murrayana* and *Swainsona procumbens* A3. Meets condition threshold with patch size exceeding 0.04 ha (patch size is about 1 ha).

CONDITION THRESHOLDS	Q191E	Q216E	Q217E
Category B. For larger patches that have good ground layer diversity: This applies where patches of the ecological community do not meet the high diversity or lack or disturbance criteria in Category A, but still retain sufficient elements of their natural diversity. Ground layer diversity: B1. 10 or more native vascular plant species are present in the patch. AND Patch size: B2. The size of the grassland patch is at least 1 ha or more in size (i.e. at least 10,000 m^2 or a 100 m x 100 m square or equivalent area in any shape).	Already meets ecological community.	Already meets ecological community	Already meets ecological community
Outcome	**Meets Step 2 (Category A) – condition threshold and forms part of the ecological community.**	**Meets Step 2 (Category A) – condition threshold and forms part of the ecological community.**	**Meets Step 2 (Category A) – condition threshold and forms part of the ecological community.**

Table 7-11 Summary of Natural Grasslands of the Murray Valley Plains within the disturbance area

THREATENED ECOLOGICAL COMMUNITY	VEGETATION TYPE	IBRA SUBREGION	VEG ZONE NAME (BAM-C)	IMPACT (HA)
Natural Grasslands of the Murray Valley Plains	PCT 44 - Forb-rich Speargrass – Windmill Grass – White Top grassland of the Riverina Bioregion	Murrumbidgee	VZ #16 44_Mod-good	15.23
			VZ #40 44_SVM_Bench	6.38
	PCT 45 – Plains Grass grassland on alluvial mainly clay soils in the Riverina Bioregion and NSW South Western Slopes Bioregion		VZ #17 45_Mod-good	24.11
			VZ #41 45_SVM_Bench	10.01
	PCT 46 – Curly Windmill Grass – speargrass – wallaby grass grassland on alluvial clay and loam on the Hay plains, Riverina Bioregion		VZ #18 46_Mod-good	16.78
Total				**72.51**

7.1.1.4 Plains mallee box woodlands of the Murray Darling Depression, Riverina and Naracoorte Coastal Plains Bioregions – Critically endangered

Plains mallee box woodland of the Murray Darling Depression, Riverina and Naracoorte Coastal Plains bioregions is a medium tall open mallee eucalypt woodland generally dominated by box-barked mallee eucalypts. It is associated with more heavily textured soils than other mallee vegetation communities and occurs on near-level to gently sloping plains in south-west New South Wales, north-west Victoria and south-east South Australia.

Within New South Wales there is no specific PCT that is aligned to this ecological community although it is considered to form part of the broader PCT 170 – Chenopod sandplain mallee woodland/shrubland of the arid and semi-arid (warm) zones complex.

Within the proposal study area patches of PCT 170 – Chenopod sandplain mallee woodland/shrubland of the arid and semi-arid (warm) zones were inspected and sampled by local mallee expert's Dr Ian Sluiter and Mr Geoffery Allen to determine if the ecological community occurred. It was found that a small area of PCT 170 in the Euston district formed part of Variant 3 of this ecological community.

A comparison of the listing advice for Plains mallee box woodland and candidate PCT patches is provided in Table 7-12. Each element of the listing advice including locality, species composition, characteristic species and resilience is compared to each condition class for the candidate PCT to determine if vegetation recorded is consistent with the listing criteria.

The location of Plains mallee box woodland in relation to the proposal study area is provided in Figure 7-5. A summary of Plains mallee box woodland, associated PCT and extent within the disturbance area for each IBRA subregion is presented in Table 7-13.

Table 7-12 Assessment of EPBC Act listed Plains mallee box woodland and associated recorded vegetation

LISTING ADVICE	PCT 170
Does the PCT occur in south-west NSW, north-west Victoria and south-east South Australia including the following bioregions, Murray Darling Depression, Riverina and Naracoorte Coastal Plain Bioregions?	Yes This PCT was recorded to occur in the Murray Darling Depression (South Olary Plain subregion) IBRA Bioregion in south-west NSW.
Does the PCT occur as a medium to tall open mallee eucalypt woodland with a canopy typically dominated by 'mallee box' *Eucalyptus* species and an understorey in which tussock grasses may be prominent in relatively wet years, low chenopod shrubs occur in variable densities, and taller shrubs are typically sparse?	Yes PCT occurs as a medium (5 – 10m) open mallee community with a canopy dominated by *Eucalyptus dumosa*, an understorey dominated by tussock grasses and a distinct low chenopod shrub layer.
Does the PCT occur in association with relatively medium-heavy textured soils on near-level to gently sloping plains? Typically, soils are heavier in texture than soils that support most other mallee communities but have a lower fraction of clay than soils supporting saltbush shrublands and black box woodlands.	Yes This PCT occurs on medium textured soils that potentially have a higher clay composition to surrounding mallee communities due to proximity to the Murray River, Dry Lake and Lake Benanee. This PCT occurs on a near-level to gently sloping plain.
Canopy species and composition Is the canopy between 5 – 15 m tall with a typical cover ranging from 10-15% (spare to open canopy)? AND Variant 1 - dominated by *Eucalyptus behriana* Variant 2 - dominated by *Eucalyptus porosa* Variant 3 – dominated by *Eucalyptus dumosa* in areas where the understorey or other characteristics are consistent with the ecological community (i.e. will not occur on sand dunes where *Triodia scariosa* subsp. *scariosa* is prominent). Note: *Eucalyptus odorata* may be codominant in some areas. *Allocasuarina luehmannii* and *Casuarina pauper* can also be locally abundant, but not dominant across an entire patch.	Yes The canopy typically ranges from 5–10 m in height with and average cover of. The patch is classed as variant 3 due to the dominance of *Eucalyptus dumosa* and lack of *Eucalyptus behriana* and *Eucalyptus porosa.* Both *Allocasuarina luehmannii* and *Casuarina pauper* occur in neighbouring PCTs (PCT 22) and have been assigned to EPBC listed Buloke woodlands of the Riverina and Murray-Darling Depression Bioregions and BC listed *Allocasuarina luehmanii* woodland in the Riverina and Murray-Darling Depression Bioregions. Understorey and other characteristics associated with the ecological community are discussed further below.
Small tree and large shrub canopy species and composition Does the patch contain a typically low (3–4 m) small tree and/or shrub layer that is very sparse (<5% cover)? A medium shrub layer may also be present but is normally very sparse (<10%). AND Contain characteristic species provided in paragraph 2.1.4.2 of the listing advice?	The patch contains small tree species such as *Pittosporum angustifolium* (Weeping Pittosporum), *Alectryon oleifolius* subsp. *canescens* (Rosewood), *Acacia oswaldii* (Umbrella wattle) and large shrub species such as *Eremophila glabra* (Common Emu-bush), *Eremophila longifolia* (Berrigan) and *Senna artemisioides* subsp. (Senna types).

LISTING ADVICE	PCT 170
Low shrub and ground layer species Does the patch have a distinct low to decumbent chenopod sub-shrub layer with a ground layer that is dominated by tussock grasses (possibly inconspicuous depending on drought conditions and grazing pressures)? AND Contain characteristic species provided in paragraph 2.1.4.3 of the listing advice?	The low shrub and ground layer species composition of the patch is dominated by characteristic species of this community.
Outcome	**Meets key characteristics and condition threshold - forms part of the ecological community**

Table 7-13 Summary of Plains mallee box woodland threatened ecological community within the disturbance area

THREATENED ECOLOGICAL COMMUNITY	VEGETATION TYPE	IBRA SUBREGION	VEG ZONE NAME (BAM-C)	IMPACT (HA)
Plains mallee box woodland of the Murray Darling Depression, Riverina and Naracoorte Coastal Plains bioregions	PCT 170 – Chenopod sandplain mallee woodland/shrubland of the arid and semi-arid (warm) zones	South Olary Plain	VZ #7 170_Mod-good_whip	2.09
			VZ #8 170_Mod-goos_Bull	3.89
Total				**5.98**

7.1.1.5 Seasonal Herbaceous Wetlands (Freshwater) of the Temperate Lowland Plains – Critically Endangered

Seasonal Herbaceous Wetlands (Freshwater) of the Temperate Lowland Plains is the name given to the ecological community comprising of wetland species that have adapted to seasonal drying and wetting or waterlogged conditions. This ecological community occurs on the lowland plains of temperate south-eastern Australia from Victoria, south-eastern South Australia and southern New South Wales.

Within the proposal study area one vegetation type was considered likely to associate with this threatened ecological community being, PCT 47 – Swamp grassland wetland of the Riverine Plain.

A comparison of the listing advice for Seasonal Herbaceous Wetlands (Freshwater) of the Temperate Lowland Plains and candidate PCT is provided in Table 7-14 and Table 7-15. Each element of the listing advice including locality, species composition, characteristic species and resilience is compared to each condition class for the candidate PCT to determine if vegetation recorded is consistent with the listing criteria.

The location of Seasonal Herbaceous Wetlands (Freshwater) of the Temperate Lowland Plains in relation to the proposal study area is provided in Figure 7-5. A summary of Seasonal Herbaceous Wetlands (Freshwater) of the Temperate Lowland Plains, associated PCT and extent within the disturbance area for each IBRA subregion is presented in Table 7-16.

Table 7-14 Assessment Step 1: use key diagnostic characteristics to identify if the ecological community is present for representative patches assigned to PCT 47 – Swamp grassland wetland of the Riverine Plain

KEY DIAGNOSTIC CHARACTERISTICS	Q194E
Landscape Limited to the temperate zones of mainland south – eastern Australia. The ecological community occurs in south – east SE, Victoria and southern NSW On flat plains grading into slopes, below 500 m asl Associated soils are generally fertile but poorly draining clays derived from arrange of geologies Typically in rainfall zones with a Winter seasonal rainfall pattern, extending into uniform seasonal rainfall pattern at the edge of its range. The mean annual rainfall is usually 400 to 800 mm/year but can be lower at the northern edge of its range.	Meets key diagnostic characteristics: Located in the Riverina (Murrumbidgee subregion) IBRA bioregion which occurs in southern NSW. Occurs on a flat plain at <500 m elevation (about 125 m in elevation). Occurs on poorly draining grey cracking clay. Locality falls within a winter seasonal rainfall period which accumulates an average of about 400 mm of rain per annum.
Hydrology On isolated drainage lines or depressions which are seasonally inundated (typically during winter-spring) and subsequently dry (typically by late summer) Rainfall is the main water source. These wetlands are not dependant on overbank flooding from riverine systems.	Meets key diagnostic characteristics: Occurs in isolated drainage lines and depressions that inundate with water following periods of winter rain. Rainfall is the main water source.
Biota Trees and shrubs are sparse to absent. When present, they mostly occur as fringing or scattered individuals. The cover of woody species accounts for no more than 10% projective foliage cover across the wetland. The vegetative cover of the ecological community is dominated by a ground layer of native wetland graminoids and/or native wetland forbs A range of graminoids is often present and typically includes one or more of the following taxa: *Amphibromus* spp., *Carex tereticaulis, Deyeuxia* spp., *Glyceria* spp., *Lachnagrostis* spp., *Poa labillardieri* and *Rytidosperma duttonianum*. Note that other graminoid taxa may also occur, though are not necessarily common – refer to Appendix A for a plant species list. Freshwater algae often are present when the wetland is, or recently has been, wet.	Meets key diagnostic characterises: Trees were absent with scattered occurrences of *Duma florulenta* which did not exceed 10% projected foliage cover (recorded as 1% cover). Five native wetland graminoid species listed in Appendix A were recorded with a cover of 58.2% and included *Juncus flavidus, Juncus radula, Lachnagrostis filiformis, Rytidosperma duttonianum* and *Walwhalleya proluta*; while 1 native wetland forb, *Swainsona procumbens*, was recorded with a cover of 0.1. Note sampling occurred prior to inundation by winter rains causing a reduction in forb richness. No algae was recorded, however, sampling occur prior to inundation by winter rains.
Modified wetlands Modifications to other types of wetland may result in the ecological community being present where it was formerly absent. These modified wetland sites are included as part of the national ecological community, if they remain a functional natural wetland and conform to the description of the ecological community	N/A – there is no evidence of modification to the sample site
Outcome	**Meets step 1 - key diagnostic characteristics**

Table 7-15 Assessment Step 2: Determine condition of the ecological community for representative patches assigned to PCT 47 – Swamp grassland wetland of the Riverine Plain

CONDITION THRESHOLDS	Q194E
Part A: Condition during 'typical' wet cycles. This is likely to occur in most years. It is best applied when the wetlands are inundated, or recently wet within a season, noting that some taxa may not have become apparent after recent filling. A1. Is the wetland consistent with the key diagnostics, noted above? AND A2. Is 50% or more of the total cover of plants in the ground layer of the wetland dominated by native species characteristic of the Seasonal Herbaceous Wetlands ecological community?	A1. Meets condition threshold as sample meets the key diagnostic characteristics A2. Six native wetland graminoid and forb species were recorded with a cover of 79.3%
Part B: To determine if the ecological community occurs at sites where there has been a prolonged dry period (e.g. drought of longer than a year)	Sample not taken during prolonged dry period; Part A conditions apply.
Part C: Minimum wetland size. The ecological community is naturally fragmented and occurs as discrete, often small wetlands. Figure 1 of the listing advice should be considered when assessing minimum size requirements. The following conditions apply. — Isolated wetland in a landscape – size must be at least 0.5 ha — Wetland occurs as a cluster of many small wetlands in reasonably close proximity (e.g. gilgais) – the collective area of wetlands within the cluster must be at least 0.5 ha AND the total area of the wetland proper accounts for 10% or more of the total cluster area — Wetland is connected to, or part of, a native vegetation remnant and wetland or wetland cluster is < 0.5 ha – the actual wetland or wetland cluster is at least 0.1 ha AND the wetland is contiguous with a native vegetation remnant AND the total area of the wetland plus other native vegetation is at least 1 ha	Meets condition threshold. Occurs as an isolated wetland with a patch size > 0.5 ha (patch size is about 2 ha)
Part D: Very high-quality wetlands. Used to determine whether the wetland is of very high quality based on presence of three or more indicator plant species listed in Table 1 of the listing advice. Not used to determine whether the community occurs.	One species listed in Table 1 was recorded, *Swainsona procumbens*, however the sample was recorded before inundation by winter rains causing a reduction in species richness.
Outcome	**Meets Step 2 (Category A) – condition threshold and forms part of the ecological community**

Table 7-16 Summary of Seasonal Herbaceous Wetlands (Freshwater) of the Temperate Lowland Plains within the disturbance area

THREATENED ECOLOGICAL COMMUNITY	VEGETATION TYPE	IBRA SUBREGION	VEG ZONE NAME (BAM-C)	IMPACT (HA)
Seasonal Herbaceous Wetlands (Freshwater) of the Temperate Lowland Plains	PCT 47 – Swampland grassland wetland of the Riverine Plain	Murrumbidgee	VZ #19 47_Mod-good	2.13
			VZ #43 47_SVM_Bench	1.30
Total				**3.43**

7.1.1.6 Weeping Myall Woodlands – Endangered

The Weeping Myall Woodlands are an ecological community occurring as an open woodland to woodland structure in which *Acacia pendula* (Weeping Myall) is the dominant tree species. The ecological community has a wide distribution area that includes the Murray-Darling Depression, Cobar Peneplain and Nandewar bioregions.

Within the proposal study area one vegetation type was considered likely to associate with this threatened ecological community being, PCT 26 – Weeping Myall open woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion.

For a vegetation patch to meet the threatened ecological listing of Weeping Myall Woodlands it must meet specific listing advice key characteristics and condition threshold criteria as outlined in Figure 7-3. An assessment of this key diagnostic characteristics and condition threshold criteria against recorded plot data is presented in Table 7-17.

The location of Weeping Myall Woodlands in relation to the proposal study area is provided in Figure 7-5. A summary of Weeping Myall Woodlands, associated PCT and extent within the disturbance area for each IBRA subregion is presented in Table 7-18.

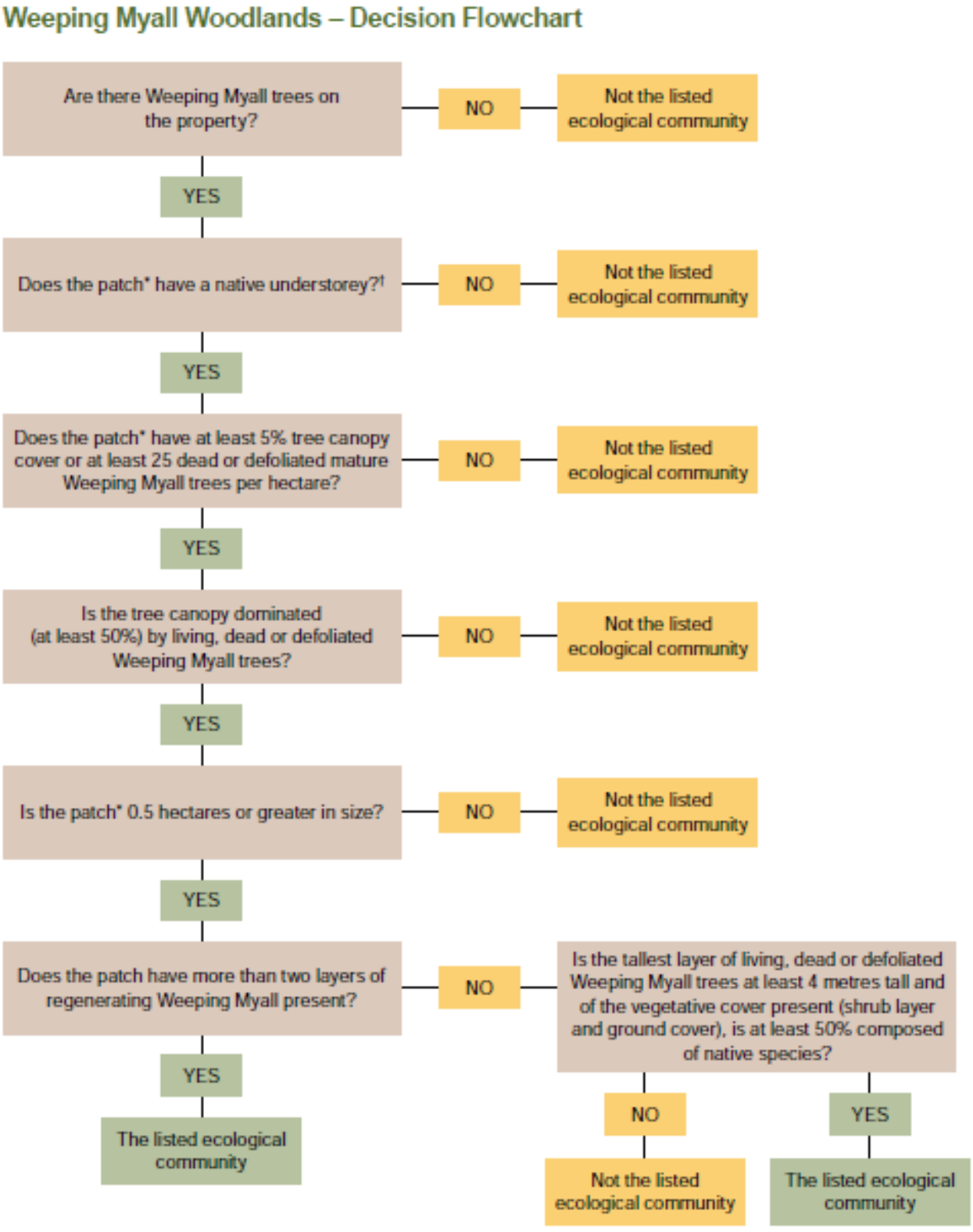


Figure 7-3 Listing advice key characteristics and condition threshold criteria for Weeping Myall Woodlands

Table 7-17 Assessment of EPBC Act listed Weeping Myall Woodlands and associated recorded vegetation

LISTING ADVICE	Q28E	Q96E	Q97E	Q98E	Q168E	Q171E	Q175E	Q181E	Q183E	Q197E
The tree canopy is dominated (at least 50% of trees present) by living, dead or defoliated Weeping Myall trees	Meets criteria. *Acacia pendula* was the only recorded tree species.	Meets criteria. *Acacia pendula* was the only recorded tree species.	Meets criteria. *Acacia pendula* was the only recorded tree species.	Meets criteria. Cover of *Acacia pendula* was recorded at 18%. *Acacia oswaldii* was the only other tree species present with a recorded cover of 0.1%.	Meets criteria. *Acacia pendula* was the only recorded tree species.	Meets criteria. *Acacia pendula* was the only recorded tree species.	Meets criteria. *Acacia pendula* was the only recorded tree species.	Meets criteria. *Acacia pendula* was the only recorded tree species.	Meets criteria. *Acacia pendula* was the only recorded tree species.	Meets criteria. *Acacia pendula* was the only recorded tree species.
The patch has a predominantly native understorey.	Meets criteria. The patch has >50% native cover in the understorey (native cover recorded at 95%)	Meets criteria. The patch has >50% native cover in the understorey (native cover recorded at 97%)	Meets criteria. The patch has >50% native cover in the understorey (native cover recorded at 99%)	Meets criteria. The patch has >50% native cover in the understorey (native cover recorded at 99%)	Meets criteria. The patch has >50% native cover in the understorey (native cover recorded at 85%)	Meets criteria. The patch has >50% native cover in the understorey (native cover recorded at 98%)	Meets criteria. The patch has >50% native cover in the understorey (native cover recorded at 90%)	Meets criteria. The patch has >50% native cover in the understorey (native cover recorded at 82%)	Meets criteria. The patch has >50% native cover in the understorey (native cover recorded at 64%)	Meets criteria. The patch has >50% native cover in the understorey (native cover recorded at 71%)
The overstorey must have at least 5% tree canopy cover or at least 25 dead or defoliated mature Weeping Myall trees/ha	Meets criteria with >5% tree canopy cover (cover recorded to be 18%)	Meets criteria with >5% tree canopy cover (cover recorded to be 6%)	Doesn't meet criteria within sample site with <5% tree canopy cover recorded (cover recorded to be 4%) and <25 dead or defoliated mature Weeping Myall trees/ha. However, at the patch level canopy cover would exceed the required 5% tree canopy cover.	Meets criteria with >5% tree canopy cover (cover recorded to be 18%)	Meets criteria with >5% tree canopy cover (cover recorded to be 22%)	Meets criteria with >5% tree canopy cover (cover recorded to be 32%)	Meets criteria with >5% tree canopy cover (cover recorded to be 32%)	Meets criteria with >5% tree canopy cover (cover recorded to be 8%)	Meets criteria with >5% tree canopy cover (cover recorded to be 8%)	Meets criteria with >5% tree canopy cover (cover recorded to be 5%)
The area is at least 0.5 ha in size	Meets criteria. Patch size >100 ha.	Meets criteria. Patch size >100 ha.	Meets criteria. Patch size >100 ha.	Meets criteria. Patch size >100 ha.	Meets criteria. Patch size about 19 ha.	Meets criteria. Patch size about 20 ha.	Meets criteria. Patch size about 35 ha.	Meets criteria. Patch size about 14 ha.	Meets criteria. Patch size about 20 ha.	Meets criteria. Patch size about 43 ha.
The patch has either: more than two layers of regeneration of Weeping Myall present OR the tallest layer of living, dead or defoliated Weeping Myall trees is at least 4 m tall and of the vegetative cover present, 50% is comprised of native species	Meets criteria More than two layers of regeneration of Weeping Myall recorded.	Meets criteria. The tallest layer of Weeping Myall was recorded to be 7 m tall and of all the vegetation cover present, 98.1% is native.	Meets criteria. The tallest layer of Weeping Myall was recorded to be 8 m tall and of all the vegetation cover present, 99.4% is native	Meets criteria. The tallest layer of Weeping Myall was recorded to be 8 m tall and of all the vegetation cover present, 99.7% is native	Meets criteria More than two layers of regeneration of Weeping Myall recorded.	Meets criteria More than two layers of regeneration of Weeping Myall recorded.	Meets criteria More than two layers of regeneration of Weeping Myall recorded.	Meets criteria More than two layers of regeneration of Weeping Myall recorded.	Meets criteria More than two layers of regeneration of Weeping Myall recorded.	Meets criteria. The tallest layer of Weeping Myall was recorded to be 8 m tall and of all the vegetation cover present, 56.3% is native
Outcome	**Meets condition criteria – forms part of the ecological community**	**Meets condition criteria – forms part of the ecological community**	**Meets condition criteria – forms part of the ecological community**	**Meets condition criteria – forms part of the ecological community**	**Meets condition criteria – forms part of the ecological community**	**Meets condition criteria – forms part of the ecological community**	**Meets condition criteria – forms part of the ecological community**	**Meets condition criteria – forms part of the ecological community**	**Meets condition criteria – forms part of the ecological community**	**Meets condition criteria – forms part of the ecological community**

Table 7-18 Summary of Weeping Myall woodlands threatened ecological community within the disturbance area

THREATENED ECOLOGICAL COMMUNITY	VEGETATION TYPE	IBRA SUBREGION	VEG ZONE NAME (BAM-C)	IMPACT (HA)
Weeping Myall woodlands	PCT 26 – Weeping Myall open woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion	Murrumbidgee	VZ #12 26_Mod-good	63.42
			VZ #13 26_Moderate	37.70
			VZ #37 26_SVM_Bench	0.09
Total				**101.21**

7.1.1.7 White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland – Critically Endangered

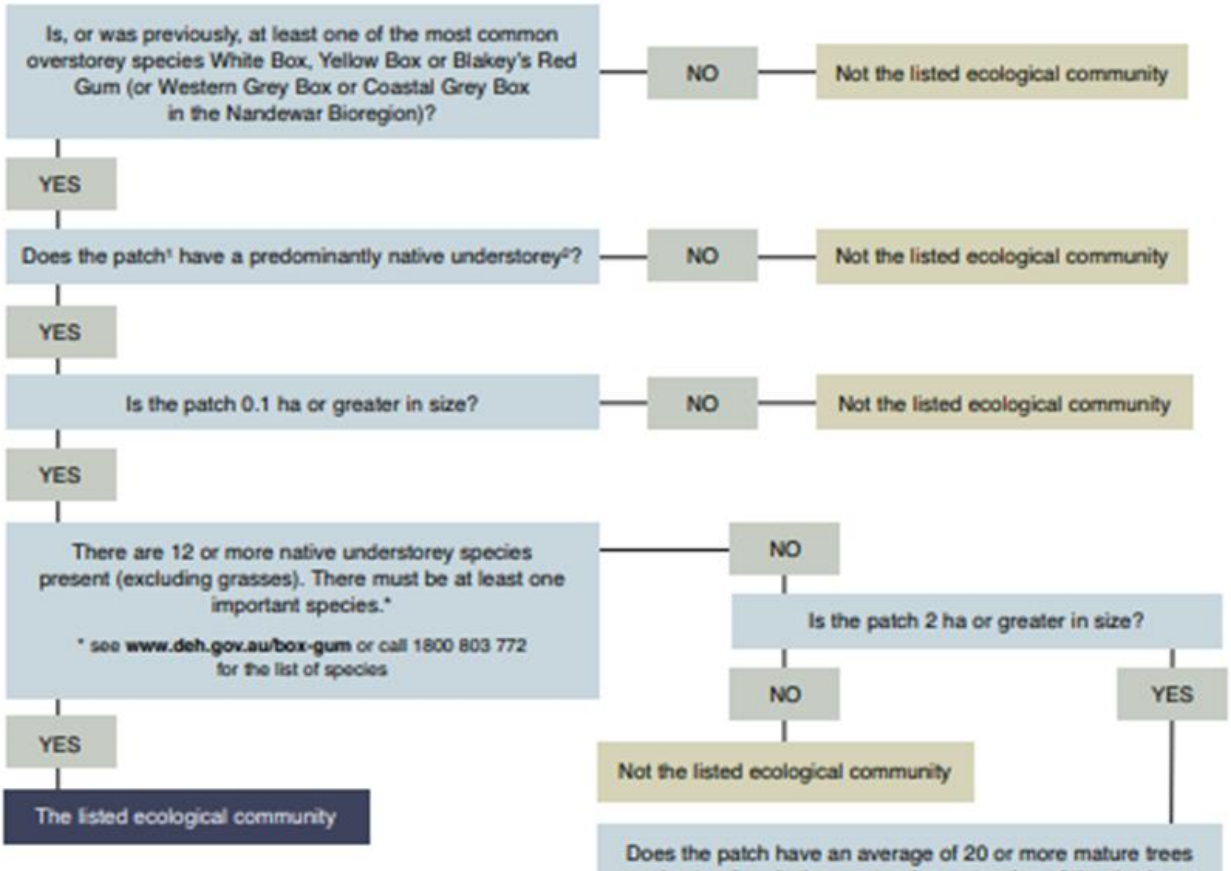
Within the proposal study area four vegetation types were considered likely to associate with this threatened ecological community, these are:

- PCT 74 – Yellow Box – River Red Gum tall grassy riverine woodland of NSW South Western Slopes Bioregion and Riverina Bioregion
- PCT 75 – Yellow Box – White Cypress Pine grassy woodland on deep sandy loam alluvial soils of the eastern Riverina Bioregion and western NSW South Western Slopes Bioregion
- PCT 267 – White Box – White Cypress Pine – Western Grey Box shrub/grass/forb woodland in the NSW South Western Slopes Bioregion
- PCT 277 – Blakely's Red Gum – Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion.

To meet the Critically Endangered listing under the EPBC Act, patches of vegetation must meet key characteristics and condition thresholds outlined in the listing advice for this ecological community. An overview of the listing advice key characteristics and condition thresholds are outlined in Figure 7-4. An assessment of this key diagnostic characteristics and condition threshold criteria against recorded plot data is presented in Table 7-20.

Vegetation analysis against listing advice criteria identified that certain patches of PCT 277 do not meet the key characteristics and condition thresholds and as such do not meet the Critically Endangered listing under the EPBC Act.

A summary of White Box – Yellow Box – Blakely's Red Gum grassy woodland threatened ecological community, associated PCT and extent within the disturbance area for each IBRA subregion is presented in Table 7-20 with the location in the proposal study area provided in Figure 7-5.



1 Patch – a patch is a continuous area containing the ecological community (areas of other ecological communities such as woodlands dominated by other species are not included in a patch). In determining patch size it is important to know what is, and is not, included within any individual patch. The patch is the larger of:
- an area that contains five or more trees in which no tree is greater than 75 m from another tree, or
- the area over which the understorey is predominantly native.

Patches must be assessed at a scale of 0.1 ha (1000m²) or greater.

2 A predominantly native ground layer is one where at least 50 per cent of the perennial vegetation cover in the ground layer is made up of native species. The best time of the year to determine this is late autumn when the annual species have died back and have not yet started to regrow. (At other times of the year, you can determine whether something is perennial or not is if it is difficult to pull out of the soil. Annual species pull out very easily.)

3 Mature trees are trees with a circumference of at least 125 cm at 130 cm above the ground.

4 Natural regeneration of the dominant overstorey eucalypts when there are mature trees plus regenerating trees of at least 15 cm circumference at 130 cm above the ground.

Figure 7-4 Listing advice key characteristic and condition thresholds for White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland

Detailed vegetation analysis of key characteristics and condition thresholds outlined in the listing advice for this ecological community is presented in Table 7-19.

Table 7-19 Vegetation assessment against White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grasslands EPBC Act listing advice criteria

KEY CHARACTERISTICS AND CONDITION THRESHOLDS	PCT 74	PCT 75								PCT 267	PCT 277		
	Q239E – Mod-good condition	Q110E – Mod-good condition	Q111E – Mod-good condition	Q188E – Mod-good condition	Q200E – Mod-good condition	Q204E – Mod-good condition	Q205E – Derived condition	Q206E – Derived condition	Q226E – Mod-good condition	Q89E- Mod-good condition	Q202E- Mod-good condition	Q242E – Mod-good condition	Q241E – Derived condition
Does the patch occur along the western slopes and tablelands of the Great Dividing Range from Southern Queensland through NSW to central Victoria including the Brigalow Belt South, Nandewar, New England Tableland, South Eastern Queensland, Sydney Basin, NSW North Coast, South Eastern Highlands, South East Corner, NSW South Western Slopes, Victorian Midlands and Riverina Bioregions.	Yes Recorded to occur in the NSW South Western Slopes (Lower Slopes and Inland Slopes subregion) IBRA Bioregion.	Yes Recorded to occur in the NSW South Western Slopes (Lower Slopes subregion) IBRA Bioregion.	Yes Recorded to occur in the NSW South Western Slopes (Lower Slopes subregion) IBRA Bioregion.	Yes Recorded to occur in the Riverina (Murrumbidgee subregion) IBRA Bioregion.	Yes Recorded to occur in the NSW South Western Slopes (Lower Slopes subregion) IBRA Bioregion.	Yes Recorded to occur in the NSW South Western Slopes (Lower Slopes subregion) IBRA Bioregion.	Yes Recorded to occur in the NSW South Western Slopes (Lower Slopes subregion) IBRA Bioregion.	Yes Recorded to occur in the NSW South Western Slopes (Lower Slopes subregion) IBRA Bioregion.	Yes Recorded to occur in the NSW South Western Slopes (Lower Slopes subregion) IBRA Bioregion.	Yes Recorded to occur in the NSW South Western Slopes (Inland Slopes subregion) IBRA Bioregion.	Yes Recorded to occur in the NSW South Western Slopes (Inland Slopes subregion) IBRA Bioregion.	Yes Recorded to occur in the NSW South Western Slopes (Inland Slopes subregion) IBRA Bioregion.	Yes Recorded to occur in the NSW South Western Slopes (Inland Slopes subregion) IBRA Bioregion.
Is the patch dominated, co-dominated or used to be dominated by White Box, Yellow Box or Blakely's Red Gum?	Yes Patch contains *Eucalyptus melliodora* and *Eucalyptus camaldulensis.* Within the sample *E. camaldulensis* was recorded as the dominant species. However, past land use (i.e. clearing for cropping) has reduced canopy cover of *E. melliodora* at a greater rate than *E. camaldulensis* given the nature of growth habits – *E. melliodora* typically occurring on upper banks/flats more suited to cropping than *E. camaldulensis* occurring on lower banks/within the creekline where it is not suitable to cropping.	Yes Patch is dominated by *Eucalyptus melliodora* (Yellow Box)	Yes Patch is dominated by *Eucalyptus melliodora* (Yellow Box)	Yes Patch is dominated by *Eucalyptus melliodora* (Yellow Box)	Yes Patch is dominated by *Eucalyptus melliodora* (Yellow Box)	Yes Patch is dominated by *Eucalyptus melliodora* (Yellow Box)	Yes Patch was dominated by *Eucalyptus melliodora* (Yellow Box)	Yes Patch was dominated by *Eucalyptus melliodora* (Yellow Box)	Yes Patch was dominated by *Eucalyptus melliodora* (Yellow Box)	Yes Patch was dominated by *Eucalyptus albens* (White Box)	Yes Patch was dominated by *Eucalyptus melliodora* (Yellow Box)	Yes Patch was dominated by *Eucalyptus melliodora* (Yellow Box)	Yes Patch would have been dominated by *Eucalyptus melliodora* (Yellow Box)

KEY CHARACTERISTICS AND CONDITION THRESHOLDS	PCT 74	PCT 75								PCT 267	PCT 277		
	Q239E – Mod-good condition	Q110E – Mod-good condition	Q111E – Mod-good condition	Q188E – Mod-good condition	Q200E – Mod-good condition	Q204E – Mod-good condition	Q205E – Derived condition	Q206E – Derived condition	Q226E – Mod-good condition	Q89E- Mod-good condition	Q202E- Mod-good condition	Q242E – Mod-good condition	Q241E – Derived condition
	Continual land use practices for cropping would also inhibit the ability for *E. melliodora* to naturally regenerate. Generally speaking, *E. melliodora* historically would have been the dominant tree species.												
Does the patch have a predominately native understorey (i.e. more than 50% of the perennial vegetative groundlayer must comprise native species)?	Yes Patch has >50% native understorey (understorey recorded to be 70% native)	Yes Patch has >50% native understorey (understorey recorded to be 98% native)	Yes Patch has >50% native understorey (understorey recorded to be 82% native)	Yes Patch has >50% native understorey (understorey recorded to be 63% native)	Yes Patch has >50% native understorey (understorey recorded to be 91% native)	Yes Patch has >50% native understorey (understorey recorded to be 85% native)	Yes Patch has >50% native understorey (understorey recorded to be 83% native)	Yes Patch has >50% native understorey (understorey recorded to be 90% native)	Yes Patch has >50% native understorey (understorey recorded to be 89% native)	Yes Patch has >50% native understorey (understorey recorded to be 51% native)	No Patch has <50% native understorey (understorey recorded to be 16% native)	Yes Patch has >50% native understorey (understorey recorded to be 65%)	No Patch has <50% native understorey (understorey recorded to be 33% native)
For patches of high quality including those without an existing canopy. 1a. Is the patch > 0.1 ha in size? AND 1b. Does the patch contain at least 12 native, non-grass understorey species? AND 1c. Does the patch contain at least one listed important understorey species (i.e. grazing-sensitive, regionally significant or uncommon species)?	Yes 1a. patch size >0.1 ha (patch size about 2.5 ha) 1b. does not meet criteria. Patch contains 7 native, non-grass understorey species 1c. patch does not meet above criteria	Yes 1a. patch size >0.1 ha (patch size about 5.5 ha) 1b. patch has 12 native, non-grass species 1c. patch contains one important species, *Sida corrugata*	Yes 1a. patch size >0.1 ha (patch size >0.1 ha) 1b. patch has 13 native, non-grass species 1c. patch contains two important species, *Glycine tabacina* and *Sida corrugata*.	No 1a. patch size >0.1 ha (patch size about 0.5 ha) 1b. does not meet criteria. Patch only has 8 native, non-grass species 1c. does not meet above criteria	Yes 1a. patch size >0.1 ha (patch size about 20 ha) 1b. patch has 15 native, non-grass species 1c. patch contains five important species, *Arthropodium fimbriatum, Daucus glochidiatus, Goodenia pinnatifida, Linum marginale* and *Sida corrugata*	Yes 1a. patch size >0.1 ha (patch size about 20 ha) 1b. patch has 12 native, non-grass species 1c. patch contains two important species, *Bulbine bulbosa* and *Sida corrugata*	Yes 1a. patch size >0.1 ha (patch size about 20 ha) 1b. patch has 12 native, non-grass species 1c. patch contains four important species, *Goodenia pinnatifida, Ptilotus erubescens, Sida corrugata* and *Wurmbea dioica*	Yes 1a. patch size >0.1 ha (patch size about 20 ha) 1b. patch has 14 native, non-grass species 1c. patch contains six important species, *Goodenia pinnatifida, Isoetopsis graminifolia, Linum marginale, Sida corrugata* and *Triptilodiscus pygmaeus*.	Yes 1a. patch size >0.1 ha (patch size about 14 ha) 1b. patch has 26 native, non-grass species 1c. patch contains 10 important species *Arthropodium minus, Chrysocephalum apiculatum, Daucus glochidiatus, Dianella revoluta, Glycine tabacina, Goodenia pinnatifida, Poranthera microphylla, Sida corrugata, Stackhousia monogyna* and *Triptilodiscus pygmaeus*	Yes 1a. patch size >0.1 ha (patch size about 11 ha) 1b. patch has 12 native, non-grass species 1c. patch contains five important species, *Acacia decora*, Calotis lappulacea, Glycine tabacina, *Sida corrugata* and *Wahlenbergia luteola*	Patch does not meet above criteria	Yes 1a. patch size >0.1 ha (patch size about 2.7 ha) 1b. does not meet criteria. Patch contains 10 native, non-grass understorey species 1c. does not meet above criteria	Patch does not meet above criteria

KEY CHARACTERISTICS AND CONDITION THRESHOLDS	PCT 74	PCT 75								PCT 267	PCT 277		
	Q239E – Mod-good condition	**Q110E – Mod-good condition**	**Q111E – Mod-good condition**	**Q188E – Mod-good condition**	**Q200E – Mod-good condition**	**Q204E – Mod-good condition**	**Q205E – Derived condition**	**Q206E – Derived condition**	**Q226E – Mod-good condition**	**Q89E- Mod-good condition**	**Q202E- Mod-good condition**	**Q242E – Mod-good condition**	**Q241E – Derived condition**
For patches of lower quality that have retained an overstorey. 2a. Is the patch size >2 ha in size? AND 2b. Does the patch have either natural regeneration of the overstorey species OR 2c. 20 or more mature trees/hectare?	Yes 2a. patch size is >2 ha (patch size is about 2.5 ha) 2b. four mature trees and regeneration >15 cm in circumference recorded 2c. meets above criteria	Meets criteria above	Meets criteria above	Yes 2a. patch size is >2 ha (patch size is about 3.3 ha) 2b. two mature trees and regeneration >15 cm in circumference recorded 2c. meets above criteria	Meets criteria above	Meets criteria above	Meets criteria above	Meets criteria above	Meets criteria above	Meets criteria above	Patch does not meet above criteria	Yes 2a. patch size is >2 ha (patch size is about 2.7 ha) 2b. three mature trees and regeneration >15 cm in circumference recorded 2c. meets above criteria	Patch does not meet above criteria
Outcome	**Meets key characteristics and condition threshold - forms part of the ecological community**	**Meets key characteristics and condition threshold - forms part of the ecological community**	**Meets key characteristics and condition threshold - forms part of the ecological community**	**Meets key characteristics and condition threshold - forms part of the ecological community**	**Meets key characteristics and condition threshold - forms part of the ecological community**	**Meets key characteristics and condition threshold - forms part of the ecological community**	**Meets key characteristics and condition threshold - forms part of the ecological community**	**Meets key characteristics and condition threshold - forms part of the ecological community**	**Meets key characteristics and condition threshold - forms part of the ecological community**	**Meets key characteristics and condition threshold - forms part of the ecological community**	**Does not meet key characteristics and condition threshold - does not form part of the ecological community**	**Meets key characteristics and condition threshold - forms part of the ecological community**	**Does not meet key characteristics and condition threshold - does not form part of the ecological community**

Table 7-20 Summary of White Box – Yellow Box – Blakely's Red Gum grassy woodland within the disturbance area

THREATENED ECOLOGICAL COMMUNITY	VEGETATION TYPE	IBRA SUBREGION	VEG ZONE NAME (BAM-C)	IMPACT (HA)
White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland	PCT 74 – Yellow Box – River Red Gum tall grassy riverine woodland of NSW South Western Slopes Bioregion and Riverina Bioregion	Lower Slopes	VZ #14 74_Mod-good	0.91
		Inland slopes	VZ #1 74_Mod-good	1.15
	PCT 75 – Yellow Box – White Cypress Pine grassy woodland on deep sandy-loam alluvial soils of the eastern Riverina Bioregion and western NSW South Western Slopes Bioregion	Murrumbidgee	VZ #32 75_Mod-good	0.21
		Lower Slopes	VZ #2 75_Mod-good	30.0
			VZ #13 75_SVM_Bench	2.41
	PCT 267 – White Box – White Cypress Pine – Western Grey Box shrub/grass/forb woodland in the NSW South Western Slopes Bioregion	Inland Slopes	VZ #6 267_Mod-good	0.26
	PCT 277 – Blakely's Red Gum – Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion	Inland Slopes	VZ #4 277_Mod-good	0.51
Total				**35.45**

7.1.2 Threatened flora species

Appendix A of the SEARs outlines an initial list of EPBC Act listed threatened flora species likely to be impacted by the action. Combined with database searches (BioNet, BAM-C and PMST), there is predicted habitat or identified known habitat within the proposal study area for 36 threatened flora species listed under the EPBC Act (refer to Appendix C-1).

Appendix C-1 provides a description of the habitat requirements for each EPBC Act listed species, and the reasoning for inclusion or exclusion of EPBC Act listed species in this assessment.

Details of the scope, timing and methodology of the targeted surveys used for EPBC Act listed threatened flora species and how they are consistent with (or justification for divergence from) published Australian Government guidelines and policy statements is provided in Section 5.5.2, Appendix C-3 and Appendix C-5.

Of the 36 threatened flora species with predicted habitat or identified known habitat within the proposal study area, 20 have been identified to have a moderate likelihood of occurrence and were the subject of targeted surveys. Of these, four threatened flora species have been recorded. These are:

- *Brachyscome papillosa* (Mossgiel Daisy) – Vulnerable
- *Lepidium monoplocoides* (Winged Peppercress) – Endangered
- *Maireana cheelii* (Chariot Wheels) – Vulnerable
- *Swainsona murrayana* (Slender Darling Pea) – Vulnerable.

The results of targeted surveys for the 20 identified EPBC Act threatened flora species are presented in Table 7-21.

The potential impacts to EPBC Act listed threatened flora species were identified in accordance with the BAM and are outlined in Chapter 9. For threatened flora species listed under the EPBC Act, significance assessments have been completed for all recorded species in accordance with the *EPBC Act Policy Statement 1.1 Significant Impact Guidelines* (Department of the Environment 2013) which are provided in Appendix D-1. Avoidance and proposed mitigation measures are outlined in Chapters 8 and 10. The residual adverse impacts likely to occur to EPBC Act listed threatened flora species after avoidance and mitigation have been calculated in accordance with the BAM (in the form of biodiversity credits) and are presented in Chapter 12 and Appendix F.

Table 7-21 Listed EPBC Act threatened flora species considered for assessment

SCIENTIFIC NAME	COMMON NAME	EPBC ACT[1]	DETAILS	ASSESSMENT
Acacia carneorum	Purple-wood Wattle	V	Identified in the SEARs as a matter requiring further consideration. This species may occur in PCT 58 & 199 in the South Olary Plain IBRA subregion.	No individuals of *Acacia carneorum* have been recorded during targeted surveys and the occurrence of this species within the disturbance area is considered unlikely. An assessment of significance is not required.
Ammobium craspedioides	Yass Daisy	V	Identified in the SEARs as a matter requiring further consideration. This species may occur in PCT 277 in the Inland Slopes IBRA subregion.	No individuals of *Ammobium craspedioides* have been recorded during targeted surveys and the occurrence of this species within the disturbance area is considered unlikely. An assessment of significance is not required.
Amphibromus fluitans	River Swamp Wallaby-grass	V	Identified in the SEARs as a matter requiring further consideration This species may occur in PCT 249 in the Lower Slopes IBRA subregion.	No individuals of *Amphibromus fluitans* have been recorded during targeted surveys and the occurrence of this species within the disturbance area is considered unlikely. An assessment of significance is not required.
Atriplex infrequens	-	V	Identified in the SEARs as a matter requiring further consideration	No individuals of *Atriplex infrequens* have been recorded during targeted surveys and the occurrence of this species within the disturbance area is considered unlikely. An assessment of significance is not required.

SCIENTIFIC NAME	COMMON NAME	EPBC ACT[1]	DETAILS	ASSESSMENT
Austrostipa metatoris	-	V	Identified in the SEARs as a matter requiring further consideration	No individuals of *Austrostipa metatoris* have been recorded during targeted surveys and the occurrence of this species within the disturbance area is considered unlikely. An assessment of significance is not required.
Austrostipa wakoolica	-	E	Identified in the SEARs as a matter requiring further consideration	No individuals of *Austrostipa wakoolica* have been recorded during targeted surveys and the occurrence of this species within the disturbance area is considered unlikely. An assessment of significance is not required.
Brachyscome papillosa	Mossgiel Daisy	V	Identified in the SEARs as a matter requiring further consideration	Candidate species credit species. *Brachyscome papillosa* recorded at multiple locations during survey period (refer to Appendix D-2). Further details on this species within the proposal study area is provided in Section 5.6.2.1. A detailed assessment of significance is presented in Appendix D-1.
Brachyscome muelleroides	Mueller Daisy	V	Identified in the SEARs as a matter requiring further consideration	Candidate species credit species. No individuals of *Brachyscome muelleroides* have been recorded during targeted surveys and the occurrence of this species within the disturbance area is considered unlikely. An assessment of significance is not required.
Caladenia arenaria	Sand-hill Spider-orchid	E	Identified in the SEARs as a matter requiring further consideration.	Candidate species credit species. A reference population of *Caladenia arenaria* at Buckingbong State Forest was inspected on 15 September 2021 where the species was observed in flower. No individuals of *Caladenia arenaria* have been recorded during targeted surveys and the occurrence of this species within the disturbance area is considered unlikely. An assessment of significance is not required.

SCIENTIFIC NAME	COMMON NAME	EPBC ACT[1]	DETAILS	ASSESSMENT
Eleocharis obicis	Spike-Rush	V	Identified in the SEARs as a matter requiring further consideration.	Candidate species credit species. No individuals of *Eleocharis obicis* have been recorded during targeted surveys and the occurrence of this species within the disturbance area is considered unlikely. An assessment of significance is not required.
Indigofera efoliata	-	E	Identified in the SEARs as a matter requiring further consideration.	Candidate species credit species. No individuals of *Indigofera efoliata* have been recorded during targeted surveys and the occurrence of this species within the disturbance area is considered unlikely. An assessment of significance is not required.
Lepidium aschersonii	Spiny Pepper-cress	V	Identified in the SEARs as a matter requiring further consideration.	Candidate species credit species. No individuals of *Lepidium aschersonii* have been recorded during targeted surveys and the occurrence of this species within the disturbance area is considered unlikely. An assessment of significance is not required.
Lepidium monoplocoides	Winged Pepper-cress	E	Identified in the SEARs as a matter requiring further consideration.	Candidate species credit species. One individual of *Lepidium monoplocoides* was recorded during targeted surveys (refer to Appendix D-2). Further details on this species within the proposal study area is provided in Section 5.6.2.2). A detailed assessment of significance is presented in Appendix D-1.
Maireana cheelii	Chariot Wheels	V	Identified in the SEARs as a matter requiring further consideration	Candidate species credit species. *Maireana cheelii* recorded at multiple locations during survey period (refer to Appendix D-2). Further details on this species within the proposal study area is provided in Section 5.6.2.4. A detailed assessment of significance is presented in Appendix D-1.

SCIENTIFIC NAME	COMMON NAME	EPBC ACT[1]	DETAILS	ASSESSMENT
Prasophyllum petilum (syn. *Prasophyllum* sp. Wybong)	Tarengo Leek Orchid	E	Identified in the SEARs as a matter requiring further consideration.	Candidate species credit species. No individuals of *Prasophyllum petilum* have been recorded during targeted surveys and the occurrence of this species within the disturbance area is considered unlikely. An assessment of significance is not required.
Sclerolaena napiformis	Turnip Copperburr	E	Identified in the SEARs as a matter requiring further consideration.	Candidate species credit species. No individuals of *Sclerolaena napiformis* have been recorded during targeted surveys and the occurrence of this species within the disturbance area is considered unlikely. An assessment of significance is not required.
Solanum karsense	Menindee Nightshade	V	Identified in the SEARs as a matter requiring further consideration.	Candidate species credit species. No individuals of *Solanum karsense* have been recorded during targeted surveys and the occurrence of this species within the disturbance area is considered unlikely. An assessment of significance is not required.
Swainsona murrayana	Slender Darling-pea	V	Identified in the SEARs as a matter requiring further consideration	Candidate species credit species. *Swainsona murrayana* recorded at multiple locations during survey period (refer to Appendix D-2). Further details on this species within the proposal study area is provided in Section 5.6.2.8. A detailed assessment of significance is presented in Appendix D-1.
Swainsona plagiotropis	Red Darling-pea	V	Identified in the SEARs as a matter requiring further consideration.	Candidate species credit species. No individuals of *Swainsona plagiotropis* have been recorded during targeted surveys and the occurrence of this species within the disturbance area is considered unlikely. An assessment of significance is not required.

SCIENTIFIC NAME	COMMON NAME	EPBC ACT[1]	DETAILS	ASSESSMENT
Swainsona pyrophila	Yellow Swainson-pea	V	Identified in the SEARs as a matter requiring further consideration.	Candidate species credit species. No individuals of *Swainsona pyrophila* have been recorded during targeted surveys and the occurrence of this species within the disturbance area is considered unlikely. An assessment of significance is not required.
Swainsona recta	Mountain Swainson-pea	E	Identified in the SEARs as a matter requiring further consideration. This species may occur in PCT 58 & 199 in the South Olary Plain IBRA subregion.	Candidate species credit species. No individuals of *Swainsona recta* have been recorded during targeted surveys and the occurrence of this species within the disturbance area is considered unlikely. An assessment of significance is not required.

7.1.3 Threatened fauna species

Appendix A of the SEARs outlines an initial list of EPBC Act listed threatened fauna species likely to be impacted by the action. Combined with database searches (BioNet, BAM-C and PMST), there is predicted habitat or identified known habitat within the proposal study area for 30 threatened fauna species listed under the EPBC Act (refer to Appendix C-2).

Appendix C-2 provides a description of the habitat requirements for each EPBC Act listed species, and the reasoning for inclusion or exclusion of EPBC Act listed species in this assessment.

Details of the scope, timing and methodology of the targeted surveys used for EPBC Act listed threatened fauna species and how they are consistent with (or justification for divergence from) published Australian Government guidelines and policy statements is provided in Section 5.5.3, Appendix C-4 and Appendix C-6.

Of the 43 threatened fauna species with predicted habitat or identified known habitat within the proposal study area, 33 have been identified to have a moderate likelihood of occurrence and were the subject of targeted surveys. Of these, four threatened fauna species have been recorded. These are:

- *Nyctophilus corbeni* (Corben's Long-eared Bat) – vulnerable
- *Pedionomus torquatus* (Plains Wanderer) – critically endangered
- *Polytelis anthopeplus monarchoides* (Regent Parrot (eastern subsp.)) – vulnerable
- *Polytelis swainsonii* (Superb Parrot) – vulnerable.

The results of targeted surveys for the 33 identified EPBC Act threatened fauna species are presented in Table 7-22.

The potential impacts to EPBC Act listed threatened fauna species were identified in accordance with the BAM and are outlined in Chapter 9. For threatened fauna species listed under the EPBC Act, significance assessments have been completed in accordance with the *EPBC Act Policy Statement 1.1 Significant Impact Guidelines* (Department of the Environment 2013) which are provided in Appendix D-1. Avoidance and proposed mitigation measures are outlined in Chapters 8 and 10. The residual adverse impacts likely to occur to EPBC Act listed threatened flora species after avoidance and mitigation have been calculated in accordance with the BAM (in the form of biodiversity credits) and are presented in Chapter 12 and Appendix F.

Table 7-22 Listed EPBC Act threatened fauna species considered for assessment

SCIENTIFIC NAME	COMMON NAME	EPBC ACT[1]	DETAILS	ASSESSMENT
Invertebrates				
Synemon plana	Golden Sun Moth	CE	Not identified in the SEARs as a matter requiring further consideration. However, suitable habitat has been identified within the proposal study area.	Suitable habitat recorded in the form of PCT 277 in the NSW South Western Slopes (Inland Slopes subregion) IBRA bioregion An assessment of significance is required.
Amphibians				
Crinia sloanei	Sloane's Froglet	E	Not identified in the SEARs as a matter requiring further consideration. However, suitable habitat has been identified within the proposal study area.	Suitable habitat recorded in the form of PCT 5, 74, 76, 80 and 249. Surveys completed – species not recorded. An assessment of significance is required.
Litoria booroolongensis	Booroolong Frog	E	Not identified in the SEARs as a matter requiring further consideration. However, suitable habitat has been identified within the proposal study area.	Suitable habitat recorded in the form of PCT 277. An assessment of significance is required.
Litoria raniformis	Southern Bell Frog	V	Identified in the SEARs as a matter requiring further consideration	Suitable habitat recorded in the form of PCT 7, 8, 11, 13, 17, 24, 53 and 249. An assessment of significant is required.
Reptiles				
Aprasia parapulchella	Pink-tailed Worm-lizard	V	Identified in the SEARs as a matter requiring further consideration	Suitable habitat recorded in the form of PCT 267, 277 and 319. An assessment of significance is required
Delma impar	Striped Legless Lizard	V	Identified in the SEARs as a matter requiring further consideration	Suitable habitat recorded in the form of PCT 277. An assessment of significance is required

SCIENTIFIC NAME	COMMON NAME	EPBC ACT[1]	DETAILS	ASSESSMENT
Birds				
Anthochaera phrygia	Regent Honeyeater	CE	Identified in the SEARs as a matter requiring further consideration	Suitable habitat recorded in the form of PCT 5, 7, 74, 75, 267, 277 and 319. An assessment of significance is required
Botaurus poiciloptilus	Australasian Bittern	E	Identified in the SEARs as a matter requiring further consideration	Suitable habitat recorded in the form of PCT 8, 11, 13, 17, 24, 53, 160, 182 and 249. An assessment of significance is required
Calidris ferruginea	Curlew Sandpiper	CE	Identified in the SEARs as a matter requiring further consideration	Suitable habitat in the form of Lake Cullivel recorded with the proposal area. An assessment of significance is required
Falco hypoleucos	Grey Falcon	V	Not identified in the SEARs as a matter requiring further consideration. However, suitable habitat has been identified within the proposal study area.	Scattered records throughout the study area. Suitable habitat identified within the proposal area. An assessment of significance is required
Grantiella picta	Painted Honeyeater	V	Identified in the SEARs as a matter requiring further consideration	Records within the locality and suitable habitat identified within the proposal study area. An assessment of significance is required
Hirundapus caudacutus	White-throated Needletail	V	Identified in the SEARs as a matter requiring further consideration	Suitable foraging habitat identified within the proposal area. An assessment of significance is required
Lathamus discolor	Swift Parrot	CE	Identified in the SEARs as a matter requiring further consideration	Suitable habitat in the form of various Red Gum communities identified within the proposal area. Disturbance area likely to represent an incremental loss of woodland habitat for this species. An assessment of significance is required

SCIENTIFIC NAME	COMMON NAME	EPBC ACT[1]	DETAILS	ASSESSMENT
Leipoa ocellata	Malleefowl	V	Identified in the SEARs as a matter requiring further consideration	Abundance of records scatted throughout the locality. Suitable habitat identified onsite. An assessment of significance is required
Limosa lapponica-baueri	Bar-tailed Godwit (baueri), Western Alaskan Bar-tailed Godwit	V	Identified in the SEARs as a matter requiring further consideration	Species considered likely to cross above the powerline during migration. An assessment of significance is required
Pachycephala rufogularis	Red-lored Whistler	V	Identified in the SEARs as a matter requiring further consideration	Suitable habitat not identified within the proposal study area. However, multiple records within the locality therefore presence cannot be entirely discounted. An assessment of significance is required
Pedionomus torquatus	Plains-wanderer	CE	Identified in the SEARs as a matter requiring further consideration	Three birds recorded at Bundure Siding TSR. Preferred habitat identified within the proposal study area. An assessment of significance is required
Polytelis anthopeplus monarchoides	Regent Parrot (Eastern subsp.)	V	Identified in the SEARs as a matter requiring further consideration	Recorded at several locations within the proposal study area. Disturbance footprint will remove both foraging and breeding habitat. An assessment of significance is required
Polytelis swainsonii	Superb Parrot	V	Identified in the SEARs as a matter requiring further consideration	Recorded at several locations within the proposal study area. Disturbance footprint will remove both foraging and breeding habitat. An assessment of significance is required
Rostratula australis	Australian Painted Snipe	E	Identified in the SEARs as a matter requiring further consideration	Suitable habitat in the form of ephemeral wetlands identified within the proposal study area. An assessment of significance is required

SCIENTIFIC NAME	COMMON NAME	EPBC ACT[1]	DETAILS	ASSESSMENT
Mammals				
Chalinolobus dwyeri	Large-eared Pied Bat	V	Not identified in the SEARs as a matter requiring further consideration. However, suitable habitat has been identified within the proposal study area.	Scattered records within the locality and predicted habitat within many Inland Slopes PCTs. An assessment of significance required.
Dasyurus maculatus maculatus	Spotted-Tailed Quoll (southern subspecies)	E	Not identified in the SEARs as a matter requiring further consideration. However, suitable habitat has been identified within the proposal study area.	Proposal occurs within know species distribution, however, lack of potential habitat identified within the proposal study area. An assessment of significance required.
Nyctophilus corbeni	Corben's Long-eared Bat	V	Identified in the SEARs as a matter requiring further consideration	Recorded during field surveys. An assessment of significance is required.
Phascolarctos cinereus	Koala	V	Identified in the SEARs as a matter requiring further consideration	Predicted habitat identified in multiple PCTs within the Murrumbidgee, Lower Slopes and Inland Slopes subregion. An assessment of significance is required.
Pteropus poliocephalus	Grey-headed Flying Fox	V	Identified in the SEARs as a matter requiring further consideration	Scattered records and known roosting sites within the locality. An assessment of significance is required.
Fish				
Bidyanus bidyanus	Silver Perch	CE	Not identified in the SEARs as a matter requiring further consideration. However, suitable habitat has been identified within the proposal study area.	Records within the locality. Potential habitat in the form of the Murrumbidgee River identified within the proposal study area. However, due to the nature of powerline construction the proposal is unlikely to impact this species (i.e. powerline will span the river). An assessment of significance is required.

SCIENTIFIC NAME	COMMON NAME	EPBC ACT[1]	DETAILS	ASSESSMENT
Craterocephalus fluviatilis	Murray Hardyhead	CE	Not identified in the SEARs as a matter requiring further consideration. However, suitable habitat has been identified within the proposal study area.	Potential habitat in the form of slow flowing lowland rivers (i.e. the Murrumbidgee River) identified within the proposal study area. However, due to the nature of powerline construction the proposal is unlikely to impact this species (i.e. powerline will span the river). An assessment of significance is required.
Galaxias rostratus	Flathead Galaxias	CE	Not identified in the SEARs as a matter requiring further consideration. However, suitable habitat has been identified within the proposal study area.	Potential habitat in the form of small streams, lakes, billabongs and backwaters identified within the proposal study area An assessment of significance is required.
Maccullochella peelii	Murray Cod	V	Not identified in the SEARs as a matter requiring further consideration. However, suitable habitat has been identified within the proposal study area.	Proposal study area within the known range of this species. Potential habitat identified. An assessment of significance is required.
Maccullochella macquariensis	Trout Cod	E	Not identified in the SEARs as a matter requiring further consideration. However, suitable habitat has been identified within the proposal study area.	Proposal study area within the known range of this species. Potential habitat identified. An assessment of significance is required.
Macquaria australasica	Macquarie Perch	E	Not identified in the SEARs as a matter requiring further consideration. However, suitable habitat has been identified within the proposal study area.	Species may occur. Preferred habitat (i.e. clear water and deep, rocky holes with lots of cover) not identified within the proposal study area. An assessment of significance is required.

7.1.4 OFFSETS FOR EPBC ACT LISTED SPECIES

Any offsets proposed for impacts to EPBC Act listed threatened species will be done in accordance with the NSW BOS, the NSW Assessment Bilateral Agreement – Amending Agreement No. 1, and NSW BC Regulation. Further details on required offsets is provided in Chapter 12.

7.2 Migratory species

Database searches have identified a total of 19 migratory species listed under the EPBC Act, that are predicted or known to occur within the proposal locality.

The results of the likelihood of occurrence assessments identified an additional 17 migratory species listed under the EPBC Act, with moderate or higher potential to occur within the proposal study area (see Appendix C-2 for further detail).

Migratory species likely to occur within the disturbance area are limited to migratory birds. Australia is seasonally visited annually by a range of international migratory birds, which are listed under the EPBC Act as a consequence of agreements made with other countries with whom we share species that visit multiple countries via their annual migratory flyway movements, and international conventions in regards to migratory bird protection. The group of international migratory bird species, which visit Australia, encompasses a range of species, but is dominated by a specialised migratory group, the migratory wading birds, or, shorebirds. While many migratory shorebird species often move through coastal areas, due to their preference for coastal shorelines and estuaries, a large proportion of those species also use freshwater wetland habitats as well.

While it may appear that species preferring coastal habitats would be reluctant to travel through the arid interior of Australia, many of these species do, as is evidenced by a cursory viewing of their Australian records within publicly accessible databases. The key international migratory bird flyway governing the movements of Australian bound migratory shorebirds, the East Asian-Australasian Flyway, is oriented from north to south with many species' southward and northward journeys between the hemispheres crossing the north and north-western coasts of Australia. Many species' southward destinations are along the Victorian and South Australian coasts. The east – west orientation of the disturbance area therefore crosses the most common line of travel for birds moving between northern Australia and Victorian destinations. It therefore appears that power infrastructure erected within the disturbance area may be a problem for an indeterminate number of birds from the collective Australian migratory flock, but this is unlikely to be the case.

Radio-tracking of migratory shorebirds has shown that long-distance migratory shorebirds can cross the Himalayan range, with elevations between 5,000 and 8,000 m. More importantly, birds radio-tracked in the same study, which took alternate routes where topography didn't require high altitude flight, still travelled at very high elevations as evidenced by the temperature of their flight paths (Li, Davison et al. 2020). In light of the findings of the study (Li, Davison et al. 2020) it is considered highly likely that shorebirds crossing the Australian continent do so at altitudes which prevent them from collision with relatively low structures like powerlines, unless those structures represent a hazard to them when they are descending to foraging and roosting locations. There are a number of ephemeral lakes that occur in the wider locality of the disturbance area, however the disturbance area has been placed at distances that reduce the likelihood of bird collisions with power infrastructure.

7.3 Listed marine species

The PMST search identified 29 listed marine bird species as occurring, possibly occurring or likely to occur within the proposal locality. Two were recorded within the proposal study area during field surveys, being:

- Rainbow Bee-eater
- White-bellied Sea-eagle.

Listed Marine Species under the EPBC Act are only afforded protection in Commonwealth Marine areas including water, air and seabed that are NOT in state or territory waters, hence discussion of these species is not relevant to this proposal location.

7.4 Wetlands of national and international importance

Wetlands are important habitat for a diverse range of animals including waterbirds, amphibians, invertebrates and fish species as well as aquatic and water loving plants such as sedges and rushes. Tree species such as River Red Gum also rely on these environments. Wetlands are important provide strategic refuge during drought and frequently support threatened species. Most of the migratory bird species listed under international convention agreements with Australia may be found in these wetlands.

7.4.1 Nationally important wetlands

There were seven nationally important wetlands returned from the PMST. None of these nationally important wetlands occur within NSW. However, there are nationally important wetlands nearby (but outside the proposal study area):

— Tala Lake and Yanga Lake, near Balranald (five kilometres from the alignment)

— Black Swamp and Coopers Swamp near Wanganella.

Mitigation measures would eliminate or mitigate the potential for downstream impacts to occur. Impacts on water quality, water bodies and hydrological processes are discussed in Chapter 10.

7.4.2 Wetlands of International importance (Ramsar wetlands)

The following four Ramsar wetlands or Wetlands of International importance were identified by database searches:

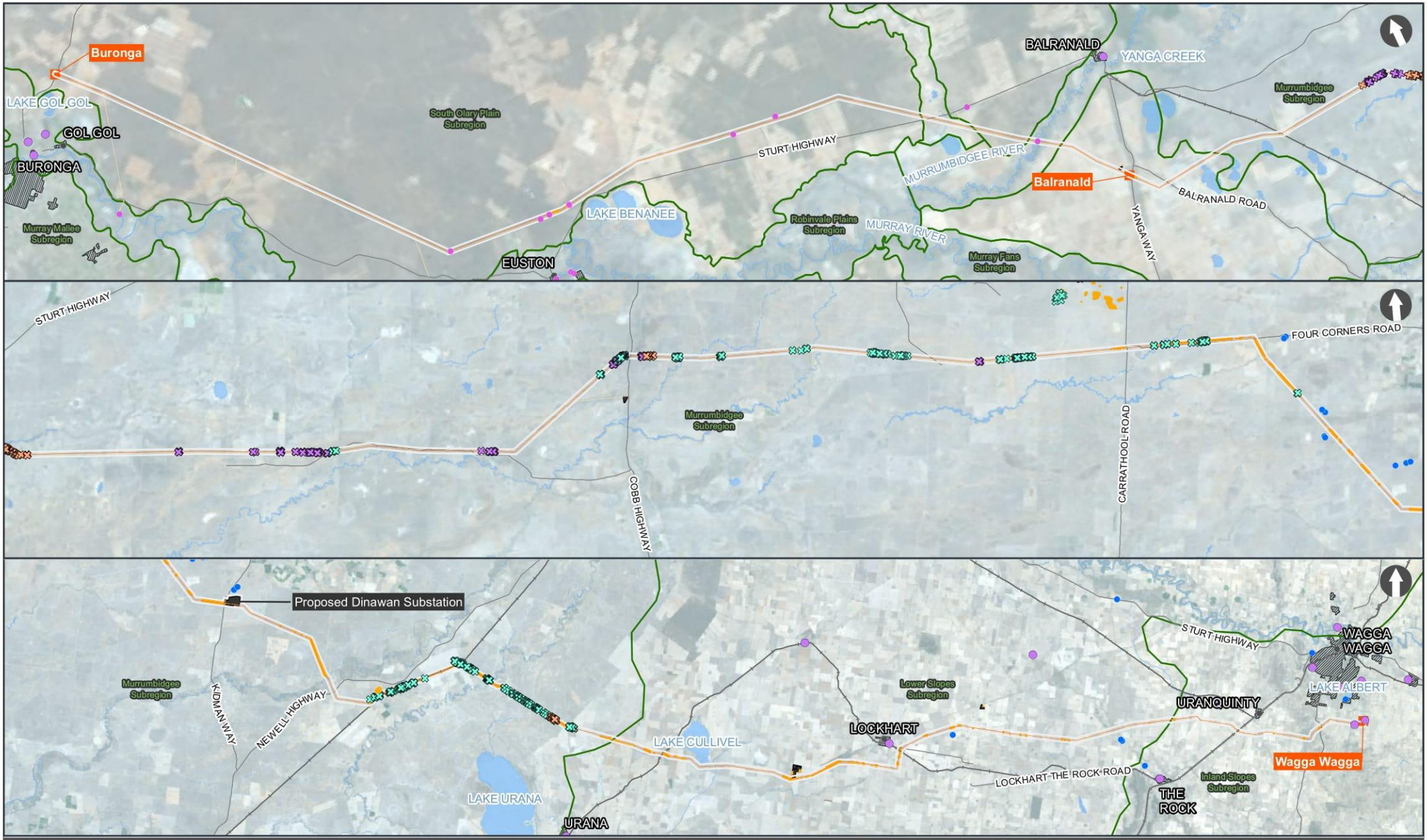
- Banrock station wetland complex
- Hattah-kulkyne lakes
- Riverland
- The coorong, and lakes alexandrina and albert wetland.

No RAMSAR wetlands or Wetlands of International importance are within 10 kilometres of the proposal study area, therefore no RAMSAR or Wetlands of International importance are considered affected by the proposed development.

7.5 Commonwealth SEAR's requirements

Appendix A of the Secretary's Environmental Assessment Requirements for Project EnergyConnect (NSW – Eastern Section) (EPBC 2020/8673) cross-reference the *Guidelines for preparing assessment documentation relevant to the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)* for proposals being assessed under the NSW Bilateral Agreement.

Appendix D-3 of this BDAR provides a table to cross-reference the Commonwealth requirements in the SEARs for the purposes of this BDAR.


Buronga
LAKE GOL GOL
GOL GOL
BURONGA
Murray Mallee Subregion
South Olary Plain Subregion
STURT HIGHWAY
LAKE BENANEE
EUSTON
BALRANALD
YANGA CREEK
Murrumbidgee Subregion
MURRUMBIDGEE RIVER
Balranald
BALRANALD ROAD
YANGA WAY
Robinvale Plains Subregion
MURRAY RIVER
Murray Fans Subregion
STURT HIGHWAY
FOUR CORNERS ROAD
Murrumbidgee Subregion
COBB HIGHWAY
CARRATHOOL ROAD
Proposed Dinawan Substation
Murrumbidgee Subregion
KIDMAN WAY
NEWELL HIGHWAY
LAKE CULLIVEL
Lower Slopes Subregion
LOCKHART
LAKE URANA
URANA
STURT HIGHWAY
WAGGA WAGGA
LAKE ALBERT
URANQUINTY
Wagga Wagga
LOCKHART-THE ROCK ROAD
Inland Slopes Subregion
THE ROCK
0
10
20 KM
BDAR - Figure 7-5
Overview of Matters of National Significance
Project Components
Proposed Alignment
Access Tracks
Main Construction Compounds and Accomodation Sites
Water Supply Point
Existing Substation
Built Up Areas
Waterbody
Biodiversity Study Area
IBRA Subregions
Threatened Fauna Species
Corben's Long-eared Bat - Nyctophilus corbeni
Plains-wanderer - Pedionomus torquatus
Regent Parrot - Polytelis anthopeplus
Superb Parrot - Polytelis swainsonii
Threatened Flora Species
Brachyscome papillosa
Maeriana cheelii
Swainsona murrayana
Matters of National Significance
C:\Users\autw500241\WSP O365\EnergyConnect - General\5_Shared\54_Production\Maps\003_PEC_East\02_SpecialistReports\01_Ecology\06_BDAR\PS117658_BDAR_F0705a_OverviewMattersOfNationalSignificance_r1v7.mxd
Source: NSWSS, ESRI, Transgrid, WSP

Stage 2 – Impact assessment

8 Avoid and minimise impacts

The following provides information on avoiding and minimising impacts on biodiversity values through the planning and design phase of the proposal. This information is provided to directly address Section 7 of the BAM.

8.1 Avoid and minimise impacts on native vegetation and associated habitat

8.1.1 Principles of avoid and minimise

In accordance with Section 7.1.1 of the BAM, efforts to avoid and minimise direct impact on native vegetation and habitat through proposal design are further addressed in Table 8-1.

Table 8-1 Efforts to avoid and minimise impacts on native vegetation and habitat during proposal design

PRINCIPLES	PROPOSAL CONSISTENCY
Locating the proposal to avoid and minimise impacts on native vegetation, threatened species, threatened ecological communities and their habitat (section 7.1.1.3 of BAM)	
(a) Locating the proposal in areas where there are no biodiversity values	The proposal was subject to corridor selection assessment methodology for assessing a broad 'hierarchy of constraints' which were developed to inform the preliminary alignment corridor and to allow for route narrowing and eventual selection of the preferred corridor for the proposed transmission line. The overall methodology for the corridor selection process included consideration of a corridor that: — minimised environmental and social impacts and maximised the use of previously disturbed areas wherever possible, including: — avoiding areas of particular environmental sensitivity where obtaining planning approvals and access were considered unlikely — preferencing areas of existing disturbance (e.g. transmission line or utility easements, roads, tracks, fence lines and cadastral boundaries) and targeting narrow crossing points of waterways and flood out areas (and their associated riparian habitats such as around the Murrumbidgee River, the Coleambally irrigation channels, Yanco Creek, Columbo Creek and Lake Cullivel) — preferencing co-locating with existing transmission alignments when traversing through conservation areas such as Yanga National Park — enabled the use of current and available technology for transmission line construction. In terms of locating the proposal to avoid high biodiversity values, the hierarchy of constraint avoidance elements were categorised as follows: — No-Go (Tier 1 constraints): Areas where the proposal cannot be located including: — Ramsar Wetlands
(b) Locating the proposal in areas where the native vegetation or threatened species habitat is in the poorest condition (i.e. areas that have a lower vegetation integrity score)	
(c) Locating the proposal in areas that avoid habitat for species with a high biodiversity risk weighting or land mapped on the important habitat map, or native vegetation that is a TEC or a highly cleared PCT.	
(d) Locating the proposal outside of the buffer area around breeding habitat features such as nest trees or caves.	

PRINCIPLES	PROPOSAL CONSISTENCY
	— Avoid (Tier 2 constraints): Areas that are to be avoided wherever possible including biodiversity constraints such as: — National Parks, ecological conservation areas (including flora reserves, state conservation areas, Biodiversity Stewardship Sites, Biobanks; wilderness protection areas) — EPBC Threatened ecological communities — serious and irreversible impacts (SAII) ecological communities and species — other Important Wetlands and Water sources for migratory birds protected by international agreements
Consideration of alternatives (section 7.1.1.4 of the BAM)	
(a) an analysis of alternative modes or technologies that would avoid or minimise impacts on biodiversity values	For detailed description of the approach to the refinement of the design for the whole of EnergyConnect (including the current proposal comprising the Eastern Section of EnergyConnect), including the development of design criteria and principles, the approach to the design principles and issues, design options considered and assessment against a range of criteria please refer to the Proposal design development Chapter 3 of the EIS.
(b) an analysis of alternative routes that would avoid or minimise impacts on biodiversity values	
(c) an analysis of alternative locations that would avoid or minimise impacts on biodiversity values	
(d) an analysis of alternative sites within a property on which the proposal is proposed that would avoid or minimise impacts on biodiversity values	
Designing a proposal to avoid and minimise impact on native vegetation, threatened species, threatened ecological communities and their habitat (section 7.1.2.1 of BAM)	
(a) Reducing the proposal's clearing footprint by minimising the number and type of facilities	In regard to specific avoidance of species with a high biodiversity risk weighting the Plains Wanderer, being an SAII entity was deemed critical for avoidance of mapped known habitat for the species. Spatial data layers were obtained from the NSW Biodiversity Conservation Division to enable design refinements such as proposed transmission line realignment near Bundure Siding, micrositing of tower locations and re-routing of maintenance tracks to avoid where possible any direct impacts to mapped Plain Wanderer habitat. Additionally, bespoke construction methodologies are proposed at primary Plains Wanderer habitat locations which would
(b) Locating ancillary facilities in areas where there are no biodiversity values	
(c) Locating ancillary facilities in areas where the native vegetation or threatened species habitat is in the poorest condition (i.e. areas that have a lower vegetation integrity score)	

PRINCIPLES	PROPOSAL CONSISTENCY
(d) Locating ancillary facilities in areas that avoid habitat for species and vegetation in high threat status categories (e.g. an EEC or CEEC or is an entity at risk of a serious and irreversible impact (SAII)	prevent vegetation clearing in the centreline area between towers. This would reduce the potential for impact in these areas. Avoidance has as enabled relocation of preferred corridor north at Gums Lane to avoid high biodiversity value areas that contains the critically endangered Box Gum Woodland. In locating ancillary facilities key factors applied to the identification of potential main construction compounds and accommodation camps included: — being in areas which have previously been disturbed, or would already require disturbance as part of the construction of the proposal — no impacts to threatened species (or their habitats) or threatened ecological communities (within the meaning of the BC Act or the EPBC Act) — being located on sites of identified lower ecological and heritage value — being located an appropriate distance from watercourses (i.e. locations greater than 200 metres away).
(e) actions and activities that provide for rehabilitation, ecological restoration and/or ongoing maintenance of retained areas of native vegetation, threatened species, threatened ecological communities and their habitat on the subject land.	Mitigation measures have been developed to address the direct and indirect impacts of the proposal, including restoration and rehabilitation, and is outlined in Chapter 10. Transgrid will develop vegetation maintenance protocols for the proposal accordingly. This might include updating existing Transgrid maintenance procedures/guides or creating new bespoke maintenance procedures/guides specifically for the proposal. Transgrid will make a decision regarding exactly how these requirements will be captured in maintenance system for the proposal prior to the commencement of operation of the infrastructure. Regardless, the new or updated vegetation maintenance procedures/guides will be implemented for the proposal to ensure that the vegetation maintenance outcomes that Transgrid has committed to in the EIS (as amended in response to the submissions received) are achieved.

8.1.2 Transgrid approach

Transgrid established a range of criteria to guide the identification and evaluation of alignment corridor options. The option selection must generally:

- be broadly acceptable to stakeholders, balancing the various environmental and social aspects with engineering limitations and project cost
- meet all regulatory obligations relevant under State and Commonwealth legislation
- avoid areas of particular environmental sensitivity and restricted access where planning approvals and access are considered unlikely
- avoid (if reasonable) or minimise impacts on areas of particular environmental sensitivity and where environmental planning approvals are potentially complex
- preference impacts to areas of existing disturbance (e.g. utility easements, roads, tracks, fence lines and cadastral boundaries) and target narrow crossing points of waterways and flood out areas (and their associated riparian habitats)
- maximise buffer distances to dwellings, inhabited areas and other sensitive land uses
- be cost effective and provide value for money
- provide ease of construction using current and available technology

- allow for accessibility and ability to be safely maintained
- consider engagement with local and regional communities including local government, State and Federal government agencies, landholders, Traditional Owners groups and other directly affected parties.

As outlined in the response to the principles, maximum avoidance and minimization of biodiversity impacts, considering the above factors, has been achieved.

8.1.3 Impacts to State Forests

With reference to the alignment traversing Cullivel and Brookong State Forests (SF's), it was necessary to consider a range of local constraints and opportunities to ensure that the final alignment refinements offered a balanced outcome in regard to the criteria outlined above. They include:

- the outcome of direct engagement with landowners and the preferences expressed by them during that engagement and alignment refinement process
- the concentration of residential receivers to the west of Cullivel SF and east of Brookong SF maximising the buffer distance (where possible) between the transmission line centreline and residential receivers
- capitalising on various local opportunities (e.g. existing, east/west trending roads and fence lines) including Andriskes Lane to the east of Cullivel SF and Tenison Lane to the east of Brookong SF
- the broader influence of Lake Cullivel, to the east of Cullivel SF and the Commonwealth department of Defence exclusion zone both of which precluded a more northerly alignment through the general area to the west of the Lockhart township
- the complexity of constraints to the south of Cullivel SF, including higher concentrations of residential receivers, ephemeral and semi-permanent water bodies south west of Lake Cullivel and avoiding material increases in transmission line length
- an existing 22kV OH distribution line located on the eastern side of the Lockhart to Urana Road and that required a line crossing perpendicular to its direction of travel, which is this case was preferentially located at the western end of Tenison Lane and the start of the Lockhart deviation.

In summary, it was the totality of constraints and opportunities that influenced the overall approach to alignment refinements in the areas around Cullivel and Brookong SF. Transgrid is of the view that the alignment selected balances the complexity of environmental, land use, social and engineering aspects.

8.2 Avoid and minimise impacts on prescribed biodiversity

This section addresses prescribed biodiversity impacts that may be difficult to quantify, replace or offset, making avoiding and minimising impacts critical in accordance with Section 7.2.1 and 7.2.2 of the BAM. Prescribed biodiversity impacts relevant to the proposal have been identified in Table 8-2.

Table 8-2 Efforts to avoid and minimise impacts on prescribed biodiversity during proposal planning

PRESCRIBED BIODIVERSITY IMPACTS	PROPOSAL PLANNING
Designing a project location to avoid and minimise impact on prescribed biodiversity (section 7.2.2.1 of BAM)	
(a) locating the envelope of surface works to avoid direct impacts on the habitat features identified in Chapter 6	The approach outlined in Section 8.1 has ensured that: — impacts to Plains-wanderer habitats have been avoided as far as possible and/or impacts minimised — impacts to rocky habitats have been avoided and/or minimised — impacts to habitat connectivity and species movement have been avoided and/or minimised — impacts to water-related values have been avoided and/or minimised — impacts of vehicle strikes have been avoided and/or minimised.

PRESCRIBED BIODIVERSITY IMPACTS	PROPOSAL PLANNING
(b) locating the envelope of sub-surface works, both in the horizontal and vertical plane, to avoid and minimise operations beneath the habitat features, e.g. locating longwall panels away from geological features of significance or water dependent plant communities and their supporting aquifers	The approach outlined in Section 8.1 has ensured that: — impacts to Plains-wanderer habitats have been avoided and/or minimised — impacts to rocky habitats have been avoided and/or minimised — impacts to habitat connectivity and species movement have been avoided and/or minimised — impacts to water-related values have been avoided and/or minimised — impacts of vehicle strikes have been avoided and/or minimised. Subsurface works are expected to be comparatively minor.
(c) locating the proposal to avoid severing or interfering with corridors connecting different areas of habitat, migratory flight paths to important habitat or local movement pathways	The approach outlined in Section 8.1 has ensured that: — impacts to Plains-wanderer habitats have been avoided and/or minimised — impacts to rocky habitats have been avoided and/or minimised — impacts to habitat connectivity and species movement have been avoided and/or minimised — impacts to water-related values have been avoided and/or minimised — impacts of vehicle strikes have been avoided and/or minimised. Connectivity may be impacted to some degree, particularly for aerial species, however such impacts are not expected to be significant. It is not possible to avoid some impact on connectivity given that the proposal needs to be located in the general location and in a manner that is functional. Connectivity corridors would occur as a minimum at: — key riparian crossings (Murrumbidgee) and — areas of the alignment joining proposed biodiversity stewardship sites and or conservation reserve estate. Exact locations would be based on the Connectivity Strategy which would be subject to review as part of the BMP review by BCD.
(d) optimising proposal layout to minimise interactions with threatened entities	The approach outlined in Section 8.1 has ensured that: — impacts to Plains-wanderer habitats have been avoided and/or minimised — impacts to rocky habitats have been avoided and/or minimised — impacts to habitat connectivity and species movement have been avoided and/or minimised — impacts to water-related values have been avoided and/or minimised — impacts of vehicle strikes have been avoided and/or minimised. Section 3.3.1 of the NSW (Eastern) EIS (Volume 1) outlines the approach to the identification and refinement of the proposal corridor. A hierarchy of constraints and opportunities was used to define and refine the preliminary and preferred alignment corridors. Proposed alternative alignments across the Murrumbidgee were not considered to be suitable.
(e) locating the proposal to avoid direct impacts on water bodies or hydrological processes.	The approach outlined in Section 8.1 has ensured that: — impacts to water-related values have been avoided and minimised. No waterbodies will be directly impacted.

PRESCRIBED BIODIVERSITY IMPACTS	PROPOSAL PLANNING
Designing a project location to avoid and minimise impact on prescribed biodiversity (section 7.2.2.2 of BAM)	
(a) an analysis of alternative modes or technologies that would avoid or minimise prescribed biodiversity impacts and justification for selecting the proposed mode or technology	Refer to Section 8.1 and to the EIS. There are no alternatives to the proposal and the proposal has already been designed in the most sympathetic way possible.
(b) an analysis of alternative routes that would avoid or minimise prescribed biodiversity impacts and justification for selecting the proposed route	
(c) an analysis of alternative locations that would avoid or minimise prescribed biodiversity impacts and justification for selecting the proposed location	
(d) an analysis of alternative sites within a property on which the proposal is proposed that would avoid or minimise prescribed biodiversity impacts and justification for selecting the proposed site.	

9 Assessment of impacts

9.1 Assessment of direct impacts unable to be avoided

Assessment of direct impacts unable to be avoided has been carried out in accordance with Section 9.1 of the BAM.

In assessing construction impacts an disturbance area (as defined in Table 9-1) has been used. For this report, the disturbance area has the same meaning as 'development site' as defined in the BAM.

This disturbance area approach is likely to be a worst-case scenario assessment given an indicative impacts approach based on a potentially larger footprint than could eventuate and that design refinement would prioritise avoidance and/or impact minimisation.

Table 9-1 Disturbance area definition for biodiversity construction impact assessment purpose

TERM	DEFINITION
Disturbance area	Refers to the area that would be directly impacted by both construction and operation of the proposal including all proposal infrastructure elements (including the proposed proposal disturbance area, substation site works and other ancillary works i.e. the permanent works footprint) as well as locations for currently proposed construction elements such as construction compounds, access tracks and site access points, laydown and staging areas, concrete batching plants, brake/winch sites, site offices and accommodation camps. The area is identified based on realistic project component locations and areas however it is indicative at this stage. The area would be confirmed during finalisation of design and construction methodology and would be developed as part of the consideration of avoidance and impact minimisation. Also termed the construction impact area.
Disturbance area A	Refers to an area at and around the transmission line towers, areas for brake and winch sites and for new/upgraded access tracks in which vegetation would be removed during construction. The area also includes the proposed Dinawan substation site, the existing Wagga Wagga substation site and each of the main construction compounds and accommodation camps at Balranald, the Cobb Highway, Dinawan (Kidman Way), Lockhart and Wagga Wagga. It would include vegetation (including tree) removal and potential sub-surface impacts through construction activities such as grading, excavation, and full tree removal. Except in areas where only temporary disturbance is required (i.e. temporary access tracks and brake and winch sites), this area would also be subject to ongoing maintenance during operation (i.e. removal to ground level) for operational and safety requirements (including bushfire).

TERM	DEFINITION
Disturbance area A (centreline)	Refers to a centreline area between the proposed transmission line towers in which all vegetation (including trees) would be removed during construction to ground level. In areas of known or potential heritage subsurface sensitivity (i.e. potential archaeological deposits (PADs)) sub-surface impacts in these areas would be avoided. In these areas vegetation would be cut to ground level and rootballs would be retained as necessary to avoid subsurface impacts. Additionally, in areas of key Plains Wanderer primary habitat these centreline areas would not be subject to vegetation clearing. Alternate methods would be adopted in these key habitat areas for the conductor stringing activities. This area would also be subject to ongoing maintenance during operation (i.e. removal to maintain vegetation clearance requirements) for operational and safety requirements (including bushfire).
Disturbance area B4	Refers to an area between transmission towers in which it is assumed vegetation removal would only be required to meet the vegetation clearance heights. Where trees within this area would or have the potential to exceed vegetation clearance heights with growth heights greater than 4 metres, these trees would be removed and may result in temporary ground disturbance. There is potential for temporary minor changes to understorey composition in these areas due to the temporary ground disturbance activities. Retention of root bases, and or tree stumps of trees identified for removal, would occur where practicable. Vegetation clearance heights are set by Transgrid for operational and safety requirements, including bushfire risk management. This zone is a subset to the disturbance area.
Disturbance area B10	Refers to an area between transmission towers in which it is assumed vegetation removal would only be required to meet the vegetation clearance heights. Where trees within this area would or have the potential to exceed vegetation clearance with growth heights greater than 10 metres, these trees would be removed and may result in temporary ground disturbance. There is potential for temporary minor changes to understorey composition in these areas due to the temporary ground disturbance activities. Retention of root bases, and or tree stumps of trees identified for removal, would occur where practicable. Vegetation clearance heights are set by Transgrid for operational and safety requirements, including bushfire risk management. This zone is a subset to the disturbance area.

It should be noted that final design refinement for the proposal has not been completed and as a result the disturbance area is identified as relatively realistic however still indicative only. It has been applied to this assessment to enable assessment of the likely quantum and type of impacts of the proposal. These would be confirmed following the completion of the final design refinement.

An illustration of the components of the disturbance area is presented in Figure 1-4 and Figure 1-5. The indicative impact areas used for calculations within the disturbance area are presented in Figure 9-2.

Additionally, in relation to proposal component impacts for disturbance area A, all construction phase water supply points identified for the proposal are existing sites. Some minor infrastructure changes would be required at some of these sites however these would not require any additional vegetation clearing to occur and the vegetation impacts presented in this BDAR reflect this.

9.1.1 Justification for determining future vegetation integrity scores

The BAM has been established under the guiding principle of avoid and minimise impacts to biodiversity values. For impacts that cannot be totally avoided, impacts must be minimised to enable better outcomes for biodiversity values. Transmission line corridor management traditionally focuses on the complete removal of vegetation using short rotation times with the aim to reduce the perceived fire hazard associated with transmission line corridor vegetation. The proposal has taken a different approach where the maintenance zone underneath the transmission line will be managed through the removal of vegetation with specific growth height levels in accordance with the vegetation clearing requirements (i.e. between growth heights of 4m levels and 10 m levels in the inner and outer maintenance zones, respectively) leaving the midstorey and ground layers intact. This partial clearing of the transmission line easement is part of the measures taken to minimise impacts to biodiversity values. Maintaining a shrub layer would help avoid loss of species richness, encourage native species and limit colonisation opportunities of introduced species (Clarke and White 2008). To facilitate these partial vegetation clearing scenarios the BAM allows for future vegetation integrity score to be determined following the procedure in Section 6.4 of the BAM Calculator User Guide.

In assessing direct impacts on native vegetation, future vegetation integrity scores were calculated in BAM-C for each disturbance area subset and associated vegetation zone. For disturbance area A, the future vegetation integrity score was calculated as zero and assumes total loss of native vegetation. For disturbance area B4 and B10 (partial clearing of the transmission line easement) future vegetation integrity scores have been calculated through changes to mean average scores in attributes associated with composition condition, structure condition and function condition.

It should be noted that BAM-C has limited flexibility in the input functions to calculate future vegetation integrity scores, specifically in that attributes can only be decreased from the recorded mean average. Attribute scores cannot be increased when using in the clearing module. This limitation means that any composition, structure or function attribute cannot be adequately adjusted to reflect likely changes in vegetation integrity where evidence suggests the attributes are likely to increase.

Transmission line clearings develop into novel habitats over time (Eldridge, Eyitayo et al. 2017) and PCT species and functional composition have been shown to be different between sites with control and thinned canopy treatments with proportionally more individuals of grasses and forbs in thinned plots (see Tsai *et al.*, 2018). Where structural elements such as the canopy tree layer is removed from existing powerline easements across NSW, shrubby mid storey layer, or derived shrub land vegetation structure may develop.

Similarly, tree thinning or clearing can lead to a range of changes in the structural cover responses in the understorey and shrub layers of arid and semi-arid vegetation types (Nobel 1997, Walker & Koen 1995). Canopy opening disturbance has immediate and substantive effects on understory microclimate and therefore the establishment and growth of understory plants (Tsai *et al.*, 2018). Specifically, for the project, Mallee PCTs within the Semi-arid Woodlands (Shrubby sub-formation**)** with existing woody shrub layers components are likely to see increases in the future shrub layers cover scores, while for those PCTs with greater grassy understorey components in the (Semi-arid Woodlands (Grassy sub-formation) similar future increase in vegetation cover for grass and grass like, forb, fern and other species cover attributes is likely (Nobel 1997, Both et al. 1996). These likely increase in mid and understorey layers due to structural canopy change cannot be reflected in BAM-C future vegetation integrity scores due to limitations within BAM-C.

Considering this, future vegetation integrity score adjustments for this BDAR have applied future structure scores within the proposed maintenance zone with canopy removal as the recorded mean average and this is considered a conservative application of any likely future structure score.

Conversely, where shrub and ground stratum cover increases it has been documented that composition or species richness may decrease through species being out competed by more dominant species. Studies show a general shift to early successional shade intolerant species and those species that reproduce through clonal growth (see Luken, *et al.*, 1992, (Eldridge, Eyitayo et al. 2017) and Walker & Koen 1995). To allow for this a conservative application of 30% reduction has been applied to the recorded mean average of all shrub, grass & grass like, forb, fern and other species richness has been applied in determining future vegetation integrity composition scores all PCTs.

In determining future vegetation integrity function scores all tree attributes were removed and assumed absent or provided a score of zero. For the future mean leaf litter and length of fallen logs, a conservative application of 25% reduction has been applied.

In summary, the following assumptions were applied in determining future vegetation integrity scores in the disturbance area B4 and B10 (partial clearing of the powerline easement):

Composition condition score:

- The future mean for tree richness was assumed as zero (this is a conservative over-estimate as it is likely that species in the tree growth form will still exist in the easement (resprout or recruit from seed) they will never be allowed to reach full height).
- For all PCTs the future mean for shrub, grass & grass like, forb, fern and other species richness was assumed to have a 30% reduction to the current recorded mean average (loss of shade tolerant species, shift towards species that can withstand or benefit from disturbance e.g. increase in clonal species.

Structure condition score:

- The future mean for tree cover was assumed as zero (a conservative over-estimate as it is likely that species in the tree growth form will still exist in the easement (resprout or recruit from seed) and there will be some level of tree cover).
- For all PCTs the future mean for shrub, grass & grass like, forb, fern and other cover was assumed as the current recorded mean average (scores cannot be adjusted upwards in the BAM-C to account for likely increase in cover due to canopy removal).

Function condition score:

- Tree regeneration <5 cm diameter was assumed absent (the easement will be maintained to prevent tree growth).
- The future mean for stem size class was assumed as zero (the easement will be maintained to prevent tree growth).
- The future mean for number of large trees was assumed as zero (the easement will be maintained to prevent tree growth).
- The future mean for leaf litter and length of fallen logs was assumed to have a 25% reduction to the current recorded mean average.
- The future mean of high threat weed cover was assumed as the current recorded mean average (no increase to high threat weed cover is expected due to implementation of weed control measures as outlined in the CEMP and low density of existing high threat weeds recorded).

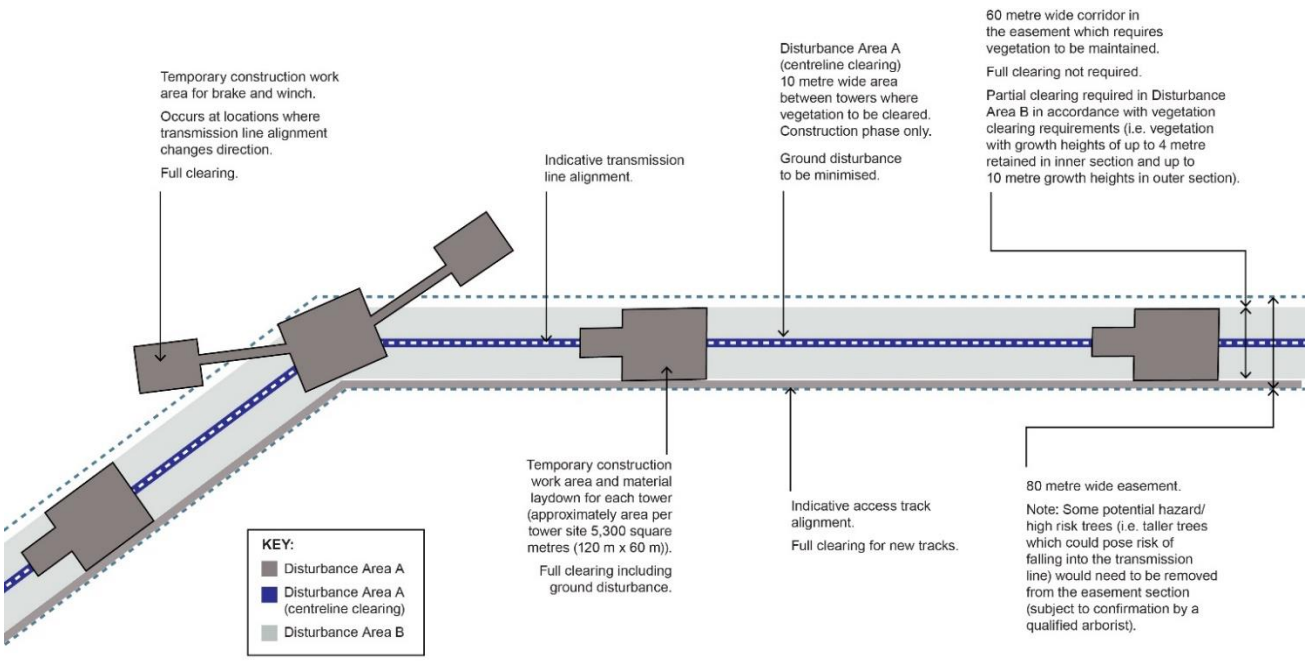
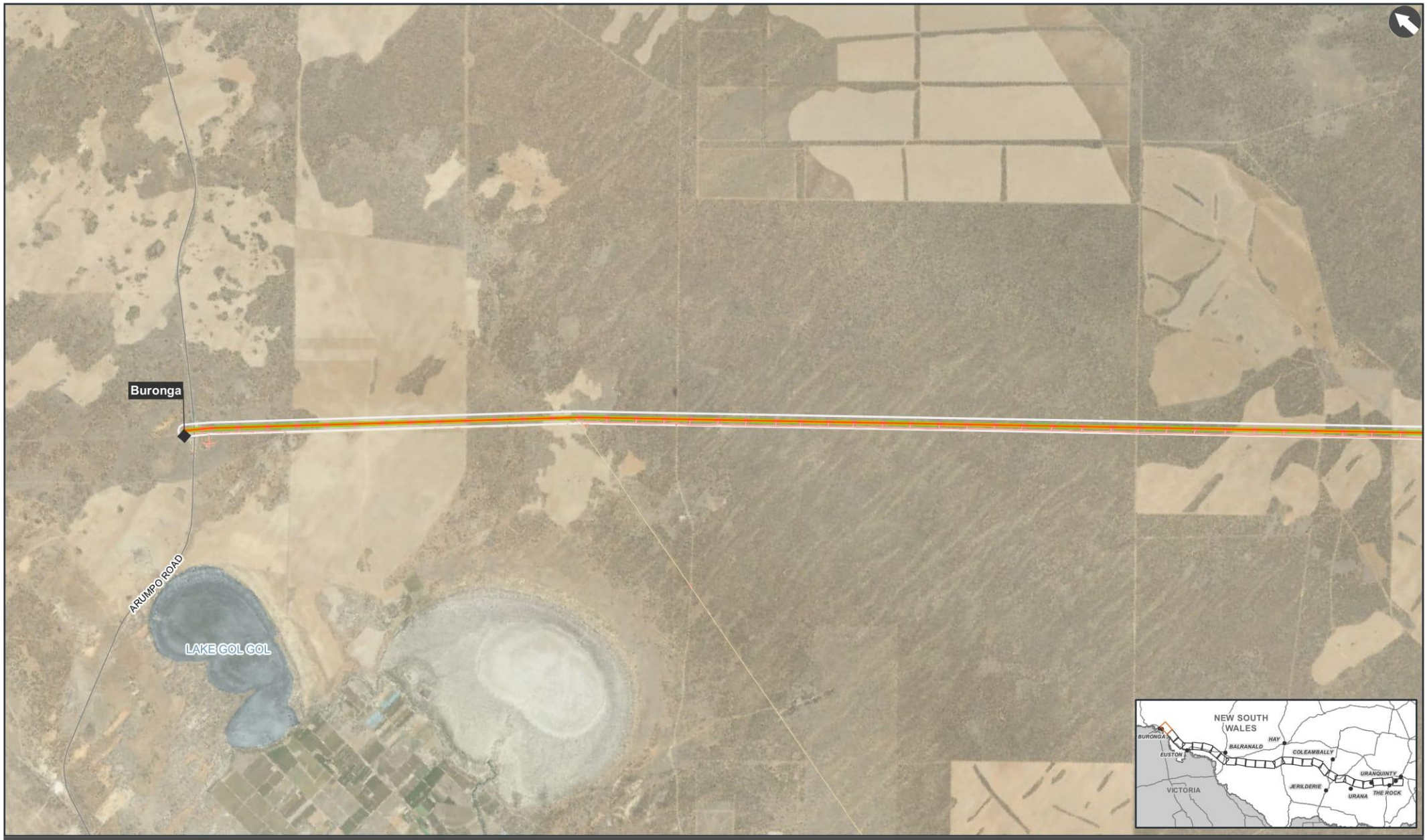


Figure 9-1 Illustration of the components of the disturbance area for 330kV line



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BDAR - Figure 9-2a

Project Components
- Proposed
- Access Tracks
- Main Construction Compounds and Accomodation
- Water Supply Point

- Existing Substation
- Built Up Areas
- Waterbody
- Biodiversity Study Area

Disturbance Impact
- Disturbance Area A (full
- Disturbance Area B (partial
- Disturbance Area B (partial

Proposal of Indicative Disturbance Area Including Construction and Operational Impacts

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Source: NSWSS, ESRI, Transgrid, WSP

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BDAR - Figure 9-2b

Project Components
- Proposed
- Access Tracks
- Main Construction Compounds and Accomodation
- Water Supply Point

- Existing Substation
- Built Up Areas
- Waterbody
- Biodiversity Study Area

Disturbance Impact
- Disturbance Area A (full
- Disturbance Area B (partial
- Disturbance Area B (partial

Proposal of Indicative Disturbance Area Including Construction and Operational Impacts

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Source: NSWSS, ESRI, Transgrid, WSP

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BDAR - Figure 9-2c

Project Components
- Proposed
- Access Tracks
- Main Construction Compounds and Accomodation
- Water Supply Point
- Existing Substation
- Built Up Areas
- Waterbody
- Biodiversity Study Area

Disturbance Impact
- Disturbance Area A (full
- Disturbance Area B (partial
- Disturbance Area B (partial

Proposal of Indicative Disturbance Area Including Construction and Operational Impacts

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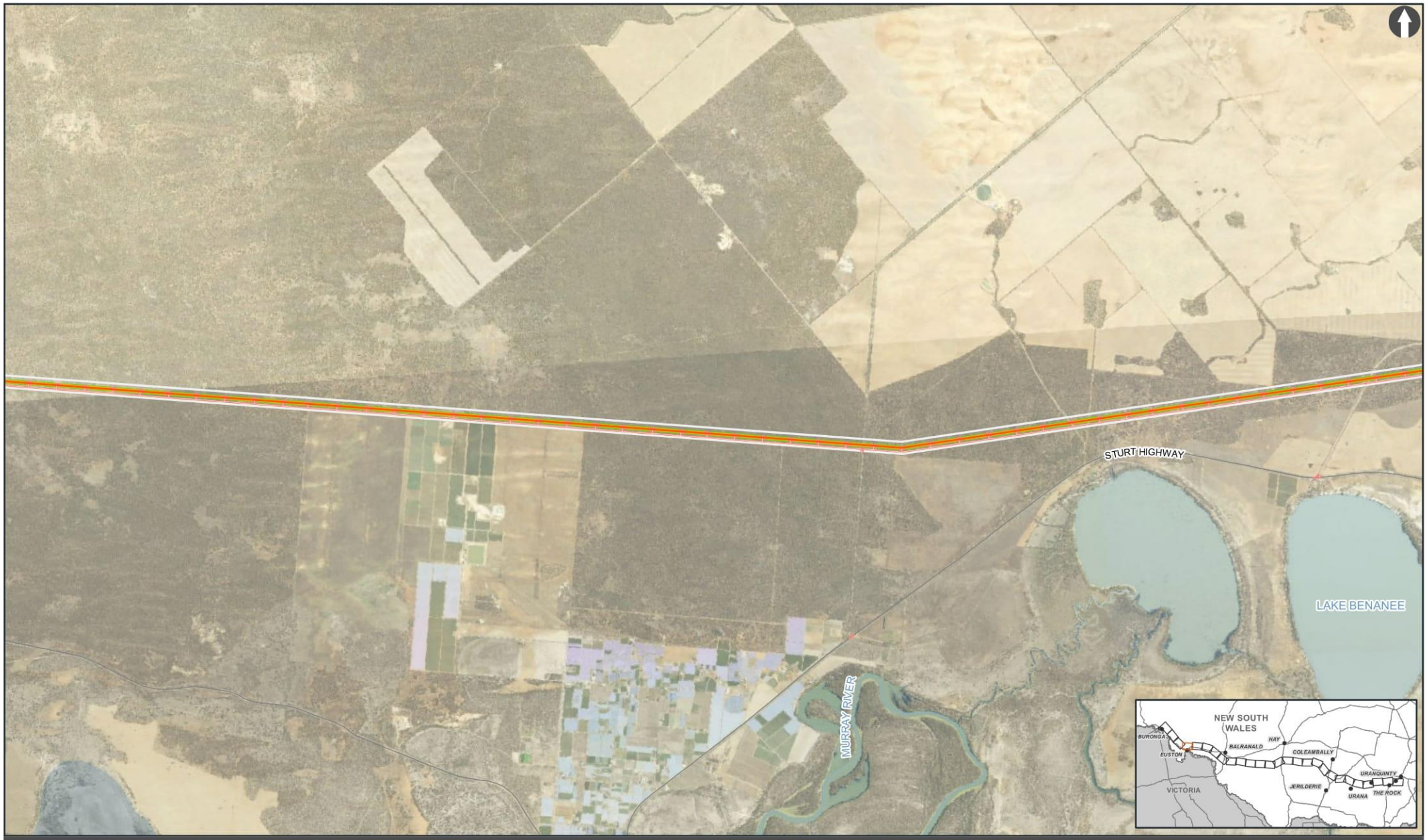
Source: NSWSS, ESRI, Transgrid, WSP



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BDAR - Figure 9-2d

Project Components
- Proposed
- Access Tracks
- Main Construction Compounds and Accomodation
- Water Supply Point
- Existing Substation
- Built Up Areas
- Waterbody
- Biodiversity Study Area

Disturbance Impact
- Disturbance Area A (full
- Disturbance Area B (partial
- Disturbance Area B (partial

Proposal of Indicative Disturbance Area Including Construction and Operational Impacts

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Source: NSWSS, ESRI, Transgrid, WSP

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BDAR - Figure 9-2e

Project Components
- Proposed
- Access Tracks
- Main Construction Compounds and Accomodation
- Water Supply Point
- Existing Substation
- Built Up Areas
- Waterbody
- Biodiversity Study Area

Disturbance Impact
- Disturbance Area A (full
- Disturbance Area B (partial
- Disturbance Area B (partial

Proposal of Indicative Disturbance Area Including Construction and Operational Impacts

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Source: NSWSS, ESRI, Transgrid, WSP

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BDAR - Figure 9-2f

Project Components
- Proposed
- Access Tracks
- Main Construction Compounds and Accomodation
- Water Supply Point

- Existing Substation
- Built Up Areas
- Waterbody
- Biodiversity Study Area

Disturbance Impact
- Disturbance Area A (full
- Disturbance Area B (partial
- Disturbance Area B (partial

Proposal of Indicative Disturbance Area Including Construction and Operational Impacts

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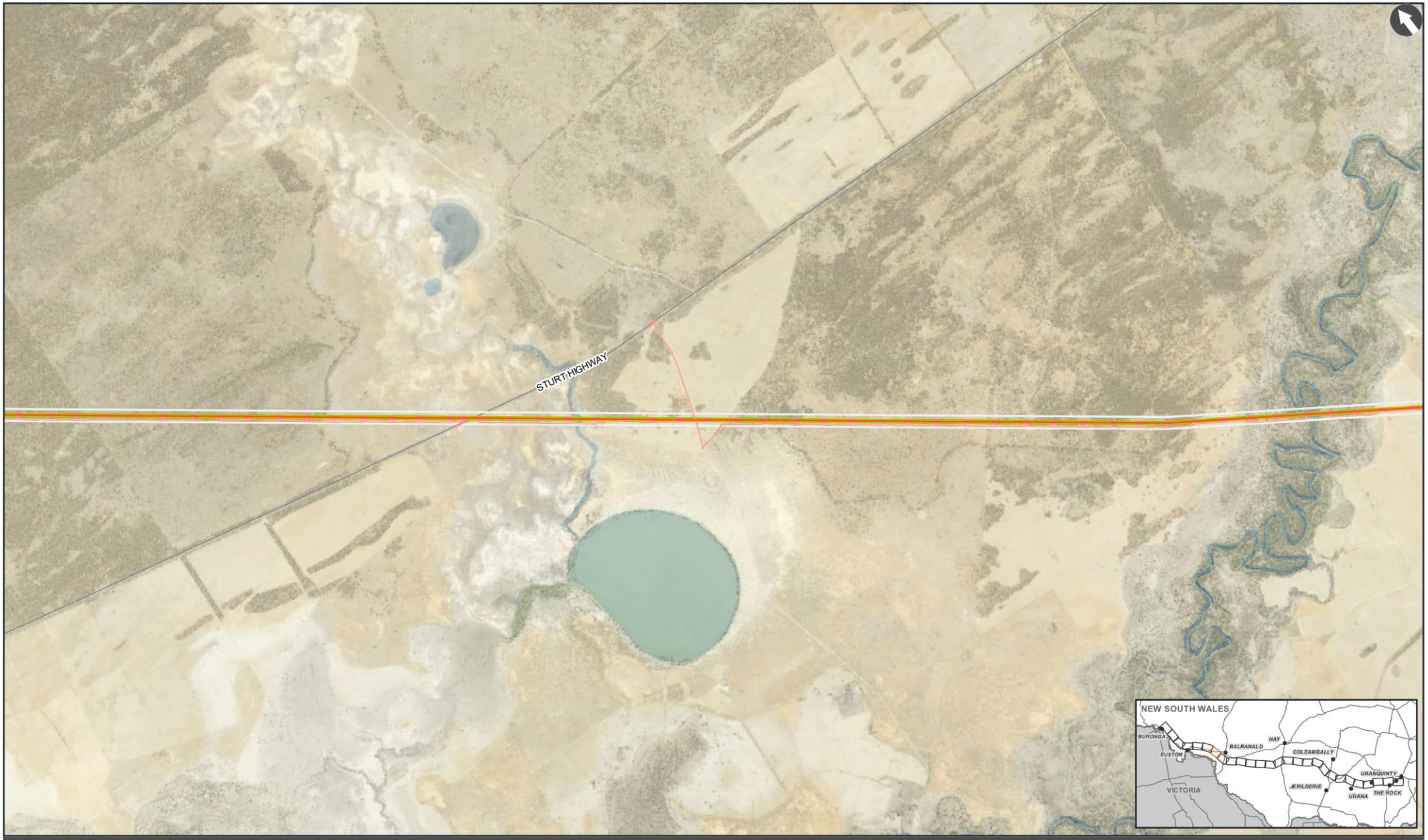

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BDAR - Figure 9-2g

Project Components
- Proposed
- Access Tracks
- Main Construction Compounds and Accomodation
- Water Supply Point

- Existing Substation
- Built Up Areas
- Waterbody
- Biodiversity Study Area

Disturbance Impact
- Disturbance Area A (full
- Disturbance Area B (partial
- Disturbance Area B (partial

Proposal of Indicative Disturbance Area Including Construction and Operational Impacts

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Source: NSWSS, ESRI, Transgrid, WSP

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BDAR - Figure 9-2h

Project Components
- Proposed
- Access Tracks
- Main Construction Compounds and Accomodation
- Water Supply Point

- Existing Substation
- Built Up Areas
- Waterbody
- Biodiversity Study Area

Disturbance Impact
- Disturbance Area A (full
- Disturbance Area B (partial
- Disturbance Area B (partial

Proposal of Indicative Disturbance Area Including Construction and Operational Impacts

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Source: NSWSS, ESRI, Transgrid, WSP

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BDAR - Figure 9-2i

Project Components
- Proposed
- Access Tracks
- Main Construction Compounds and Accomodation
- Water Supply Point
- Existing Substation
- Built Up Areas
- Waterbody
- Biodiversity Study Area

Disturbance Impact
- Disturbance Area A (full
- Disturbance Area B (partial
- Disturbance Area B (partial

Proposal of Indicative Disturbance Area Including Construction and Operational Impacts

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Source: NSWSS, ESRI, Transgrid, WSP

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BDAR - Figure 9-2j

Project Components
- Proposed
- Access Tracks
- Main Construction Compounds and Accomodation
- Water Supply Point
- Existing Substation
- Built Up Areas
- Waterbody
- Biodiversity Study Area

Disturbance Impact
- Disturbance Area A (full
- Disturbance Area B (partial
- Disturbance Area B (partial

Proposal of Indicative Disturbance Area Including Construction and Operational Impacts

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Source: NSWSS, ESRI, Transgrid, WSP

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BDAR - Figure 9-2k

Project Components
- Proposed
- Access Tracks
- Main Construction Compounds and Accomodation
- Water Supply Point
- Existing Substation
- Built Up Areas
- Waterbody
- Biodiversity Study Area

Disturbance Impact
- Disturbance Area A (full
- Disturbance Area B (partial
- Disturbance Area B (partial

Proposal of Indicative Disturbance Area Including Construction and Operational Impacts

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Source: NSWSS, ESRI, Transgrid, WSP

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BDAR - Figure 9-2

Project Components
- Proposed
- Access Tracks
- Main Construction Compounds and Accomodation
- Water Supply Point
- Existing Substation
- Built Up Areas
- Waterbody
- Biodiversity Study Area

Disturbance Impact
- Disturbance Area A (full
- Disturbance Area B (partial
- Disturbance Area B (partial

Proposal of Indicative Disturbance Area Including Construction and Operational Impacts

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Source: NSWSS, ESRI, Transgrid, WSP

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BDAR - Figure 9-2m

Project Components
- Proposed
- Access Tracks
- Main Construction Compounds and Accomodation
- Water Supply Point
- Existing Substation
- Built Up Areas
- Waterbody
- Biodiversity Study Area

Disturbance Impact
- Disturbance Area A (full
- Disturbance Area B (partial
- Disturbance Area B (partial

Proposal of Indicative Disturbance Area Including Construction and Operational Impacts

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Source: NSWSS, ESRI, Transgrid, WSP

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BDAR - Figure 9-2n

Project Components
- Proposed
- Access Tracks
- Main Construction Compounds and Accomodation
- Water Supply Point
- Existing Substation
- Built Up Areas
- Waterbody
- Biodiversity Study Area

Disturbance Impact
- Disturbance Area A (full
- Disturbance Area B (partial
- Disturbance Area B (partial

Proposal of Indicative Disturbance Area Including Construction and Operational Impacts

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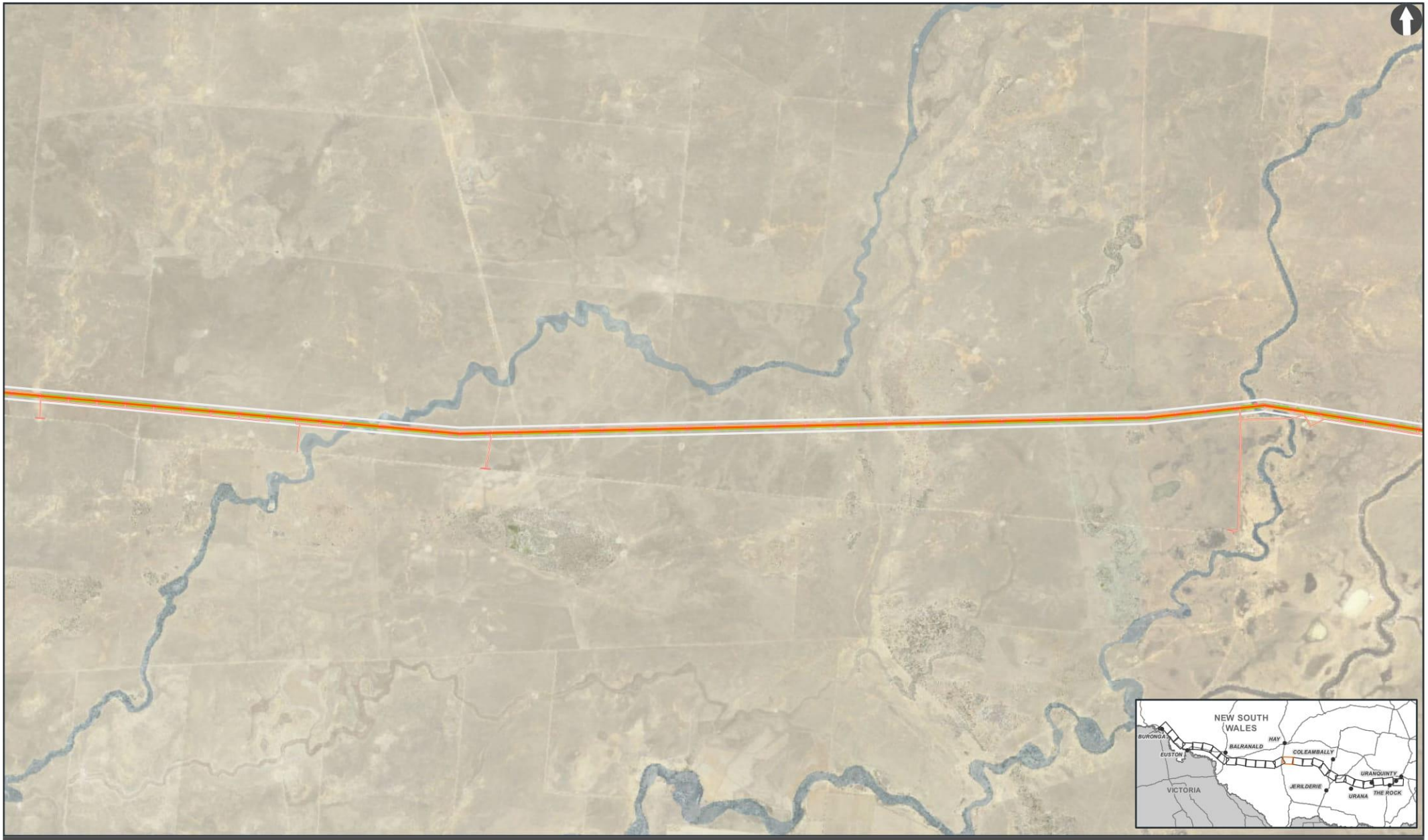
Source: NSWSS, ESRI, Transgrid, WSP



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BDAR - Figure 9-2o

Project Components
- Proposed
- Access Tracks
- Main Construction Compounds and Accomodation
- Water Supply Point
- Existing Substation
- Built Up Areas
- Waterbody
- Biodiversity Study Area

Disturbance Impact
- Disturbance Area A (full
- Disturbance Area B (partial
- Disturbance Area B (partial

Proposal of Indicative Disturbance Area Including Construction and Operational Impacts

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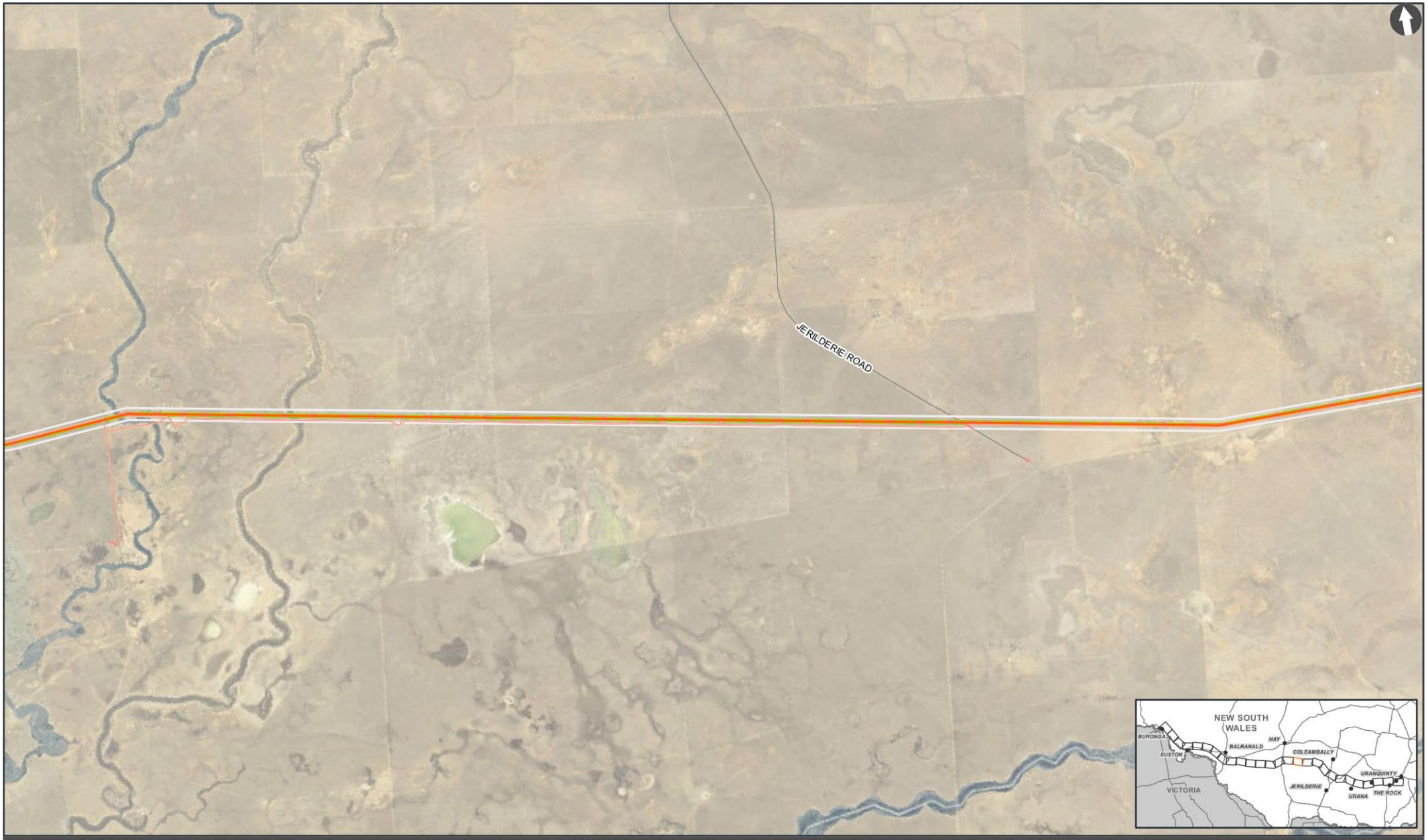
Source: NSWSS, ESRI, Transgrid, WSP



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BDAR - Figure 9-2p

Project Components
- Proposed
- Access Tracks
- Main Construction Compounds and Accomodation
- Water Supply Point
- Existing Substation
- Built Up Areas
- Waterbody
- Biodiversity Study Area

Disturbance Impact
- Disturbance Area A (full
- Disturbance Area B (partial
- Disturbance Area B (partial

Proposal of Indicative Disturbance Area Including Construction and Operational Impacts

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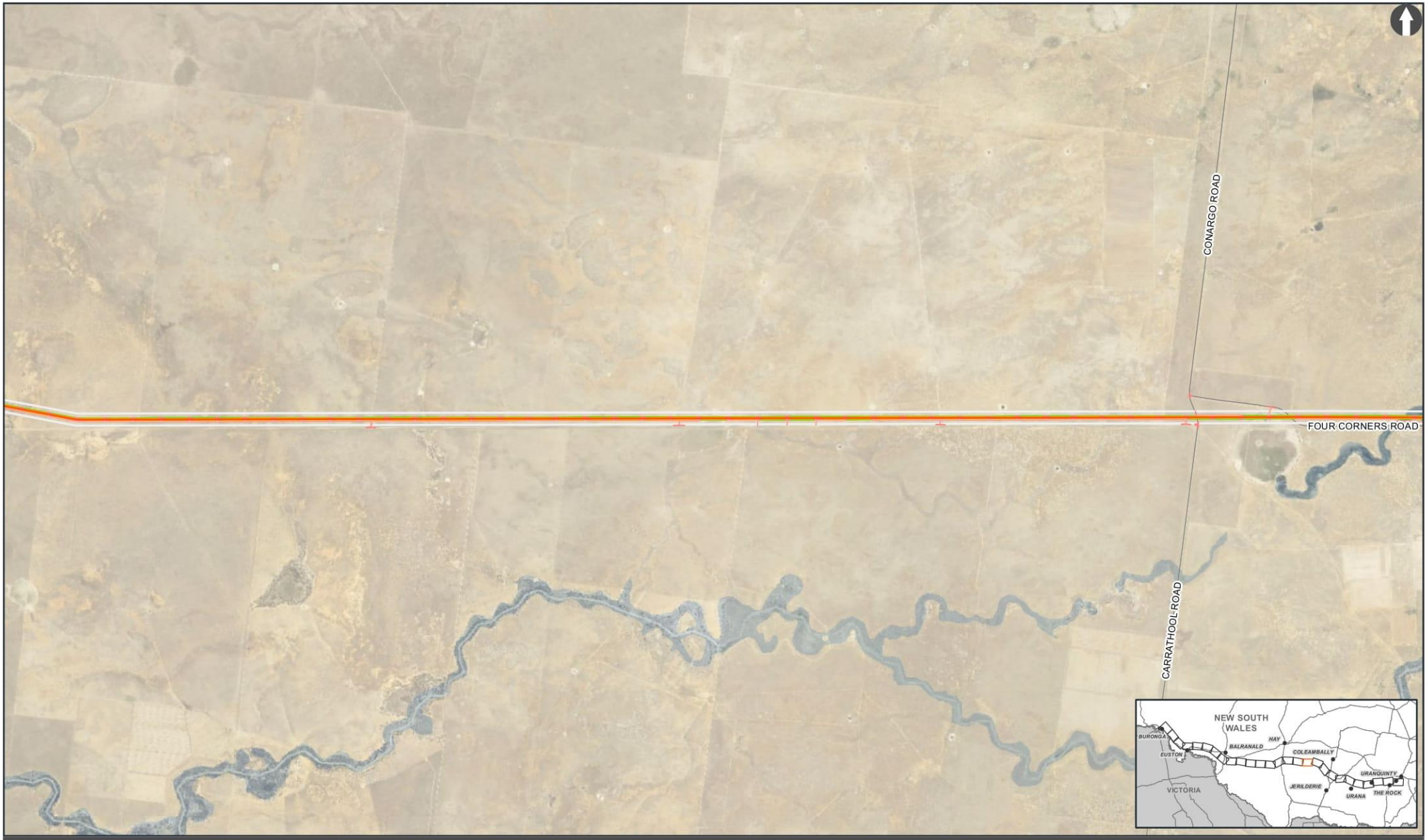
Source: NSWSS, ESRI, Transgrid, WSP



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BDAR - Figure 9-2q

Project Components
- Proposed
- Access Tracks
- Main Construction Compounds and Accomodation
- Water Supply Point

- Existing Substation
- Built Up Areas
- Waterbody
- Biodiversity Study Area

Disturbance Impact
- Disturbance Area A (full
- Disturbance Area B (partial
- Disturbance Area B (partial

Proposal of Indicative Disturbance Area Including Construction and Operational Impacts

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Source: NSWSS, ESRI, Transgrid, WSP

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BDAR - Figure 9-2r

Project Components
- Proposed
- Access Tracks
- Main Construction Compounds and Accomodation
- Water Supply Point
- Existing Substation
- Built Up Areas
- Waterbody
- Biodiversity Study Area

Disturbance Impact
- Disturbance Area A (full
- Disturbance Area B (partial
- Disturbance Area B (partial

Proposal of Indicative Disturbance Area Including Construction and Operational Impacts

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Source: NSWSS, ESRI, Transgrid, WSP

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BDAR - Figure 9-2s

Project Components
- Proposed
- Access Tracks
- Main Construction Compounds and Accomodation
- Water Supply Point

- Existing Substation
- Built Up Areas
- Waterbody
- Biodiversity Study Area

Disturbance Impact
- Disturbance Area A (full
- Disturbance Area B (partial
- Disturbance Area B (partial

Proposal of Indicative Disturbance Area Including Construction and Operational Impacts

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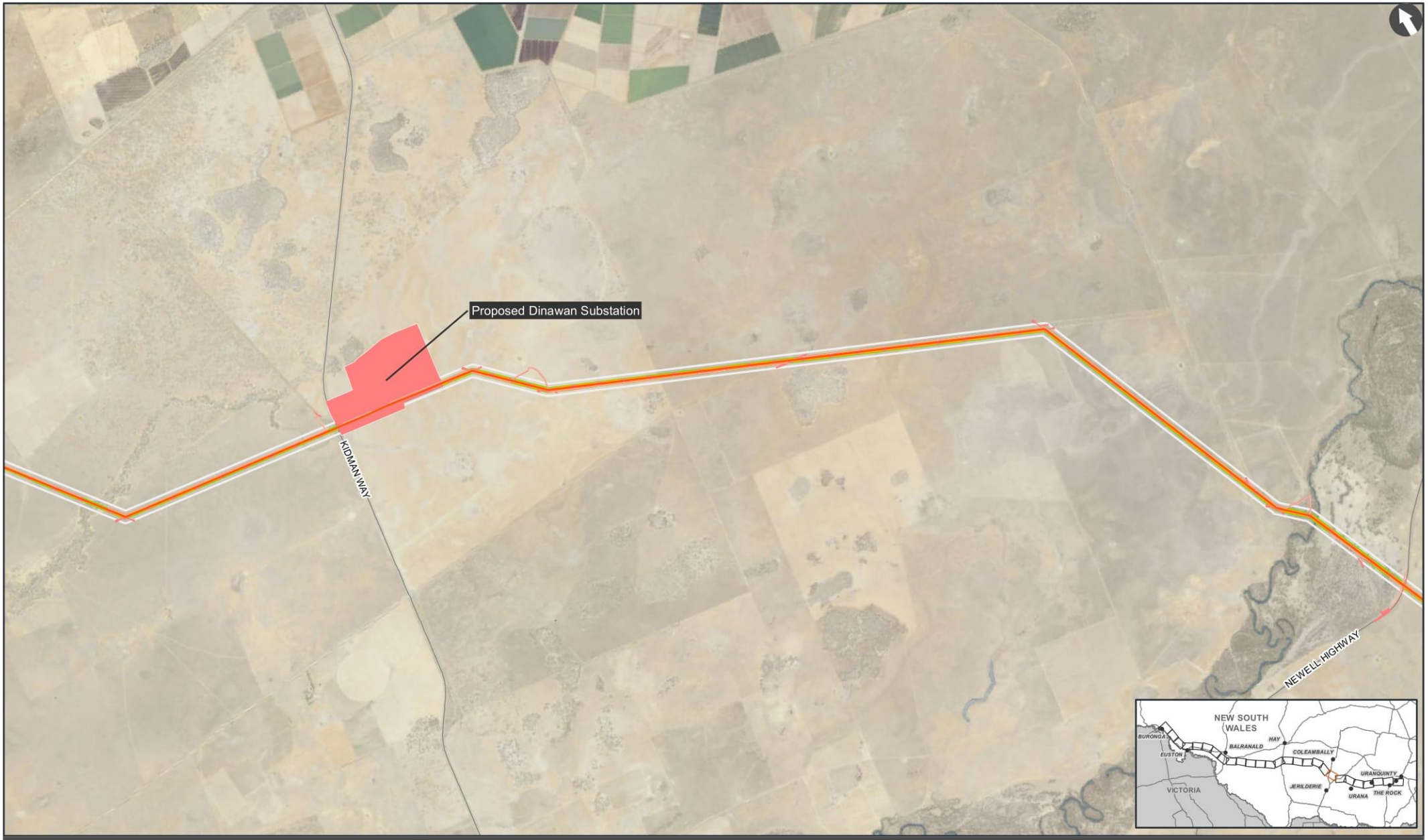
Source: NSWSS, ESRI, Transgrid, WSP



BDAR - Figure 9-2t

Project Components
- Proposed
- Access Tracks
- Main Construction Compounds and Accomodation
- Water Supply Point
- Existing Substation
- Built Up Areas
- Waterbody
- Biodiversity Study Area

Disturbance Impact
- Disturbance Area A (full
- Disturbance Area B (partial
- Disturbance Area B (partial

Proposal of Indicative Disturbance Area Including Construction and Operational Impacts

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Source: NSWSS, ESRI, Transgrid, WSP

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BDAR - Figure 9-2u

Project Components
- Proposed
- Access Tracks
- Main Construction Compounds and Accomodation
- Water Supply Point
- Existing Substation
- Built Up Areas
- Waterbody
- Biodiversity Study Area

Disturbance Impact
- Disturbance Area A (full
- Disturbance Area B (partial
- Disturbance Area B (partial

Proposal of Indicative Disturbance Area Including Construction and Operational Impacts

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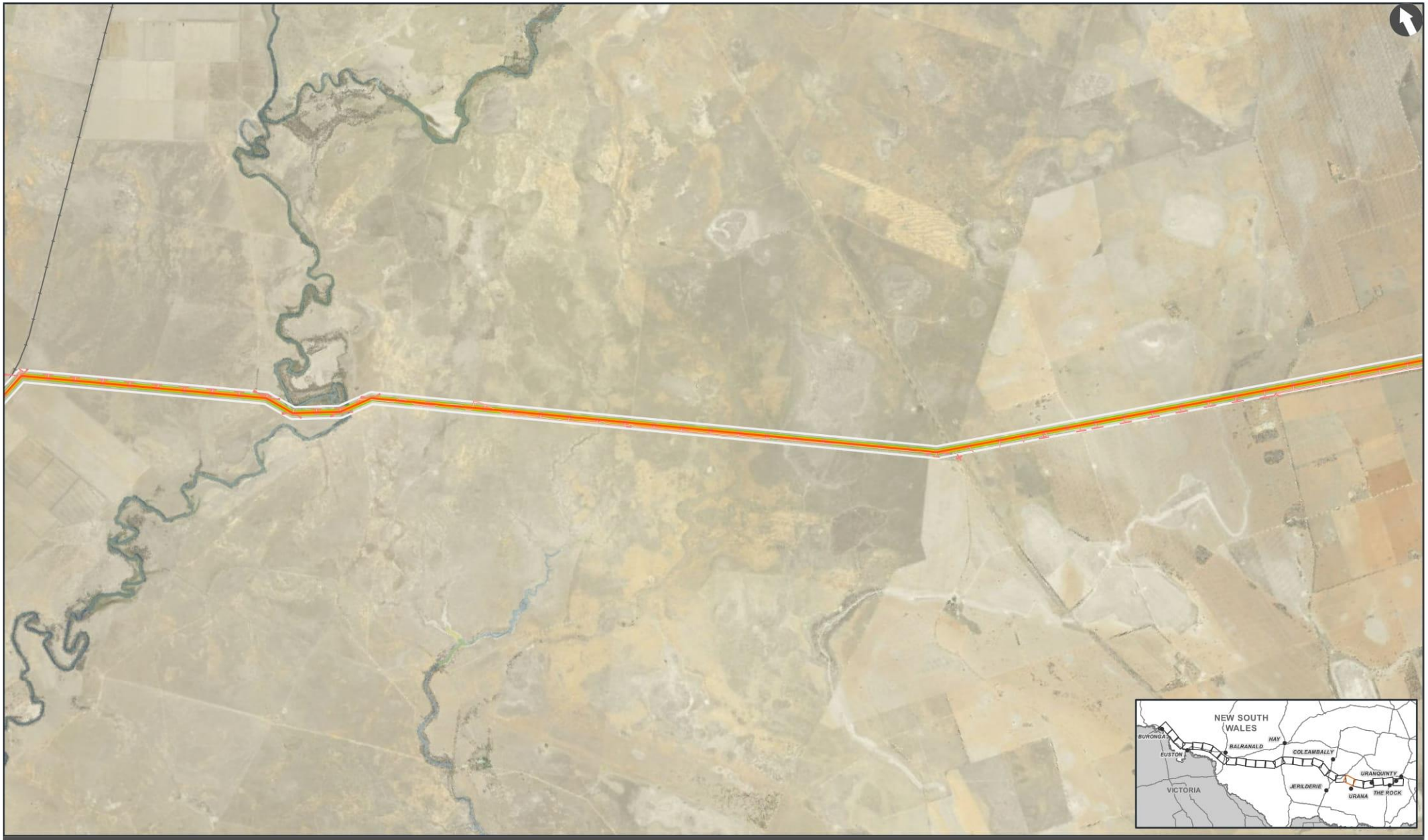
Source: NSWSS, ESRI, Transgrid, WSP



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BDAR - Figure 9-2v

Project Components
- Proposed
- Access Tracks
- Main Construction Compounds and Accomodation
- Water Supply Point
- Existing Substation
- Built Up Areas
- Waterbody
- Biodiversity Study Area

Disturbance Impact
- Disturbance Area A (full
- Disturbance Area B (partial
- Disturbance Area B (partial

Proposal of Indicative Disturbance Area Including Construction and Operational Impacts

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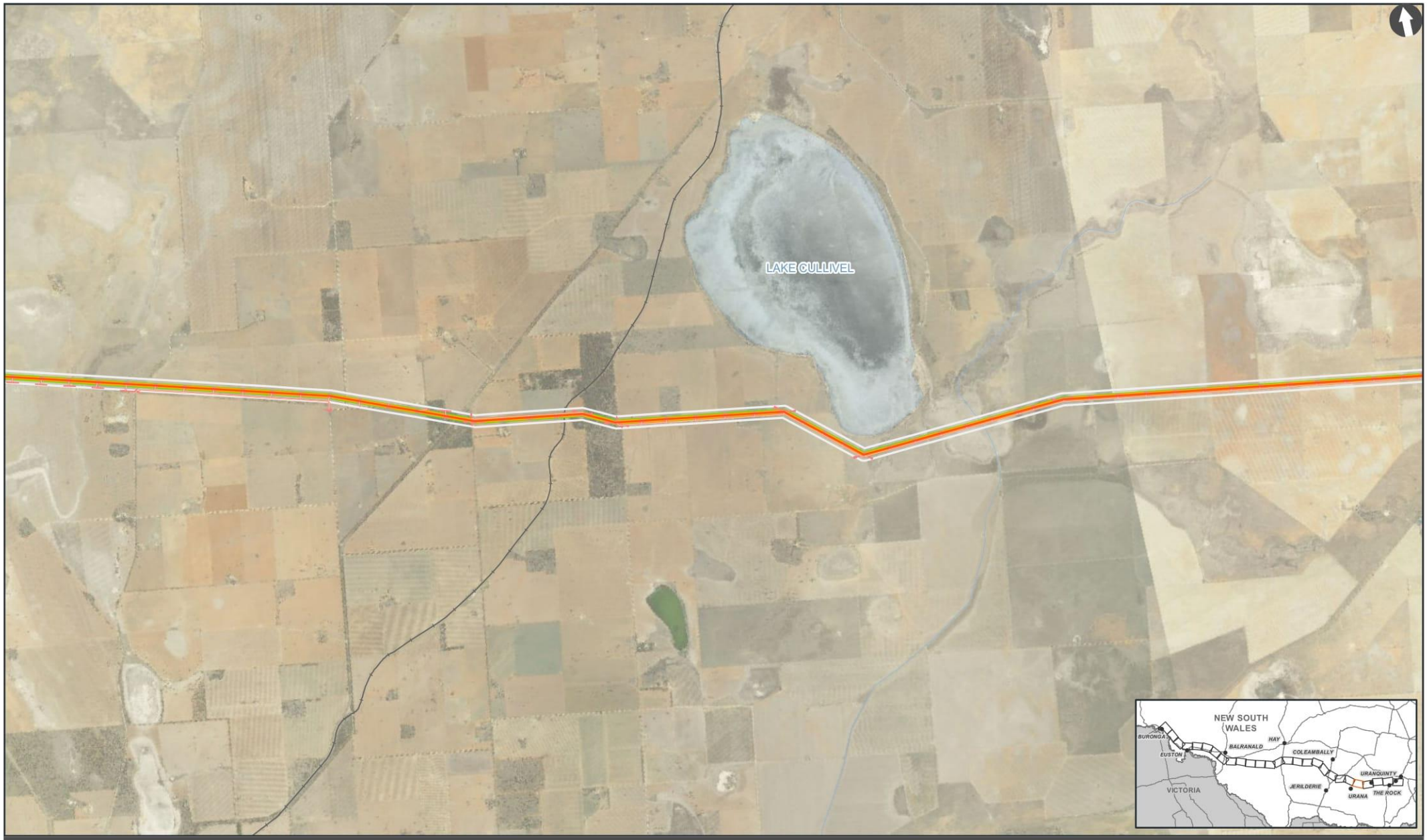
Source: NSWSS, ESRI, Transgrid, WSP



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BDAR - Figure 9-2w

Project Components
- Proposed
- Access Tracks
- Main Construction Compounds and Accomodation
- Water Supply Point

- Existing Substation
- Built Up Areas
- Waterbody
- Biodiversity Study Area

Disturbance Impact
- Disturbance Area A (full
- Disturbance Area B (partial
- Disturbance Area B (partial

Proposal of Indicative Disturbance Area Including Construction and Operational Impacts

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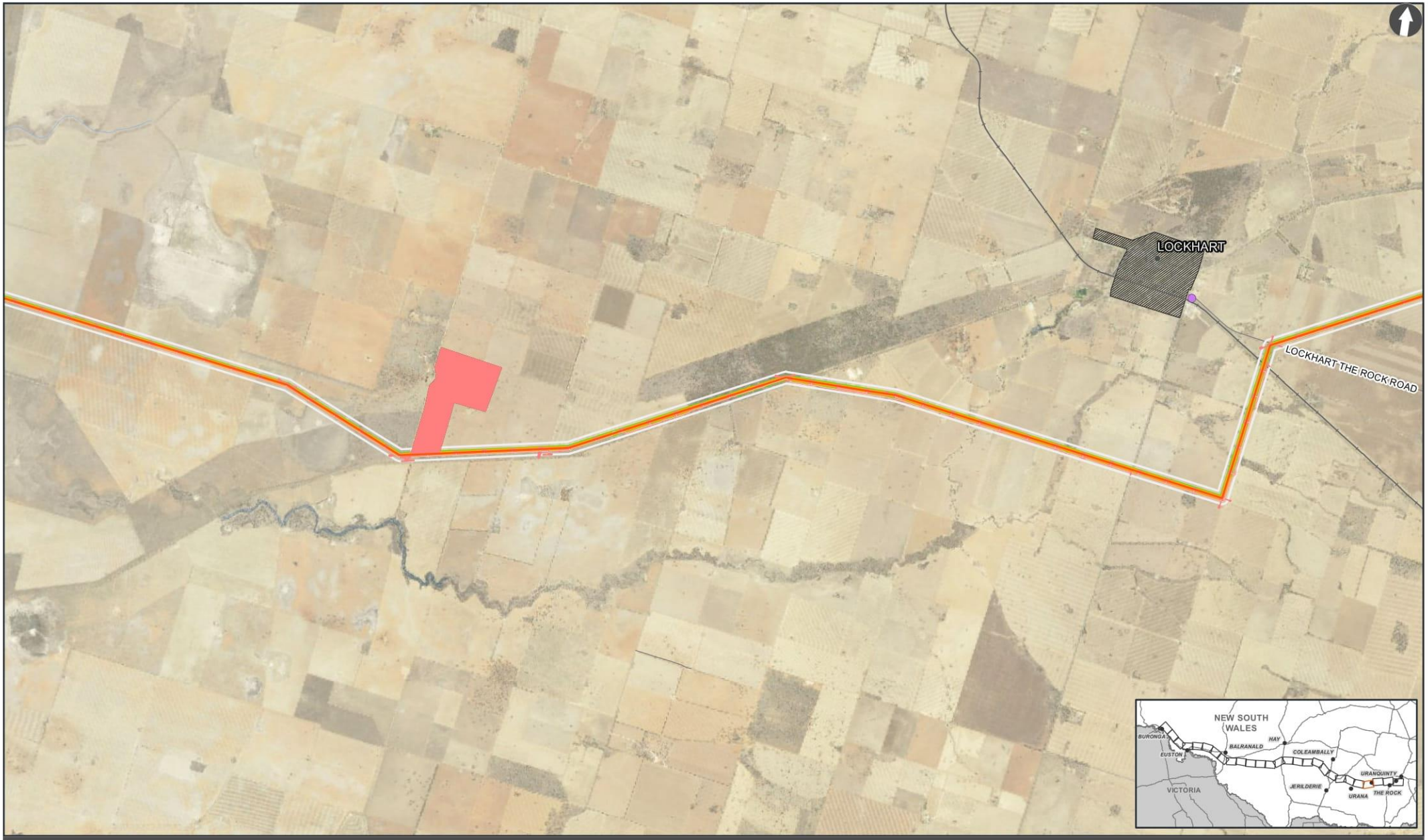
Source: NSWSS, ESRI, Transgrid, WSP



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BDAR - Figure 9-2x

Project Components
- Proposed
- Access Tracks
- Main Construction Compounds and Accomodation
- Water Supply Point

- Existing Substation
- Built Up Areas
- Waterbody
- Biodiversity Study Area

Disturbance Impact
- Disturbance Area A (full
- Disturbance Area B (partial
- Disturbance Area B (partial

Proposal of Indicative Disturbance Area Including Construction and Operational Impacts

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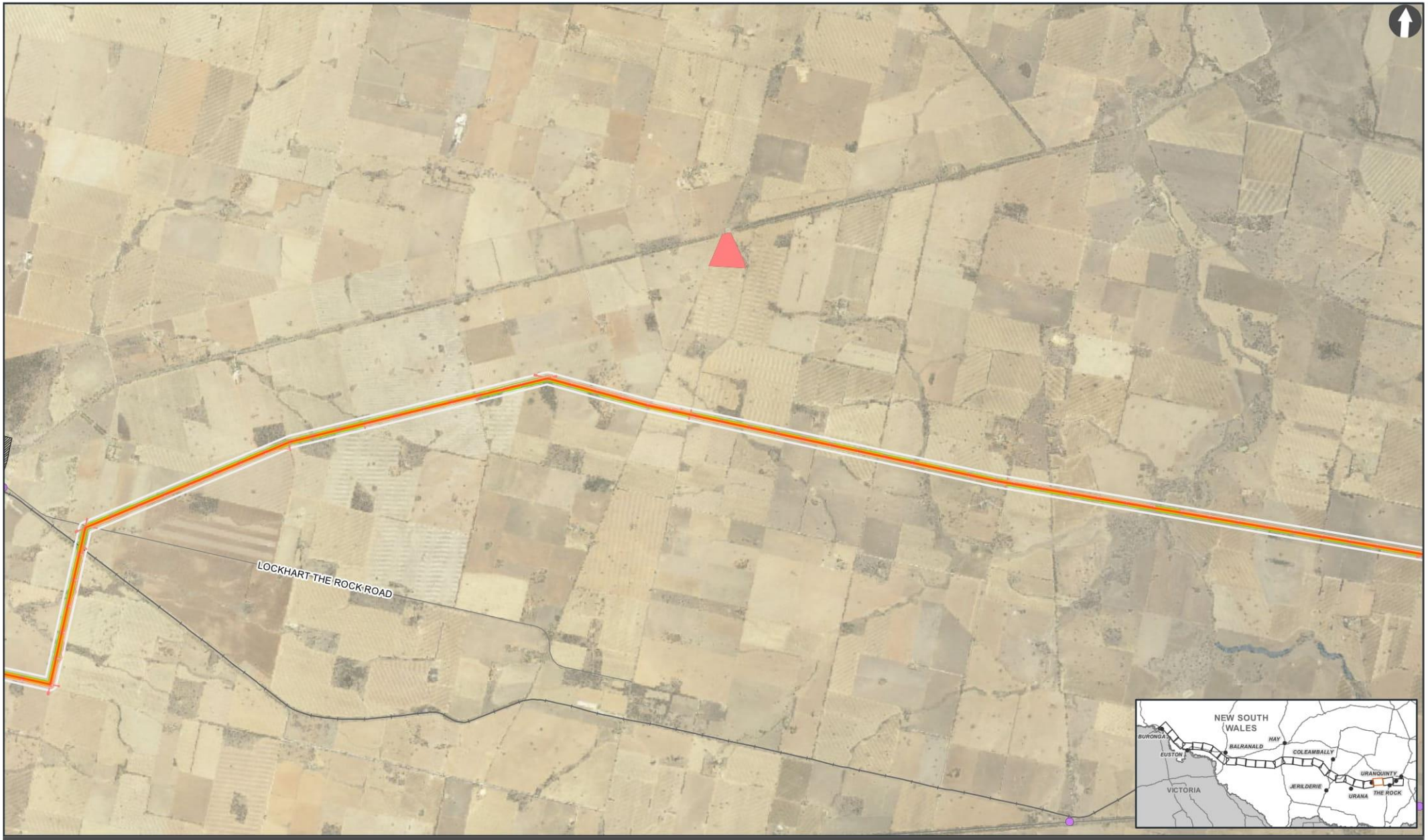
Source: NSWSS, ESRI, Transgrid, WSP



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BDAR - Figure 9-2y

Project Components
- Proposed
- Access Tracks
- Main Construction Compounds and Accomodation
- Water Supply Point
- Existing Substation
- Built Up Areas
- Waterbody
- Biodiversity Study Area

Disturbance Impact
- Disturbance Area A (full
- Disturbance Area B (partial
- Disturbance Area B (partial

Proposal of Indicative Disturbance Area Including Construction and Operational Impacts

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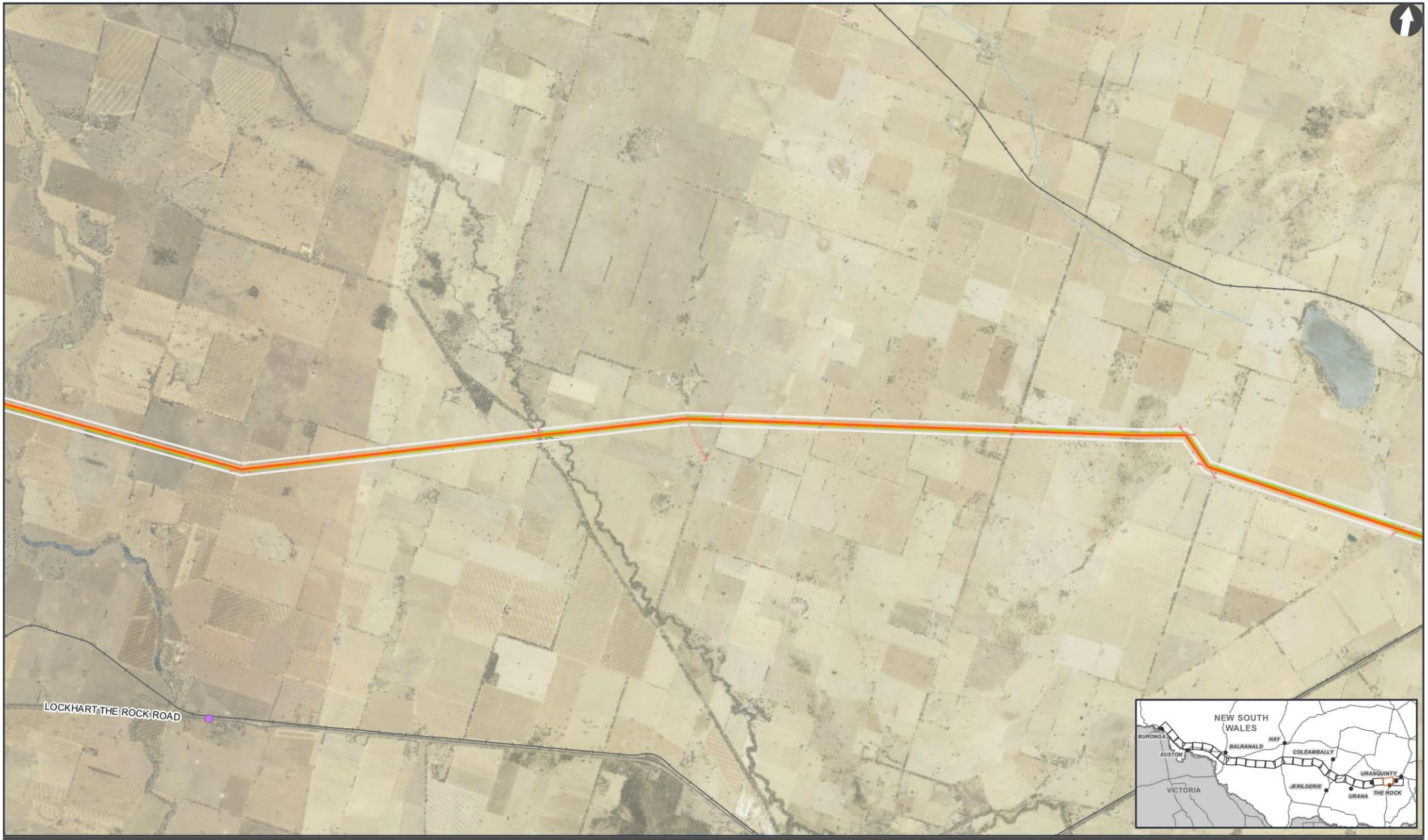
Source: NSWSS, ESRI, Transgrid, WSP



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BDAR - Figure 9-2z

Project Components
- Proposed
- Access Tracks
- Main Construction Compounds and Accomodation
- Water Supply Point

- Existing Substation
- Built Up Areas
- Waterbody
- Biodiversity Study Area

Disturbance Impact
- Disturbance Area A (full
- Disturbance Area B (partial
- Disturbance Area B (partial

Proposal of Indicative Disturbance Area Including Construction and Operational Impacts

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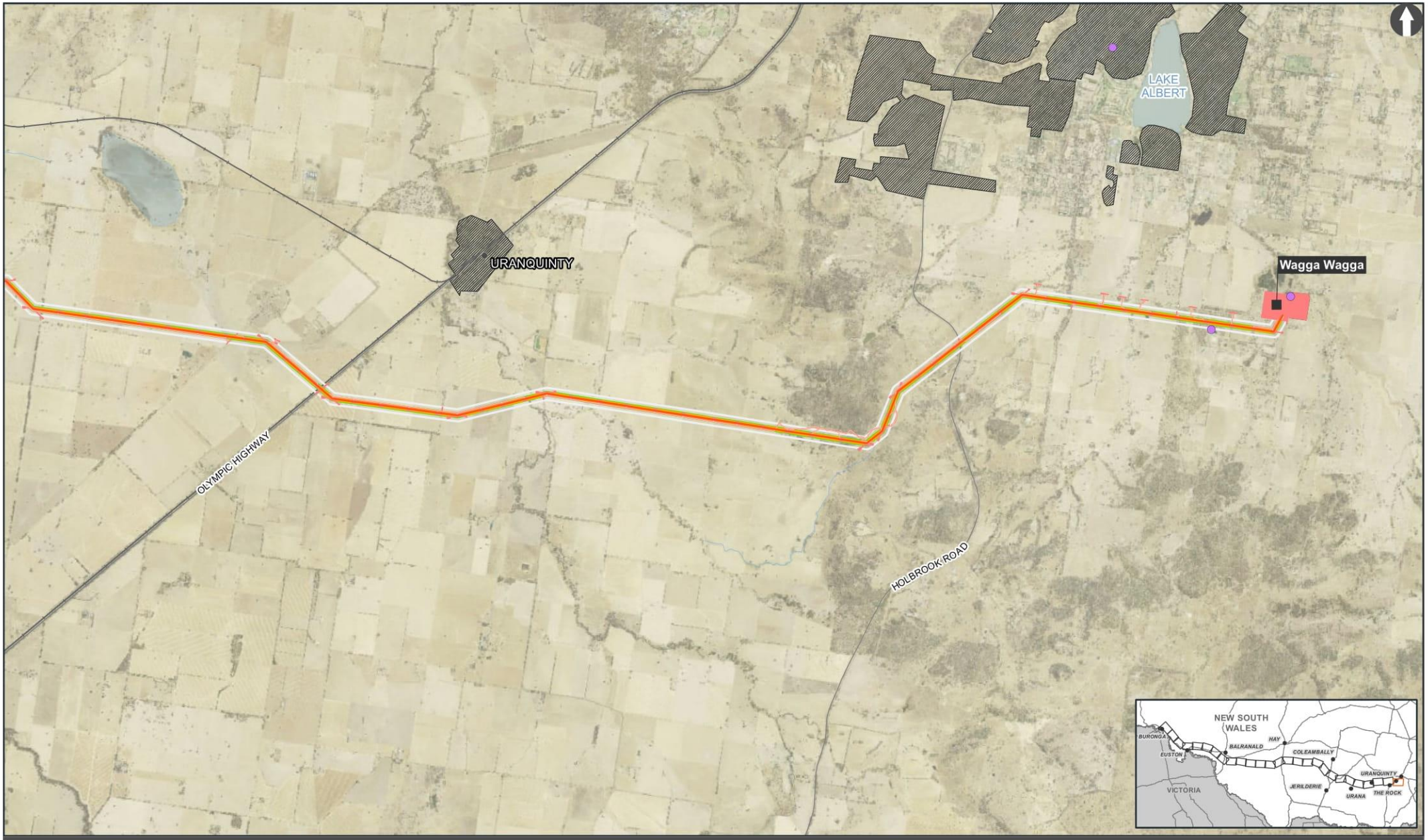
Source: NSWSS, ESRI, Transgrid, WSP



BDAR - Figure 9-2aa

Proposal of Indicative Disturbance Area Including Construction and Operational Impacts

Project Components
- Proposed
- Access Tracks
- Main Construction Compounds and Accomodation
- Water Supply Point

- Existing Substation
- Built Up Areas
- Waterbody
- Biodiversity Study Area

Disturbance Impact
- Disturbance Area A (full
- Disturbance Area B (partial
- Disturbance Area B (partial

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Source: NSWSS, ESRI, Transgrid, WSP

9.1.2 Impacts on native vegetation

The direct impacts on native vegetation due to the proposal for each IBRA subregion is summarised in Table 9-2. Details on direct impacts on native vegetation zones including the change in vegetation integrity and future vegetation integrity for each IBRA subregion is presented Table 9-3, Table 9-4, Table 9-5 and Table 9-6.

Table 9-2 Summary of total direct impact on native vegetation

NATIVE VEGETATION	SOP	LAC	MUR	LS	IS	DIRECT IMPACT (HA)
Total direct impact on native vegetation for each IBRA subregion	483.71	17.17	952.58	72.11	29.31	1,554.88
Total direct impact on native vegetation						**1,554.88**

Note: IBRA subregions

SOP – South Olary Plain

LAC – Lachlan

MUR – Murrumbidgee

LS – Lower Slopes

IS – Inland Slopes

9.1.2.1 Impacts on native vegetation in the South Olary Plain IBRA subregion

Direct impact to native vegetation within the South Olary Plain IBRA subregion will occur on the following PCTs:

- PCT 15 – Black Box open woodland wetland with chenopod understorey mainly on the outer floodplains in south-western NSW (mainly Riverina Bioregion and Murray Darling Depression Bioregion) – 5.75 hectares
- PCT 22 – Semi-arid shrubby Buloke – Slender Cypress Pine woodland, far south-western NSW
- PCT 23 – Yarran tall open shrubland of the sandplains and plains of the semi-arid (warm) and arid climate zones
- PCT 58 – Black Oak – Western Rosewood open woodland on deep sandy loams mainly in the Murray Darling Depression Bioregion
- PCT 143 – Narrow-leaved Hopbush – Scrub Turpentine – Senna shrubland on semi-arid and arid sandplains and dunes
- PCT 163 – Dillon Bush (Nitre Bush) shrubland of the semi-arid and arid zones
- PCT 170 – Chenopod sandplain mallee woodland/ shrubland of the arid and semi-arid (warm) zones
- PCT 171 – Spinifex linear dune mallee mainly of the Murray Darling Depression Bioregion
- PCT 172 – Deep sand mallee of irregular dunefields of the semi-arid (warm) zone
- PCT 199 – Hooked Needlewood – Needlewood – Mulga – Turpentine Bush open shrubland of the semi-arid and arid plains.

The direct impacts on native vegetation and change in vegetation integrity due to the proposal for South Olary Plain IBRA subregion is outlined in Table 9-3.

Table 9-3 Direct impacts on native vegetation and change in vegetation integrity within the South Olary Plain IBRA subregion due to the proposal

NATIVE VEGETATION TYPE (PCT)	VEG. ZONE # (BAM-C)	VEG. ZONE NAME (BAM-C)	MGT. ZONE NAME (BAM-C)	CURRENT VEGETATION INTEGRITY SCORE	CHANGE IN VEGETATION INTEGRITY SCORE	TOTAL VEGETATION INTEGRITY LOSS[1]	DIRECT IMPACT (HA)
Arid Shrublands (Acacia sub-formation)							
PCT 143	VZ #5	143_Mod-good	Area A	92.2	-92.2	-92.2	2.20
PCT 199	VZ #11	199_Mod-good	Area A	77.8	-77.8	-48.5	0.72
			Area B4	77.8	-12.8		0.59
Arid Shrublands (Chenopod sub-formation)							
PCT 163	VZ #6	163_Mod-good	Area A	68.2	-68.2	-68.2	8.18
Semi-arid Woodlands (Grassy sub-formation)							
PCT 15	VZ #1	15_Mod-good	Area A	56.1	-56.1	-36.2	2.01
			Area B4	56.1	-25.5		2.09
			Area B10	56.1	-25.5		1.65
Semi-arid Woodlands (Shrubby sub-formation)							
PCT 22	VZ #2	22_Mod-good	Area A	60.8	-60.8	-43.7	1.20
			Area B4	60.8	-31.9		1.04
			Area B10	60.8	-31.9		0.69
PCT 23	VZ #3	23_Mod-good	Area A	77.4	-77.4	-55.8	2.32
			Area B4	77.4	-37.3		2.73
PCT 58	VZ #4	58_Mod-good	Area A	95	-95	-61.4	20.68
			Area B4	95	-46.5		26.85
			Area B10	95	-46.5		19.79
	VZ #14	58_SVM_Bench	Area A	100	-100	-67.1	3.28
			Area B4	100	-44.9		2.73
			Area B10	100	-44.9		2.16
PCT 170	VZ #7	170_Mod-good_bull	Area A	75	-75	-52.1	24.87
			Area B4	75	-34.5		32.43
	VZ #8	170_Mod-good_whip	Area A	69.7	-69.7	-49.5	102.39
			Area B4	69.7	-32.2		119.32
	VZ #12	170_Derived	Area A	4.3	-4.3	-4.3	5.16
	VZ #15	170_SVM_Bench	Area A	100	-100	-77.6	4.31
			Area B4	100	-56.3		4.52

NATIVE VEGETATION TYPE (PCT)	VEG. ZONE # (BAM-C)	VEG. ZONE NAME (BAM-C)	MGT. ZONE NAME (BAM-C)	CURRENT VEGETATION INTEGRITY SCORE	CHANGE IN VEGETATION INTEGRITY SCORE	TOTAL VEGETATION INTEGRITY LOSS[1]	DIRECT IMPACT (HA)
PCT 171	VZ #9	171_Mod-good_whip	Area A	85.1	-85.1	-63.6	22.14
			Area B4	85.1	-41.8		21.70
	VZ #13	171_Derived	Area A	42.8	-42.8	-42.8	0.63
PCT 172	VZ #10	172_Mod-good_whip	Area A	71.4	-71.4	-53.8	20.88
			Area B4	71.4	-38.8		24.43
Total direct impacts on native vegetation within the South Olary Plain IBRA subregion							**483.71**

9.1.2.2 Impacts on native vegetation in the Lachlan IBRA subregion

Direct impact to native vegetation within the Lachlan IBRA subregion will occur on the following PCTs:

- PCT 15 – Black Box open woodland wetland with chenopod understorey mainly on the outer floodplains in south-western NSW (mainly Riverina Bioregion and Murray Darling Depression Bioregion)
- PCT 23 – Yarran tall open shrubland of the sandplains and plains of the semi-arid (warm) and arid climate zones
- PCT 24 – Canegrass swamp tall grassland wetland of drainage depressions, lakes and pans of the inland plains
- PCT 58 – Black Oak – Western Rosewood open woodland on deep sandy loams mainly in the Murray Darling Depression Bioregion
- PCT 163 – Dillon Bush (Nitre Bush) shrubland of the semi-arid and arid zones
- PCT 170 – Chenopod sandplain mallee woodland/ shrubland of the arid and semi-arid (warm) zones.

The direct impacts on native vegetation and change in vegetation integrity due to the proposal for Lachlan IBRA subregion is outlined in Table 9-4.

Table 9-4 Direct impacts on native vegetation and change in vegetation integrity within the Lachlan IBRA subregion due to the proposal

NATIVE VEGETATION ZONE (PCT)	VEG. ZONE # (BAM-C)	VEG. ZONE NAME (BAM-C)	MGT. ZONE NAME (BAM-C)	CURRENT VEGETATION INTEGRITY SCORE	CHANGE IN VEGETATION INTEGRITY SCORE	TOTAL VEGETATION INTEGRITY LOSS	DIRECT IMPACT (HA)
Arid Shrublands (Chenopod sub-formation)							
PCT 163	VZ #5	163_Mod-good	Area A	97.8	-97.8	-97.8	5.66
Freshwater Wetlands							
PCT 24	VZ #3	24_Mod-good	Area A	64.3	-64.3	-64.3	0.37
Semi-arid Woodlands (Grassy sub-formation)							
PCT 15	VZ #1	15_Mod-good	Area A	82.6	-82.6	-76.3	0.06
			Area B4	82.6	-38.5		0
			Area B10	82.6	-38.5		0.01
	VZ #7	15_Derived	Area A	3.9	-3.9	-3.9	0.91

NATIVE VEGETATION ZONE (PCT)	VEG. ZONE # (BAM-C)	VEG. ZONE NAME (BAM-C)	MGT. ZONE NAME (BAM-C)	CURRENT VEGETATION INTEGRITY SCORE	CHANGE IN VEGETATION INTEGRITY SCORE	TOTAL VEGETATION INTEGRITY LOSS	DIRECT IMPACT (HA)
Semi-arid Woodlands (Shrubby sub-formation)							
PCT 23	VZ #2	23_Mod-good	Area A	52.6	-52.6	-28.3	0.04
			Area B4	52.6	-16.2		0.07
PCT 58	VZ #4	58_Mod-good	Area A	46.4	-46.4	-29.5	1.11
			Area B4	46.4	-22.3		1.43
			Area B10	46.4	-22.3		1.15
PCT 170	VZ #6	170_Mod-good_bull	Area A	41.2	-41.2	-33.5	3.10
			Area B4	41.2	-26.1		3.26
Total direct impacts on native vegetation within the Lachlan IBRA subregion							**17.17**

9.1.2.3 Impacts on native vegetation in the Murrumbidgee IBRA subregion

Direct impact to native vegetation within the Murrumbidgee IBRA subregion will occur on the following PCTs:

- PCT 5 – River Red Gum herbaceous-grassy very tall open forest wetland on inner floodplains in the lower slopes sub-region of the NSW South Western Slopes Bioregion and the eastern Riverina Bioregion
- PCT 7 – River Red Gum – Warrego Grass – herbaceous riparian tall open forest wetland mainly in the Riverina Bioregion
- PCT 8 – River Red Gum – Warrego Grass – Couch Grass riparian tall woodland wetland of the semi-arid (warm) climate zone (Riverina Bioregion and Murray Darling Depression Bioregion)
- PCT 11 – River Red Gum – Lignum very tall open forest or woodland wetland on floodplains of semi-arid (warm) climate zone (mainly Riverina Bioregion and Murray Darling Depression Bioregion)
- PCT 13 – Black Box – Lignum woodland wetland of the inner floodplains in the semi-arid (warm) climate zone (mainly Riverina Bioregion and Murray Darling Depression Bioregion)
- PCT 15 – Black Box open woodland wetland with chenopod understorey mainly on the outer floodplains in south-western NSW (mainly Riverina Bioregion and Murray Darling Depression Bioregion)
- PCT 17 – Lignum shrubland wetland of the semi-arid (warm) plains (mainly Riverina Bioregion and Murray Darling Depression Bioregion)
- PCT 23 – Yarran tall open shrubland of the sandplains and plains of the semi-arid (warm) and arid climate zones
- PCT 24 – Canegrass swamp tall grassland wetland of drainage depressions, lakes and pans of the inland plains
- PCT 26 – Weeping Myall open woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion
- PCT 28 – White Cypress Pine open woodland of sand plains, prior streams and dunes mainly of the semi-arid (warm) climate zones
- PCT 44 – Forb-rich Speargrass – Windmill Grass – White Top grassland of the Riverina Bioregion
- PCT 45 – Plains Grass grassland on alluvial mainly clay soils in the Riverina Bioregion and NSW South Western Slopes Bioregion
- PCT 46 – Curly Windmill Grass – speargrass – wallaby grass grassland on alluvial clay and loam on the Hay plain, Riverina Bioregion
- PCT 47 – Swamp grassland wetland of the Riverine Plain
- PCT 53 – Shallow freshwater wetland sedgeland in depressions on floodplains on inland alluvial plains and floodplains

- PCT 58 – Black Oak – Western Rosewood open woodland on deep sandy loams mainly in the Murray Darling Depression Bioregion
- PCT 75 – Yellow Box – White Cypress Pine grassy woodland on deep sandy-loam alluvial soils of the eastern Riverina Bioregion and western NSW South Western Slopes Bioregion
- PCT 143 – Narrow-leaved Hopbush – Scrub Turpentine – Senna shrubland on semi-arid and arid sandplains and dunes
- PCT 157 – Bladder Saltbush shrubland on alluvial plains in the semi-arid (warm) zone including Riverina Bioregion
- PCT 160 – Nitre Goosefoot shrubland wetland on clays of the inland floodplains
- PCT 163 – Dillon Bush (Nitre Bush) shrubland of the semi-arid and arid zones
- PCT 164 – Cotton Bush open shrubland of the semi-arid (warm) zone
- PCT 166 – Disturbed annual saltbush forbland on clay plains and inundation zones mainly of south-western NSW
- PCT 170 – Chenopod sandplain mallee woodland/ shrubland of the arid and semi-arid (warm) zones
- PCT 182 – Cumbungi rushland wetland of shallow semi-permanent water bodies and inland watercourses
- PCT 216 – Black Roly Poly low open shrubland of the Riverina.

The direct impacts on native vegetation and change in vegetation integrity due to the proposal for Murrumbidgee IBRA subregion is outlined in Table 9-5.

Table 9-5 Direct impacts on native vegetation and change in vegetation integrity within the Murrumbidgee IBRA subregion due to the proposal

NATIVE VEGETATION ZONE (PCT)	VEG. ZONE # (BAM-C)	VEG. ZONE NAME (BAM-C)	MGT. ZONE NAME (BAM-C)	CURRENT VEGETATION INTEGRITY SCORE	CHANGE IN VEGETATION INTEGRITY SCORE	TOTAL VEGETATION INTEGRITY LOSS	DIRECT IMPACT (HA)
Arid Shrublands (Acacia sub-formation)							
PCT 143	VZ #28	143_Mod-good	Area A	52.9	-52.9	-52.9	0.05
Arid Shrublands (Chenopod sub-formation)							
PCT 157	VZ #23	157_Mod-good	Area A	81.9	-81.9	-81.9	35.80
	VZ #43	157_SVM_Bench	Area A	100	-100	-100	11.80
PCT 163	VZ #25	163_Mod-good	Area A	98.4	-98.4	-98.4	87.79
	VZ #48	163_SVM_Bench	Area A	100	-100	-100	7.73
PCT 164	VZ #26	164_Mod-good	Area A	98.2	-98.2	-98.2	89.23
	VZ #45	164_SVM_Bench	Area A	100	-100	-100	43.12
PCT 216	VZ #29	216_Mod-good	Area A	81.3	-81.3	-81.3	14.96
Freshwater Wetlands							
PCT 17	VZ #8	17_Mod-good	Area A	97.7	-97.7	-97.7	13.10
	VZ #35	17_SVM_Bench	Area A	100	-100	-100	4.10
PCT 24	VZ #11	24_Mod-good	Area A	88.9	-88.9	-88.9	11.85
	VZ #36	24_SVM_Bench	Area A	100	-100	-100	0.01
PCT 47	VZ #19	47_Mod-good	Area A	82.5	-82.5	-82.5	2.13
	VZ #43	47_SVM_Bench	Area A	100	-100	-100	0.88
PCT 53	VZ #20	53_Mod-good	Area A	100	-100	-100	1.73

NATIVE VEGETATION ZONE (PCT)	VEG. ZONE # (BAM-C)	VEG. ZONE NAME (BAM-C)	MGT. ZONE NAME (BAM-C)	CURRENT VEGETATION INTEGRITY SCORE	CHANGE IN VEGETATION INTEGRITY SCORE	TOTAL VEGETATION INTEGRITY LOSS	DIRECT IMPACT (HA)
PCT 160	VZ #24	160_Mod-good	Area A	97.7	-97.7	-97.7	27.24
	VZ #44	160_SVM_Bench	Area A	100	-100	-100	0.95
PCT 182	VZ #30	182_Mod-good	Area A	100	-100	-100	0.07
Forested Wetlands							
PCT 5	VZ #1	5_Mod-good	Area A	64	-64	-54.9	1.64
			Area B4	64	-50.3		1.95
			Area B10	64	-50.3		1.29
PCT 7	VZ #2	7_Mod-good	Area A	59.4	-59.4	-44.3	0.25
			Area B4	59.4	-37.1		0.36
			Area B10	59.4	-37.1		0.16
	VZ #33	7_SVM_Bench	Area A	100	-100	-100	0.01
PCT 8	VZ #3	8_Mod-good	Area A	61.8	-61.8	-53.2	1.70
			Area B4	61.8	-48.5		1.73
			Area B10	61.8	-48.5		1.34
PCT 11	VZ #4	11_Mod-good	Area A	82.2	-82.2	-58.5	5.00
			Area B4	82.2	-44.9		5.33
			Area B10	82.2	-44.9		3.53
Grasslands							
PCT 44	VZ #16	44_Mod-good	Area A	88.6	-88.6	-88.6	36.75
	VZ #39	44_SVM_Bench	Area A	100	-100	-100	8.40
PCT 45	VZ #17	45_Mod-good	Area A	88.1	-88.1	-88.1	27.25
	VZ #40	45_SVM_Bench	Area A	100	-100	-100	10.01
PCT 46	VZ #18	46_Mod-good	Area A	96.5	-96.5	-96.5	45.18
	AZ #41	46_SVM_Bench	Area A	100	-100	-100	23.08
Saline Wetlands							
PCT 166	VZ #46	166_SVM_Bench	Area A	100	-100	-100	0.95
Semi-arid Woodlands (Grassy sub-formation)							
PCT 13	VZ # 5	13_Mod-good	Area A	96.7	-96.7	-75.8	5.76
			Area B4	96.7	-45.7		2.33
			Area B10	96.7	-45.7		1.67
	VZ #47	13_SVM_Bench	Area A	100	-100	-100	0.20
			Area B4	100	-100		0.04

NATIVE VEGETATION ZONE (PCT)	VEG. ZONE # (BAM-C)	VEG. ZONE NAME (BAM-C)	MGT. ZONE NAME (BAM-C)	CURRENT VEGETATION INTEGRITY SCORE	CHANGE IN VEGETATION INTEGRITY SCORE	TOTAL VEGETATION INTEGRITY LOSS	DIRECT IMPACT (HA)
PCT 15	VZ #6	15_Mod-good	Area A	84	-84	-54.9	5.30
			Area B4	84	-38.1		5.31
			Area B10	84	-38.1		3.88
	VZ #7	15_Derived	Area A	38	-38	-38	1.89
	VZ #34	15_SVM_Bench	Area A	100	-100	-49.2	0.01
			Area B4	100	-45		0.04
			Area B10	100	-45		0.09
PCT 26	VZ #12	26_Mod-good	Area A	93.1	-93.1	-63.8	32.57
			Area B4	93.1	-32.9		30.85
	VZ #13	26_Moderate	Area A	64.5	-64.5	-50	19.69
			Area B4	64.5	-34.1		18.01
	VZ #14	26_Derived	Area A	40.2	-40.2	-40.2	212.33
	VZ #37	26_SVM_Bench	Area A	100	-100	-73.1	0.07
			Area B4	100	-37.3		0.02
Semi-arid Woodlands (Shrubby sub-formation)							
PCT 23	VZ #9	23_Mod-good	Area A	72.5	-72.5	-52.2	2.51
			Area B4	72.5	-36		3.11
	VZ #10	23_Derived	Area A	42.2	-42.2	-42.2	7.71
PCT 28	VZ # 15	28_Mod-good	Area A	57.2	-57.2	-36.2	6.99
			Area B4	57.2	-24.8		7.56
			Area B10	57.2	-24.8		5.21
	VZ #38	28_SVM_Bench	Area A	100	-100	-58.5	6.84
			Area B4	100	-37.4		1.49
			Area B10	100	-37.4		1.06
PCT 58	VZ #21	58_Mod-good	Area A	76.7	-76.7	-45.2	11.99
			Area B4	76.7	-29.6		13.92
			Area B10	76.7	-29.6		10.15
	VZ #27	58_Moderate	Area A	52.6	-52.6	-26.7	0.09
			Area B4	52.6	-15.6		0.14
			Area B10	52.6	-15.6		0.07
	VZ #22	58_Derived	Area A	14.4	-14.4	-14.4	4.81

NATIVE VEGETATION ZONE (PCT)	VEG. ZONE # (BAM-C)	VEG. ZONE NAME (BAM-C)	MGT. ZONE NAME (BAM-C)	CURRENT VEGETATION INTEGRITY SCORE	CHANGE IN VEGETATION INTEGRITY SCORE	TOTAL VEGETATION INTEGRITY LOSS	DIRECT IMPACT (HA)
PCT 75	VZ #32	75_Mod-good	Area A	80.7	-80.7	-53.6	0.06
			Area B4	80.7	-42.8		0.10
			Area B10	80.7	-42.8		0.05
PCT 170	VZ #32	170_Mod-good_whip	Area A	74	-74	-40.3	0.06
			Area B4	74	-26.9		0.15
Total direct impacts on native vegetation within the Murrumbidgee IBRA subregion							**952.58**

9.1.2.4 Impacts on native vegetation in the Lower Slopes IBRA subregion

Direct impact to native vegetation within the Lower Slopes IBRA subregion will occur on the following PCTs:

- PCT 5 – River Red Gum herbaceous-grassy very tall open forest wetland on inner floodplains in the lower slopes sub-region of the NSW South Western Slopes Bioregion and the eastern Riverina Bioregion
- PCT 28 – White Cypress Pine open woodland of sand plains, prior streams and dunes mainly of the semi-arid (warm) climate zone
- PCT 74 – Yellow Box grassy tall woodland on alluvium or parna loams and clays on flats in NSW South Western Slopes Bioregion
- PCT 75 – Yellow Box – White Cypress Pine grassy woodland on deep sandy-loam alluvial soils of the eastern Riverina Bioregion and western NSW South Western Slopes Bioregion
- PCT 76 – Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions
- PCT 80 – Western Grey Box – White Cypress Pine tall woodland on loam soil on alluvial plains of NSW South Western Slopes Bioregion and Riverina Bioregion
- PCT 249 – River Red Gum swampy woodland wetland on cowals (lakes) and associated flood channels in central NSW.

Table 9-6 Direct impacts on native vegetation and change in vegetation integrity within the Lower Slopes IBRA subregion due to the proposal

NATIVE VEGETATION ZONE (PCT)	VEG. ZONE # (BAM-C)	VEG. ZONE NAME (BAM-C)	MGT. ZONE MANE (BAM-C)	CURRENT VEGETATION INTEGRITY SCORE	CHANGE IN VEGETATION INTEGRITY SCORE	TOTAL VEGETATION INTEGRITY LOSS	DIRECT IMPACT (HA)
Forested Wetlands							
PCT 5	VZ #1	5_Mod-good	Area A	71.7	-71.7	-61.1	1.02
			Area B4	71.7	-54.6		1.01
			Area B10	71.7	-54.6		0.65
PCT 249	VZ #7	249_Moderate	Area A	51.9	-51.9	-41.9	1.56
			Area B4	51.9	-35.6		1.86
			Area B10	51.9	-35.6		0.61
	VZ #8	249_Derived	Area A	32.4	-32.4	-32.4	2.10

NATIVE VEGETATION ZONE (PCT)	VEG. ZONE # (BAM-C)	VEG. ZONE NAME (BAM-C)	MGT. ZONE MANE (BAM-C)	CURRENT VEGETATION INTEGRITY SCORE	CHANGE IN VEGETATION INTEGRITY SCORE	TOTAL VEGETATION INTEGRITY LOSS	DIRECT IMPACT (HA)
Grassy Woodlands							
PCT 74	VZ #14	74_Mod-good	Area A	71.6	-71.6	-51.2	0.30
			Area B4	71.6	-41.2		0.40
			Area B10	71.6	-41.2		0.21
PCT 76	VZ #3	76_Mod-good	Area A	69.7	-69.7	-53.6	0.54
			Area B4	69.7	-42.4		0.53
			Area B10	69.7	-42.4		0.24
	VZ #15	76_SVM_Bench	Area A	100	-100	-100	0.03
PCT 80	VZ #5	80_Mod-good	Area A	87.9	-87.9	-69.3	4.76
			Area B4	87.9	-56.9		4.36
			Area B10	87.9	-56.9		2.74
	VZ #4	80_Moderate	Area A	56	-56	-44.3	3.51
			Area B4	56	-36.7		3.52
			Area B10	56	-36.7		1.90
	VZ #6	80_Derived	Area A	28.5	-28.5	-28.5	1.51
	VZ #12	80_SVM_Bench	Area A	100	-100	-80.9	0.32
			Area B4	100	-46.8		0.07
			Area B10	100	-46.8		0.11
Semi-arid Woodlands (Shrubby sub-formation)							
PCT 28	VZ #11	28_SVM_Bench	Area A	100	-100	-62.1	1.15
			Area B4	100	-36.3		1.04
			Area B10	100	-36.3		0.65
PCT 75	VZ #2	75_Mod-good	Area A	89.4	-89.4	-57.9	12.01
			Area B4	89.4	-35.3		10.97
			Area B10	89.4	-35.3		5.82
	VZ #9	75_Poor	Area A	44.8	-44.8	-38.5	1.09
			Area B4	44.8	-21.9		0.12
			Area B10	44.8	-21.9		0.29
	VZ #10	75_Derived	Area A	10.2	-10.2	-10.2	4.69
	VZ #13	75_SVM_Bench	Area A	100	-100	-85	0.32
			Area B4	100	-36.9		0.02
			Area B10	100	-36.9		0.08
Total direct impacts on native vegetation within the Lower Slopes IBRA subregion							**72.11**

9.1.2.5 Impacts on native vegetation in the Inland Slopes IBRA subregion

Direct impact to native vegetation within the Inland Slopes IBRA subregion will occur on the following PCTs:

- PCT 5 – River Red Gum herbaceous-grassy very tall open forest wetland on inner floodplains in the lower slopes sub-region of the NSW South Western Slopes Bioregion and the eastern Riverina Bioregion
- PCT 74 – Yellow Box – River Red Gum tall grassy riverine woodland of NSW South Western Slopes Bioregion and Riverina Bioregion
- PCT 80 – Western Grey Box – White Cypress Pine tall woodland on loam soil on alluvial plains of NSW South Western Slopes Bioregion and Riverina Bioregion
- PCT 110 – Western Grey Box – Cypress Pine shrubby woodland on stony footslopes in the NSW South Western Slopes Bioregion and Riverina Bioregion
- PCT 267 – White Box – White Cypress Pine – Western Grey Box shrub/grass/forb woodland in the NSW South Western Slopes Bioregion
- PCT 277 – Blakely's Red Gum – Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion
- PCT 319 – Tumbledown Red Gum – White Cypress Pine hill woodland in the southern part of the NSW South Western Slopes Bioregion.

Table 9-7 Direct impacts on native vegetation and change in vegetation integrity within the Inland Slopes IBRA subregion due to the proposal

NATIVE VEGETATION ZONE (PCT)	VEG. ZONE # (BAM-C)	VEG. ZONE NAME (BAM-C)	MGT. ZONE MANE (BAM-C)	CURRENT VEGETATION INTEGRITY SCORE	CHANGE IN VEGETATION INTEGRITY SCORE	TOTAL VEGETATION INTEGRITY LOSS	DIRECT IMPACT (HA)
Dry Sclerophyll Forests (Shrubby sub-formation)							
PCT 110	VZ #3	110_Mod-good	Area A	64.9	-64.9	-41.4	0.70
			Area B4	64.9	-33.1		1.27
			Area B10	64.9	-33.1		0.70
Forested Wetlands							
PCT 5	VZ #9	5_Poor	Area A	26.7	-26.7	-26.4	0.29
			Area B4	26.7	-26.3		0.44
			Area B10	26.7	-26.3		0.15
Grassy Woodlands							
PCT 74	VZ #1	74_Mod-good	Area A	73.1	-73.1	-56.6	0.53
			Area B4	73.1	-42.7		0.37
			Area B10	73.1	-42.7		0.26
PCT 80	VZ #2	80_Moderate	Area A	25.9	-25.9	-25.9	0.80
			Area B4	25.9	-25.8		0.70
			Area B10	25.9	-25.8		0.14
PCT 267	VZ #6	267_Mod-good	Area A	63.2	-63.2	-51	0.09
			Area B4	63.2	-44.5		0.13
			Area B10	63.2	-44.5		0.04

NATIVE VEGETATION ZONE (PCT)	VEG. ZONE # (BAM-C)	VEG. ZONE NAME (BAM-C)	MGT. ZONE MANE (BAM-C)	CURRENT VEGETATION INTEGRITY SCORE	CHANGE IN VEGETATION INTEGRITY SCORE	TOTAL VEGETATION INTEGRITY LOSS	DIRECT IMPACT (HA)
PCT 277	VZ #4	277_Mod-good	Area A	79.8	-79.8	-65.4	1.41
			Area B4	79.8	-51.9		1.04
			Area B10	79.8	-51.9		0.47
	VZ #7	277_Derived	Area A	11	-11	-11	0.57
Semi-arid Woodlands (Grassy sub-formation)							
PCT 319	VZ #5	319_Mod-good	Area A	70.6	-70.6	-48.4	5.18
			Area B4	70.6	-32.7		5.05
			Area B10	70.6	-32.7		2.29
	VZ #10	319_Poor	Area A	27.4	-27.4	25.1	0.18
			Area B4	27.4	-23.3		0.15
			Area B10	27.4	-23.3		0.09
	VZ #8	319_Derived	Area A	39.3	-39.3	-39.3	6.03
Total direct impacts on native vegetation within the Lower Slopes IBRA subregion							**29.31**

9.1.3 Impacts on threatened ecological communities

Direct impacts of the proposal on threatened ecological communities listed under the BC Act are presented in Table 9-8.

Table 9-8 Direct impacts on threatened ecological communities

THREATENED ECOLOGICAL COMMUNITY	BC ACT	SAII	SOP	LAC	MUR	LS	IS	DIRECT IMPACT (HA)
Acacia melvillei shrubland in the Riverina and Murray Darling Depression bioregions	E	No	5.07	0.11	0	0	0	5.18
Allocasuarina luehmanii woodland in the Riverina and Murray-Darling Depression bioregions	E	Yes	2.93	0	0	0	0	2.93
Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions	E	No	0	0	0	22.63	4.31	26.94
Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray – Darling Depression, Riverina and NSW South Western Slopes bioregions	E	No	0	0	101.2	0	0	101.20
Sandhill Pine Woodland in the Riverina, Murray-Darling Depression and NSW South Western Slopes bioregions	E	No	0	0	23.63	2.79	0	26.42
White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland	CE	Yes	0	0	0.21	36.32	4.91	41.44
Total direct impact on threatened ecological communities								**204.11**

Note: IBRA subregions
SOP – South Olary Plain
LAC – Lachlan
MUR – Murrumbidgee
LS – Lower Slopes
IS – Inland Slopes

9.1.4 Impacts on threatened species and/or their habitat

9.1.4.1 Direct impacts on predicted ecosystem credit species

Direct impacts on predicted ecosystem credit species habitat due to the proposal for each IBRA subregion is outlined in Table 9-9.

Table 9-9 Direct impacts on predicted ecosystem credit species habitat due to the proposal for each IBRA subregion

SCIENTIFIC NAME	COMMON NAME	BC ACT[1]	ASSOCIATED NATIVE VEGETATION (BY PCT) AND HABITAT CONSTRAINTS	IBRA SUBREGIONS[2]				
				SOP	LAC	MUR	LS	IS
Reptiles								
Aprasia inaurita	Mallee Worm-lizard	E	PCT's 170, 171, 172	✓	–	–	–	–
Ctenotus brooksi	Wedgesnout Ctenotus	V	PCT's 143, 171, 172, 199	✓	–	–	–	–
Cyclodomorphus melanops elongatus	Mallee Slender Blue-tongue Lizard	V	PCT's 171, 172	✓	–	–	–	–
Delma australis	Marble-faced Delma	E	PCT's 170, 171, 172	✓	–	–	–	–
Echiopsis curta	Bardick	E	PCT's 171, 172	✓	–	–	–	–
Pseudonaja modesta	Ringed Brown Snake	E	PCT's 58, 143, 170, 171, 172, 199	✓	–	–	–	–
Ramphotyphlops endoterus	Interior Blind Snake	E	PCT's 143, 163, 199	✓	–	–	–	–
Strophurus elderi	Jewelled Gecko	V	PCT's 170, 171, 172	✓	–	–	–	–
Tiliqua occipitalis	Western Blue-tongued Lizard	V	PCT's 170, 171, 172	✓	✓	✓	–	–
Birds								
Anseranas semipalmata	Magpie Goose	V	PCT's 15, 24, 45, 47, 53, 160, 163, 182, 249	–	✓	✓	✓	–
Anthochaera phrygia	Regent Honeyeater	CE	PCT's 5, 7, 74, 75,267, 277, 319 Riparian and Box woodlands	–	–	✓	✓	✓
Artamus cyanopterus	Dusky Woodswallow	V	PCT's 5, 7, 8, 11, 13, 15, 17, 22, 23, 24, 26, 28, 44, 45, 47, 53, 58, 74, 75, 76, 80, 110, 143, 157, 160, 163, 164, 166, 170, 171, 172, 182, 199, 216, 249, 267, 277, 319	✓	✓	✓	✓	✓
Botaurus poiciloptilus	Australasian Bittern	E	PCT's 8, 11, 13, 17, 24, 53, 160, 182, 249	–	✓	✓	✓	–
Calidris ferruginea	Curlew Sandpiper	E	PCT's 24, 47, 53 Wetlands, lake edges	–	✓	✓	–	–
Callocephalon fimbriatum	Gang-Gang Cockatoo	V	PCT's 5, 74, 75, 267, 277 Grassy woodland	–	–	–	✓	✓
Calyptorhynchus lathami	Glossy Black-Cockatoo	V	PCT's 74, 75, 76, 80, 110 Grassy woodland	–	–	–	✓	✓
Certhionyx variegatus	Pied Honeyeater	V	PCT's 8, 11, 13, 15, 22, 23, 24, 26, 28, 58, 80, 143, 163, 170, 171, 172, 199, 249	✓	✓	✓	✓	✓

SCIENTIFIC NAME	COMMON NAME	BC ACT[1]	ASSOCIATED NATIVE VEGETATION (BY PCT) AND HABITAT CONSTRAINTS	IBRA SUBREGIONS[2]				
				SOP	LAC	MUR	LS	IS
Cinclosoma castanotum	Chestnut Quail-thrush	V	PCT's 170, 171, 172	✓	✓	–	–	–
Circus assimilis	Spotted Harrier	V	PCT's 5, 7, 8, 11, 13, 15, 17, 22, 23, 24, 26, 28, 44, 45, 46, 47, 53, 58, 74,75, 143, 157, 163, 164, 166, 170, 171, 172, 182, 199, 216, 249, 277	✓	✓	✓	✓	✓
Climacteris picumnus victoriae	Brown Treecreeper (eastern subspecies)	V	PCT's 74, 76, 249, 267, 277	–	–	–	✓	✓
Chthonicola sagittata	Speckled Warbler	V	PCT's 74, 75, 76, 80, 110, 249, 267, 277, 319	–	–	✓	✓	✓
Daphoenositta chrysoptera	Varied Sittella	V	PCT's 5, 7, 8, 11, 13, 15, 22, 23, 26, 28, 58, 74, 75, 76, 80, 110, 170, 171, 172, 249, 267, 277, 319	✓	✓	✓	✓	✓
Drymodes brunneopygia	Southern Scrub-robin	V	PCT's 171	✓	–	–	–	–
Epthianura albifrons	White-fronted Chat	V	PCT's 17, 24, 44, 45, 46, 47, 53, 157, 160, 163, 164, 166, 182, 216	✓	✓	✓	–	–
Falco hypoleucos	Grey Falcon	E	PCT's 8, 11, 13, 15, 17, 22, 23, 24, 26, 28, 44, 45, 46, 47, 53, 58, 76, 80, 143, 157, 160, 163, 164, 166, 170, 171, 172, 182, 199, 216, 249	✓	✓	✓	✓	–
Falco subniger	Black Falcon	V	PCT's 5, 7, 8, 11, 13, 15, 17, 23, 24, 26, 28, 44, 45, 46, 47, 53, 58, 74, 75, 76, 80, 110, 143, 157, 160, 163, 164, 166, 170, 171, 182, 199, 216, 267, 277	✓	✓	✓	✓	✓
Glossopsitta porphyrocephala	Purple-crowned Lorikeet	V	PCT's 5, 74, 170, 171, 172, 249	✓	–	–	✓	✓
Glossopsitta pusilla	Little Lorikeet	V	PCT's 5, 74, 75, 267, 277, 319	–	–	–	✓	✓
Grantiella picta	Painted Honeyeater	V	PCT's 5, 7, 8, 11, 13, 15, 23, 26, 28, 58, 74, 75, 76, 80, 110, 143, 249, 267, 277, 319	✓	✓	✓	✓	✓
Grus rubicunda	Brolga	V	PCT's 7, 8, 11, 13, 15, 24, 26, 45, 47, 53, 160, 163, 166, 182, 249	✓	✓	✓	✓	–
Haliaeetus leucogaster	White-bellied Sea-Eagle	V	PCT's 5, 7, 8, 11, 13, 15, 17, 23, 24, 26, 28, 44, 45, 46, 47, 53, 58, 74, 75, 76, 80, 110, 143, 157, 160, 163, 164, 166, 170, 171, 182, 216, 249, 267, 277, 319 Riparian forest – inland lakes and rivers	✓	✓	✓	✓	✓

SCIENTIFIC NAME	COMMON NAME	BC ACT[1]	ASSOCIATED NATIVE VEGETATION (BY PCT) AND HABITAT CONSTRAINTS	IBRA SUBREGIONS[2]				
				SOP	LAC	MUR	LS	IS
Hamirostra melanosternon	Black-breasted Buzzard	V	PCT's 15, 23, 24, 28, 58, 143, 163, 170, 171, 172, 199 Semi-arid zone – open country	✓	✓	–	–	–
Hieraaetus morphnoides	Little Eagle	V	PCT's 5, 7, 8, 11, 13, 15, 17, 22, 23 24, 26, 28, 44, 45, 46, 47, 53, 58, 74, 75, 76, 80, 110,143, 157, 160, 163, 164, 166, 170, 171, 172, 182,199,216, 249, 267, 277, 319 Woodlands with associated grassland	✓	✓	✓	✓	✓
Hirundapus caudacutus	White-throated Needletail	-	PCTs 5, 7, 8, 11, 13, 15, 17, 24, 26, 44, 45, 46, 47, 53, 74, 76, 80, 110, 157, 160, 182, 216, 249, 277, 319	✓	✓	✓	✓	✓
Hylacola cautus	Shy Heathwren	V	PCT's 170, 171, 172	✓	–	–	–	–
Lathamus discolor	Swift Parrot	E	PCT's 5, 7, 8, 11, 74, 75, 76 80, 110, 249, 267, 277 Winter foraging resources – Riparian and lake-side habitats	–	–	✓	✓	✓
Leipoa ocellata	Malleefowl	E	PCT's 110, 170, 171, 172	✓	✓	–	–	✓
Lichenostomus cratitius	Purple-gaped Honeyeater	V	PCT's 170, 171, 172	✓	–	–	–	–
Limosa limosa	Black-tailed Godwit	V	PCT's 53, 166	–	-	✓	–	–
Lophochroa leadbeateri	Major Mitchell's Cockatoo	V	PCT's 7, 8, 11, 13, 15, 22, 23, 26, 28, 58, 74, 76, 80, 110, 143, 163, 166, 170, 171, 172,199, 249, Callitris and Mallee – arid riverine	✓	✓	✓	✓	✓
Lophoictinia isura	Square-tailed Kite	V	PCT's 5, 7, 8, 11, 13, 15, 22, 23, 26, 28, 45, 58, 74, 76, 110, 249, 267, 277 Woodlands – Mallee, floodplain and riverine	✓	✓	✓	✓	✓
Melanodryas cucullata	Hooded Robin (south-eastern form)	V	PCT's 5, 7, 8, 11, 13, 15, 22, 23, 26, 28, 58, 74, 75, 76, 80, 110, 143, 170, 171, 172, 199, 249, 267, 277, 319	✓	✓	✓	✓	✓
Melithreptus gularis	Black-chinned Honeyeater (eastern subspecies)	V	PCT's 5, 7, 8, 11, 74, 80, 110, 249, 267, 277, 319	–	–	✓	✓	✓
Neophema pulchella	Turquoise Parrot	V	PCT's 5, 74, 75, 76, 80, 110, 249, 267, 277, 319	–	–	✓	✓	✓
Neophema splendida	Scarlet-chested Parrot	V	PCT's 170, 171, 172	✓	–	–	–	–

SCIENTIFIC NAME	COMMON NAME	BC ACT[1]	ASSOCIATED NATIVE VEGETATION (BY PCT) AND HABITAT CONSTRAINTS	IBRA SUBREGIONS[2]				
				SOP	LAC	MUR	LS	IS
Ninox connivens	Barking Owl	V	PCT's 5, 7, 8, 11, 13, 15, 24, 26, 53, 74, 75, 76, 80, 110, 267, 277, 249, 319 Not mallee – woodlands and riparian	✓	✓	✓	✓	✓
Pachycephala inornata	Gilberts Whistler	V	PCT's 5, 11, 13, 17, 22, 28, 58, 80, 110, 170, 171, 172, 267	✓	✓	✓	✓	✓
Petroica boodang	Scarlet Robin	V	PCT's 5, 7, 11, 23, 26, 74, 75, 76, 80, 110, 249, 267, 277, 319	–	–	✓	✓	✓
Petroica phoenicea	Flame Robin	V	PCT's 5, 7, 74, 76, 80, 110, 249, 277	–	–	✓	✓	✓
Polytelis anthopeplus monarchoides	Regent Parrot (eastern subspecies)	E	PCT's 8, 11, 13, 15, 22, 58, 170, 171 Mallee, floodplain and riparian	✓	✓	✓	–	–
Polytelis swainsonii	Superb Parrot	V	PCT's 5, 7, 11, 13, 23, 26, 28, 45, 46, 74, 75, 76, 80, 110, 249, 267, 277	–	✓	✓	✓	✓
Pomatostomus temporalis	Grey-crowned Babbler (eastern subspecies)	V	PCT's 13, 15, 22, 23, 26, 28, 58, 74, 75, 76, 80, 110, 143, 249, 267, 277, 319	✓	✓	✓	✓	✓
Pyrrholaemus brunneus	Redthroat	V	PCT's 17, 24, 163	✓	✓	✓	–	–
Rostratula australis	Australian Painted Snipe	E	PCT's 5, 7, 8, 11, 13, 17, 24, 47, 53, 160, 182, 249	–	✓	✓	✓	–
Stagonopleura guttata	Diamond Firetail	V	PCT's 5, 7, 8, 11, 13, 22, 23, 26, 28, 44, 45, 46, 58, 74, 75, 76, 80, 110, 170, 249, 267, 277, 319	✓	✓	✓	✓	✓
Stictonetta naevosa	Freckled Duck	V	PCT's 5, 7, 8, 11, 13, 17, 24, 53, 160, 182, 249	–	✓	✓	✓	–
Tyto Novaehollandiae	Masked Owl	V	PCT's 7, 11, 13, 24, 26, 53, 74, 76, 80, 110, 249, 267, 277 Open forest and woodlands	–	–	✓	✓	✓
Mammals								
Antechinomys laniger	Kultarr	E	PCT's 23, 58, 143, 163, 170, 171, 199	✓	–	–	–	–
Cercartetus concinnus	Western Pygmy Possum	E	PCT's 58, 170, 171, 172	✓	–	–	–	–
Chalinolobus picatus	Little Pied Bat	V	PCT's 5, 7, 8, 11, 13, 15, 17, 22, 23, 24,26, 28,53, 58,76, 110, 143, 157, 160 163, 164, 166, 170, 171, 172, 182, 199, 216, 267, 249	✓	✓	✓	✓	–
Dasyurus maculatus	Spotted-tailed Quoll	V	PCT's 5, 110, 249, 267, 277	–	–	–	✓	✓

SCIENTIFIC NAME	COMMON NAME	BC ACT[1]	ASSOCIATED NATIVE VEGETATION (BY PCT) AND HABITAT CONSTRAINTS	IBRA SUBREGIONS[2]				
				SOP	LAC	MUR	LS	IS
Falsistrellus tasmaniensis	Eastern False Pipistrelle	V	PCT's 277	–	–	–	–	✓
Miniopterus orianae oceanensis	Large Bent-winged Bat	V	PCT's 277	–	–	–	–	✓
Ningaui yvonneae	Southern Ningaui	V	PCT's 170, 171, 172 Mallee spinifex	✓	–	–	–	–
Nyctophilus corbeni	Corben's Long-eared Bat	V	PCT's 22, 23, 28, 58, 75, 80, 110, 170, 171, 172, 199, 249, 267 Forests and woodlands	✓	✓	–	✓	✓
Phascolarctos cinereus	Koala	V	PCT's 5, 7, 8, 11, 13, 15, 74, 75, 76, 80, 110, 249, 267, 277 Forests and woodlands	–	–	✓	✓	✓
Pteropus poliocephalus	Grey-headed Flying-fox	V	PCT's 5, 76, 267 Forests and woodlands	–	–	–	✓	✓
Pseudomys bolami	Bolam's Mouse	E	PCT 22, 58, 170, 171, 172 Inland shrubby woodlands and spinifex mallee	✓	–	–	–	–
Pseudomys hermannsburgensis	Sandy Inland Mouse	V	PCT's 23, 58, 143, 171, 199 Inland woodlands and shrublands	✓	–	–	–	–
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	V	PCT's 5, 7, 8, 11, 13, 15, 17, 23, 24, 26, 28, 45, 53, 58, 74, 75, 76, 80, 110, 143, 160, 170, 182, 249, 267, 277 Inland habitats, from open spaces to forests	✓	✓	✓	✓	✓
Sminthopsis macroura	Stripe-faced Dunnart	V	PCT's 58, 143, 163, 171, 172, 199, 249	✓	–	–	✓	–
Vespadelus baverstocki	Inland Forest Bat	V	PCT's 13, 15, 22, 28, 58, 143, 170, 171, 172 Inland woodlands and mallee	✓	–	✓	–	–

(1) Threat status under the BC Act: V = vulnerable, E = endangered, CE = critically endangered

(2) IBRA subregions:

SOP – South Olary Plain
LAC – Lachlan
MUR – Murrumbidgee
LS – Lower Slopes
IS – Inland Slopes

9.1.4.2 Direct impact on threatened species credit species

A total of nine threatened flora and six threatened fauna species listed under the BC Act are considered affected by the proposal. The direct impacts on threatened species credit species due to the proposal is summarised in Table 9-10. Details on direct impacts on native vegetation zones including the change in vegetation integrity and future vegetation integrity for each IBRA subregion is presented Table 9-11, Table 9-12, Table 9-13, Table 9-14 and Table 9-15.

Table 9-10 Summary of direct impacts on threatened species credit species

SPECIES NAME	COMMON NAME	BC ACT[1]	SAII	DIRECT IMPACT
Threatened flora species				
Brachyscome papillosa	Mossgiel Daisy	V	No	71.17 ha
Cullen parvum	Small Scurf-pea	E	No	50.31 ha
Lepidium monoplocoides	Winged Peppercress	E	No	7.00 ha
Leptorhynchos orientalis	Lanky Buttons	E	No	15.32 ha
Maireana cheelii	Chariot Wheels	V	No	109.68 ha
Pilularia novae-hollandiae	Austral Pillwort	E	Yes	8.62 ha
Pimelea serpyllifolia subsp. *serpyllifolia*	Thyme Rice-Flower	E	Yes	1.70 ha
Swainsona murrayana	Slender Darling Pea	V	No	232.35 ha
Swainsona sericea	Silky Swainson-pea	V	No	109.17 ha
Threatened fauna species				
Lophochroa leadbeateri	Major Mitchell's Cockatoo	V	No	32.36 ha
Myotis macropus	Southern Myotis	V	No	4.77 ha
Pedionomus torquatus	Plains Wanderer	E	Yes	0.41 ha
Petaurus norfolcensis	Squirrel Glider	V	No	52.70 ha
Polytelis anthopeplus monarchoides	Regent Parrot (eastern subspecies)	E	No	32.36 ha
Polytelis swainsonii	Superb Parrot	V	No	36.57 ha

(1) Threat status under the BC Act: V = vulnerable, E = endangered, CE = critically endangered

Table 9-11 Direct impacts on threatened species credit species within the South Olary Plain IBRA subregion

SPECIES NAME	COMMON NAME	BC ACT[1]	SAII	NATIVE VEGETATION TYPE (PCT)	VEG. ZONE # (BAM-C)	VEG. ZONE NAME (BAM-C)	DIRECT IMPACT (AREA / INDIVIDUALS)
Threatened flora species							
Pimelea serpyllifolia subsp. *serpyllifolia*	Thyme Rice-Flower	E	Yes	PCT 172	VZ #10	172_Mod-good_whip	1.70 ha
						Subtotal	1.70 ha
Threatened fauna species							
Lophochroa leadbeateri	Major Mitchell's Cockatoo	V	No	PCT 15	VZ #1	15_Mod-good	5.75 ha
						Subtotal	5.75 ha
Polytelis anthopeplus monarchoides	Regent Parrot (eastern subspecies)	E	No	PCT 15	VZ #1	15_Mod-good	5.75 ha
						Subtotal	5.75 ha

(1) Threat status under the BC Act: V = vulnerable, E = endangered, CE = critically endangered

Table 9-12 Direct impacts on threatened species credit species within the Lachlan IBRA subregion

SPECIES NAME	COMMON NAME	BC ACT[1]	SAII	NATIVE VEGETATION TYPE (PCT)	VEG. ZONE # (BAM-C)	VEG. ZONE NAME (BAM-C)	DIRECT IMPACT (AREA / INDIVIDUALS)
Threatened fauna species							
Lophochroa leadbeateri	Major Mitchell's Cockatoo	V	No	PCT 15	VZ #1	15_Mod-good	0.07 ha
						Subtotal	0.07 ha
Polytelis anthopeplus monarchoides	Regent Parrot (eastern subspecies)	E	No	PCT 15	VZ #1	15_Mod-good	0.07 ha
						Subtotal	0.07 ha

(1) Threat status under the BC Act: V = vulnerable, E = endangered, CE = critically endangered

Table 9-13 Direct impacts on threatened species credit species within the Murrumbidgee IBRA subregion

SPECIES NAME	COMMON NAME	BC ACT[1]	SAII	NATIVE VEGETATION TYPE (PCT)	VEG. ZONE # (BAM-C)	VEG. ZONE NAME (BAM-C)	DIRECT IMPACT (AREA / INDIVIDUALS)
Threatened flora species							
Brachyscome papillosa	Mossgiel Daisy	V	No	PCT 17	VZ #8	17_Mod-good	3.74 ha
					VZ #35	17_SVM_Bench	4.10 ha
				PCT 24	VZ #11	24_Mod-good	1.51 ha
					VZ #36	24_SVM_Bench	0.01 ha
				PCT 160	VZ #24	160_Mod-good	6.32 ha
					VZ #44	160_SVM_Bench	1.17 ha
				PCT 163	VZ #25	163_Mod-good	8.79 ha
				PCT 164	VZ #26	164_Mod-good	2.41 ha
					VZ #45	164_SVM_Bench	43.12 ha
						Subtotal	71.17 ha
Cullen parvum	Small Scurf-pea	E	No	PCT 5	VZ #1	5_Mod-good	1.64 ha
				PCT 7	VZ #2	7_Mod-good	0.25 ha
					VZ #33	7_SVM_Bench	<0.01 ha
				PCT 44	VZ #16	44_Mod-good	36.61 ha
					VZ #39	44_SVM_Bench	6.38 ha
				PCT 45	VZ #17	45_Mod-good	<0.01 ha
				PCT 46	VZ #18	46_Mod-good	<0.01 ha
				PCT 160	VZ #24	160_Mod-good	0.25 ha
				PCT 164	VZ #26	164_Mod-good	<0.01 ha
				PCT 182	VZ #30	182_Mod-good	<0.01 ha
						Subtotal	45.18
Lepidium monoplocoides	Winged Peppercress	E	No	PCT 44	VZ #16	44_Mod-good	0.20 ha
					VZ #39	44_SVM_Bench	6.55 ha
				PCT 160	VZ #24	160_Mod-good	0.25 ha
						Subtotal	7.00 ha
Leptorhynchos orientalis	Lanky Buttons	E	No	PCT 44	VZ #16	44_Mod-good	8.69 ha
					VZ #39	44_SVM_Bench	6.38 ha
					VZ #24	160_Mod-good	0.25 ha
						Subtotal	15.32 ha

SPECIES NAME	COMMON NAME	BC ACT[1]	SAII	NATIVE VEGETATION TYPE (PCT)	VEG. ZONE # (BAM-C)	VEG. ZONE NAME (BAM-C)	DIRECT IMPACT (AREA / INDIVIDUALS)
Maireana cheelii	Chariot Wheels	V	No	PCT 17	VZ #8	17_Mod-good	2.19 ha
					VZ #35	17_SVM_Bench	3.48 ha
				PCT 28	VZ #38	28_SVM_Bench	1.30 ha
				PCT 44	VZ #16	44_Mod-good	8.20 ha
				PCT 46	VZ #18	46_Mod-good	5.05 ha
					VZ #41	46_SVM_Bench	23.08 ha
				PCT 58	VZ #21	58_Mod-good	0.01 ha
				PCT 157	VZ #23	157_Mod-good	6.14 ha
					VZ #43	157_SVM_Bench	10.70 ha
				PCT 163	VZ #25	163_Mod-good	4.90 ha
				PCT 164	VZ #26	164_Mod-good	1.34 ha
					VZ #45	164_SVM_Bench	43.12 ha
				PCT 216	VZ #29	216_Mod-good	0.17 ha
						Subtotal	109.68 ha
Pilularia novae-hollandiae	Austral Pillwort	E	Yes	PCT 17	VZ #8	17_Mod-good	2.36 ha
					VZ #35	17_SVM_Bench	4.10 ha
				PCT 44	VZ #39	44_SVM_Bench	0.01 ha
				PCT 160	VZ #24	160_Mod-good	0.98 ha
					VZ #44	160_SVM_Bench	1.17 ha
						Subtotal	8.62 ha
Swainsona murrayana	Slender Darling Pea	V	No	PCT 17	VZ #8	17_Mod-good	4.95 ha
					VZ #35	17_SVM_Bench	4.10 ha
				PCT 24	VZ #11	24_Mod-good	3.33 ha
					VZ #36	24_SVM_Bench	0.01 ha
				PCT 26	VZ #12	26_Mod-good	2.87 ha
					VZ #13	26_Moderate	18.92 ha
					VZ #14	26_Derived	23.73 ha
					VZ #37	26_SVM_Bench	0.04 ha
				PCT 44	VZ #16	44_Mod-good	16.72 ha
					VZ #39	44_SVM_Bench	6.38 ha
				PCT 45	VZ #17	45_Mod-good	13.07 ha
					VZ #40	45_SVM_Bench	10.01 ha
				PCT 46	VZ #18	46_Mod-good	25.92 ha

SPECIES NAME	COMMON NAME	BC ACT[1]	SAII	NATIVE VEGETATION TYPE (PCT)	VEG. ZONE # (BAM-C)	VEG. ZONE NAME (BAM-C)	DIRECT IMPACT (AREA / INDIVIDUALS)
					VZ #41	46_SVM_Bench	23.08 ha
				PCT 47	VZ #19	47_Mod-good	0.17 ha
					VZ #42	47_SVM_Bench	0.88 ha
				PCT 53	VZ #20	53_Mod-good	1.73 ha
				PCT 157	VZ #23	157_Mod-good	5.79 ha
					VZ #43	157_SVM_Bench	10.70 ha
				PCT 160	VZ #24	160_Mod-good	1.40 ha
					VZ #44	160_SVM_Bench	1.17 ha
				PCT 163	VZ #25	163_Mod-good	10.98 ha
				PCT 164	VZ #26	164_Mod-good	3.27 ha
					VZ #45	164_SVM_Bench	43.12 ha
				PCT 216	VZ #29	216_Mod-good	0.01 ha
						Subtotal	232.35 ha
Swainsona sericea	Silky Swainson-pea	V	No	PCT 44	VZ #16	44_Mod-good	13.21 ha
					VZ #39	44_SVM_Bench	6.39 ha
				PCT 45	VZ #17	45_Mod-good	3.94 ha
					VZ #40	45_SVM_Bench	10.01 ha
				PCT 46	VZ #18	46_Mod-good	5.94 ha
					VZ #41	46_SVM_Bench	23.08 ha
				PCT 47	VZ #19	47_Mod-good	0.17 ha
					VZ #42	47_SVM_Bench	0.88 ha
				PCT 160	VZ #24	160_Mod-good	1.22 ha
					VZ #44	160_SVM_Bench	1.17 ha
				PCT 164	VZ #26	164_Mod-good	0.04 ha
					VZ #45	164_SVM_Bench	43.12 ha
						Subtotal	109.17 ha
Threatened fauna species							
Lophochroa leadbeateri	Major Mitchell's Cockatoo	V	No	PCT 8	VZ #3	8_Mod-good	4.77 ha
				PCT 11	VZ #4	11_Mod-good	7.91 ha
				PCT 13	VZ # 5	13_Mod-good	1.36 ha
				PCT 15	VZ #6	15_Mod-good	12.36 ha
					VZ #34	15_SVM_Bench	0.14 ha
						Subtotal	26.54 ha

SPECIES NAME	COMMON NAME	BC ACT[1]	SAII	NATIVE VEGETATION TYPE (PCT)	VEG. ZONE # (BAM-C)	VEG. ZONE NAME (BAM-C)	DIRECT IMPACT (AREA / INDIVIDUALS)
Myotis macropus	Southern Myotis	V	No	PCT 8	VZ #3	8_Mod-good	4.77 ha
						Subtotal	4.77 ha
Pedionomus torquatus	Plains Wanderer	E	Yes	PCT 17	VZ #8	17_Mod-good	0.01 ha
				PCT 44	VZ #16	44_Mod-good	0.09 ha
				PCT 46	VZ #18	46_Mod-good	0.21 ha
					VZ #42	46_SVM_Bench	0.03 ha
				PCT 164	VZ #26	164_Mod-good	0.07 ha
						Subtotal	0.41 ha
Polytelis anthopeplus monarchoides	Regent Parrot (eastern subspecies)	E	No	PCT 8	VZ #3	8_Mod-good	4.77 ha
				PCT 11	VZ #4	11_Mod-good	7.91 ha
				PCT 13	VZ # 5	13_Mod-good	1.36 ha
				PCT 15	VZ #6	15_Mod-good	12.36 ha
					VZ #34	15_SVM_Bench	0.14 ha
						Subtotal	26.54 ha
Polytelis swainsonii	Superb Parrot	V	No	PCT 5	VZ #1	5_Mod-good	4.88 ha
				PCT 7	VZ #2	7_Mod-good	0.77 ha
				PCT 11	VZ #4	11_Mod-good	5.96 ha
				PCT 13	VZ # 5	13_Mod-good	9.76 ha
				PCT 15	VZ #6	15_Mod-good	2.78 ha
						Subtotal	24.15 ha

(1) Threat status under the BC Act: V = vulnerable, E = endangered, CE = critically endangered

Table 9-14 Direct impacts on threatened species credit species within the Lower Slopes IBRA subregion

SPECIES NAME	COMMON NAME	BC ACT[1]	SAII	NATIVE VEGETATION TYPE (PCT)	VEG. ZONE # (BAM-C)	VEG. ZONE NAME (BAM-C)	DIRECT IMPACT (AREA / INDIVIDUALS)
Threatened flora species							
Cullen parvum	Small Scurf-pea	E	No	PCT 5	VZ #1	5_Mod-good	1.02 ha
				PCT 74	VZ #14	74_Mod-good	0.30 ha
				PCT 249	VZ #7	249_Mod-good	1.56 ha
					VZ #8	249_Derived	0.01 ha
						Subtotal	2.89 ha
Threatened fauna species							
Petaurus norfolcensis	Squirrel Glider	V	No	PCT 5	VZ #1	5_Mod-good	2.69 ha
				PCT 74	VZ #14	74_Mod-good	0.24 ha
				PCT 75	VZ #2	75_Mod-good	28.80 ha
				PCT 76	VZ #3	76_Mod-good	1.31 ha
				PCT 80	VZ #5	80_Mod-good	11.85 ha
					VZ #4	80_Moderate	6.47 ha
						Subtotal	51.36 ha
Polytelis swainsonii	Superb Parrot	V	No	PCT 5	VZ #1	5_Mod-good	2.68 ha
				PCT 75	VZ #2	75_Mod-good	4.09 ha
				PCT 80	VZ #4	80_Moderate	1.62 ha
				PCT 249	VZ #7	249_Moderate	4.03 ha
						Subtotal	12.42 ha

(1) Threat status under the BC Act: V = vulnerable, E = endangered, CE = critically endangered

Table 9-15 Direct impacts on threatened species credit species within the Inland Slopes IBRA subregion

SPECIES NAME	COMMON NAME	BC ACT[1]	SAII	NATIVE VEGETATION TYPE (PCT)	VEG. ZONE # (BAM-C)	VEG. ZONE NAME (BAM-C)	DIRECT IMPACT (AREA / INDIVIDUALS)
Threatened flora species							
Cullen parvum	Small Scurf-pea	E	No	PCT 5	VZ #9	5_Poor	0.29 ha
				PCT 74	VZ #1	74_Mod-good	0.65 ha
				PCT 277	VZ #4	277_Mod-good	1.29 ha
						Subtotal	2.23 ha
Threatened fauna species							
Petaurus norfolcensis	Squirrel Glider	V	No	PCT 74	VZ #1	74_Mod-good	1.15 ha
				PCT 267	VZ #7	267_Mod-good	0.26 ha
						Subtotal	1.41 ha

(1) Threat status under the BC Act: V = vulnerable, E = endangered, CE = critically endangered

9.1.5 *Impacts on scattered trees*

The direct impacts on scattered trees due to the proposal for each IBRA subregion is summarised in Table 9-16. Details on direct impacts on scattered trees including the tree class, associated PCT, tree species and number of individual trees for each IBRA subregion is presented Table 9-17, Table 9-18, Table 9-19 and Table 9-20.

Table 9-16 Summary of total direct impact on scattered trees

NATIVE VEGETATION	SOP	LAC	MUR	LS	IS	DIRECT IMPACT (HA)
Total direct impact on scattered trees for each IBRA subregion	12	0	14	52	16	94
Total direct impact on scattered trees						**94**

Note: IBRA subregions

SOP – South Olary Plain

LAC – Lachlan

MUR – Murrumbidgee

LS – Lower Slopes

IS – Inland Slopes

Table 9-17 Direct impacts on scattered trees within the South Olary Plain IBRA subregion

SCATTERED TREE CLASS	ASSOCIATED PCT	SCATTERED TREE SPECIES	NUMBER OF TREES
Class 3 (contains hollows)	PCT 15 – Black Box open woodland wetland with chenopod understorey mainly on the outer floodplains in the south-western NSW (mainly Riverina Bioregion and Murray Darling Depression Bioregion)	*Eucalyptus largiflorens* (Black Box)	1
	PCT 58 – Black Oak – Western Rosewood open woodland on deep sandy loams mainly in the Murray Darling Depression Bioregion	*Casuarina pauper* (Black Oak)	1
	PCT 170 – Chenopod sandplain mallee woodland/ shrubland of the arid and semi-arid (warm) zones	*Eucalyptus gracilis* (Yorrell)	10
Total scattered trees			**12**

Table 9-18 Direct impacts on scattered trees within the Murrumbidgee IBRA subregion

SCATTERED TREE CLASS	ASSOCIATED PCT	SCATTERED TREE SPECIES	NUMBER OF TREES
Class 3 (contains hollows)	PCT 11 – River Red Gum – Lignum very tall open forest or woodland wetland on floodplains of semi-arid (warm) climate zone (mainly Riverina Bioregion and Murray Darling Depression Bioregion)	*Eucalyptus camaldulensis* (River red Gum)	6
	PCT 75 – Yellow Box – White Cypress Pine grassy woodland on deep sandy-loam alluvial soils of the eastern Riverina Bioregion and western NSW South Western Slopes Bioregion	*Eucalyptus melliodora* (Yellow Box)	3
Class 2 (does not contain hollows)	PCT 75 – Yellow Box – White Cypress Pine grassy woodland on deep sandy-loam alluvial soils of the eastern Riverina Bioregion and western NSW South Western Slopes Bioregion	*Eucalyptus melliodora* (Yellow Box)	5
Total scattered trees			**14**

Table 9-19 Direct impacts on scattered trees within the Lower Slopes IBRA subregion

SCATTERED TREE CLASS	ASSOCIATED PCT	SCATTERED TREE SPECIES	NUMBER OF TREES
Class 3 (contains hollows)	PCT 75 – Yellow Box – White Cypress Pine grassy woodland on deep sandy-loam alluvial soils of the eastern Riverina Bioregion and western NSW South Western Slopes Bioregion	*Eucalyptus melliodora* (Yellow Box)	11
	PCT 76 – Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions	*Eucalyptus microcarpa* (Grey Box)	13
	PCT 80 – Western Grey Box – White Cypress Pine tall woodland on loam soil on alluvial plains of NSW South Western Slopes Bioregion and Riverina Bioregion	*Eucalyptus microcarpa* (Grey Box)	10
	PCT 277 – Blakely's Red Gum – Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion	*Eucalyptus melliodora* (Yellow Box)	2
Class 3 (does not contain hollows)	PCT 75 – Yellow Box – White Cypress Pine grassy woodland on deep sandy-loam alluvial soils of the eastern Riverina Bioregion and western NSW South Western Slopes Bioregion	*Eucalyptus melliodora* (Yellow Box)	1
	PCT 80 – Western Grey Box – White Cypress Pine tall woodland on loam soil on alluvial plains of NSW South Western Slopes Bioregion and Riverina Bioregion	*Eucalyptus microcarpa* (Grey Box)	7

SCATTERED TREE CLASS	ASSOCIATED PCT	SCATTERED TREE SPECIES	NUMBER OF TREES
Class 2 (does not contain hollows)	PCT 75 – Yellow Box – White Cypress Pine grassy woodland on deep sandy-loam alluvial soils of the eastern Riverina Bioregion and western NSW South Western Slopes Bioregion	*Allocasuarina luehmannii* (Buloke)	1
		Callitris glaucophylla (White Cypress Pine)	1
	PCT 76 – Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions	*Allocasuarina luehmannii* (Buloke)	1
	PCT 80 – Western Grey Box – White Cypress Pine tall woodland on loam soil on alluvial plains of NSW South Western Slopes Bioregion and Riverina Bioregion	*Eucalyptus microcarpa* (Grey Box)	2
		Eucalyptus melliodora (Yellow Box)	1
		Callitris glaucophylla (White Cypress Pine)	2
Total scattered trees			**52**

Table 9-20 Direct impacts on scattered trees within the Inland Slopes IBRA subregion

SCATTERED TREE CLASS	ASSOCIATED PCT	SCATTERED TREE SPECIES	NUMBER OF TREES
Class 3 (contains hollows)	PCT 80 – Western Grey Box – White Cypress Pine tall woodland on loam soil on alluvial plains of NSW South Western Slopes Bioregion and Riverina Bioregion	*Eucalyptus microcarpa* (Grey Box)	8
	PCT 277 – Blakely's Red Gum – Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion	*Eucalyptus melliodora* (Yellow Box)	8
Total scattered trees			**16**

9.2 Assessment of indirect impacts unable to be avoided

9.2.1 Assessment of indirect impacts

The assessment of indirect impacts has been prepared in accordance with section 9.1.4 of the BAM. Indirect impacts have been considered in terms of the nature, extent and duration of impacts on native vegetation, threatened ecological communities and threatened species habitats likely to be affected. The assessment of indirect impacts is presented in Table 9-21.

Table 9-21 Assessment of indirect impacts

INDIRECT IMPACT	CONSTRUCTION / OPERATIONAL	NATURE (I.E. IMPACTED ENTITIES)	EXTENT	DURATION	CONSEQUENCE
Inadvertent impacts on adjacent habitat or vegetation	Construction	All PCTs Threatened species Threatened ecological communities Aquatic habitat	All PCT Aquatic habitats associated with creeks and rivers	Short term	**Low.** Inadvertent impacts on adjacent vegetation can include a range of indirect impacts including soil disturbance, erosion, sedimentation, enriched run-off and water quality. Construction of the proposal has the potential to result in sedimentation and erosion and mobilisation of contaminants within the disturbance area and into adjoining native vegetation and aquatic habitats, through soil disturbance and construction activities. Sediment laden runoff and spills affect water quality and adversely affect aquatic life particularly during construction near rivers, creeklines and Key Fish Habitats. These impacts have the potential to reduce the viability of habitat for aquatic and semi aquatic species temporarily. The proposal has been carefully designed to minimise impact to these sensitive environmental receivers through targeting narrow width crossing points of waterways and flood out areas (and their associated riparian habitats e.g. around the Murrumbidgee River, Yanco Creek and Colombo Creek). The mobilisation of sediments would be contained within the disturbance area as sediment containment measures would be implemented as part of mitigation measures.

INDIRECT IMPACT	CONSTRUCTION / OPERATIONAL	NATURE (I.E. IMPACTED ENTITIES)	EXTENT	DURATION	CONSEQUENCE
Reduced viability of adjacent habitat due to edge effects	Construction / operational	Native vegetation	All PCTs	Long term	**Negligible.** Where possible works are to occur within existing easements and infrastructure such that fragmentation would be minimised. In addition, indirect impacts on native vegetation and adjacent habitats are considered unlikely due to shrub and ground stratum native vegetation retention to a height of 4 and 10 m growth height in areas buffering direct permanent loss. These areas form part of the disturbance area and are required to ensure safe clearance distances are achieved from the conductors. Retained native vegetation within these areas would provide a buffer to permanent impact areas such as transmission towers and access tracks. Impacts from the main construction compound and accommodation camp sites, and substation works would be comparatively minor at a local and regional scale.
Reduced viability of adjacent habitat due to noise, dust or light spill	Construction / operational	Native vegetation Threatened species Threatened ecological communities	All PCTs	Short term	**Negligible.** During construction increased levels of noise and dust are likely however these will be short term and mostly associated with vehicle movements, vegetation clearing, access track and transmission tower construction, break and winch sites and substation construction. Operational phase would result in no lights on the transmission line sections and minimal additional lighting only at Dinawan substation and Wagga Wagga substation.

INDIRECT IMPACT	CONSTRUCTION / OPERATIONAL	NATURE (I.E. IMPACTED ENTITIES)	EXTENT	DURATION	CONSEQUENCE
					A short term increase in construction noise will be mostly limited to daylight hours and is unlikely to have long term adverse effects on the viability of adjacent habitats as they would be short-term in nature only. In terms of increased dust, construction impacts associated with permanent vegetation clearing is limited to disturbance area-A. This clearing area would mostly be buffered by disturbance area-B where partial clearing is limited to vegetation above 4 m and 10 m growth height areas. Disturbance area-B would have limited dust generation post construction. Increased vehicle movements would have a short-term increase in localised dust levels although given the ongoing agricultural landscape usage, current dust levels are unlikely to substantial increase to an extent that would adversely reduce the viability of adjacent habitats. Beyond the easement (such as for construction compounds and substation works) dust impacts are likely to also be limited and short term in nature. The proposal is unlikely to generate light spill to an extent that would adversely reduce the viability of adjacent habitats as lighting within the proposal would be minimal. Operational impacts would be mostly limited to vehicle movements for maintenance activities. These activities would be periodic and of an extent and duration that is unlikely to reduced viability of adjacent habitat due to noise, dust or light spill. Any residual negligible impact such as short-term impact aspects is considered likely to be adequately managed with mitigation measures.

INDIRECT IMPACT	CONSTRUCTION / OPERATIONAL	NATURE (I.E. IMPACTED ENTITIES)	EXTENT	DURATION	CONSEQUENCE
Transport of weeds and pathogens from the site to adjacent vegetation	Construction / operational	Native vegetation Threatened flora species Threatened ecological communities	All PCTs	Long term	**Negligible.** Whilst this type of indirect impact has the potential to lead to a reduction of native vegetation integrity in surrounding habitats, management measures would be developed during construction to maintain the integrity of native vegetation in adjoining habitats. During operational phase, all maintenance and associated works would be subject to Transgrid biosecurity protocols.
Increased risk of starvation, exposure and loss of shade or shelter	Construction	All fauna species	All PCTs	Short term	**Negligible.** Significant portion of the proposal route has been subject to agricultural development, and only small proportions of the route are made up of native vegetation Displacement of resident fauna species during native vegetation clearing is considered relatively low due to the modified vegetation structure resulting from long term agricultural stock grazing. Given the linear nature of the proposal and mostly highly mobile nature of most potential resident fauna species the increased risk of starvation, exposure and loss of shade or shelter due to the proposal is considered low.
Loss of breeding habitats	Construction	All fauna species	All PCTs	Long term	**Moderate.** The loss of breeding habitat such as hollow-bearing trees, old growth bull mallee lignotubers, *Triodia* grass clumps and fallen timber has the potential to affect native animals such as: — hollow-dependent bats — hollow-nesting and canopy-nesting birds — arboreal mammals — reptiles. The loss of breeding habitats is unlikely to extend beyond the disturbance area. Impacts beyond this area would be avoided through mitigation and management measures.

INDIRECT IMPACT	CONSTRUCTION / OPERATIONAL	NATURE (I.E. IMPACTED ENTITIES)	EXTENT	DURATION	CONSEQUENCE
Trampling of threatened flora species	Construction / operation	*Austrostipa nullanulla* associated with PCT 253 – moderate to good 'lunette' *Atriplex infrequens* associated with PCT 17	PCT 253 – moderate to good 'lunette' and PCT 17	Short term	**Low.** Reduction in population extent and available habitat of threatened flora species that occur in the ground stratum could occur due to trampling or unauthorised material, storage, vehicle and plant equipment. All populations and associated habitat for threatened flora species will be available in GIS files for all contractors and would be designated no-go areas during construction. Mitigation measures would include protection for these areas and inadvertent impacts such as trampling is considered unlikely. During operational phase any maintenance would be subject to Transgrid environmental operational protocols and have a low risk of any inadvertent impacts to any threatened flora species.
Increased risk of fire	Construction / operational	Native vegetation All flora & fauna species	All PCTs	Long term	**Low.** Bushfire risk assessment has been considered as part of the proposal. During construction and operation, the proposal would implement the required bushfire management measures to manage any increased risk of bushfire. The proposed access roads would provide addition opportunity for fire breaks across the regional landscape to enable better management of fire and reduce the potential for inappropriate regular fire intervals Design specifications would be adopted to ensure conductor clearance heights exceed recommended levels to minimise any risk of arcing or potential fire events. Vegetation maintenance would occur in accordance with Transgrid standard operational procedures. Impact assessment has considered this maintenance provision and is included in disturbance area-B calculations.

INDIRECT IMPACT	CONSTRUCTION / OPERATIONAL	NATURE (I.E. IMPACTED ENTITIES)	EXTENT	DURATION	CONSEQUENCE
Increased risk of collision with lines and EMF impacts with new infrastructure	Operational	Larger and higher-flying birds, and which generally reside over larger territories, such as birds of prey, ravens and magpies, cockatoos and some parrots, waterbirds and waterfowl	All PCTs	Long term	**Moderate.** Whilst this type of indirect impact has the potential to lead to some level of increase of bird mortality, mitigation measures would be implemented to ensure the likely impacts are minimised. The proposal is mostly located well away from waterways and wetlands which reduces the overall risk. The proposal transmission lines are likely to be below flight paths for a majority of species. As outlined in Chapter 10 mitigation measures will include line markers (i.e. bird flappers/divertors). Given uncertainty around these indirect operational impacts, biodiversity offsets have been calculated for following at risk species: — *Haliaeetus leucogaster* (White-bellied Sea-Eagle) — *Hamirostra melanosternon* (Black-breasted Buzzard) — *Hieraaetus morphnoides* (Little Eagle) — *Lophochroa leadbeateri* (Major Mitchell's Cockatoo) — *Polytelis anthopeplus monarchoides* (Regent Parrot (eastern subspecies)). Further discussion on this issue is provided below.

9.2.2 *Indirect impacts on bird strike and EMF criteria assessment*

Vehicle strike prescribed impact assessment criteria were applied for bird strike as no specific assessment criteria has been listed under the BAM for this type of impact for indirect or prescribed impacts. Of the listed prescribed impact assessment criteria under the BAM, vehicle strike was considered most appropriate for bird strike and EMF impacts associated with electrical power infrastructure.

The vehicle strike criteria and assessment of each species are provided below, with relevant assessment undertaken for the potential indirect impacts. A worked example of the assessment process is firstly provided, followed by the individual species assessments. This is provided so that the process for assessment can be clearly followed, given that birdstrike and EMF impacts do not neatly fit into the BAM process.

9.2.2.1 Assessed species selection

Given uncertainty around these indirect operational impacts, in association with discussions with BCD, additional biodiversity offsets (over and above the biodiversity offsets required by the BAM for direct impacts) have been calculated for the following at risk species:

- *Hieraaetus morphnoides* (Little Eagle)
- *Lophochroa leadbeateri* (Major Mitchell's Cockatoo)
- *Polytelis anthopeplus monarchoides* (Regent Parrot (eastern subspecies))
- *Polytelis swainsonii* (Superb Parrot).

These species have been selected:

- as surrogate species to be able to calculate proportional impacts to threatened and non-threatened avifauna
- as they have all been recorded within the proposal study area
- as they have a greater likelihood of interaction with the powerline infrastructure as outlined in this section.

In the BAM calculator it is not possible to calculate credits for non-threatened or ecosystem credit species, so the use of surrogate species to provide additional impact compensation over and above that required for direct impacts is considered appropriate.

For this assessment these dual credit species have been treated as species credit species to enable calculation of additional species credits to account for these impacts. That is, they have been treated as breeding species (despite breeding actually not being observed. This is considered to be a conservative approach.

Indirect impacts from bird strike and EMF whilst unlikely, have been considered for the proposals greenfield areas that do not currently have electrical infrastructure. Habitats within the parts of the proposal that follow existing similar electrical infrastructure are assumed to be already being affected by indirect impacts associated with bird strike and EMF.

Within the areas assessed for indirect impacts from bird strike and EMF, impact calculations have assumed 10 per cent of habitat for these species to be impacted. This conservative assumption is considered to be proportional to the likely extent of impacts to the airspace, when compared to full clearing of directly impacted areas (Disturbance Area A) in which the tree canopy layer that these species would use will be impacted. Limiting the assessed impacts to 10 percent of the available habitat is considered to be appropriate representative given the impacts of birdstrike or EMF are considered to be at a much lower level than actual habitat removal. Impacted habitat was conservatively based on the assigned habitat PCT's in Bionet for each of the five species.

Indirect impacts from bird strike and EMF are restricted to the Murrumbidgee and Lower Slopes IBRA subregions, as these are the IBRA subregions in which the proposal will be located in area that do not currently already have existing parallel electrical infrastructure.

9.2.3 Summary of bird strike and EMF impacts

A summary of affected habitat for the Murrumbidgee and Lower Slopes IBRA subregions is presented in Table 9-22.

Table 9-22 Indirect impacts of bird strike and EMF for the Murrumbidgee IBRA subregion

SPECIES NAME	COMMON NAME	BC ACT[1]	SAII	NATIVE VEGETATION TYPE (PCT)	VEG. ZONE # (BAM-C)	VEG. ZONE NAME (BAM-C)	INDIRECT IMPACT (AREA), 10% OF DIRECT AREA
Threatened fauna species							
Hieraaetus morphnoides	Little Eagle	V	No	PCT 5	VZ #1	5_Mod-good	0.16 ha
				PCT 7	VZ #2	7_Mod-good	0.02 ha
				PCT 11	VZ #4	11_Mod-good	0.24 ha
				PCT 13	VZ #5	13_Mod-good	0.09 ha
				PCT 15	VZ #6	15_Mod-good	0.08 ha
				PCT 17	VZ #8	17_Mod-good	0.16 ha
					VZ #35	17_SVM_Bench	0.06 ha
				PCT 26	VZ #12	26_Mod-good	2.72 ha
					VZ #13	26_Moderate	0.11 ha
					VZ #14	26_Derived	4.66 ha
					VZ #37	26_SVM_Bench	0.01 ha
				PCT 46	VZ #18	46_Mod-good	2.47 ha
				PCT 75	VZ #32	75_Mod-good	0.01 ha
				PCT 216	VZ #29	216_Mod-good	0.52 ha
						Subtotal	11.31 ha
Lophochroa leadbeateri	Major Mitchell's Cockatoo	V	No	PCT 7	VZ #2	7_Mod-good	0.02 ha
				PCT 11	VZ #4	11_Mod-good	0.24 ha
				PCT 13	VZ #5	13_Mod-good	0.09 ha
				PCT 15	VZ #6	15_Mod-good	0.08 ha
				PCT 26	VZ #12	26_Mod-good	2.72 ha
					VZ #13	26_Moderate	0.11 ha
					VZ #14	26_Derived	4.66 ha
					VZ #37	26_SVM_Bench	0.01 ha
				PCT 28	VZ #15	28_Mod-good	0.40 ha
						Subtotal	8.33 ha
Polytelis anthopeplus monarchoides	Regent Parrot (eastern subspecies)	E	No	PCT 11	VZ #4	11_Mod-good	0.24 ha
				PCT 13	VZ #5	13_Mod-good	0.09 ha
				PCT 15	VZ #6	15_Mod-good	0.08 ha
						Subtotal	0.41 ha

SPECIES NAME	COMMON NAME	BC ACT[1]	SAII	NATIVE VEGETATION TYPE (PCT)	VEG. ZONE # (BAM-C)	VEG. ZONE NAME (BAM-C)	INDIRECT IMPACT (AREA), 10% OF DIRECT AREA
Polytelis swainsonii	Superb Parrot	V	No	PCT 5	VZ #1	5_Mod-good	0.16 ha
				PCT 7	VZ #2	7_Mod-good	0.02 ha
				PCT 11	VZ #4	11_Mod-good	0.24 ha
				PCT 13	VZ #5	13_Mod-good	0.09 ha
				PCT 15	VZ #6	15_Mod-good	0.08 ha
				PCT 26	VZ #12	26_Mod-good	2.72 ha
					VZ #13	26_Moderate	0.11 ha
					VZ #14	26_Derived	4.66 ha
					VZ #37	26_SVM_Bench	0.01 ha
				PCT 28	VZ #15	28_Mod-good	0.40 ha
				PCT 45	VZ #17	45_Mod-good	2.72 ha
					VZ #40	45_SVM_Bench	1.01 ha
				PCT 46	VZ #18	46_Mod-good	2.47 ha
				PCT 75	VZ #32	75_Mod-good	0.01 ha
						Subtotal	14.70 ha

Table 9-23 Indirect impacts of bird strike and EMF for the Lower Slope IBRA subregion

SPECIES NAME	COMMON NAME	BC ACT[1]	SAII	NATIVE VEGETATION TYPE (PCT)	VEG. ZONE # (BAM-C)	VEG. ZONE NAME (BAM-C)	INDIRECT IMPACT (AREA), 10% OF DIRECT AREA
Threatened fauna species							
Hieraaetus morphnoides	Little Eagle	V	No	PCT 28	VZ #11	28_SVM_Bench	0.11 ha
				PCT 75	VZ #2	75_Mod-good	1.09 ha
					VZ #10	75_Derived	0.47 ha
					VZ #13	75_SVM_Bench	0.20 ha
				PCT 80	VZ #5	80_Mod-good	0.48 ha
					VZ #4	80_Moderate	0.10 ha
					VZ #6	80_Derived	0.13 ha
					VZ #12	80_SVM_Bench	0.02 ha
				PCT 249	VZ #7	249_Moderate	0.16 ha
					VZ #8	249_Derived	0.21 ha
						Subtotal	2.94 ha

SPECIES NAME	COMMON NAME	BC ACT[1]	SAII	NATIVE VEGETATION TYPE (PCT)	VEG. ZONE # (BAM-C)	VEG. ZONE NAME (BAM-C)	INDIRECT IMPACT (AREA), 10% OF DIRECT AREA
Lophochroa leadbeateri	Major Mitchell's Cockatoo	V	No	PCT 80	VZ #5	80_Mod-good	0.48 ha
					VZ #4	80_Moderate	0.10 ha
					VZ #6	80_Derived	0.13 ha
					VZ #12	80_SVM_Bench	0.02 ha
				PCT 249	VZ #7	249_Moderate	0.16 ha
					VZ #8	249_Derived	0.21 ha
						Subtotal	1.10 ha
Polytelis swainsonii	Superb Parrot	V	No	PCT 28	VZ #11	28_SVM_Bench	0.11 ha
				PCT 74	VZ #14	74_Mod-good	0.01 ha
				PCT 75	VZ #2	75_Mod-good	1.09 ha
					VZ #10	75_Derived	0.47 ha
					VZ #13	75_SVM_Bench	0.20 ha
				PCT 80	VZ #5	80_Mod-good	0.48 ha
					VZ #4	80_Moderate	0.10 ha
					VZ #6	80_Derived	0.13 ha
					VZ #12	80_SVM_Bench	0.02 ha
				PCT 249	VZ #7	249_Moderate	0.16 ha
					VZ #8	249_Derived	0.21 ha
						Subtotal	2.95 ha

9.3 Assessment of prescribed biodiversity impacts

Assessment of prescribed biodiversity impacts is prepared in accordance with section 8.3 of the BAM and presented in Table 9-24.

Table 9-24 Assessment of prescribed biodiversity impacts

PRESCRIBED BIODIVERSITY IMPACTS	NATURE (I.E. RELEVANCE TO THE PROPOSAL)	EXTENT	DURATION	CONSEQUENCE
(a) impacts of development on the habitat of threatened species or ecological communities associated with karst, caves, crevices, cliffs and other geological features of significance, or rocks.	No areas of species geological features of significance occur, although a typical rocky hilltop environment exists in the area mapped as rocky woodland fauna habitat stratification unit, near Wagga Wagga. This provides a different type of terrestrial habitat to other parts of the proposal study area.	Impacts will be negligible; the rocky environment will be minimally impacted and these habitats will remain post-construction.	The minor impacts to the rocky woodlands will be permanent.	The consequence of the impacts would be minor and non-significant as a result of the pro-active design process and the residual impact will be appropriately offset.
(b) impacts of development on the habitat of threatened species or ecological communities associated with: (i) human made structures, or (ii) non-native vegetation	No human made structures will be impacted. Areas of cropped and exotic-dominated vegetation will be impacted, however this are of comparatively minimal value for the native species and communities along the alignment.	Impacts will be negligible; the extensive cropped and exotic vegetation habitats will remain post-construction.	The minor impacts to the extensive cropped and exotic vegetation habitats will be permanent.	The consequence of the impacts will be minor and non-significant as a result of the pro-active design process.

PRESCRIBED BIODIVERSITY IMPACTS	NATURE (I.E. RELEVANCE TO THE PROPOSAL)	EXTENT	DURATION	CONSEQUENCE
(c) impacts of development on habitat connectivity	The proposal has the potential to impact on connectivity for habitat of threatened species that facilitates movement across species' ranges. The nature of the potential impacts to connectivity primarily relate to impacts to aerial species such as birds or bats through interaction with the proposed towers or associated lines. Generally, terrestrial connectivity would not be substantially affected.	The proposal would result in a highly permeable structure for biodiversity and connectivity is expected to remain largely unaffected for all species. Transgrid would also establish 20 metre wide connectivity corridors near tower locations that occur in woodland vegetation at strategic locations that would be developed as part of a connectivity strategy. However, an unknown (though likely low) level of interaction such as birdstrike (and fatality) may occur. Mitigating factors include: — the additional gaps for connectivity likely to be created by the proposal are limited to infrequently used access tracks approximately 10 m in width, which native flora and fauna can generally still disperse across — native vegetation up to 4 and 10 m growth height along the easement would be retained, providing cover for native species and connectivity — much of the proposal is co-located with existing transmission easements and along roadside, substantially reducing the overall extent of impact to connectivity.	The impacts to connectivity area expected to be permanent, though minor. They are likely to reduce over time as biodiversity acclimatises to the presence of the towers and powerlines.	The consequence of the impacts would be minor and non-significant as a result of the pro-active design process.
(d) impacts of development on water bodies, water quality and hydrological processes that sustain threatened species and threatened ecological communities	The proposal has the potential to impact on water quality, water bodies and hydrological processes that sustain threatened biodiversity.	The extent of impact related to this issue is expected to be minor. Essentially the works would mostly be limited to above-ground tower construction and powerline installation, with appropriate water management measures to be implemented. No direct impacts are expected to occur to these aquatic values of reliant threatened species.	The highest potential for these impacts is during construction, although these are subject to detailed management measures. Once operational, such impacts are considered to be negligible on an ongoing basis.	The consequence of the predicted low-level of impact to water-values is minor and expected to be able to be appropriately managed.

PRESCRIBED BIODIVERSITY IMPACTS	NATURE (I.E. RELEVANCE TO THE PROPOSAL)	EXTENT	DURATION	CONSEQUENCE
(e) impacts of wind turbine strikes on protected animals	Not applicable.	Not applicable.	Not applicable.	Not applicable.
(f) the impacts of vehicle strikes on threatened species of animals or on animals that are part of a threatened ecological community	The proposal has the potential to impact on animals through vehicular strike.	The extent of vehicular strike is expected to be minor in context.	The most vehicular movements would be generated during construction. Once construction is completed, vehicular movements are not expected to significantly increase compared to the existing situation.	The consequence of the predicted level of impact is expected to overall be minor. Particular focus would be required during the construction phase to manage vehicle and animal interaction.

9.4 Assessment of impacts on aquatic species and habitat

9.4.1 Threatened species

Areas of mapped key fish habitat have been considered to provide moderate likelihood of occurrence for four threatened species listed under the FM Act. These species are:

- Murray Hardyhead (*Craterocephalus fluviatilis*) listed as critically endangered under the FM Act
- Silver Perch (*Bidyanus bidyanus*) listed as vulnerable under the FM Act.
- Flathead Galaxias (*Galaxias rostratus*) listed as critically endangered under the FM Act
- Macquarie Perch (*Macquaria australasica*) listed as endangered under the FM Act.

Under the FM Act, a '7-part test' is carried out to assess the likelihood of significant impact upon threatened species, populations or ecological communities listed under the FM Act. Appendix E-1 contains detailed 7-part tests for these species, which conclude that due to the predicted negligible aquatic impact a significant impact is unlikely to occur.

Impacts from the proposal on aquatic habitats, particularly mapped key fish habitats (Strahler 4/5th Order streams) are considered likely to be negligible. Avoiding and minimising impacts on aquatic habitats would be a priority of detailed design and any residual indirect impacts would be subject to mitigation measures. Transmission line structures would be located around 50 to 100 metres from the waterways to minimise impact to riparian areas.

The only likely impact to occur in an area of key fish habitat would be the removal or trimming of tree canopy on the river banks to facilitate the construction and operation of the powerlines spanning each riparian area. All trunk bases and understorey would be retained in-situ adjoining the river banks. All potential indirect impacts associated with erosion and sedimentation impacts would be managed and monitored to ensure that these do not impact the riparian areas. At most, any impact to water quality would be temporary and negligible. Each riparian area would continue to function as it currently functions.

9.4.2 Threatened ecological communities

9.4.2.1 Aquatic ecological community in the natural drainage system of the Lowland Catchment of the Murray River Lowland

The proposal would span tributaries of Murray River and would not lead to direct impacts on the assemblage of native fish and aquatic invertebrates that have been listed to form part of this ecological community. The disturbance area would lead to modification of native vegetation associated with the riparian zone influence of this community.

Disturbance within the riparian zone would be limited to upper stratum tree removal with all shrub and ground stratum vegetation below four and 10 metres of growth height (based on disturbance area B4 and B10) would be retained in-situ. Transmission line structures would be located around 50 to 100 metres from the waterways to limit impact to riparian areas. An assessment of significance in accordance with Section 221ZV of the FM Act has been undertaken in Appendix E-1 for impact on this ecological community and concludes that the proposal is unlikely to lead to a significant impact, due to the predicted negligible aquatic impact.

9.5 Assessment of impacts on matters of national environmental significance

Chapter 7 outlines the MNES considered to be relevant to the proposal. Assessment for each MNES was done in accordance with the Significant Impact Guidelines 1.1 – Matters of National Environmental Significance (Department of the Environment 2013) (Appendix D-1) and a summary of the outcomes of these are provided hereunder.

9.5.1 Impacts on threatened ecological communities

The proposal will have an impact on seven threatened ecological communities listed under the EPBC Act. A summary of impacts is presented in Table 9-25.

Table 9-25 Listed EPBC Act threatened ecological community summary of significance of impact

THREATENED ECOLOGICAL COMMUNITY	EPBC ACT	DIRECT IMPACT (HA)	SIGNIFICANT IMPACT?
Buloke Woodlands of the Riverina and Murray-Darling Depression Bioregions	E	2.93	This threatened ecological community was recorded in the Murray Darling Depression (South Olary Plain subregion) IBRA region – refer to Section 7.1.1. The EPBC Act significance assessment for this species is detailed in Appendix D-1. No – the proposal is considered unlikely to have a significant impact on the threatened ecological community.

THREATENED ECOLOGICAL COMMUNITY	EPBC ACT	DIRECT IMPACT (HA)	SIGNIFICANT IMPACT?
Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia	E	15.41	This threatened ecological community was recorded in the NSW South Western Slopes (Lower Slopes and Inland Slopes subregion) IBRA bioregion – refer to Section 7.1.1. The EPBC Act significance assessment for this species is detailed in Appendix D-1. Yes – the proposal is considered likely to have a significant impact on the threatened ecological community.
Natural Grasslands of the Murray Valley Plains	CE	72.51	This threatened ecological community was recorded in the Riverina (Murrumbidgee subregion) IBRA bioregion – refer to Section 7.1.1. The EPBC Act significance assessment for this species is detailed in Appendix D-1. Yes – the proposal is considered likely to have a significant impact on the threatened ecological community.
Plains mallee box woodland of the Murray Darling Depression, Riverina and Naracoorte Coastal Plains bioregions	CE	5.98	This threatened ecological community was recorded in the Murray Darling Depression (South Olary Plain subregion) IBRA region – refer to Section 7.1.1. The EPBC Act significance assessment for this species is detailed in Appendix D-1. No – the proposal is considered unlikely to have a significant impact on the threatened ecological community.
Seasonal Herbaceous Wetlands (Freshwater) of the Temperate Lowland Plains	CE	3.01	This threatened ecological community was recorded in the Riverina (Murrumbidgee subregion) IBRA region – refer to Section 7.1.1. The EPBC Act significance assessment for this species is detailed in Appendix D-1. No – the proposal is considered unlikely to have a significant impact on the threatened ecological community.
Weeping Myall Woodlands	E	101.21	This threatened ecological community was recorded in the Riverina (Murrumbidgee subregion) IBRA region – refer to Section 7.1.1. The EPBC Act significance assessment for this species is detailed in Appendix D-1. Yes – the proposal is considered likely to have a significant impact on the threatened ecological community.
White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland	CE	35.45	This threatened ecological community was recorded in the Riverina (Murrumbidgee subregion) and NSW South Western Slopes (Lower Slopes and Inland Slopes subregion) IBRA subregions – refer to Section 7.1.1. The EPBC Act significance assessment for this species is detailed in Appendix D-1. Yes – the proposal is considered likely to have a significant impact on the threatened ecological community.

9.5.2 Impacts on threatened flora species

The proposal will have an impact on four threatened flora species listed under the EPBC Act. A summary of impacts is presented in Table 9-26. The significance assessments for these threatened flora species are provided in detail in Appendix D-1.

Table 9-26 Listed EPBC Act threatened flora species summary of significance of impact

SCIENTIFIC NAME	COMMON NAME	EPBC ACT	DIRECT IMPACT (HA)	SIGNIFICANT IMPACT?
Brachyscome papillosa	Mossgiel Daisy	V	71.17	*Brachyscome papillosa* was recorded from various properties across the proposal study area in PCTs 17, 160, 163 and 164. For a more detailed analysis refer to Appendix C-3. The EPBC Act significance assessment for this species is detailed in Appendix D-1. Yes – the proposal is considered likely to have a significant impact on the species.
Lepidium monoplocoides	Winged Peppercress	E	7.0	*Lepidium monoplocoides* was recorded from one location on property H104 in PCT 44. The EPBC Act significance assessment for this species is detailed in Appendix D-1. No – the proposal is considered unlikely to have a significant impact on the species.
Maireana cheelii	Chariot Wheels	V	109.68	*Maireana cheelii* was recorded from various properties across the proposal study area in PCTs 17, 44, 46, 157, 163, 164 and 216. For a more detailed analysis refer to Appendix C-3. The EPBC Act significance assessment for this species is detailed in Appendix D-1. Yes – the proposal is considered likely to have a significant impact on the species.
Swainsona murrayana	Slender Darling Pea	V	232.35	*Swainsona murrayana* was recorded from various properties across the proposal study area in PCTs 24, 26, 44, 45, 46, 157, 163 and 164. For a more detailed analysis refer to Appendix C-3. The EPBC Act significance assessment for this species is detailed in Appendix D-1. Yes – the proposal is considered likely to have a significant impact on the species.

9.5.3 *Impacts on threatened fauna species*

The proposal will have an impact on potential habitat for 33 threatened fauna species listed under the EPBC Act. A summary of these species is presented in Table 9-27. The significance assessments for these threatened fauna species are provided in detail in Appendix D-1.

Table 9-27 Listed EPBC Act threatened fauna species summary of significance of impact

SCIENTIFIC NAME	COMMON NAME	EPBC ACT	SIGNIFICANT IMPACT?
Invertebrates			
Synemon plana	Golden Sun Moth	CE	Suitable habitat recorded in the form of PCT 277 in the NSW South Western Slopes (Inland Slopes subregion) IBRA bioregion. Surveys completed – species not recorded. The EPBC Act significance assessment for this species is detailed in Appendix D-1. No – the proposal is considered unlikely to have a significant impact on the species
Amphibians			
Crinia sloanei	Sloane's Froglet	E	Suitable habitat recorded in the form of PCT 5, 74, 76, 80 and 249. Surveys completed – species not recorded. The EPBC Act significance assessment for this species is detailed in Appendix D-1. No – the proposal is considered unlikely to have a significant impact on the species
Litoria booroolongensis	Booroolong Frog	E	Suitable habitat recorded in the form of PCT 277. Surveys completed – species not recorded. The EPBC Act significance assessment for this species is detailed in Appendix D-1. No – the proposal is considered unlikely to have a significant impact on the species
Litoria raniformis	Southern Bell Frog	V	Suitable habitat recorded in the form of PCT 7, 8, 11, 13, 17, 24, 53 and 249. Surveys completed – species not recorded. The EPBC Act significance assessment for this species is detailed in Appendix D-1. No – the proposal is considered unlikely to have a significant impact on the species
Reptiles			
Aprasia parapulchella	Pink-tailed Worm Lizard	V	Suitable habitat recorded in the form of PCT 267, 277 and 319. Surveys completed – species not recorded. The EPBC Act significance assessment for this species is detailed in Appendix D-1. No – the proposal is considered unlikely to have a significant impact on the species

SCIENTIFIC NAME	COMMON NAME	EPBC ACT	SIGNIFICANT IMPACT?
Delma impar	Striped Legless Lizard	V	Suitable habitat recorded in the form of PCT 277. Surveys completed – species not recorded. The EPBC Act significance assessment for this species is detailed in Appendix D-1. No – the proposal is considered unlikely to have a significant impact on the species
Birds			
Anthochaera phrygia	Regent Honeyeater	CE	Suitable habitat recorded in the form of PCT 5, 7, 74, 75, 267, 277 and 319. The EPBC Act significance assessment for this species is detailed in Appendix D-1. No – the proposal is considered unlikely to have a significant impact on the species
Botaurus poiciloptilus	Australasian Bittern	E	Suitable habitat recorded in the form of PCT 8, 11, 13, 17, 24, 53, 160, 182 and 249. The EPBC Act significance assessment for this species is detailed in Appendix D-1. No - the proposal is considered unlikely to have a significant impact on the species
Calidris ferruginea	Curlew Sandpiper	CE	Suitable habitat in the form of Lake Cullivel recorded with the proposal area, including PCT 24, 47 and 53. The EPBC Act significance assessment for this species is detailed in Appendix D-1. No – the proposal is considered unlikely to have a significant impact on the species
Falco hypoleucos	Grey Falcon	V	Suitable habitat recorded in the form of PCT 8, 11, 13, 15, 17, 22, 23, 24, 26, 28, 44, 45, 46, 47, 53, 58, 76, 80, 143, 157, 160, 163, 164, 166, 170, 171, 172, 182, 199, 216 and 249. The EPBC Act significance assessment for this species is detailed in Appendix D-1. No – the proposal is considered unlikely to have a significant impact on the species
Grantiella picta	Painted Honeyeater	V	Suitable habitat recorded in the form of PCT 5, 7, 8, 11, 13, 15, 23, 26, 28, 58, 74, 75, 76, 80, 110, 143, 249, 267, 277 and 319. The EPBC Act significance assessment for this species is detailed in Appendix D-1. No – the proposal is considered unlikely to have a significant impact on the species

SCIENTIFIC NAME	COMMON NAME	EPBC ACT	SIGNIFICANT IMPACT?
Hirundapus caudacutus	White-throated Needletail	V	Suitable habitat recorded in the form of PCT 5, 7, 8, 11, 13, 15, 17, 24, 26, 44, 45, 46, 47, 53, 74, 76, 80, 110, 157, 160, 182, 216, 249, 277, 319. The EPBC Act significance assessment for this species is detailed in Appendix D-1. No – the proposal is considered unlikely to have a significant impact on the species
Lathamus discolor	Swift Parrot	CE	Suitable habitat recorded in the form of PCT 5, 7, 8, 11, 74, 75, 76, 80, 110, 249, 267 and 277. The EPBC Act significance assessment for this species is detailed in Appendix D-1. No – the proposal is considered unlikely to have a significant impact on the species
Leipoa ocellata	Malleefowl	V	Suitable habitat recorded in the form of PCT 110, 170, 171 and 172. The EPBC Act significance assessment for this species is detailed in Appendix D-1. No – the proposal is considered unlikely to have a significant impact on the species
Limosa lapponica-baueri	Bar-tailed Godwit (baueri), Western Alaskan Bar-tailed Godwit	V	Species considered likely to cross above the powerline during migration. The EPBC Act significance assessment for this species is detailed in Appendix D-1. No – the proposal is considered unlikely to have a significant impact on the species
Pachycephala rufogularis	Red-lored Whistler	V	Suitable habitat recorded in the form of PCT 171 and 172. The EPBC Act significance assessment for this species is detailed in Appendix D-1. No – the proposal is considered unlikely to have a significant impact on the species
Pedionomus torquatus	Plains-wanderer	CE	Suitable habitat recorded in the form of PCT 44 and 46. Three birds recorded at Bundure Siding TSR. Preferred habitat identified within the proposal study area. The EPBC Act significance assessment for this species is detailed in Appendix D-1. No – the proposal is considered unlikely to have a significant impact on the species

SCIENTIFIC NAME	COMMON NAME	EPBC ACT	SIGNIFICANT IMPACT?
Polytelis anthopeplus monarchoides	Regent Parrot (eastern subspecies)	V	Suitable habitat recorded in the form of PCT 5, 7, 11, 13, 23, 26, 45, 46, 74, 75, 76, 80, 267 and 277. Recorded at several locations within the proposal study area. Disturbance footprint will remove both foraging and breeding habitat. The EPBC Act significance assessment for this species is detailed in Appendix D-1. No – the proposal is considered unlikely to have a significant impact on the species
Polytelis swainsonii	Superb Parrot	V	Species considered likely to cross above the powerline during migration. The EPBC Act significance assessment for this species is detailed in Appendix D-1. No – the proposal is considered unlikely to have a significant impact on the species
Rostratula australis	Australian Painted Snipe	E	Suitable habitat recorded in the form of PCT 5, 7, 8, 11, 13, 17, 24, 47, 53, 160, 182 and 249. Suitable habitat in the form of ephemeral wetlands identified within the proposal study area. The EPBC Act significance assessment for this species is detailed in Appendix D-1. No – the proposal is considered unlikely to have a significant impact on the species
Mammals			
Chalinolobus dwyeri	Large-eared Pied Bat	V	Suitable habitat recorded in the form of PCT 267 and 277 Scattered records within the locality and predicted habitat within many Inland Slopes PCTs The EPBC Act significance assessment for this species is detailed in Appendix D-1. No – the proposal is considered unlikely to have a significant impact on the species
Dasyurus maculatus maculatus	Spotted-Tailed Quoll (southern subspecies)	E	Suitable habitat recorded in the form of PCT 5, 110, 249, 267 and 277. Proposal occurs within know species distribution, however, lack of potential habitat identified within the proposal study area. The EPBC Act significance assessment for this species is detailed in Appendix D-1. No – the proposal is considered unlikely to have a significant impact on the species

SCIENTIFIC NAME	COMMON NAME	EPBC ACT	SIGNIFICANT IMPACT?
Nyctophilus corbeni	Corben's Long-eared Bat	V	Suitable habitat recorded in the form of PCT 22, 23, 28, 58, 75, 80, 110, 170, 171, 172, 199, 249 and 267. Recorded during field surveys. The EPBC Act significance assessment for this species is detailed in Appendix D-1. No – the proposal is considered unlikely to have a significant impact on the species
Phascolarctos cinereus	Koala	V	Suitable habitat recorded in the form of PCT 5, 7, 8, 11, 13, 15, 74, 75, 76, 80, 110, 249, 267 and 277. Predicted habitat identified in multiple PCTs within the Murrumbidgee, Lower Slopes and Inland Slopes subregion. The EPBC Act significance assessment for this species is detailed in Appendix D-1. No – the proposal is considered unlikely to have a significant impact on the species
Pteropus poliocephalus	Grey-headed Flying-fox	V	Suitable habitat recorded in the form of PCT 5, 76 and 267. Scattered records and known roosting sites within the locality. The EPBC Act significance assessment for this species is detailed in Appendix D-1. No – the proposal is considered unlikely to have a significant impact on the species
Fish			
Bidyanus bidyanus	Silver Perch	CE	Records within the locality. Potential habitat in the form of the Murrumbidgee River identified within the proposal study area. However, due to the nature of powerline construction the proposal is unlikely to impact this species (i.e. powerline will span the river). The EPBC Act significance assessment for this species is detailed in Appendix D-1. No – the proposal is considered unlikely to have a significant impact on the species
Craterocephalus fluviatilis	Murray Hardyhead	CE	Potential habitat in the form of slow flowing lowland rivers (i.e. the Murrumbidgee River) identified within the proposal study area. However, due to the nature of powerline construction the proposal is unlikely to impact this species (i.e. powerline will span the river). The EPBC Act significance assessment for this species is detailed in Appendix D-1. No – the proposal is considered unlikely to have a significant impact on the species

SCIENTIFIC NAME	COMMON NAME	EPBC ACT	SIGNIFICANT IMPACT?
Galaxias rostratus	Flathead Galaxias	CE	Potential habitat in the form of small streams, lakes, billabongs and backwaters identified within the proposal study area. The EPBC Act significance assessment for this species is detailed in Appendix D-1. No – the proposal is considered unlikely to have a significant impact on the species
Maccullochella peelii	Murray Cod	V	Proposal study area within the known range of this species. Potential habitat identified. The EPBC Act significance assessment for this species is detailed in Appendix D-1. No – the proposal is considered unlikely to have a significant impact on the species
Maccullochella macquariensis	Trout Cod	E	Proposal study area within the known range of this species. Potential habitat identified. The EPBC Act significance assessment for this species is detailed in Appendix D-1. No – the proposal is considered unlikely to have a significant impact on the species
Macquaria australasica	Macquarie Perch	E	Species may occur. Preferred habitat (i.e. clear water and deep, rocky holes with lots of cover) not identified within the proposal study area. The EPBC Act significance assessment for this species is detailed in Appendix D-1. No – the proposal is considered unlikely to have a significant impact on the species

9.5.4 Impacts on migratory species

The proposal will have an impact on 12 migratory species listed under the EPBC Act. A summary of impacts is presented in Table 9-28. The outcomes of the significance assessments undertaken in detail in Appendix D-1.

Table 9-28 Listed EPBC Act migratory species summary of significance of impact

MIGRATORY SPECIES		EPBC ACT	SIGNIFICANT IMPACT?
Scientific name	Common name		
Actitis hypoleucos	Common Sandpiper	M	Suitable habitats in the form of freshwater wetlands identified within the proposal study area. The EPBC Act significance assessment for this species is detailed in Appendix D-1. No – the proposal is considered unlikely to have a significant impact on the species

MIGRATORY SPECIES		EPBC ACT	SIGNIFICANT IMPACT?
Scientific name	**Common name**		
Apus pacificus	Fork-tailed Swift	M	The disturbance area may represent an increase in powerline strike for this species. The EPBC Act significance assessment for this species is detailed in Appendix D-1. No – the proposal is considered unlikely to have a significant impact on the species
Calidris acuminata	Sharp-tailed Sandpiper	M	Suitable habitat in the form of Lake Cullivel recorded with the proposal area. The disturbance area may represent an increased powerline collision risk. The EPBC Act significance assessment for this species is detailed in Appendix D-1. No – the proposal is considered unlikely to have a significant impact on the species
Calidris ferruginea	Curlew Sandpiper	CE, M	Suitable habitat in the form of Lake Cullivel recorded with the proposal area. The disturbance area may represent an increased powerline collision risk. The EPBC Act significance assessment for this species is detailed in Appendix D-1. No – the proposal is considered unlikely to have a significant impact on the species
Gallinago harwickii	Latham's Snipe	M	Suitable habitat in the form of intermittent wetlands recorded across the proposal study area. The EPBC Act significance assessment for this species is detailed in Appendix D-1. No – the proposal is considered unlikely to have a significant impact on the species
Grantiella picta	Painted Honeyeater	V, M	Records within the locality and suitable habitat found within the proposal study area. The EPBC Act significance assessment for this species is detailed in Appendix D-1. No – the proposal is considered unlikely to have a significant impact on the species
Hirundapus caudacutus	White-throated Needletail	V, M	Potential foraging habitat occurs over the proposal study area. The EPBC Act significance assessment for this species is detailed in Appendix D-1. No – the proposal is considered unlikely to have a significant impact on the species

MIGRATORY SPECIES		EPBC ACT	SIGNIFICANT IMPACT?
Scientific name	**Common name**		
Leipoa ocellata	Malleefowl	V, M	Abundance of records scattered throughout the locality. Suitable habitat identified onsite. The EPBC Act significance assessment for this species is detailed in Appendix D-1. No – the proposal is considered unlikely to have a significant impact on the species
Limosa lapponica	Bar-tailed Godwit	M	The disturbance area may represent an increased powerline collision risk for the species. The EPBC Act significance assessment for this species is detailed in Appendix D-1. No – the proposal is considered unlikely to have a significant impact on the species
Limosa lapponica baueri	Bar-tailed Godwit (baueri), Western Alaskan Bar-tailed Godwit	V, M	The disturbance area may represent an increased powerline collision risk for the species. The EPBC Act significance assessment for this species is detailed in Appendix D-1. No – the proposal is considered unlikely to have a significant impact on the species
Limosa limosa	Black-tailed Godwit	M	The e disturbance area may represent an increased powerline collision risk for the species. The EPBC Act significance assessment for this species is detailed in Appendix D-1. No – the proposal is considered unlikely to have a significant impact on the species
Tringa nebularia	Common Greenshank	M	The disturbance area may represent an increased powerline collision risk for the species. The EPBC Act significance assessment for this species is detailed in Appendix D-1. No – the proposal is considered unlikely to have a significant impact on the species

9.5.5 Impacts on wetlands of national and international importance

The closest Ramsar listed wetland is Hattah-kulkyne lakes which occurs 10–20 km upstream from the far western end of the proposal and is in Victoria. The Riverland RAMSAR site and Banrock station wetland complex are located about 150 km to the west of the far western end of the proposal, near Renmark, SA. The Coorong, and Lakes Alexandrina and Albert wetland occurs 200–300 kms away in SA. These wetlands will not be directly or indirectly impacted by the proposal. Management measures will ensure that water quality impacts will not occur downstream to these areas.

9.5.6 World and national heritage

No World Heritage Properties or National Heritage Places are located within or nearby the proposal study area.

9.6 Key threatening processes

Key Threatening Processes (KTP's) applicable to the proposal have been considered and are outlined below in Table 9-29.

Table 9-29 Key Threatening Processes

KEY THREATENING PROCESS	RELEVANCE	MITIGATION MEASURES
Clearing of native vegetation	High	The proposal would result in the clearing of native vegetation and contribute to this key threatening process. Avoidance and minimisation of native vegetation have been considered during transmission line corridor placement, including the strategic options assessment and identification and refinement of the proposal process, however, complete avoidance of removal of native vegetation is not practicable. Reductions in native vegetation clearing has been achieved through spanning native vegetation communities in disturbance area B. Within this area native vegetation with growth heights of less than 4 m and 10 m (in the inner and outer maintenance zones, respectively) would be achievable resulting in the overall reduction of full clearing within the construction impact area. Mitigation measures would be implemented during construction to manage the impacts of the proposal on biodiversity values, including clearing of native vegetation. These mitigation measures would be outlined in a Biodiversity Management Plan that would form part of the CEMP. A Biodiversity Management Plan (BMP) would set out measures to minimise and manage impacts on biodiversity. It would include (as a minimum): — measures to minimise impacts to biodiversity, including measures to reduce disturbance to sensitive flora and fauna — a Connectivity Strategy — procedures for clearing of vegetation, including pre-clearing inspections and procedures for the relocation of flora and fauna — procedures for the demarcation and protection of retained vegetation, including vegetation adjacent to construction areas — weed management — rehabilitation strategies including progressive rehabilitation, and measures for the management and maintenance of rehabilitated areas (including duration) — procedures for unexpected EECs or threatened flora and fauna during construction, including stop work procedures — monitoring requirements and compliance management. Additional mitigation measures in relation to clearing of native vegetation are stated in Chapter 10. Whilst the proposal would contribute to the clearing of native vegetation, with the implementation of the above mitigation measures it is unlikely that the proposal would significantly exacerbate this key threatening process.

KEY THREATENING PROCESS	RELEVANCE	MITIGATION MEASURES
Infection of native plants by *Phytophthora cinnamomi*	Low	The proposal has the potential to contribute towards these key threatening processes, however, due to the nature, location and implementation of mitigation measures there is a low likelihood that the proposal would result in these key threatened processes from being established within the proposal study area. Whilst the proposal has the potential to lead to a reduction of native vegetation integrity in surrounding habitats, mitigation measures would be implemented to ensure biosecurity is managed during construction. A BMP would set out measures to minimise and manage impacts on biodiversity associated with weeds and pathogens, including weed management and Transgrid biosecurity protocols.
Introduction and establishment of Exotic Rust Fungi of the order Pucciniales pathogenic on plants of the family Myrtaceae	Low	
Infection of frogs by amphibian chytrid causing the disease chytridiomycosis	Low	
Invasion and establishment of exotic vines and scramblers	Low	
Invasion of native plant communities by exotic perennial grasses	Low	
Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants	Low	
Loss of Hollow-bearing Trees	High	The proposal would contribute towards these key threatening processes. The loss of breeding habitat such as hollow-bearing trees, old growth bull mallee lignotubers, *Triodia* grass clumps and dead fallen timber has the potential to affect native animals such as; — hollow-dependent bats — hollow-nesting and canopy-nesting birds — arboreal mammals — reptiles. The loss of breeding habitats is unlikely to extend beyond the disturbance area.
Removal of dead wood and dead trees	High	

KEY THREATENING PROCESS	RELEVANCE	MITIGATION MEASURES
		Avoidance and minimisation of native vegetation and key habitat features have been considered during transmission line corridor placement, including the strategic options assessment and identification and refinement of the proposal process, however, complete avoidance of removal of these habitat features is not practicable. Mitigation measures would be implemented during construction to manage the impacts of the proposal on habitat features and minimise the effect of these key threatening processes. A BMP would set out the following measures to minimise and manage impacts on biodiversity associated with loss of hollow-bearing tree and removal of dead wood and dead trees: — pre-clearing surveys will be completed prior to construction by a suitability qualified ecologist — implementation of nest box strategy and hollow replacement — retention of habitat features where possible and translocation of habitat features (i.e. fallen timber) in adjacent habitat. Mitigation measures in relation to loss of hollow-bearing tree and removal of dead wood and dead trees are stated in Chapter 10. Whilst the proposal would contribute to these key threatening processes, with the implementation of the above mitigation measures and those in the BMP it is unlikely that the proposal would significantly exacerbate these key threatening process.

9.7 Cumulative impacts (construction)

The concept of assessing cumulative impacts aims to avoid discussing the impact of a development in isolation and aims to assess the impact in terms of the overall past and future degradation of a region's biodiversity resource.

9.7.1 EnergyConnect

The proposal forms part of a EnergyConnect and would share a direct interface at each connection point with the SA section, Victorian Section and the NSW-Western sections. These other proposals are currently within the mixed stages of development and environmental assessment. Ecological impacts will be carefully managed between sections of EnergyConnect but will still result in a linear impact to primarily mallee habitats, similar to those at the western end of the current proposal.

Cumulative impacts pertaining to loss of biodiversity has the potential to extend beyond the construction of the proposal, through the loss of habitat and vegetation. To manage the cumulative biodiversity impacts of EnergyConnect, the options development for EnergyConnect has considered routes to avoid and minimise impacts to biodiversity, and opportunities will continue to be explored during further proposal development and based on further field investigations. In addition to environmentally sensitive design responses, biodiversity offsets will be provided for the proposal, and would be expected for the NSW-Western and Victorian Sections of EnergyConnect, to address cumulative biodiversity impacts where removal of habitat and vegetation is unavoidable. These measures when combined would ensure that a net increase in conservation and protection of impacted species and Plant Community Types.

9.7.2 *Other projects*

The assessment of cumulative impacts has considered projects that are currently under development, or at the planning state that may also influence the assessment of this project's potential impacts. Projects with the potential for cumulative impacts with the proposal were identified through a review of publicly available information and environmental impact assessments from the following databases:

- NSW Major Projects website (NSW Government, searched October 2020)
- Wagga Wagga, Narrandera, Edward River, Murray River, Balranald, Hay council websites (searched October 2021)
- Australian Government – Department of Environment and Energy, EPBC Public notices list (Australian Government, searched October 2020).

A number of proposed developments have been identified and these include:

- Buronga Solar Farm
- Buronga Landfill Expansion
- Buronga – Gol Gol residential expansion
- Inland Rail – Albury to Illabo
- Uranquinty Solar Farm
- Gregadoo Solar Farm.

9.7.2.1 Buronga Solar Farm

The Buronga Solar Farm development includes a 400 MW solar farm with energy storage and associated infrastructure located adjacent to the proposal Buronga substation. The EIS for the project is currently being prepared. The project would also involve the construction of a 220kV or 330kV transmission line for connection to the existing Buronga substation. The construction schedule for the proposal is identified as being about 18 to 24 months from site establishment to completion (noting commencement subject to approval from DPIE).

It is believed that this solar project will mostly occur on cropped lands and is unlikely to result in substantive cumulative impacts.

9.7.2.2 Buronga landfill expansion

The proposal includes the expansion to the existing Buronga landfill to allow for an increase in the total quantity of waste that can be accommodated from 30,000 tonnes to 100,000 tonnes of general waste per annum. The proposal would consist of the construction of multiple additional landfill cells over the next 30 years comprising a volume of about 4.8 million cubic metres over an area of about 395,000 square metres (including the current active landfill cell).

Impacts from this project will be in a distinct area and unlikely to contribute substantially to large regional ecological impacts.

9.7.2.3 Buronga – Gol Gol residential expansion

Wentworth Shire Council is proposing new subdivisions to provide about 500 new large residential housing allotments in the Buronga – Gol Gol growth area, about 10 kilometres to the west of the hydrology and flooding study area

It is not expected that there would be cumulative impacts to flood risk and geomorphology because the development will need to comply with the Wentworth Shire Council Development Control Plan 2011 which outlines conditions for erosion and sediment control and flood liable land.

Impacts from this project will be in a distinct area and unlikely to contribute substantially to large regional ecological impacts.

9.7.2.4 Inland Rail – Albury to Illabo

ARTC is proposing to upgrade the Albury to Illabo section, along the 185 kilometres of existing operational narrow-gauge railway from the Victorian/New South Wales border to Illabo in regional NSW. The Proposal would provide clearance of the existing 'Main South' corridor to operate 1,800 metres long, 6.5 metres high, double stacked trains and includes the provision of dual track in areas for train passing. The project is made up of discrete sections of proposed upgrade, including upgrades within the existing rail corridor at Uranquinty, The Rock and within the centre of Wagga Wagga.

Subject to planning approval, construction is planned to commence in mid-2023 and complete by late 2024. Operations to commence in 2025.

Impacts to biodiversity from this project are comparatively minor as it impacts edge areas along the existing railway. Such impacts are not considered likely to substantially contribute to cumulative impacts in a regional context.

9.7.2.5 Uranquinty Solar Farm

Origin Energy is proposing to develop a commercial scale solar photovoltaic site and associated battery storage at Uranquinty. The proposal would have a capacity of up to 200 megawatts (MW) of renewable energy production for the local electricity supply. The site is located north west of Uranquinty village along Uranquinty Cross Road, around 15 kilometres south west of Wagga Wagga. Given current timing for the proposed solar farm, there is the potential for the proposal and the solar farm construction periods to overlap.

It is believed that this solar project will mostly occur on cropped lands and is unlikely to result in substantive cumulative impacts.

9.7.2.6 Gregadoo Solar Farm

The Gregadoo Solar Farm will be located about 13 km south-east of Wagga Wagga. The project is proposed to comprise construction, operation and decommissioning of a maximum 47 MW solar farm and associated infrastructure. Construction is expected to commence mid-2021.

It is believed that this solar project will mostly occur on cropped lands and is unlikely to result in substantive cumulative impacts.

9.7.3 Cumulative impact conclusion

While these other projects (including other components of EnergyConnect) are in the planning phase and could potentially occur at similar times to the proposal, cumulative impacts during construction are not considered likely to be substantial or significant.

10 Mitigation and management of impacts

This chapter describes the environmental management approach and framework for biodiversity for the proposal during construction and operation.

10.1 Approach to management and mitigation

The environmental management approach has been developed to be consistent with the regulatory requirements for management of biodiversity impacts, during the construction and operational phases of the proposal. Further details on the environmental management approach for the proposal are provided in Chapter 23 (Environmental management and mitigation) of the EIS.

Mitigation measures would be implemented during construction to manage the potential impacts of the proposal on biodiversity values. These mitigation measures would be outlined in a Biodiversity Management Plan (BMP) (including a Connectivity Strategy) that would form part of the CEMP.

Upfront assessment of the proposal's impacts and commitments to mitigation and offsets have been incorporated into the proposal assessment. This approach includes a conservative assessment and upfront mitigation measures in accordance with Section 8.4 of the BAM.

10.1.1 Line strike

In regard to the potential for line strike, the options for mitigation strategies are limited once the structures are in place. Given the stationary nature of the powerlines and their inability to be turned off as is the case for wind farms the principal mitigation is through the provision of line diverters/flappers to deter collision. Transgrid have committed to this upfront mitigation within 1km of the major riparian zones to address uncertain biodiversity impacts relating to line strike combined with the commitment to provide direct offsets for these indirect impacts on affected species credit species.

10.1.2 The proposed disturbance area B4 and B10

Irrespective of the potential proposal related changes within the B4 and B10 disturbance areas the dynamics of undestroyed cover and diversity within the arid environment is also significantly influenced by a range of other variables, notably; fire, water availability/drought, grazing, soil crust (Noble &, Bradstock 1996, Walker & Koen 1995, Kerle 2008). These variables are likely to have disproportionate greater impacts on any future site values scores of the understorey outside of the control of Transgrid's management. A clear example of the potential impact of one of variables, was seen in the (>50% decrease in cover and species diversity) site values score of the Mallee PCT 171 following drought conditions when compared to post drought site values used in this assessment. Similarly, a >90% decrease in site values scores were observed in the derived grasslands areas of PCT 171 significantly impacted by grazing.

Conservative assessment of impacts in this BDAR is supported by scientific literature that maximises upfront liability in the preference to any future implementation of management or review of site value scenarios and offset liabilities.

In addition, the BMP will still include measures such as weed maintenance, limiting ground disturbance and other activities outside of minimum requirements to manage vegetation for ecological purposes.

10.1.3 EMF for nesting birds in towers

A review of available scientific literature on EMF indicates that it is likely that EMF's may influence the physiology of birds nesting on transmission towers. However, the levels of those effects to each species under a range of different conditions is not easily quantifiable and there is currently no conclusive evidence to suggest that such effects would have a significant effect on the long-term viability of local bird populations. The EMF Study for the proposal by BECA also states that:

"There is a body of research examining the effects of EMF on the reproductive biology and physiology of birds in the wild and under aviary conditions. Most studies indicate that EMF exposure of birds generally changes, but not always consistently in effect or in direction, their behaviour, reproductive success, growth and development, physiology and endocrinology, and oxidative stress under EMF conditions".

From data derived from a range of studies, it is considered likely that EMFs may influence the physiology of birds nesting on transmission towers. However, the levels of those effects to each species under all different conditions is not easily quantifiable and there is currently no conclusive evidence that such effects would be significant on the long-term viability of local bird populations (Tomas, Barba et al. 2012) (Fernie and Bird 2001).

In essence the studies indicate that there are no known substantial impacts to biodiversity (particularly nesting birds) as a result of EMF.

A preference for the conservative assessment of impacts that maximises upfront liability in the preference to any future implementation of uncertain management has been applied. The key measures proposed are:

- upfront commitment to provide direct offsets for indirect impacts on affected species credits that includes consideration of both EMF and birdstrike impacts in areas that do not currently already have transmission lines.

10.2 Mitigation measures

10.2.1 Final design refinement phase

Impacts to matters of biodiversity conservation significance will be avoided to the greatest extent practicable during finalisation of the design and construction methodology for the proposal. Micro siting of the transmission line infrastructure and associated construction working areas and other areas of disturbance would occur to avoid impacts wherever practicable. Site features with the highest biodiversity conservation significance will be given the highest priority. In particular threatened species recorded and their habitat.

Where native vegetation disturbance activities are required in areas that have not been previously subject to biodiversity survey, additional survey will be carried out prior to works occurring in any such areas and to inform design refinement. Additionally this will potentially allow for impact reduction through field validation of conditions which have been assessed conservatively at this stage with assumed presence. These surveys will be carried out by a suitably qualified ecologist.

Opportunities to locate site offices, compounds and ancillary facilities in areas of limited biodiversity value (e.g. cleared land or areas of native vegetation with vegetation integrity scores of less than 17) will be prioritised during design refinement.

Existing tracks and clearings will be used, where possible, to avoid the construction of new tracks. Where this is not possible, the design will seek to minimise impacts to native vegetation.

Transmission line structures will be located and constructed to minimise impact to vegetated riparian zones wherever practicable.

Transgrid will establish a series of 20-metre-wide connectivity corridors near tower locations that occur in woodland vegetation. These would occur at strategic locations that would be developed as part of a Connectivity Strategy under the Biodiversity Management Plan. These connectivity corridors will involve native vegetation retention up to the 10 metre (330kV line) or 20 metre (500kV line) wide temporary construction centreline clearing zone to better facilitate woodland connectivity. The inclusion of these corridors would also assist in further reducing clearing volumes during design refinement stage. Connectivity corridors would occur as a minimum at:

- key riparian crossings (Murrumbidgee River, Yanco Creek, Colombo Creek) and
- areas of the alignment joining proposed biodiversity stewardship sites and or conservation reserve estate
- areas of existing dense mallee/belah.

Exact locations and mapping of connectivity areas would be based on the Connectivity Strategy which would be subject to review as part of the BMP review by BCD.

Any biodiversity credit liabilities related to retained vegetation such as the connectivity corridors will be considered in final BAM calculations (refer to mitigation measures B2 and Section 12.4 Biodiversity offset strategy.

The primary design mitigation measures to be directed towards bird impacts are:

- minimising interaction of birds with the powerlines which might otherwise result in injury or fatality; and
- minimising nesting on the tower structures, which might otherwise result in low-level EMF impacts to birds.

The following electrical transmission industry-recognised method is proposed in regard to mitigating birdstrike and EMF impacts during the design refinement phase:

- use of bird diverters, most likely consisting of the “flapper” variety. Positioning and exact diverter model is to be finalised during design refinement but at minimum these will be used within 1 km of wetland/riverine habitats to reduce impacts on aerial fauna species from collision and allow safer passage within these areas.

10.2.2 Pre-construction phase

In addition to the development and implementation of the CEMP, specific mitigation measures have been identified for inclusion in a BMP. The proposed measures have been identified to manage both construction and operational impacts and some measures have been identified to manage impacts in a site-specific location. The location/s applicable to each mitigation measure are identified in the table where relevant.

For construction, the BMP would set out measures to minimise and manage impacts on biodiversity. It would include (as a minimum):

- measures to minimise impacts to biodiversity, including measures to reduce disturbance to sensitive flora and fauna
- procedures for clearing of vegetation, including pre-clearing inspections and procedures for the relocation of flora and fauna
- procedures for the demarcation and protection of retained vegetation, including vegetation adjacent to construction areas
- weed management
- habitat supplementation measures such as nest boxes, hollow re-use / creation and re-use of timber / logs as habitat in broader easement area if practicable
- rehabilitation strategies including progressive rehabilitation, and measures for the management and maintenance of rehabilitated areas (including duration)
- procedures for unexpected EECs or threatened flora and fauna during construction, including stop work procedures
- monitoring requirements and compliance management
- approach to relocation of nests found within construction area (i.e. nests found in hazardous areas will be translocated to nearby safe areas, direct handling of eggs and chicks will be avoided). This could include potentially new poles/nest platforms
- approach to avoid building in raptor nesting periods.

Other specific pre-construction measures are also listed in Table 10-1. These include preparation of:

- Supplementary Hollow and Nest Strategy to offset loss of tree hollow fauna habitat.

10.2.3 Construction phase

The construction phase would be guided by implementation of the CEMP and related BMP as well as the Supplementary Hollow and Nest Strategy. Other specific construction measures are also listed in Table 10-1.

10.2.4 Operation phase

Transgrid will develop and implement guidelines and procedures for operation and maintenance of the proposal that address the vegetation clearing and maintenance commitments in the BDAR and EIS and seek to avoid or minimise disturbance in areas of high biodiversity conservation significance. Relevant Transgrid operational personnel and vegetation maintenance contractors will receive training regarding the operational and maintenance guidelines and procedures.

Proposed mitigation measures are detailed below in Table 10-1.

Table 10-1 Mitigation measures

REFERENCE	MITIGATION MEASURES	TIMING	APPLICATION LOCATION(S)
B1	Impacts to matters of biodiversity conservation significance would be avoided to the greatest extent practicable during finalisation of the design and construction methodology for the proposal. Micro-siting of the transmission line infrastructure and associated construction working areas and other areas of disturbance would occur to avoid impacts wherever practicable. Site features with the highest biodiversity conservation significance, in particular, threatened species recorded and their habitat would be given the highest priority. Spatial data (species polygons for species credit species) and buffered threatened species locations would be provided to the design and construction teams and considered in detailed construction planning. Associated mapping would be included on sensitive area plans and provided to the construction workforce.	Pre-construction	All locations
B2	If refinements to the proposal design and construction methodology or additional field surveys result in changed impacts to biodiversity which are not included in this BDAR, these would be assessed in accordance with the requirements of the BAM by an accredited assessor.	Pre-construction and construction	All locations
B3	Opportunities to locate site offices, compounds and ancillary facilities in areas of limited biodiversity value (e.g. cleared land or areas of native vegetation with vegetation integrity scores of less than 17 in accordance with the NSW Government Biodiversity Assessment Method Operational Manual) would be prioritised during finalisation of the design and construction methodology.	Pre-construction	All locations
B4	Existing tracks and clearings would be used, where possible, to limit the construction of new tracks. Where this is not possible, the design would seek to minimise impacts to native vegetation, including cut and fill, as a priority.	Pre-construction and construction	Transmission line corridor
B5	Transmission line structures would be located and constructed to minimise impact to vegetated riparian corridors.	Pre-construction	Transmission line within the riparian corridor as defined by “Guidelines for riparian corridors on waterfront land” (DPI – Office of Water, July 2012) of Murrumbidgee River

REFERENCE	MITIGATION MEASURES	TIMING	APPLICATION LOCATION(S)
B6	Conductor line-marking techniques would be implemented during design refinement to minimise bird strike. Use of bird diverters, most likely consisting of the "flapper" variety, would be implemented. Positioning and exact diverter model would be finalised during design refinement but at minimum these would be used within one kilometre of wetland/riverine habitats to reduce impacts on aerial fauna species from collision and allow safer passage within these areas.	Pre-construction and construction	Transmission line – within one kilometre of wetland/riverine habitats (i.e. Murrumbidgee River)
B7	A series of 20-metre-wide connectivity corridors would be established near tower locations that occur in woodland vegetation. These would occur at strategic locations that would be developed as part of a Connectivity Strategy under the Biodiversity Management Plan, targeting the following locations (wherever practicable): — key riparian crossings — areas of the alignment joining proposed biodiversity stewardship sites and or conservation reserve estate; and — areas of existing dense mallee/belah. These connectivity corridors would involve native vegetation retention up to the 10 metre or 20 metre (for 330kV and 500kV lines, respectively) wide temporary construction centreline clearing zone to better facilitate woodland connectivity. Vegetation heights to be retained would be determined in accordance with vegetation clearing requirements at each location. Any biodiversity credit liabilities related to retained vegetation such as the connectivity corridors will be considered in final BAM calculations (refer to mitigation measures B2 and Section 12.4 Biodiversity offset strategy.	Pre-construction	All locations

REFERENCE	MITIGATION MEASURES	TIMING	APPLICATION LOCATION(S)
B8	Nest boxes would be provided to provide alternative roosting habitat for threatened fauna displaced during clearing in accordance with a Supplementary Hollow and Nest Strategy. The strategy would include the following requirements: — survey of tree hollows and nests within the proposed clearing extents — identify the size, type, number and location of nest boxes required based on the results of the ecological surveys and active hollow resources in adjacent areas — appropriately sized nest boxes would be installed within the vicinity of hollow-bearing trees (subject to landowner agreement and suitable existing trees being present) no more than two weeks prior to clearing of the tree — nest boxes would also include the re-use of existing hollows salvaged prior to or during clearing where practicable; and — measures to address and manage nests (such as raptor nests) prior to clearing.	Pre-construction and construction	All locations where hollow bearing trees are being removed
B9	Pre-clearing surveys would be completed prior to clearing at each location by a suitability qualified ecologist. The proposed clearing extents would be marked out on site prior to the pre-clearing surveys. During the surveys, the ecologist would: — survey the proposed clearing extent — identify any fauna that would require relocation prior to clearing — confirm the location and mark out the extents of any biodiversity exclusion zones — confirm that hollow-bearing trees within and adjacent to the clearing extents are prominently marked/tagged; and — confirm that nest boxes are in place (where required) in suitable locations adjacent to areas to be cleared, or suitable locations for installation have been identified.	Pre-construction	All locations
B10	The results of the pre-clearing surveys would be used to update and confirm the accuracy of sensitive area maps.	Pre-construction	All locations

REFERENCE	MITIGATION MEASURES	TIMING	APPLICATION LOCATION(S)
B11	Biodiversity exclusion zones for retained vegetation would be confirmed by a suitably qualified ecologist and identified as 'No disturbance' zones prior to the commencement of clearing or any site activity that could damage the vegetation within the exclusion zone. 'No disturbance' zones would consider: — identified Plains-wanderer habitat — identified threatened flora populations and — PCTs in disturbance area B that are not of a growth form height that would ever require management. Biodiversity exclusion zones would be physically marked and demarcated, and included on sensitive area maps, prior to clearing.	Pre-construction	All locations
B12	A Plains-wanderer specific protocol would be developed to ensure that all project staff are aware of the sensitivities around this critically endangered species and to ensure that all specific requirements in relation to protection, avoidance, management and observation of individual Plains-wanderers are considered, in association with BCD staff.	Pre-construction	All locations
B13	All relevant project personnel, including relevant sub-contractors would be trained on biodiversity management protocols and the requirements for the project, through inductions, toolbox talks and targeted training, and provided with sensitive area maps (showing clearing boundaries and exclusion zones) and updates as required.	Construction	All locations
B14	The predicted clearing of native vegetation by the proposal would be monitored against the recorded clearing. A revised BAM-C calculation on the project's final project disturbance post construction would be completed and any additional credit liability identified would be met as part of the biodiversity offset requirements within the biodiversity offset package.	Construction	All locations
B15	Shrub or ground stratum native vegetation within vegetated riparian zones (within the definition of *Water Management Act 2000*) of defined riparian areas would be protected to the greatest extent practicable, with vegetation clearing ideally limited to the tree stratum only, with trunk bases being retained in-situ.	Construction	Transmission line within the riparian corridor as defined by "Guidelines for riparian corridors on waterfront land" (DPI – Office of Water, July 2012)

REFERENCE	MITIGATION MEASURES	TIMING	APPLICATION LOCATION(S)
B16	Activities within vegetated riparian zones would be managed to minimise impacts to aquatic environments. Riparian areas subject to disturbance would be progressively stabilised and rehabilitated.	Construction	Transmission line within the riparian corridor as defined by "Guidelines for riparian corridors on waterfront land"
B17	A species unexpected finds protocol would be implemented if threatened ecological communities, flora and fauna species, not assessed in the biodiversity assessment, are identified in the disturbance area.	Construction	All locations
B18	Clearing of any hollow bearing trees within the mapped PCT 8 and PCT 11 vegetation at the crossing point of the Murrumbidgee River would be undertaken outside of the period between September and December to avoid key breeding periods of the Regent Parrot.	Construction	Murrumbidgee River
B19	Features of high biodiversity conservation significance within the operational easement, including biodiversity exclusions zones identified during construction and retained habitat for threatened species, would be recorded in Transgrid's GIS. The GIS information will be reviewed during the planning of all maintenance or other future activities that could cause disturbance.	Operation	All locations
B20	Develop and implement guidelines and procedures for operation and maintenance of the proposal that address the following: — vegetation clearing and maintenance commitments in the BDAR and EIS — avoiding access and disturbance in biodiversity exclusion zones identified during the construction — avoiding access and disturbance in areas of high biodiversity conservation significance; and — avoiding maintenance of vegetation that does not need to be maintained during operation. Provide training to relevant Transgrid operational personnel and vegetation maintenance contractors regarding the operational and maintenance guidelines and procedures.	Operation	All locations

11 Impact summary – thresholds for assessment and offsetting impacts

This chapter sets out the impact thresholds for residual impacts to biodiversity values after avoid, minimise and mitigate measures have been applied. Thresholds for assessment and offsetting impacts are outlined in Chapter 9 of the BAM and include:

- impacts on biodiversity values at risk of a serious and irreversible impact
- impacts that require offsetting
- impacts which do not require offsetting
- impacts that do not require further assessment.

11.1 Serious and irreversible impacts

This section identifies every potential serious and irreversible impact (SAII) entity that are listed in the Guidance to assist a decision-maker to determine a serious and irreversible impact that would be caused on by the proposal site.

Impact assessment of potential entities of SAII impacts on biodiversity values are outlined under Chapter 9 of the BAM and addressed below.

11.1.1 Threatened ecological communities SAII entities

To assist the determining authority to evaluate the nature of an impact on a potential entity at risk of a serious and irreversible impact, the BDAR must contain details of the assessment of SAII, in accordance with the assessment criteria set out in the BAM.

The following SAII threatened ecological communities are considered to be affected by the proposal:

- *Allocasuarina luehmannii* Woodland in the Riverina and Murray-Darling Depression Bioregions
- White Box Yellow Box Blakely's Red Gum Woodland and Derived Native Grassland.

11.1.1.1 *Allocasuarina luehmannii* Woodland in the Riverina

Allocasuarina luehmannii Woodland in the Riverina and Murray-Darling Depression Bioregions is identified as candidate SAII entities in the BioNet Atlas. The extent to which this proposal impacts on this SAII TEC is provided in Table 11-1 and in Appendix D-2.

Table 11-1 Extent of the SAII threatened ecological community *Allocasuarina luehmannii* Woodland in the Riverina and Murray-Darling Depression Bioregions within the disturbance area

THREATENED ECOLOGICAL COMMUNITY	VEGETATION TYPE	IBRA SUBREGION	VEG ZONE NAME (BAM-C)	DIRECT IMPACT (HA)
Allocasuarina luehmanii woodland in the Riverina and Murray-Darling Depression bioregions	PCT 22 – Semi-arid shrubby Buloke – Slender Cypress Pine woodland, far south-western NSW	South Olary Plain	VZ #2 22_Mod-good	2.93
Total				**2.93**

An assessment of *Allocasuarina luehmannii* Woodland in the Riverina and Murray-Darling Depression Bioregions was assessed against the serious and irreversible impacts on biodiversity values in accordance with section 9.1.1 of the BAM and is provided in Table 11-2.

Table 11-2 SAII assessment for the threatened ecological community *Allocasuarina luehmannii* Woodland in the Riverina and Murray-Darling Depression Bioregions

ASSESSMENT REQUIREMENTS	***ALLOCASUARINA LUEHMANNII* WOODLAND IN THE RIVERINA AND MURRAY-DARLING DEPRESSION BIOREGIONS**
1. The action and measures taken to avoid the direct and indirect impact on the TEC at risk of an SAII	1. The direct impacts on *Allocasuarina luehmannii* Woodland in the Riverina and Murray-Darling Depression Bioregions (*Allocasuarina luehmannii* Woodland) have been avoided where possible through design refinement. This proposal has utilised co-location with existing electrical transmission easement (X5) to avoid further fragmentation and isolation of as many areas of ecological constraint (including *Allocasuarina luehmannii* Woodland) as practical. Direct impact can be further avoided through design refinement and through careful placement of compound sites and construction zones. Indirect impacts will be managed through mitigation measures which are outlined in Chapter 10.
2. The assessor must consult the TBDC and/or other sources to report on the current status of the TEC including: a. evidence of reduction in geographic distribution (Principle 1, clause 6.7(2)(a) BC Regulation) as the current total geographic extent of the TEC in NSW AND the estimated reduction in geographic extent of the TEC since 1970 (not including impacts of the proposal) b. extent of reduction in ecological function for the TEC using evidence that describes the degree of environmental degradation or disruption to biotic processes (Principle 2, clause 6.7(2)(b) BC Regulation) indicated by: i. change in community structure ii. change in species composition iii. disruption of ecological processes iv. invasion and establishment of exotic species v. degradation of habitat, and vi. fragmentation of habitat.	2.a. The total current extent of *Allocasuarina luehmannii* Woodland is estimated to be about 1,300 hectares. *Allocasuarina luehmannii* Woodland is known to be associated with two PCTs being: — PCT 20 – Buloke – Moonah – Black Box open woodland on sandy rises of semi-arid (warm) climate zone (mainly Riverina Bioregion and Murray Darling Depression Bioregion) — PCT 22 – Semi-arid shrubby Buloke – Slender Cypress Pine woodland, far south-western NSW The estimated reduction in geographic extent of the TEC since 1970 is unknown, although the TBDC has estimated that about 1,000 hectares of PCT 20 remains in NSW. The reduction in geographic distribution of PCT 20 from an estimated pre-European extent of about 8000 hectares is 88%. The estimated reduction in geographic distribution of PCT 22 is about 80% having a pre-European extent of about 1,000 hectares to a current estimated extent of 300 hectares. 2.b. Within the disturbance area, this community currently occurs in mod-good condition with a vegetation integrity score of 60.8.

ASSESSMENT REQUIREMENTS	*ALLOCASUARINA LUEHMANNII* WOODLAND IN THE RIVERINA AND MURRAY-DARLING DEPRESSION BIOREGIONS
	In terms of floristic composition and structural changes to *Allocasuarina luehmannii* Woodland, the proposal will impact a total extent area of 2.93 hectares. This impact includes a completed vegetation integrity loss in disturbance area A of 1.20 hectares where vegetation integrity loss of -60.8 is calculated. The remaining 1.73 hectares (disturbance area B4 and B10) is estimated to have a vegetation integrity loss of -31.9 giving a total vegetation integrity loss of -43.7 for this TEC (refer to Table 9-3). In relation to disruption of ecological processes, weed invasion, degradation of habitat and habitat fragmentation, the proposal is co-located adjacent to an existing electrical transmission line (X5) and as such impacts will be limited to edges of vegetation patches and not result in further fragmentation of larger habitat patches. Given this and the fact that the disturbance area B4 and B10 will retain partial native vegetation cover, the proposal is unlikely to significantly degrade or increase fragmentation of this community within the region.
3. Where the TBDC indicates data is 'unknown' or 'data deficient' for a TEC for a criterion listed in Subsection 9.1.1(2.), the assessor must record this in the BDAR.	3. *Allocasuarina luehmannii* Woodland is not listed in the TBDC as a data deficient entity.
4.a. the impact on the geographic extent of the TEC (Principles 1 and 3) by estimating the total area of the TEC to be impacted by the proposal: i. in hectares, and ii. as a percentage of the current geographic extent of the TEC in NSW. 4.b. the extent that the proposed impacts are likely to contribute to further environmental degradation or the disruption of biotic processes (Principle 2) of the TEC by: i. estimating the size of any remaining, but now isolated, areas of the TEC; including areas of the TEC within 500 m of the development footprint or equivalent area for other types of proposals ii. describing the impacts on connectivity and fragmentation of the remaining areas of TEC measured by: • distance between isolated areas of the TEC, presented as the average distance if the remnant is retained AND the average distance if the remnant is removed as proposed, and	4.a. the direct impacts to this SAII entity is: — PCT 22 – Semi-arid shrubby Buloke – Slender Cypress Pine woodland, far south-western NSW – moderate to good condition will be 2.93 hectares. The impact of 2.93 hectares of *Allocasuarina luehmannii* Woodland comprises of 1.20 hectares of total removal (disturbance area A) and 1.73 hectares of partial removal (disturbance areas B4 and B10). Indirect impact will be managed through mitigation measures outlined in Chapter 10. In NSW the current geographic extent of *Allocasuarina luehmannii* Woodland has been estimated to be 1,300 hectares. The total loss of 1.20 hectares and partial loss of 1.73 hectares as a result of the proposal would constitute an additional loss of about 0.22% of the current geographic extent of the TEC in NSW.

ASSESSMENT REQUIREMENTS	*ALLOCASUARINA LUEHMANNII* WOODLAND IN THE RIVERINA AND MURRAY-DARLING DEPRESSION BIOREGIONS
• estimated maximum dispersal distance for native flora species characteristic of the TEC, and • other information relevant to describing the impact on connectivity and fragmentation, such as the area to perimeter ratio for remaining areas of the TEC as a result of the development iii. describing the condition of the TEC according to the vegetation integrity score for the relevant vegetation zone(s).	4b. The proposal mostly impacts already fragmented and isolated patches of *Allocasuarina luehmannii* Woodland. Large more intact patches occur to the south of the alignment at Balranald substation. These better-quality intact patches will not be directly or indirectly impacted by the proposal. The closest patch to the proposal is within the Balranald – Wombah TSR where a patch of about 8 hectares occurs. Small patches also occur to the north and south of the proposal within the TSR. These patches will not be directly or indirectly impacted by the proposal. All patches of *Allocasuarina luehmannii* Woodland are considered small with high edge area ratios. Threats to the TEC are considered consistent with many other listed TECs being, vegetation clearing, fragmentation, weed invasion, and overgrazing from both feral and domestic stock. The largest threat, outside of vegetation clearing is poor recruitment and subsequent low genetic diversity / inbreeding (Department of Planning Industry and Environment 2021). In terms of threats, the proposal is considered unlikely to result in substantial alteration of surface water flows or groundwater levels, fire or flooding regimes, this will continue to be monitored during further design refinement phase. The proposal would not include use of fertilisers or other pollutants which would inhibit or impact the community. Mitigation measures have been provided (Chapter 10) to minimise any potential indirect impacts to remaining areas of the community. In terms of condition of the TEC according to the vegetation integrity score for *Allocasuarina luehmannii* Woodland, the proposal will impact a total extent area of 2.93 hectares. This impact includes a completed vegetation integrity loss in disturbance area A of 1.20 hectares where vegetation integrity loss of -60.8 is calculated. The remaining 1.73 hectares (disturbance area B4 and B10) is estimated to have a vegetation integrity loss of -31.9 giving a total vegetation integrity loss of -43.7 for this TEC (refer to Table 9-3).
5. The assessor may also provide new information that demonstrates that the principle identifying that the TEC is at risk of an SAII is not accurate.	5. This BDAR does not provide any new information that demonstrates that the principle identifying that the TEC is at risk of an SAII is not accurate.

11.1.1.2 White Box Yellow Box Blakely's Red Gum Woodland and Derived Native Grassland

White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland is identified as candidate SAII entities in the BioNet Atlas (Environment Energy and Science 2021). The extent to which this proposal impacts on this SAII TEC is provided in Table 11-3 and in Appendix D-2.

Table 11-3 Extent of the SAII threatened ecological community White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland within the disturbance area

THREATENED ECOLOGICAL COMMUNITY	VEGETATION TYPE	IBRA SUBREGION	VEG ZONE NAME (BAM-C)	DIRECT IMPACT (HA)
White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland	PCT 74 – Yellow Box – River Red Gum tall grassy riverine woodland of NSW South Western Slopes Bioregion and Riverina Bioregion	Lower Slopes	VZ #14 74_Mod-good	0.91
		Inland slopes	VZ #1 74_Mod-good	1.16
	PCT 75 – Yellow Box – White Cypress Pine grassy woodland on deep sandy-loam alluvial soils of the eastern Riverina Bioregion and western NSW South Western Slopes Bioregion	Murrumbidgee	VZ #32 75_Mod-good	0.21
		Lower Slopes	VZ #2 75_Mod-good	28.80
			VZ #9 75_Poor	1.5
			VZ #10 75_Derived	4.69
			VZ #13 75_SVM_Bench	0.42
	PCT 267 – White Box – White Cypress Pine – Western Grey Box shrub/grass/forb woodland in the NSW South Western Slopes Bioregion	Inland Slopes	VZ #6 267_Mod-good	0.26
	PCT 277 – Blakely's Red Gum – Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion	Inland Slopes	VZ #4 277_Mod-good	2.92
			VZ #7 277_Derived	0.57
Total				**41.44**

An assessment of White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland was assessed against the serious and irreversible impacts on biodiversity values in accordance with section 9.1.1 of the BAM and is provided in Table 11-4.

Table 11-4 SAII assessment for the threatened ecological community White Box Yellow Box Blakely's Red Gum Woodland and Derived Native Grassland

ASSESSMENT REQUIREMENTS	WHITE BOX YELLOW BOX BLAKELY'S RED GUM WOODLAND AND DERIVED NATIVE GRASSLAND
1. The action and measures taken to avoid the direct and indirect impact on the TEC at risk of an SAII	1. The direct impacts on White Box Yellow Box Blakely's Red Gum Woodland and Derived Native Grassland (Box Gum Woodland) have been avoided where possible through design refinement. This proposal has utilised co-location with existing electrical transmission easements where possible to avoid further fragmentation and isolation of as many areas of ecological constraint (including Box Gum Woodland) as practical. In greenfield areas between Four Corners and Lockhart the proposal has been modified and refined in places to avoid Box Gum Woodland. An example of avoidance of this TEC is along Gums Lane where the proposed transmission line was moved slightly northward between towers 224 and 230 to avoid impacts to a patch of PCT 75 in mod-good condition. In this location avoidance of a patch of Box Gum Woodland that fringed an unformed section of Gums Lane for about 3.2 kilometers was achieved. Direct impact can be further avoided through design refinement and through careful placement of compound sites and construction zones. Indirect impacts will be managed through mitigation measures which are outlined in Chapter 10.
2. The assessor must consult the TBDC and/or other sources to report on the current status of the TEC including: a. evidence of reduction in geographic distribution (Principle 1, clause 6.7(2)(a) BC Regulation) as the current total geographic extent of the TEC in NSW AND the estimated reduction in geographic extent of the TEC since 1970 (not including impacts of the proposal) b. extent of reduction in ecological function for the TEC using evidence that describes the degree of environmental degradation or disruption to biotic processes (Principle 2, clause 6.7(2)(b) BC Regulation) indicated by: i. change in community structure ii. change in species composition iii. disruption of ecological processes iv. invasion and establishment of exotic species v. degradation of habitat, and vi. fragmentation of habitat.	2a. The scientific determination for Box Gum Woodland lists the community as Critically Endangered with an estimated reduction in geographic distribution of 90%. The estimated reduction in geographic extent of the TEC since 1970 is unknown although the scientific determination for Box Gum Woodland estimates that the annual rate of loss for the TEC between the period 2009–2018 for the NSW South Western Slopes was 545 hectares. 2.b. Within the disturbance area, this community currently occurs in a range of conditions including mod-good, poor and derived. Benchmark condition was applied where state vegetation mapping was used in area where access had not been permitted, as this was considered to be a conservative approach. Vegetation integrity scores (VI) for each condition class can be viewed in Section 1.1.1 and Section 4.4.6.

ASSESSMENT REQUIREMENTS	WHITE BOX YELLOW BOX BLAKELY'S RED GUM WOODLAND AND DERIVED NATIVE GRASSLAND
	The proposal will impact a total of 40.44 hectares of Box Gum Woodland. In terms of floristic composition and structural changes to Box Gum Woodland, the proposal will impact 21.07 hectares within disturbance area A where all vegetation will be removed to ground level, thereby substantially changing the vegetation structure and composition. The remaining 20.37 hectares (disturbance area B4 and B10) will only require vegetation trimming to meet vegetation clearance heights and the ground cover will be undisturbed. This will change the vegetation structure but will change the species composition to a lesser degree compared to area A leading to a reduced change in VI score. Change in VI score per disturbance area and total VI loss can be viewed in Table 9-5, Table 9-6 and Table 9-7. In relation to disruption of ecological processes, weed invasion, degradation of habitat and habitat fragmentation, the proposal is co-located adjacent to an existing electrical transmission line (X5) and as such impacts will be limited to edges of vegetation patches and not result in further fragmentation of larger habitat patches. . In the greenfield areas between Four Corners and Lockhart, the proposal sought to co-locate adjacent to existing road infrastructure and agricultural areas to limit impacts to edges of vegetation patches and reduce further fragmentation of larger patches. Examples of co-location of road infrastructure include West Gum's lane, Andriske's lane, Urana-Lockhart road, Tenison lane and King's road; examples of co-location of agricultural areas include between tower 224 and 240. Given this and the fact that the disturbance area B4 and B10 will retain partial native vegetation cover, the proposal is unlikely to significantly degrade or increase fragmentation of this community within the region.
3. Where the TBDC indicates data is 'unknown' or 'data deficient' for a TEC for a criterion listed in Subsection 9.1.1(2.), the assessor must record this in the BDAR.	3. Box Gum Woodland is not listed in the TBDC as a data deficient entity.
4.a. the impact on the geographic extent of the TEC (Principles 1 and 3) by estimating the total area of the TEC to be impacted by the proposal: i. in hectares, and ii. as a percentage of the current geographic extent of the TEC in NSW.	4.a. The direct impacts to this SAII entity is: — PCT 74 – 2.07 hectares — PCT 75 – 35.62 hectares — PCT 267 – 0.26 hectares — PCT 277 – 3.49 hectares — Total impact on Box Gum Woodland is 41.44 hectares Indirect impact will be managed through mitigation measures outlined in Chapter 10.

ASSESSMENT REQUIREMENTS	WHITE BOX YELLOW BOX BLAKELY'S RED GUM WOODLAND AND DERIVED NATIVE GRASSLAND
4.b. the extent that the proposed impacts are likely to contribute to further environmental degradation or the disruption of biotic processes (Principle 2) of the TEC by: i. estimating the size of any remaining, but now isolated, areas of the TEC; including areas of the TEC within 500 m of the development footprint or equivalent area for other types of proposals ii. describing the impacts on connectivity and fragmentation of the remaining areas of TEC measured by: • distance between isolated areas of the TEC, presented as the average distance if the remnant is retained AND the average distance if the remnant is removed as proposed, and • estimated maximum dispersal distance for native flora species characteristic of the TEC, and • other information relevant to describing the impact on connectivity and fragmentation, such as the area to perimeter ratio for remaining areas of the TEC as a result of the development iii. describing the condition of the TEC according to the vegetation integrity score for the relevant vegetation zone(s).	In NSW the current geographic extent of Box Gum Woodland has been estimated to be 250,000 hectares. The loss of 40.14 hectares as a result of the proposal would constitute an additional loss of less than 0.02% to the current geographic extent of the TEC in NSW. 4b. The extent of Box Gum Woodland within 500 meters of the proposal is mostly highly fragmented with patches occurring in an agricultural landscape. Most patches are degraded from sheep and other domestic stock grazing practices with many remnant elements reduced to scattered trees in cropping land. In terms of threats, the proposal is considered unlikely to result in substantial alteration of surface water flows or groundwater levels, fire or flooding regimes, this will continue to be monitored during further design refinement phase. The proposal would not include use of fertilisers or other pollutants which would inhibit or impact the community. Mitigation measures have been provided (Chapter 10) to minimise any potential indirect impacts to remaining areas of the community. In terms of condition of the TEC according to the vegetation integrity score for Box Gum Woodland, the proposal will impact a total extent area of 41.44 hectares. This impact includes a complete vegetation integrity loss in disturbance area A of 21.07 hectares and a partial vegetation integrity loss in the remaining 20.37 hectares (disturbance area B4 and B10). Vegetation integrity loss can be viewed for each vegetation zone and disturbance area in Table 9-5, Table 9-6 and Table 9-7.
5. The assessor may also provide new information that demonstrates that the principle identifying that the TEC is at risk of an SAII is not accurate.	5. This BDAR does not provide any new information that demonstrates that the principle identifying that the TEC is at risk of an SAII is not accurate.

11.1.2 Threatened flora candidate SAII entities

Two SAII threatened flora listed under the BC Act are considered affected species by the proposal. These are:

- *Pilularia novae-hollandiae* (Austral Pillwort)
- *Pimelea serpyllifolia* subsp. *serpyllifolia* (Thyme Rice-Flower).

The extent to which this proposal impacts on these SAII threatened flora candidate species are provided in Table 11-5 and Table 11-6.

Table 11-5 SAII assessment for candidate threatened flora species *Pilularia novae-hollandiae*

ASSESSMENT REQUIREMENTS	***PILULARIA NOVAE-HOLLANDIAE***
1. The action and measures taken to avoid the direct and indirect impact on a species at risk of an SAII	1. the direct impacts on *Pilularia novae-hollandiae* have been avoided where possible through design refinement. Direct impact can be further avoided through design refinement and through careful placement of compound sites and construction zones. Indirect impacts will be managed through mitigation measures which are outlined in Chapter 10
2. The assessor must consult the TBDC and/or other sources to report on the current population of the species including: a. evidence of rapid decline (Principle 1, clause 6.7(2)(a) BC Regulation) presented by an estimate of the: i. decline in population of the species in NSW in the past 10 years or three generations (whichever is longer), or ii. decline in population of the species in NSW in the past 10 years or three generations (whichever is longer) as indicated by: an index of abundance appropriate to the species; decline in geographic distribution and/or habitat quality; exploitation; effect of introduced species, hybridisation, pathogens, pollutants, competitors or parasites b. evidence of small population size (Principle 2, clause 6.7(2)(b) BC Regulation) presented by: i. an estimate of the species' current population size in NSW, and ii. an estimate of the decline in the species' population size in NSW in three years or one generation (whichever is longer), and iii. where such data is available, an estimate of the number of mature individuals in each subpopulation, or the percentage of mature individuals in each subpopulation, or whether the species is likely to undergo extreme fluctuations	2a. The population of *Pilularia novae-hollandiae* in NSW is currently unknown although many of the known records for this species pre-date the 2000s. Several of the records from southern NSW including the Riverina and NSW South Western Slopes bioregions were recorded during the 1950s. More recent records post 2000 includes subpopulation from Lake Cowal, Oolambeyan National Park and Doodle Corner Swamp near Henty (ALA 2021). Difficulties in understanding the population status of this species occur due to the ephemeral nature of the species life cycle and preferred habitat of shallow (mostly temporary) pools and in mud in swamps and depressions. Survey difficulties also inhibit population understanding as the species is grass like in appearance, obscure and considered possibly overlooked elsewhere in its probable distribution range (Environment Energy and Science 2021). The rate of decline in NSW is currently unknown although the two main extant populations at Lake Cowal and Oolambeyan National Park are proposed key management sites for *Pilularia novae-hollandiae* under the Saving Our Species (SoS) program (Environment Energy and Science 2021). The management objective for *Pilularia novae-hollandiae* at these sites is to secure the species in the wild for 100 years and maintain its conservation status under the BC Act. 2b. The rate of population decline in NSW is currently unknown.

ASSESSMENT REQUIREMENTS	*PILULARIA NOVAE-HOLLANDIAE*
c. evidence of limited geographic range for the threatened species (Principle 3, clause 6.7(2)(c) BC Regulation) presented by: i. extent of occurrence ii. area of occupancy iii. number of threat-defined locations (geographically or ecologically distinct areas in which a single threatening event may rapidly affect all species occurrences), and iv. whether the species' population is likely to undergo extreme fluctuations d. evidence that the species is unlikely to respond to management (Principle 4, clause 6.7(2)(d) BC Regulation) because: i. known reproductive characteristics severely limit the ability to increase the existing population on, or occupy new habitat (e.g. species is clonal) on, a biodiversity stewardship site ii. the species is reliant on abiotic habitats which cannot be restored or replaced (e.g. karst systems) on a biodiversity stewardship site, or iii. life history traits and/or ecology is known but the ability to control key threatening processes at a biodiversity stewardship site is currently negligible (e.g. frogs severely impacted by chytrid fungus).	2c. In NSW there is scant information on the current population extent of *Pilularia novae-hollandiae*. For this proposal, surveys within the biodiversity study area have identified about 0.32 hectares of occupied habitat for this species. Extensive areas of similar suitable habitat occur both to the north and south of this occupied habitat and it is considered that this subpopulation is likely to be larger that currently known. In addition to the 0.32 hectares of occupied habitat an additional 5.59 hectares of assumed habitat has been considered for this species due to restricted land access for adequate targeted surveys. The subpopulation size at the Lake Cowal SoS management site for *Pilularia novae-hollandiae* is unknown although managed habitat area is listed as 144.85 hectares (Environment Energy and Science 2021). Likewise, the subpopulation size at the Oolambeyan National Park SoS management site is unknown with managed habitat area identified as 1.55 hectares (Environment Energy and Science 2021). The population size and area of occupancy at Doodle Corner Swamp near Henty is unknown. Whilst little is known of the current extent in NSW, the species appears to be widespread in distribution occurring from south-western WA through southern SA and Vic and Tasmania. Given the ephemeral nature of the species life cycle it is considered likely to undergo extreme population fluctuations particularly during drought and prolonged dry periods where the species dies back and remains underground in as arhizome (underground stem) or as sporocarps (fruiting body) often buried in mud. During favourable wet conditions dispersal vectors of sporocarps are considered probably waterfowl as many of the recorded location of the species are from artificial pools and in recently inundated areas (Jones 1998). 2d. There is little evidence on the response of *Pilularia novae-hollandiae* to active management.
3. Where the TBDC indicates data is 'unknown' or 'data deficient' for a species for a criterion listed in Subsection 9.1.1(2.), the assessor must record this in the BDAR.	3. *Pilularia novae-hollandiae* is not listed in the TBDC as a data deficient entity.
4. In relation to the impacts from the proposal on the species at risk of an SAII, the assessor must include data and information on:	4a. Within the biodiversity study area, *Pilularia novae-hollandiae* was recorded from nine-shallow muddy gilgai depressions each with 20 to 50 individuals. The estimated number of individuals (mature and immature) recorded in the subpopulation is estimated to be 180-450 individuals.

ASSESSMENT REQUIREMENTS	*PILULARIA NOVAE-HOLLANDIAE*
4a. the impact on the species' population (Principles 1 and 2) presented by: i. an estimate of the number of individuals (mature and immature) present in the subpopulation on the subject land (the site may intersect or encompass the subpopulation) and as a percentage of the total NSW population, and ii. an estimate of the number of individuals (mature and immature) to be impacted by the proposal and as a percentage of the total NSW population, or iii. if the species' unit of measure is area, provide data on the number of individuals on the site, and the estimated number that will be impacted, along with the area of habitat to be impacted by the proposal 4b. impact on geographic range (Principles 1 and 3) presented by: i. the area of the species' geographic range to be impacted by the proposal in hectares, and a percentage of the total AOO, or EOO within NSW ii. the impact on the subpopulation as either: all individuals will be impacted (subpopulation eliminated); OR impact will affect some individuals and habitat; OR impact will affect some habitat, but no individuals of the species will be directly impacted iii. to determine if the persisting subpopulation that is fragmented will remain viable, estimate (based on published and unpublished sources such as scientific publications, technical reports, databases or documented field observations) the habitat area required to support the remaining population, and habitat available within dispersal distance, and distance over which genetic exchange can occur (e.g. seed dispersal) and pollination distance for the species iv. to determine changes in threats affecting remaining subpopulations and habitat if the proposed impact proceeds, estimate changes in environmental factors including changes to fire regimes (frequency, severity); hydrology, pollutants; species interactions (increased competition and effects on pollinators or dispersal); fragmentation, increased edge effects, likelihood of disturbance; and disease, pathogens and parasites. Where these factors have been considered elsewhere in relation to the target species, the assessor may refer to the relevant sections of the BDAR or BCAR.	The NSW population is currently unknown although these 180-450 individuals are considered to only constitute a very small percentage of the overall NSW population for this species. The proposal will avoid direct removal of the nine-shallow muddy gilgai depressions that contain the recorded individuals of *Pilularia novae-hollandiae.* This avoidance will be achieved through design refinements including micro siting of tower pads and careful track design. 4b. Within NSW the only current extant populations of this species are considered to be at Lake Cowal and Oolambeyan National Park. The subpopulation size at the Lake Cowal SoS management site for *Pilularia novae-hollandiae* is unknown although managed habitat area is listed as 144.85 hectares (Environment Energy and Science 2021). Likewise, the subpopulation size at the Oolambeyan National Park SoS management site is unknown with managed habitat area identified as 1.55 hectares (Environment Energy and Science 2021). Given this, the current known estimated area of occupancy for *Pilularia novae-hollandiae* in NSW is 146.40 hectares. The proposal will impact on 0.32 hectares of occupied habitat which is estimated to be 0.22% of habitat within NSW. The proposal impact will affect some habitat, but no individuals of the species will be directly impacted. Avoidance of direct removal of the nine-shallow muddy gilgai depressions that contain the recorded individuals of *Pilularia novae-hollandiae* will be achieved through design refinements including micro siting of tower pads and careful track design.
5. The assessor may also provide new information that demonstrates that the principle identifying that the TEC is at risk of an SAII is not accurate.	5. This BDAR does not provide any new information that demonstrates that the principle identifying that the species is at risk of an SAII is not accurate.

Table 11-6 SAII assessment for candidate threatened flora species *Pimelea serpyllifolia* subsp. *serpyllifolia*

ASSESSMENT REQUIREMENTS	*PIMELEA SERPYLLIFOLIA SUBSP. SERPYLLIFOLIA*
1. The action and measures taken to avoid the direct and indirect impact on a species at risk of an SAII	1. the direct impacts on *Pimelea serpyllifolia* subsp. *serpyllifolia* have been avoided where possible through design refinement. Direct impact can be further avoided through design refinement and through careful placement of compound sites and construction zones. Indirect impacts will be managed through mitigation measures which are outlined in Chapter 10.
2. The assessor must consult the TBDC and/or other sources to report on the current population of the species including: a. evidence of rapid decline (Principle 1, clause 6.7(2)(a) BC Regulation) presented by an estimate of the: i. decline in population of the species in NSW in the past 10 years or three generations (whichever is longer), or ii. decline in population of the species in NSW in the past 10 years or three generations (whichever is longer) as indicated by: an index of abundance appropriate to the species; decline in geographic distribution and/or habitat quality; exploitation; effect of introduced species, hybridisation, pathogens, pollutants, competitors or parasites b. evidence of small population size (Principle 2, clause 6.7(2)(b) BC Regulation) presented by: i. an estimate of the species' current population size in NSW, and ii. an estimate of the decline in the species' population size in NSW in three years or one generation (whichever is longer), and iii. where such data is available, an estimate of the number of mature individuals in each subpopulation, or the percentage of mature individuals in each subpopulation, or whether the species is likely to undergo extreme fluctuations c. evidence of limited geographic range for the threatened species (Principle 3, clause 6.7(2)(c) BC Regulation) presented by: i. extent of occurrence ii. area of occupancy	2a. The population of *Pimelea serpyllifolia subsp. serpyllifolia* in NSW is currently restricted to the far south-western plains in the Euston district. It is far more common in Victoria and South Australia, with 2584 records on the Australian Living Atlas (ALA 2021), including only 10 individuals recorded on the NSW Bionet Atlas within NSW, 37 km west of Euston. Records in NSW are from 1955, 1970, 2000 and 2007 (Environment Energy and Science 2020). WSP recorded an additional, estimated 40 individuals on property H035 (refer to Section 5.6.2.5). The increase in records of 40, from the 10 individuals previously recorded on Bionet, would indicate that there has not been a rapid decline in this species over the past 10 years. 2b. There is evidence of a small population size in NSW of approximately 50 individuals; including 10 from Bionet (Department of Planning Industry and Environment 2021) and 40 recorded by WSP in 2021. However, less than 10% of this species' total population occurs within NSW (Department of Planning Industry and Environment 2021). As a result of this, SOS has assigned management of this species to Partnership (widespread) management. Currently no management sites have been identified in NSW for this species (Department of Planning Industry and Environment 2021). 2c. This species is not common in NSW, being only known to occur in the Euston district, on the South Olary Plain IBRA subregion. The current known area of occupancy in NSW is not known, but based on existing records of occurrence in NSW, it is likely to be small, possibly than 10 ha.

ASSESSMENT REQUIREMENTS	*PIMELEA SERPYLLIFOLIA SUBSP. SERPYLLIFOLIA*
iii. number of threat-defined locations (geographically or ecologically distinct areas in which a single threatening event may rapidly affect all species occurrences), and iv. whether the species' population is likely to undergo extreme fluctuations d. evidence that the species is unlikely to respond to management (Principle 4, clause 6.7(2)(d) BC Regulation) because: i. known reproductive characteristics severely limit the ability to increase the existing population on, or occupy new habitat (e.g. species is clonal) on, a biodiversity stewardship site ii. the species is reliant on abiotic habitats which cannot be restored or replaced (e.g. karst systems) on a biodiversity stewardship site, or iii. life history traits and/or ecology is known but the ability to control key threatening processes at a biodiversity stewardship site is currently negligible (e.g. frogs severely impacted by chytrid fungus).	The species grows in scrub and woodland, often in mallee scrub. In NSW, the known locations of the species occur in areas of high agricultural use. This indicates that the species has a limited geographic range and occurs in vegetation types that are threatened by clearing for agricultural purposes (Environment Energy and Science 2021). 2d. The response to management of this species is not known. The TBDC for this species provides a warning that the provided Response to Management scores may not be valid due to several factors.
3. Where the TBDC indicates data is 'unknown' or 'data deficient' for a species for a criterion listed in Subsection 9.1.1(2.), the assessor must record this in the BDAR.	3. The response to management of *Pimelea serpyllifolia* subsp. *serpyllifolia* is not known. The TPBC for this species provides a warning that the provided Response to Management scores may not be valid due to several factors. In addition, the threshold types for the SAII's are still under development in the TBDC (Environment Energy and Science 2021).
4. In relation to the impacts from the proposal on the species at risk of an SAII, the assessor must include data and information on: a. the impact on the species' population (Principles 1 and 2) presented by: i. an estimate of the number of individuals (mature and immature) present in the subpopulation on the subject land (the site may intersect or encompass the subpopulation) and as a percentage of the total NSW population, and ii. an estimate of the number of individuals (mature and immature) to be impacted by the proposal and as a percentage of the total NSW population, or iii. if the species' unit of measure is area, provide data on the number of individuals on the site, and the estimated number that will be impacted, along with the area of habitat to be impacted by the proposal	4a. *Pimelea serpyllifolia* subsp. *serpyllifolia* was recorded within the proposal study area to the north of Euston on property H035, growing in PCT 172. The estimated 40 plants were recorded from a single population on 12 October 2021, which represents a range extension to the previously recorded population in NSW (refer to Section 5.6.2.5). The NSW population is approximately 50 individuals; including 10 from Bionet (2021) and 40 recorded by WSP in 2021. Therefore, the 40 estimated individuals recorded in the study area represents 80% of this species' known total population within NSW. Under BAM-C the unit of measure for *Pimelea serpyllifolia* subsp. *serpyllifolia* is area. The total area of occupancy of this species within the proposed disturbance area is 0.11 hectares.

ASSESSMENT REQUIREMENTS	*PIMELEA SERPYLLIFOLIA SUBSP. SERPYLLIFOLIA*
b. impact on geographic range (Principles 1 and 3) presented by: i. the area of the species' geographic range to be impacted by the proposal in hectares, and a percentage of the total AOO, or EOO within NSW ii. the impact on the subpopulation as either: all individuals will be impacted (subpopulation eliminated); OR impact will affect some individuals and habitat; OR impact will affect some habitat, but no individuals of the species will be directly impacted iii. to determine if the persisting subpopulation that is fragmented will remain viable, estimate (based on published and unpublished sources such as scientific publications, technical reports, databases or documented field observations) the habitat area required to support the remaining population, and habitat available within dispersal distance, and distance over which genetic exchange can occur (e.g. seed dispersal) and pollination distance for the species iv. to determine changes in threats affecting remaining subpopulations and habitat if the proposed impact proceeds, estimate changes in environmental factors including changes to fire regimes (frequency, severity); hydrology, pollutants; species interactions (increased competition and effects on pollinators or dispersal); fragmentation, increased edge effects, likelihood of disturbance; and disease, pathogens and parasites. Where these factors have been considered elsewhere in relation to the target species, the assessor may refer to the relevant sections of the BDAR or BCAR.	4b. Within NSW the previously known population of this species was restricted to a small area of about 5 ha in the Euston district, in the far south-western plains (Environment Energy and Science 2020). Work for this proposal by WSP in 2021 recorded an additional population of this species, about 32 km to the south east of the previously known population. This represents a range extension for this species within NSW. The population size and extent of this species in NSW are currently unknown; however, current knowledge indicates that the proposed impact to 0.11 hectares of occupied habitat is likely to equate to a low proportion of its habitat within NSW. Less than 10% of this species' total population occurs within NSW (Department of Planning Industry and Environment 2021), which extends into Victoria and South Australia. Therefore, the proposed 0.11 ha of impact area represents a very low percentage of the species' total geographic range. The proposal would avoid direct removal of the 40 known individuals within the study area. However, the proposal would impact the 0.11 ha of habitat. Avoidance of impact to this species' habitat would be maximised through design refinements including micro siting of tower pads and careful track design.
5. The assessor may also provide new information that demonstrates that the principle identifying that the TEC is at risk of an SAII is not accurate.	5. This BDAR does not provide any new information that demonstrates that the principle identifying that the species is at risk of an SAII is not accurate.

11.1.3 Threatened fauna candidate SAII entities

Table 11-7 SAII assessment for candidate threatened fauna species Plains-wanderer

ASSESSMENT REQUIREMENTS	PLAINS WANDERER
1. The action and measures taken to avoid the direct and indirect impact on a species at risk of an SAII	1. In regard to specific avoidance of species with a high biodiversity risk weighting the Plains-wanderer, being an SAII entity was deemed critical for avoidance of mapped known habitat for the species. Spatial data layers were obtained from the NSW Biodiversity Conservation Division to enable design refinements such as proposed transmission line realignment near Bundure Siding, micro-siting of tower locations and re-routing of maintenance tracks to avoid where possible any direct impacts to mapped Plain Wanderer habitat.
2. The assessor must consult the TBDC and/or other sources to report on the current population of the species including: a. evidence of rapid decline (Principle 1, clause 6.7(2)(a) BC Regulation) presented by an estimate of the: i. decline in population of the species in NSW in the past 10 years or three generations (whichever is longer), or ii. decline in population of the species in NSW in the past 10 years or three generations (whichever is longer) as indicated by: an index of abundance appropriate to the species; decline in geographic distribution and/or habitat quality; exploitation; effect of introduced species, hybridisation, pathogens, pollutants, competitors or parasites b. evidence of small population size (Principle 2, clause 6.7(2)(b) BC Regulation) presented by: i. an estimate of the species' current population size in NSW, and ii. an estimate of the decline in the species' population size in NSW in three years or one generation (whichever is longer), and iii. where such data is available, an estimate of the number of mature individuals in each subpopulation, or the percentage of mature individuals in each subpopulation, or whether the species is likely to undergo extreme fluctuations c. evidence of limited geographic range for the threatened species (Principle 3, clause 6.7(2)(c) BC Regulation) presented by: i. extent of occurrence ii. area of occupancy	2. a. i) In consultation with David Parker, Senior Threatened Species Officer, Office of Environment and Heritage (NSW) who manages Plains-wanderer recovery and management, it is estimated from survey data that the species population has fallen from some 3,000 individuals to around 700 individuals over the last twenty years. By implementing avoidance measures impacts were reduced to 0.42 ha from initial impact estimates of 26.1 ha. ii The population decline estimates of Plains-wanderer are tied to habitat condition, which has been compromised by persisting dry conditions and land management practices throughout its range over the last 20 years. b. Current detail in regard to Plains-wanderer population estimates are centred on the area of mapped habitat distribution in the Riverina area of NSW, and monitoring of sites. i. The current estimate of individuals in the Riverina area of NSW is 700. ii. There is no accurate detail in hand, in regard to declines in the last 3 years, however, if the decline from 3,000 individuals to 700 individuals over the last 20 years has progressed at the same rate of decline, then the population decline in the last 3 years would be 345 individuals. Nevertheless, declines in the Victorian Patho Plains populations were estimated at >90% between 2010 and 2012, and the Riverina experienced a 75% decline in response to the 2002 drought (Department of the Environment 2016). Therefore, reductions of population numbers in the last 20 years may be a net result of several declines and subsequent recoveries being insufficient to replace the losses.

ASSESSMENT REQUIREMENTS	PLAINS WANDERER
iii. number of threat-defined locations (geographically or ecologically distinct areas in which a single threatening event may rapidly affect all species occurrences), and iv. whether the species' population is likely to undergo extreme fluctuations d. evidence that the species is unlikely to respond to management (Principle 4, clause 6.7(2)(d) BC Regulation) because: i. known reproductive characteristics severely limit the ability to increase the existing population on, or occupy new habitat (e.g. species is clonal) on, a biodiversity stewardship site ii. the species is reliant on abiotic habitats which cannot be restored or replaced (e.g. karst systems) on a biodiversity stewardship site, or iii. life history traits and/or ecology is known but the ability to control key threatening processes at a biodiversity stewardship site is currently negligible (e.g. frogs severely impacted by chytrid fungus).	iii. Accurate data is not at hand in regard to accurate estimates of population demographics, but Plains-wanderers like many other dry country species successfully breed and increase in numbers when conditions are good and decline due to the inability to replace previous generations during poor seasons. The species appears to be very capable of rebounding when conditions are good, but sustained lower than average rainfall values, have resulted in a reduced capacity to replace breeding individuals over the past 20 years. There is evidence that their populations can fall drastically during severe drought conditions (Department of the Environment 2016). c. i. The most important habitat for Plains-wanderer in the NSW Riverina area is well known, with accurate ground-truthed mapping of high quality and supplementary habitat available. ii. The area of occupancy at any given time is constantly changing due to the constant fluctuation of habitat condition, which is a function of, rainfall inputs and land management actions to maintain the specific habitat conditions that the Plains-wanderer requires. iii. There is no available data relating to the extent and location of threat-defined locations for this species, but it is expected that such areas do exist and would likely be defined by the management, or lack thereof, of Plains-wanderer habitat on lands held by both private and government land managers. iv. It is considered likely that population numbers of Plains-wanderer are strongly tied to the condition of habitat. Extreme poor weather patterns affecting habitat quality is considered likely to result in a commensurate decline in Plains-wanderer population numbers. d. There is good evidence to support, that under good climatic conditions, when suitable habitat for the Plains-wanderer is managed to encourage population growth, that the species is capable of recovering population numbers. i. The species has no reproductive characteristics that would severely limit its reproductive capacity. ii. The species is not reliant on abiotic habitats which cannot be restored. iii. The species has no life history traits or ecological habits that prevent its recovery, other than a dependence on specific native grassland habitat types.

ASSESSMENT REQUIREMENTS	PLAINS WANDERER
3. Where the TBDC indicates data is 'unknown' or 'data deficient' for a species for a criterion listed in Subsection 9.1.1(2.), the assessor must record this in the BDAR.	3. The species is not data deficient in regard to its habitat requirements, but the exact status and favoured habitat use is in a constant state of flux, due to variation in weather patterns and land management.
4a. In relation to the impacts from the proposal on the species at risk of an SAII, the assessor must include data and information on: a. the impact on the species' population (Principles 1 and 2) presented by: i. an estimate of the number of individuals (mature and immature) present in the subpopulation on the subject land (the site may intersect or encompass the subpopulation) and as a percentage of the total NSW population, and ii. an estimate of the number of individuals (mature and immature) to be impacted by the proposal and as a percentage of the total NSW population, or iii. if the species' unit of measure is area, provide data on the number of individuals on the site, and the estimated number that will be impacted, along with the area of habitat to be impacted by the proposal 4b. impact on geographic range (Principles 1 and 3) presented by: i. the area of the species' geographic range to be impacted by the proposal in hectares, and a percentage of the total AOO, or EOO within NSW ii. the impact on the subpopulation as either: all individuals will be impacted (subpopulation eliminated); OR impact will affect some individuals and habitat; OR impact will affect some habitat, but no individuals of the species will be directly impacted iii. to determine if the persisting subpopulation that is fragmented will remain viable, estimate (based on published and unpublished sources such as scientific publications, technical reports, databases or documented field observations) the habitat area required to support the remaining population, and habitat available within dispersal distance, and distance over which genetic exchange can occur (e.g. seed dispersal) and pollination distance for the species	4a. i. There is no mechanism for accurately estimating the numbers of Plains-wanderers that might occur in the vicinity of the disturbance area. Estimated numbers in Oolambeyan National Park during the late autumn 2021 survey period were around 5 birds (David Parker pers. comm.). No Plains-wanderers were observed during reference site surveys in Oolambeyan National Park, and only three birds were encountered during the same survey period in land associated with the disturbance area. Those observations were all made in a single night at one location, Bundure TSR, which was the only habitat during the survey period that exhibited excellent habitat characteristics. ii. It not expected that the proposal will impact any adult Plains-wanderer individuals, due to the measures put in place to minimise impacts to important habitat areas. iii. The species unit of measure is not known, nor can be accurately estimated, since the distribution is only very sparsely populated by the species. Furthermore, as a consequence of constant change, the drivers of habitat quality, being habitat condition and therefore distribution of habitat are in a constant state of flux. 4b.i. The total area of habitat for Plains-wanderer in NSW has not been quantified, but the area of habitat in the mapped Riverina distribution has. Within 10 km of the proposal alignment there is a total of 12,676 ha. ii. Impact will affect some habitat (0.42 ha), but no individuals of the species will be directly impacted. iii. Early calculations of impacts to Plains-wanderer habitat by the proposal without avoidance measures was 21.6 ha, but that figure has been reduced to 0.42 ha by implementing avoidance measures. Apart from the displacement of 0.42 ha of habitat, there are no other impacts that are expected to have an adverse effect on Plains-wanderers in the wider locality (10 km) or other Plains-wanderer habitats further afield. vi. Mitigation measures relating to the Plains Wanderer are presented in Chapter 10.

ASSESSMENT REQUIREMENTS	PLAINS WANDERER
iv. to determine changes in threats affecting remaining subpopulations and habitat if the proposed impact proceeds, estimate changes in environmental factors including changes to fire regimes (frequency, severity); hydrology, pollutants; species interactions (increased competition and effects on pollinators or dispersal); fragmentation, increased edge effects, likelihood of disturbance; and disease, pathogens and parasites. Where these factors have been considered elsewhere in relation to the target species, the assessor may refer to the relevant sections of the BDAR or BCAR.	
5. The assessor may also provide new information that demonstrates that the principle identifying that the TEC is at risk of an SAII is not accurate.	5. The implementing of avoidance measures will reduce impacts to Plains-wanderers to levels that will not constitute a SAII.

11.2 Determining an offset requirement for impacts

Biodiversity offsetting for residual impacts on biodiversity values listed under the BC Act is mandatory for SSI developments being assessed under Part 7 of the BC Act and subject to a BDAR.

11.2.1 Impacts on native vegetation and TECs (ecosystem credits)

In accordance with section 9.2.1 of the BAM, an offset is required for all impacts of proposals on PCTs that are associated with a vegetation zone that has a vegetation integrity score of:

- ≥15, where the PCT is representative of an EEC or a CEEC
- ≥17, where the PCT is associated with threatened species habitat (as represented by ecosystem credits) or represents a vulnerable ecological community
- ≥20, where the PCT does not represent a TEC and is not associated with threatened species habitat.

12 Impact summary – no net loss standard

No net loss in biodiversity value is the standard that underpins the BAM. The standard is attained through ensuring that the amount of biodiversity offset credit required from an impact is proportional to the amount of credit generated through improvements in the condition of native vegetation or threatened species habitat at a biodiversity stewardship site. The application of no net loss standard is set out in Chapter 10 of the BAM.

12.1 Applying the no net loss standard

No net loss in biodiversity is achieved where:

- the impacts on biodiversity values from a proposal are avoided, minimised or mitigated through reasonable measures (refer Chapters 8 and 10)
- all residual direct impacts on biodiversity values from clearing native vegetation and habitat loss are offset by:
  - retiring the required number of biodiversity credits determined in Section 10.1 of the BAM, with a class of credit identified in Section 10.2 of the BAM that meets the 'like-for-like' or 'variation. rules required in clauses 6.3 and 6.4 of the BC Regulation 2017 respectively.

All residual impacts on biodiversity resulting from the proposal, after applying the avoid, minimise and mitigate hierarchy, have been outlined in Section 11.2 of this report. The ecosystem and species credit offset requirements calculated for these residual impacts are presented below.

12.2 Ecosystem credit offset requirement

The total required ecosystem credit offset requirement, as determined using the BAM-C (version 1.3.0.00), for impacts on native vegetation unable to be avoided is provided for each IBRA subregion in Table 12-1.

Table 12-1 Total ecosystem credit offset requirement

ECOSYSTEM CREDIT OFFSET REQUIREMENT	SOP	LAC	MUR	LS	IS	CREDITS
Total biodiversity offset ecosystem credit requirement for each IBRA subregion	10,120	349	29,388	1,850	631	42,338
Total scattered trees ecosystem offset requirement for each IBRA subregion	12	0	12	48	16	88
Total biodiversity offset ecosystem credit requirement						**42,426**

Note: IBRA subregions

SOP – South Olary Plain

LAC – Lachlan

MUR – Murrumbidgee

LS – Lower Slopes

IS – Inland Slopes

12.2.1 South Olary Plain IBRA subregion ecosystem credit offset

Ecosystem credits required by the proposal for impacts calculated in the South Olary Plain IBRA subregion are outlined in Table 12-2 with the full credit report, including the ecosystem credit species predicted to utilise these native vegetation types, provided in Appendix F-1.

Table 12-2 Biodiversity offset ecosystem credit requirement for South Olary Plain IBRA subregion

VEGETATION TYPE	VEGETATION ZONE	TEC	SAII	BIODIVERSITY RISK WEIGHTING	VEGETATION INTEGRITY LOSS	AREA (HA)[3]	HBT CR	NO HBT CR	CREDITS REQUIRED
Arid Shrublands (Chenopod sub-formation)									
PCT 143	VZ #5 143_Mod-good	No	No	1.5	92.2	2.2	0	76	76
PCT 199	#11 199_Mod-good	No	No	1.5	48.5	1.3	0	24	24
Arid Shrublands (Chenopod sub-formation)									
PCT 163	#6 163_Mod-good	No	No	1.5	68.2	8.2	0	209	209
Semi-arid Woodlands (Grassy sub-formation)									
PCT 15	#1 15_Mod-good	No	No	1.75	36.2	5.8	91	0	91
Semi-arid Woodlands (Shrubby sub-formation)									
PCT 22	#2 22_Mod-good	Yes[1]	Yes	2	46.9	2.9	0	64	64
PCT 23	#3 23_Mod-good	Yes[2]	No	2	55.8	5.1	0	141	141
PCT 58	#4 58_Mod-good	No	No	1.75	61.4	67.3	1,810	0	1,810
	#14 58_SVM_Bench	No	No	1.75	67.1	8.2	240	0	240
PCT 170	#7 170_Mod-good_bull	No	No	1.5	52.1	57.3	1,120	0	1,120
	#8 170_Mod-good_whip	No	No	1.5	49.5	221.7	4,113	0	4,117
	#12 170_Derived	No	No	1.5	4.3	5.2	0	0	0

VEGETATION TYPE	VEGETATION ZONE	TEC	SAII	BIODIVERSITY RISK WEIGHTING	VEGETATION INTEGRITY LOSS	AREA (HA)[3]	HBT CR	NO HBT CR	CREDITS REQUIRED
	#15 170_SVM_Bench	No	No	1.5	77.5	8.8	253	0	257
PCT 171	#9 171_Mod-good_whip	No	No	1.5	63.6	43.8	1,046	0	1,046
	#13 171_Derived	No	No	1.5	42.8	0.63	0	10	10
PCT 172	#10 172_Mod-good_whip	No	No	1.5	53.8	45.3	0	915	915
Total									**10,120**

(1) *Allocasuarina luehmanii* woodland in the Riverina and Murray-Darling Depression bioregions – Endangered BC Act and EPBC Act

(2) *Acacia melvillei* shrubland in the Riverina and Murray Darling Depression bioregions – Endangered BC Act

(3) Area calculation have rounding applied from BAM-C

12.2.2 South Olary Plain IBRA subregion scattered trees ecosystem credit offset

Scattered trees ecosystem credits required by the proposal for impacts calculated in the South Olary Plain IBRA subregion are outlined in Table 12-3 with the full credit report, including the ecosystem credit species predicted to utilise these native vegetation types, provided in Appendix F-6.

Table 12-3 Scattered trees ecosystem credit requirement for South Olary Plain IBRA subregion

ASSOCIATED PCT	CLASS	NUMBER OF TREES	CONTAINS HOLLOWS	CREDITS PER TREE	CREDITS REQUIRED
PCT 15 – Black Box open woodland wetland with chenopod understorey mainly on the outer floodplains in the south-western NSW (mainly Riverina Bioregion and Murray Darling Depression Bioregion)	3	1	Yes	1	1
PCT 58 – Black Oak – Western Rosewood open woodland on deep sandy loams mainly in the Murray Darling Depression Bioregion	3	1	Yes	1	1
PCT 170 – Chenopod sandplain mallee woodland/ shrubland of the arid and semi-arid (warm) zones	3	10	Yes	1	10
Total					**12**

12.2.3 Lachlan IBRA subregion ecosystem credit offset

Ecosystem credits required by the proposal for impacts calculated in the Lachlan IBRA subregion are outlined in Table 12-4 with the full credit report, including the ecosystem credit species predicted to utilise these native vegetation types, provided in Appendix F-2.

Table 12-4 Biodiversity offset ecosystem credit requirement for Lachlan IBRA subregion

VEGETATION TYPE	VEGETATION ZONE	TEC	SAII	BIODIVERSITY RISK WEIGHTING	VEGETATION INTEGRITY LOSS	AREA (HA)[2]	HBT CR	NO HBT CR	CREDITS REQUIRED
Arid Shrublands (Chenopod sub-formation)									
PCT 163	#5 163_Mod-good	No	No	1.5	97.8	5.7	0	208	208
Freshwater Wetlands									
PCT 24	#3 24_Mod-good	No	No	1.5	64.3	0.37	0	9	9
Semi-arid Woodlands (Grassy sub-formation)									
PCT 15	#1 15_Mod-good	No	No	1.75	76.3	0.07	2	0	2
	#7 15_Derived	No	No	1.75	3.9	0.91	0	0	0
Semi-arid Woodlands (Shrubby sub-formation)									
PCT 23	#2 23_Mod-good	Yes[1]	No	2	28.3	0.11	0	2	2
PCT 58	#4 58_Mod-good	No	No	1.75	29.5	3.7	48	0	48
PCT 170	#6 170_Mod-good_bull	No	No	1.5	33.5	6.4	80	0	80
Total									**349**

(1) *Acacia melvillei* shrubland in the Riverina and Murray Darling Depression bioregions – Endangered BC Act

(2) Area calculation have rounding applied from BAM-C

12.2.4 Lachlan IBRA subregion scattered trees ecosystem credits

No scattered trees ecosystem credit offsets are required for the Lachlan IBRA subregion.

12.2.5 Murrumbidgee IBRA subregion ecosystem credit offset

Ecosystem credits required by the proposal for impacts calculated in the Murrumbidgee IBRA subregion are outlined in Table 12-5 with the full credit report, including the ecosystem credit species predicted to utilise these native vegetation types, provided in Appendix F-3.

Table 12-5 Biodiversity offset ecosystem credit requirement for Murrumbidgee IBRA subregion

VEGETATION TYPE	VEGETATION ZONE	TEC	SAII	BIODIVERSITY RISK WEIGHTING	VEGETATION INTEGRITY LOSS	AREA (HA)[7]	HBT CR	NO HBT CR	CREDITS REQUIRED
Arid Shrublands (Acacia sub-formation)									
PCT 143	VZ #29 143_Mod-good	No	No	1.5	52.9	0.05	0	1	1
Arid Shrublands (Chenopod sub-formation)									
PCT 157	VZ #23 157_Mod-good	No	No	1.75	81.9	35.8	0	1,282	1,282
	VZ #43 157_SVM_Bench	No	No	1.75	100	11.8	0	516	516
PCT 163	VZ #25 163_Mod-good	No	No	1.5	98.4	87.8	0	3,239	3,239
	VZ #48 163_SVM_Bench	No	No	1.5	100	7.7	0	290	290
PCT 164	VZ #26 164_Mod-good	No	No	1.5	98.2	89.2	0	3,287	3,287
	VZ #47 164_SVM_Bench	No	No	1.5	100	43.1	0	1,617	1,617
PCT 216	VZ #29 216_Mod-good	No	No	1.5	81.3	15	0	456	456
Freshwater Wetlands									
PCT 17	VZ #8 17_Mod-good	No	No	1.75	97.7	13.1	0	560	560
	VZ #35 17_SVM_Bench	No	No	1.75	100	4.1	0	179	179
PCT 24	VZ #11 24_Mod-good	No	No	1.5	88.9	11.9	0	395	395
	VZ #36 24_SVM_Bench	No	No	1.5	100	0.01	0	1	1
PCT 47	VZ #19 47_Mod-good	Yes	No	1.75	82.5	2.1	0	77	77

VEGETATION TYPE	VEGETATION ZONE	TEC	SAII	BIODIVERSITY RISK WEIGHTING	VEGETATION INTEGRITY LOSS	AREA (HA)[7]	HBT CR	NO HBT CR	CREDITS REQUIRED
	VZ #42 47_SVM_Bench	Yes[1]	No	1.75	100	0.88	0	39	39
PCT 53	VZ #20 53_Mod-good	No	No	1.75	100	1.7	0	76	76
PCT 160	VZ #24 160_Mod-good	No	No	1.5	97.7	27.2	0	998	998
	VZ #44 160_SVM_Bench	No	No	1.5	100	1.2	0	44	44
PCT 182	VZ #30 182_Mod-good	No	No	1.5	100	0.07	0	3	3
Forested Wetlands									
PCT 5	#1 5_Mod-good	No	No	1.5	54.9	4.9	100	0	100
PCT 7	#2 7_Mod-good	No	No	1.5	44.3	0.77	0	13	13
	VZ #33 7_SVM_Bench	No	No	1.5	100	0.01	1	0	1
PCT 8	#3 8_Mod-good	No	No	1.5	53.2	4.8	95	0	95
PCT 11	#4 11_Mod-good	No	No	1.5	58.5	13.9	303	0	303
Grasslands									
PCT 44	VZ #16 44_Mod-good	Yes[2]	No	2	88.6	36.8	0	1,629	1,629
	VZ #39 44_SVM_Bench	Yes[2]	No	2	100	8.4	0	420	420
PCT 45	VZ #17 45_Mod-good	Yes[2]	No	1.75	88.1	27.2	0	1,051	1,051
	VZ #40 45_SVM_Bench	Yes[2]	No	1.75	100	10	0	438	438
PCT 46	VZ #18 46_Mod-good	Yes[2]	No	1.5	96.5	45.2	0	1,635	1,635

VEGETATION TYPE	VEGETATION ZONE	TEC	SAII	BIODIVERSITY RISK WEIGHTING	VEGETATION INTEGRITY LOSS	AREA (HA)[7]	HBT CR	NO HBT CR	CREDITS REQUIRED
	VZ #41 46_SVM_Bench	Yes[2]	No	1.5	100	23.1	0	866	866
Saline Wetlands									
PCT 166	VZ #46 166_SVM_Bench	No	No	1.5	100	0.95	0	36	36
Semi-arid Woodlands (Grassy sub-formation)									
PCT 13	VZ #5 13_Mod-good	No	No	1.75	75.8	9.8	324	0	324
	VZ #47 13_SVM_Bench	No	No	1.75	100	0.24	10	0	10
PCT 15	VZ #6 15_Mod-good	No	No	1.75	54.9	14.5	348	0	348
	VZ #7 15_Derived	No	No	1.75	38	1.9	0	31	31
	VZ #34 15_SVM_Bench	No	No	1.75	49.2	0.13	3	0	3
PCT 26	VZ #12 26_Mod-good	Yes[3]	No	2	63.8	63.4	0	2,023	2,023
	VZ #13 26_Moderate	Yes[3]	No	2	50	37.7	0	943	943
	VZ #14 26_Derived	No	No	2	40.2	212.3	0	4,269	4,269
	VZ #37 26_SVM_Bench	Yes[3]	No	2	73.1	0.09	0	4	4
Semi-arid Woodlands (Shrubby sub-formation)									
PCT 23	VZ #9 23_Mod-good	Yes[4]	No	2	52.2	5.6	0	147	147
	VZ #10 23_Derived	No	No	2	42.2	7.7	0	163	163
PCT 28	VZ #15 28_Mod-good	Yes[5]	No	2	36.2	19.8	0	358	358
	VZ #38 28_SVM_Bench	Yes[5]	No	2	58.5	9.4	0	390	390

VEGETATION TYPE	VEGETATION ZONE	TEC	SAII	BIODIVERSITY RISK WEIGHTING	VEGETATION INTEGRITY LOSS	AREA (HA)[7]	HBT CR	NO HBT CR	CREDITS REQUIRED
PCT 58	VZ #21 58_Mod-good	No	No	1.75	45.2	36.1	714	0	714
	VZ #27 58_Moderate	No	No	1.75	14.4	4.8	0	0	0
	VZ #22 58_Derived	No	No	1.75	26.7	0.3	0	4	4
PCT 75	VZ #32 75_Mod-good	Yes[6]	Yes	2.5	53.6	0.21	7	0	7
PCT 170	VZ #31 170_Mod-good_whip	No	No	1.5	40.3	0.21	0	3	3
Total									**29,388**

(1) Seasonal Herbaceous Wetlands (Freshwater) of the Temperate Lowland Plains - Endangered EPBC Act

(2) Natural Grasslands of the Murray Valley Plains – Critically Endangered EPBC Act

(3) Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray – Darling Depression, Riverina and NSW South Western Slopes bioregions – Endangered BC Act and EPBC Act

(4) *Acacia melvillei* shrubland in the Riverina and Murray Darling Depression bioregions – Endangered BC Act

(5) Sandhill Pine woodland in the Riverina, Murray – Darling Depression and NSW South Western Slopes bioregions – Endangered BC Act

(6) White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland – Critically Endangered BC Act and EPBC Act

(7) Area calculation have rounding applied from BAM-C

12.2.6 Murrumbidgee IBRA subregion scattered trees ecosystem credit offset

Scattered trees ecosystem credits required by the proposal for impacts calculated in the Murrumbidgee IBRA subregion are outlined in Table 12-6 with the full credit report, including the ecosystem credit species predicted to utilise these native vegetation types, provided in Appendix F-7.

Table 12-6 Scattered trees ecosystem credit requirement for Murrumbidgee IBRA subregion

ASSOCIATED PCT	CLASS	NUMBER OF TREES	CONTAINS HOLLOWS	CREDITS PER TREE	CREDITS REQUIRED
PCT 11 – River Red Gum – Lignum very tall open forest or woodland wetland on floodplains of semi-arid (warm) climate zone (mainly Riverina Bioregion and Murray Darling Depression Bioregion)	3	6	Yes	1	6
PCT 75 – Yellow Box – White Cypress Pine grassy woodland on deep sandy-loam alluvial soils of the eastern Riverina Bioregion and western NSW South Western Slopes Bioregion	3	3	Yes	1	3
	2	5	No	0.5	3
Total					**12**

12.2.7 Lower Slopes IBRA subregion ecosystem credit offset

Ecosystem credits required by the proposal for impacts calculated in the Lower Slopes IBRA subregion are outlined in Table 12-7 with the full credit report, including the ecosystem credit species predicted to utilise these native vegetation types, provided in Appendix F-4.

Table 12-7 Biodiversity offset ecosystem credit requirement for Lower Slopes IBRA subregion

VEGETATION TYPE	VEGETATION ZONE	TEC	SAII	BIODIVERSITY RISK WEIGHTING	VEGETATION INTEGRITY LOSS	AREA (HA)[4]	HBT CR	NO HBT CR	CREDITS REQUIRED
Forested Wetlands									
PCT 5	VZ #1 5_Mod-good	No	No	1.5	61.1	2.7	61	0	61
PCT 249	VZ #7 249_Moderate	No	No	1.75	41.9	4	74	0	74
	VZ #8 249_Derived	No	No	1.75	32.4	2.1	0	30	30
Grassy Woodlands									
PCT 74	VZ #14 74_Mod-good	Yes[2]	Yes	2.5	51.2	0.91	29	0	29
PCT 76	VZ #3 76_Mod-good	Yes[1]	No	2	53.6	1.3	35	0	35
	VZ #15 76_SVM_ Bench	Yes[1]	No	2	100	0.03	2	0	2
PCT 80	VZ #5 80_Mod-good	Yes[1]	No	2	69.3	11.9	411	0	411
	VZ #4 80_Moderate	Yes[1]	No	2	44.3	8.9	198	0	198
	VZ #6 80_Derived	No	No	2	28.5	1.5	0	21	21
	VZ #12 80_SVM_ Bench	Yes[1]	No	2	80.9	0.5	20	0	20
Semi-arid Woodlands (Grassy sub-formation)									
PCT 28	VZ #11 28_SVM_ Bench	Yes[3]	No	2	62.1	2.8	0	88	88

VEGETATION TYPE	VEGETATION ZONE	TEC	SAII	BIODIVERSITY RISK WEIGHTING	VEGETATION INTEGRITY LOSS	AREA (HA)[4]	HBT CR	NO HBT CR	CREDITS REQUIRED
PCT 75	VZ #2 75_Mod-good	Yes[2]	Yes	2	57.9	28.8	834	0	834
	VZ #9 75_Poor	Yes[2]	Yes	2	38.5	1.5	29	0	29
	VZ #10 75_Derived	Yes[2]	Yes	2	10.2	4.7	0	0	0
	VZ #13 75_SVM_ Bench	Yes[2]	Yes	2	85	0.42	18	0	18
Total									**1,850**

(1) Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions – Endangered BC Act and EPBC Act

(2) White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland – Critically Endangered BC Act and EPBC Act

(3) Sandhill Pine woodland in the Riverina, Murray – Darling Depression and NSW South Western Slopes bioregions – Endangered BC Act

(4) Area calculation have rounding applied from BAM-C

12.2.8 Lower Slopes IBRA subregion scattered trees ecosystem credit offset

Scattered trees ecosystem credits required by the proposal for impacts calculated in the Lower Slopes IBRA subregion are outlined in Table 12-8 with the full credit report, including the ecosystem credit species predicted to utilise these native vegetation types, provided in Appendix F-8.

Table 12-8 Scattered trees ecosystem credit requirement for Lower Slopes IBRA subregion

ASSOCIATED PCT	CLASS	NUMBER OF TREES	CONTAINS HOLLOWS	CREDITS PER TREE	CREDITS REQUIRED
PCT 75 – Yellow Box – White Cypress Pine grassy woodland on deep sandy-loam alluvial soils of the eastern Riverina Bioregion and western NSW South Western Slopes Bioregion	3	11	Yes	1	11
	3	1	No	0.75	1
	2	2	No	0.5	2
PCT 76 – Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions	3	13	Yes	1	13
	2	1	No	0.5	1
PCT 80 – Western Grey Box – White Cypress Pine tall woodland on loam soil on alluvial plains of NSW South Western Slopes Bioregion and Riverina Bioregion	3	10	Yes	1	10
	3	7	No	0.75	5
	2	5	No	0.5	3
PCT 277 – Blakely's Red Gum – Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion	3	2	Yes	1	2
Total					**48**

12.2.9 Inland Slopes IBRA subregion ecosystem credit offset

Ecosystem credits required by the proposal for impacts calculated in the Inland Slopes IBRA subregion are outlined in Table 12-9 with the full credit report, including the ecosystem credit species predicted to utilise these native vegetation types, provided in Appendix F-5.

Table 12-9 Biodiversity offset ecosystem credit requirement for Inland Slopes IBRA subregion

VEGETATION TYPE	VEGETATION ZONE	TEC	SAII	BIODIVERSITY RISK WEIGHTING	VEGETATION INTEGRITY LOSS	AREA (HA)[3]	HBT CR	NO HBT CR	CREDITS REQUIRED
Dry Sclerophyll Forests (Shrubby sub-formation)									
PCT 110	VZ #3 110_Mod-good	No	No	2	41.4	2.7	55	0	55
Forested Wetlands									
PCT 5	VZ #9 5_Poor	No	No	1.5	26.4	0.88	9	0	9
Grassy Woodlands									
PCT 74	VZ #1 74_Mod-good	Yes[1]	Yes	2.5	56.6	1.2	41	0	41
PCT 80	VZ #2 80_Poor	Yes[2]	No	2	25.9	1.6	21	0	21
PCT 267	VZ #6 267_Mod-good	Yes[1]	Yes	2.5	51	0.26	8	0	8
PCT 277	VZ #4 277_Mod-good	Yes[1]	Yes	2.5	65.4	2.9	119	0	119
	VZ #7 277_Derived	Yes[1]	Yes	2.5	11	0.57	0	0	0
Semi-arid Woodlands (Grassy sub-formation)									
PCT 319	VZ #5 319_Mod-good	No	No	1.75	48.4	12.5	265	0	265
	VZ #10 319_Poor	No	No	1.75	25.1	0.42	5	0	5
	VZ #8 319_Derived	No	No	1.75	39.3	6.3	0	108	108
Total									**631**

(1) White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland – Critically Endangered BC Act and EPBC Act

(2) Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions – Endangered BC Act and EPBC Act

(3) Area calculation have rounding applied from BAM-C

12.2.10 Inland Slopes IBRA subregion scattered trees ecosystem credit offset

Scattered trees ecosystem credits required by the proposal for impacts calculated in the Inland Slopes IBRA subregion are outlined in Table 12-10 with the full credit report, including the ecosystem credit species predicted to utilise these native vegetation types, provided in Appendix F-9.

Table 12-10 Scattered trees ecosystem credit requirement for Inland Slopes IBRA subregion

ASSOCIATED PCT	CLASS	NUMBER OF TREES	CONTAINS HOLLOWS	CREDITS PER TREE	CREDITS REQUIRED
PCT 80 – Western Grey Box – White Cypress Pine tall woodland on loam soil on alluvial plains of NSW South Western Slopes Bioregion and Riverina Bioregion	3	8	Yes	1	8
PCT 277 – Blakely's Red Gum – Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion	3	8	Yes	1	8
Total					**16**

12.3 Species credit offset requirement

The total required species credit offset requirement, as determined using the BAM-C (version 1.3.0.00), for impacts on native vegetation unable to be avoided is provided for each IBRA subregion in Table 12-11.

Table 12-11 Total species credit offset requirement

SPECIES CREDIT OFFSET REQUIREMENT	SOP	LAC	MUR	LS	IS	CREDITS
Total biodiversity offset species credit requirement for each IBRA subregion	277	6	31,373	1,743	104	33,503
Total biodiversity offset species credit requirement						**33,503**

Note: IBRA subregions

SOP – South Olary Plain

LAC – Lachlan

MUR – Murrumbidgee

LS – Lower Slopes

IS – Inland Slopes

12.3.1 South Olary Plain IBRA subregion species credit offset

Species credits required by the proposal for impacts calculated in the South Olary Plain IBRA subregion are outlined in Table 12-12 with the full credit report, including like for like trading options, provided in Appendix F-1.

Table 12-12 Biodiversity offset species credit requirement for South Olary Plain IBRA subregion

SCIENTIFIC NAME	COMMON NAME	BC ACT[1]	VEGETATION ZONE	HABITAT CONDITION LOSS	AREA / COUNT[2]	BRW	SAII	SPECIES CREDITS
Threatened flora species								
Pimelea serpyllifolia subsp. *serpyllifolia*	Thyme Rice-Flower	E	VZ #10 172_Mod-good_whip	53.8	1.70 ha	3	Yes	69
							Subtotal	69
Threatened fauna species								
Lophochroa leadbeateri	Major Mitchell's Cockatoo	V	#1 15_Mod-good	36.2	5.8 ha	2	No	104
							Subtotal	104
Polytelis anthopeplus monarchoides	Regent Parrot (eastern subspecies)	E	#1 15_Mod-good	36.2	5.8 ha	2	No	104
							Subtotal	104
Total								**277**

(1) Threat status under the BC Act: V = vulnerable, E = endangered, CE = critically endangered

(2) Area calculation have rounding applied from BAM-C

12.3.2 Lachlan IBRA subregion species credit offsets

No species credit offsets are required for the Lachlan IBRA subregion.

Species credits required by the proposal for impacts calculated in the Lachlan IBRA subregion are outlined in Table 12-13 with the full credit report, including like for like trading options, provided in Appendix F-1.

Table 12-13 Biodiversity offset species credit requirement for Lachlan IBRA subregion

SCIENTIFIC NAME	COMMON NAME	BC ACT[1]	VEGETATION ZONE	HABITAT CONDITION LOSS	AREA / COUNT[2]	BRW	SAII	SPECIES CREDITS
Threatened fauna species								
Lophochroa leadbeateri	Major Mitchell's Cockatoo	V	#1 15_Mod-good	36.2	0.07 ha	2	No	3
							Subtotal	3
Polytelis anthopeplus monarchoides	Regent Parrot (eastern subspecies)	E	#1 15_Mod-good	36.2	0.07 ha	2	No	3
							Subtotal	3
Total								**6**

12.3.3 Murrumbidgee IBRA subregion species credit offset

Species credits required by the proposal for impacts calculated in the South Olary Plain IBRA subregion are outlined in Table 12-14 with the full credit report, including like for like trading options, provided in Appendix F-1.

Table 12-14 Biodiversity offset species credit requirement for Murrumbidgee IBRA subregion

SCIENTIFIC NAME	COMMON NAME	BC ACT[1]	VEGETATION ZONE	HABITAT CONDITION LOSS	AREA / COUNT[2]	BRW	SAII	SPECIES CREDITS
Threatened flora species								
Brachyscome papillosa	Mossgiel Daisy	V	VZ #8 17_Mod-good	97.7	3.7 ha	2	No	183
			VZ #35 17_SVM_Bench	100	4.1 ha	2	No	205
			VZ #11 24_Mod-good	88.9	1.5 ha	2	No	67
			VZ #36 24_SVM_Bench	100	0.01 ha	2	No	1
			VZ #24 160_Mod-good	97.7	6.3 ha	2	No	309
			VZ #44 160_SVM_Bench	100	1.2 ha	2	No	59
			VZ #25 163_Mod-good	98.4	8.8 ha	2	No	432
			VZ #26 164_Mod-good	98.2	2.4 ha	2	No	118
			VZ #45 164_SVM_Bench	100	43.1 ha	2	No	2,156
							Subtotal	3,530
Cullen parvum	Small Scurf-pea	E	VZ #1 5_Mod-good	54.9	1.6 ha	2	No	45
			VZ #2 7_Mod-good	44.3	0.25 ha	2	No	6
			VZ #33 7_SVM_Bench	100	0.01 ha	2	No	1
			VZ #16 44_Mod-good	88.6	36.6 ha	2	No	1,623
			VZ #39 44_SVM_Bench	100	6.4 ha	2	No	319
			VZ #17 45_Mod-good	88.1	0.01 ha	2	No	1

SCIENTIFIC NAME	COMMON NAME	BC ACT[1]	VEGETATION ZONE	HABITAT CONDITION LOSS	AREA / COUNT[2]	BRW	SAII	SPECIES CREDITS
			VZ #18 46_Mod-good	96.5	0.01 ha	2	No	1
			VZ #24 160_Mod-good	97.7	0.25 ha	2	No	12
			VZ #26 164_Mod-good	98.2	0.01 ha	2	No	1
			VZ #30 182_Mod-good	100	0.01 ha	2	No	1
							Subtotal	2,010
Lepidium monoplocoides	Winged Peppercress	E	VZ #16 44_Mod-good	88.6	0.2 ha	2	No	9
			VZ #39 44_SVM_Bench	100	6.6 ha	2	No	328
			VZ #24 160_Mod-good	97.7	0.25 ha	2	No	12
							Subtotal	349
Leptorhynchos orientalis	Lanky Buttons	E	VZ #16 44_Mod-good	88.6	8.7 ha	2	No	385
			VZ #39 44_SVM_Bench	100	6.4 ha	2	No	319
			VZ #24 160_Mod-good	97.7	0.25 ha	2	No	12
							Subtotal	716
Maireana cheelii	Chariot Wheels	V	VZ #8 17_Mod-good	97.7	2.2 ha	2	No	107
			VZ #35 17_SVM_Bench	100	3.5 ha	2	No	174
			VZ #38 28_SVM_Bench	83	1.3 ha	2	No	54
			VZ #16 44_Mod-good	88.6	8.2 ha	2	No	363
			VZ #18 46_Mod-good	96.5	5.1 ha	2	No	244
			VZ #41 46_SVM_Bench	100	23.1 ha	2	No	1,154
			VZ #21 58_Mod-good	45.3	0.01 ha	2	No	1

SCIENTIFIC NAME	COMMON NAME	BC ACT[1]	VEGETATION ZONE	HABITAT CONDITION LOSS	AREA / COUNT[2]	BRW	SAII	SPECIES CREDITS
			VZ #23 157_Mod-good	81.9	6.1 ha	2	No	251
			VZ #43 157_SVM_Bench	100	10.7 ha	2	No	535
			VZ #25 163_Mod-good	98.4	4.9 ha	2	No	241
			VZ #26 164_Mod-good	98.2	1.3 ha	2	No	66
			VZ #45 164_SVM_Bench	100	43.1 ha	2	No	2,156
			VZ #29 216_Mod-good	81.3	0.07 ha	2	No	7
							Subtotal	5,353
Pilularia novae-hollandiae	Austral Pillwort	E	VZ #8 17_Mod-good	97.7	2.4 ha	3	Yes	173
			VZ #35 17_SVM_Bench	100	4.1 ha	3	Yes	308
			VZ #39 44_SVM_Bench	100	0.01 ha	3	Yes	1
			VZ #24 160_Mod-good	97.7	0.98 ha	3	Yes	72
			VZ #44 160_SVM_Bench	100	1.2 ha	3	Yes	88
							Subtotal	642
Swainsona murrayana	Slender Darling Pea	V	VZ #8 17_Mod-good	97.7	5 ha	2	No	242
			VZ #35 17_SVM_Bench	100	4.1 ha	2	No	205
			VZ #11 24_Mod-good	88.9	3.3 ha	2	No	148
			VZ #36 24_SVM_Bench	100	0.01 ha	2	No	1
			VZ #12 26_Mod-good	63.8	2.9 ha	2	No	92
			VZ #13 26_Moderate	50	18.9	2	No	473

SCIENTIFIC NAME	COMMON NAME	BC ACT[1]	VEGETATION ZONE	HABITAT CONDITION LOSS	AREA / COUNT[2]	BRW	SAII	SPECIES CREDITS
			VZ #14 26_Derived	40.2	23.7	2	No	477
			VZ #37 26_SVM_Bench	86.1	0.04 ha	2	No	2
			VZ #16 44_Mod-good	88.6	16.7 ha	2	No	741
			VZ #39 44_SVM_Bench	100	6.4 ha	2	No	319
			VZ #17 45_Mod-good	88.1	13.1 ha	2	No	576
			VZ #40 45_SVM_Bench	100	10 ha	2	No	501
			VZ #18 46_Mod-good	96.5	25.9 ha	2	No	1,251
			VZ #41 46_SVM_Bench	100	23.1 ha	2	No	1,154
			VZ #19 47_Mod-good	82.5	0.17 ha	2	No	7
			VZ #42 47_SVM_Bench	100	0.88 ha	2	No	44
			VZ #20 53_Mod-good	100	1.7 ha	2	No	87
			VZ #23 157_Mod-good	81.9	5.8 ha	2	No	237
			VZ #43 157_SVM_Bench	100	10.7 ha	2	No	535
			VZ #24 160_Mod-good	97.7	1.4 ha	2	No	68
			VZ #44 160_SVM_Bench	100	1.2 ha	2	No	59
			VZ #25 163_Mod-good	98.4	11 ha	2	No	540
			VZ #26 164_Mod-good	98.2	3.3 ha	2	No	161
			VZ #45 164_SVM_Bench	100	43.1 ha	2	No	2,156

SCIENTIFIC NAME	COMMON NAME	BC ACT[1]	VEGETATION ZONE	HABITAT CONDITION LOSS	AREA / COUNT[2]	BRW	SAII	SPECIES CREDITS
			VZ #29 216_Mod-good	81.3	0.01 ha	2	No	1
							Subtotal	10,077
Swainsona sericea	Silky Swainson-pea	V	VZ #16 44_Mod-good	88.6	13.2 ha	2	No	585
			VZ #39 44_SVM_Bench	100	6.4 ha	2	No	320
			VZ #17 45_Mod-good	88.1	3.9 ha	2	No	174
			VZ #40 45_SVM_Bench	100	10 ha	2	No	501
			VZ #18 46_Mod-good	96.5	5.9 ha	2	No	287
			VZ #41 46_SVM_Bench	100	23.1 ha	2	No	1,154
			VZ #19 47_Mod-good	82.5	0.17 ha	2	No	7
			VZ #42 47_SVM_Bench	100	0.88 ha	2	No	44
			VZ #24 160_Mod-good	97.7	0.01 ha	2	No	1
			VZ #44 160_SVM_Bench	100	1.2 ha	2	No	59
			VZ #26 164_Mod-good	98.2	0.04 ha	2	No	2
			VZ #45 164_SVM_Bench	100	43.1 ha	2	No	2,156
							Subtotal	5,290
Threatened fauna species								
Hieraaetus morphnoides	Little Eagle	V	VZ #1 5_Mod-good	54.9	0.16 ha	1.5	No	3
			VZ #2 7_Mod-good	44.3	0.02	1.5	No	1
			VZ #4 11_Mod-good	58.4	0.24 ha	1.5	No	5
			VZ #5 13_Mod-good	75.8	0.09 ha	1.5	No	3

SCIENTIFIC NAME	COMMON NAME	BC ACT[1]	VEGETATION ZONE	HABITAT CONDITION LOSS	AREA / COUNT[2]	BRW	SAII	SPECIES CREDITS
			VZ #6 15_Mod-good	54.9	0.08 ha	1.5	No	2
			VZ #8 17_Mod-good	97.7	0.16 ha	1.5	No	6
			VZ #35 17_SVM_Bench	100	0.06	1.5	No	2
			VZ #12 26_Mod-good	63.8	2.7 ha	1.5	No	65
			VZ #13 26_Moderate	50	0.11 ha	1.5	No	2
			VZ #14 26_Derived	40.2	4.7 ha	1.5	No	70
			VZ #37 26_SVM_Bench	86.1	0.01 ha	1.5	No	1
			VZ #18 46_Mod-good	96.5	2.5 ha	1.5	No	89
			VZ #32 75_Mod-good	53.6	0.01 ha	1.5	No	1
			VZ #29 216_Mod-good	81.3	0.52 ha	1.5	No	16
							Subtotal	266
Lophochroa leadbeateri	Major Mitchell's Cockatoo	V	VZ #2 7_Mod-good	44.3	0.02	2	No	1
			VZ #3 8_Mod-good	53.2	4.8 ha	2	No	127
			VZ #4 11_Mod-good	58.4	8.2 ha	2	No	238
			VZ #5 13_Mod-good	75.8	1.5 ha	2	No	55
			VZ #6 15_Mod-good	54.9	12.4 ha	2	No	341
			VZ #34 15_SVM_Bench	48.9	0.14 ha	2	No	3
			VZ #12 26_Mod-good	63.8	2.7 ha	2	No	87

SCIENTIFIC NAME	COMMON NAME	BC ACT[1]	VEGETATION ZONE	HABITAT CONDITION LOSS	AREA / COUNT[2]	BRW	SAII	SPECIES CREDITS
			VZ #13 26_Moderate	50	0.11 ha	2	No	3
			VZ #14 26_Derived	40.2	4.7 ha	2	No	94
			VZ #37 26_SVM_Bench	86.1	0.01 ha	2	No	1
			VZ #15 28_Mod-good	36.2	0.4 ha	2	No	7
							Subtotal	957
Myotis macropus	Southern Myotis	V	VZ #3 8_Mod-good	44.3	0.02	2	No	127
							Subtotal	127
Pedionomus torquatus	Plains Wanderer	E	VZ #8 17_Mod-good	97.7	0.01	3	Yes	1
			VZ #16 44_Mod-good	88.6	0.09	3	Yes	6
			VZ #18 46_Mod-good	96.5	0.21	3	Yes	15
			VZ #41 46_SVM_Bench	100	0.03	3	Yes	2
			VZ #45 164_SVM_Bench	100	0.07	3	Yes	5
							Subtotal	29
Polytelis anthopeplus monarchoides	Regent Parrot (eastern subspecies)	E	VZ #3 8_Mod-good	53.2	4.8 ha	2	No	127
			#4 11_Mod-good	58.4	8.2 ha	2	No	238
			VZ #5 13_Mod-good	75.8	1.5 ha	2	No	55
			VZ #6 15_Mod-good	54.9	12.4 ha	2	No	341
			VZ #34 15_SVM_Bench	48.9	0.14 ha	2	No	3
							Subtotal	764

SCIENTIFIC NAME	COMMON NAME	BC ACT[1]	VEGETATION ZONE	HABITAT CONDITION LOSS	AREA / COUNT[2]	BRW	SAII	SPECIES CREDITS
Polytelis swainsonii	Superb Parrot	V	#1 5_Mod-good	54.9	4.9 ha	2	No	134
			#2 7_Mod-good	44.3	0.77	2	No	17
			#4 11_Mod-good	58.4	6.2 ha	2	No	181
			VZ #5 13_Mod-good	75.8	9.8 ha	2	No	370
			VZ #6 15_Mod-good	54.9	2.9 ha	2	No	78
			VZ #12 26_Mod-good	63.8	2.7 ha	2	No	87
			VZ #13 26_Moderate	50	0.11 ha	2	No	3
			VZ #14 26_Derived	40.2	4.7 ha	2	No	94
			VZ #37 26_SVM_Bench	86.1	0.01 ha	2	No	1
			VZ #15 28_Mod-good	36.2	0.4 ha	2	No	7
			VZ #17 45_Mod-good	88.1	2.7 ha	2	No	120
			VZ #40 45_SVM_Bench	100	1 ha	2	No	51
			VZ #18 46_Mod-good	96.5	2.5 ha	2	No	119
			VZ #32 75_Mod-good	53.6	0.01 ha	2	No	1
							Subtotal	1,263
Total								**31,373**

(1) Threat status under the BC Act: V = vulnerable, E = endangered, CE = critically endangered

(2) Area calculation have rounding applied from BAM-C

12.3.4 Lower Slopes IBRA subregion species credit offset

Species credits required by the proposal for impacts calculated in the Lower Slopes IBRA subregion are outlined in Table 12-15 with the full credit report, including like for like trading options, provided in Appendix F-1.

Table 12-15 Biodiversity offset species credit requirement for Lower Slopes IBRA subregion

SCIENTIFIC NAME	COMMON NAME	BC ACT[1]	VEGETATION ZONE	HABITAT CONDITION LOSS	AREA / COUNT[2]	BRW	SAII	SPECIES CREDITS
Threatened flora species								
Cullen parvum	Small Scurf-pea	E	VZ #1 5_Mod-good	61.3	0.84 ha	2	No	31
			VZ #14 74_Mod-good	51.2	0.3 ha	2	No	8
			VZ #7 249_Mod-good	41.9	1.6	2	No	33
			VZ #8 249_Derived	32.4	0.01 ha	2	No	1
							Subtotal	73
Threatened fauna species								
Hieraaetus morphnoides	Little Eagle	V	VZ #11 28_SVM_Bench	62.1	0.11 ha	1.5	No	3
			VZ #2 75_Mod-good	57.9	1.1 ha	1.5	No	24
			VZ #10 75_Derived	10.2	0.47 ha	1.5	No	2
			VZ #13 75_SVM_Bench	85	0.2 ha	1.5	No	6
			VZ #5 80_Mod-good	69.3	0.48 ha	1.5	No	12
			VZ #4 80_Moderate	44.3	0.1	1.5	No	2
			VZ #6 80_Derived	28.5	0.13 ha	1.5	No	1
			VZ #12 80_SVM_Bench	80.9	0.02	1.5	No	1
			VZ #7 249_Moderate	41.9	0.16	1.5	No	3
			VZ #8 249_Derived	32.4	0.21	1.5	No	3
							Subtotal	57

SCIENTIFIC NAME	COMMON NAME	BC ACT[1]	VEGETATION ZONE	HABITAT CONDITION LOSS	AREA / COUNT[2]	BRW	SAII	SPECIES CREDITS
Lophochroa leadbeateri	Major Mitchell's Cockatoo	V	VZ #5 80_Mod-good	69.3	0.48 ha	2	No	17
			VZ #4 80_Moderate	44.3	0.1	2	No	2
			VZ #6 80_Derived	28.5	0.13 ha	2	No	2
			VZ #12 80_SVM_Bench	80.9	0.02	2	No	1
			VZ #7 249_Moderate	41.9	0.16	2	No	3
			VZ #8 249_Derived	32.4	0.21	2	No	3
							Subtotal	28
Petaurus norfolcensis	Squirrel Glider	V	VZ #1 5_Mod-good	61.1	2.7 ha	2	No	82
			VZ #14 74_Mod-good	51.2	0.24	2	No	6
			VZ #2 75_Mod-good	57.9	28.8 ha	2	No	834
			VZ #3 76_Mod-good	53.6	1.3 ha	2	No	35
			VZ #5 80_Mod-good	69.3	11.9 ha	2	No	411
			VZ #4 80_Moderate	44.3	6.5 ha	2	No	143
							Subtotal	1,511
Polytelis swainsonii	Superb Parrot	V	VZ #11 28_SVM_Bench	62.1	0.11 ha	2	No	3
			VZ #14 74_Mod-good	51.2	0.01 ha	2	No	1
			VZ #2 75_Mod-good	57.9	1.1 ha	2	No	32
			VZ #10 75_Derived	10.2	0.47 ha	2	No	2
			VZ #13 75_SVM_Bench	85	0.2 ha	2	No	8
			VZ #5 80_Mod-good	69.3	0.48 ha	2	No	17

SCIENTIFIC NAME	COMMON NAME	BC ACT[1]	VEGETATION ZONE	HABITAT CONDITION LOSS	AREA / COUNT[2]	BRW	SAII	SPECIES CREDITS
			VZ #4 80_Moderate	44.3	0.1	2	No	2
			VZ #6 80_Derived	28.5	0.13 ha	2	No	2
			VZ #12 80_SVM_Bench	80.9	0.02	2	No	1
			VZ #7 249_Moderate	41.9	0.16	2	No	3
			VZ #8 249_Derived	32.4	0.21	2	No	3
							Subtotal	74
Total								**1,743**

(1) Threat status under the BC Act: V = vulnerable, E = endangered, CE = critically endangered

(2) Area calculation have rounding applied from BAM-C

12.3.5 Inland Slopes IBRA subregion species credit offset

Species credits required by the proposal for impacts calculated in the Inland Slopes IBRA subregion are outlined in Table 12-16 with the full credit report, including like for like trading options, provided in Appendix F-1.

Table 12-16 Biodiversity offset species credit requirement for Inland Slopes IBRA subregion

SCIENTIFIC NAME	COMMON NAME	BC ACT[1]	VEGETATION ZONE	HABITAT CONDITION LOSS	AREA / COUNT[1]	BRW	SAII	SPECIES CREDITS
Threatened flora species								
Cullen parvum	Small Scurf-pea	E	VZ #9 5_Poor	26.4	0.29 ha	2	No	4
			VZ #1 74_Mod-good	74.1	0.65 ha	2	No	18
			VZ #4 277_Mod-good	24	0.57 ha	2	No	42
							Subtotal	64
Petaurus norfolcensis	Squirrel Glider	V	VZ #1 74_Mod-good	56.6	1.2 ha	2	No	33
			VZ #6 267_Mod-good	51	0.26 ha	2	No	7
							Subtotal	40
Total								**104**

(1) Threat status under the BC Act: V = vulnerable, E = endangered, CE = critically endangered

(2) Area calculation have rounding applied from BAM-C

12.4 Biodiversity offset strategy

The biodiversity offset strategy (BOS) for this proposal, that would enable the credit obligations to be met, comprises four options. These options are:

- the purchase and retirement of existing biodiversity credits currently available on the biodiversity credit register
- establishing biodiversity stewardship site(s) on lands with like for like biodiversity values to those impacted by the proposal
- making a payment into the Biodiversity Conservation Fund (BCF)
- alternative strategic offset outcomes.

The proposed BOS will deliver the like for like retirement of the proposal credit liability, through the establishment of a series of Biodiversity Stewardship Agreements (BSAs) and /or purchase of existing credits from the market. Any residual credit liability not met through these offset strategies will met through the payment into the BCF.

12.4.1 Existing biodiversity credits

The purchase and retirement of existing biodiversity credits is required to be undertaken based on like for like trading rules as outlined under the BC Reg and as identified by the BAM calculator output for the proposal (see Appendix F).

12.4.1.1 Ecosystem credit options – like for like

Like for like ecosystem credit trading rules are based around two main principles, being offsets for impacts on threatened ecological communities and offset for impacts on the habitat of threatened species that are ecosystem credit species or other native vegetation (other than impacts on threatened ecological communities). The like for like ecosystem credit trading rules are:

In the case of impacts on threatened ecological communities, like-for-like biodiversity credits represent:

- the same threatened ecological community located in:
  - the same or an adjoining Interim Biogeographic Regionalisation of Australia subregion as the impacted site, or
  - any such subregion that is within 100 kilometers of the outer edge of the impacted site, and
- if the threatened ecological community contains hollow bearing trees--vegetation that contains hollow bearing trees.

In the case of impacts on the habitat of threatened species that are ecosystem credit species or other native vegetation (other than impacts on threatened ecological communities), like-for-like biodiversity credits represent:

- the same class of native vegetation located in:
  - the same or an adjoining Interim Biogeographic Regionalisation of Australia subregion as the impacted site, or
  - any such subregion that is within 100 kilometers of the outer edge of the impacted site, and
- the same or a higher offset trading group, and
- if the impacted habitat contains hollow bearing trees – vegetation that contains hollow bearing trees.

In circumstances where like for like ecosystem credits options are not available, variations rules may be applied as outlined in Section of the BC Reg.

The like for like ecosystem credit class options for the proposal biodiversity offset credit obligation is summarised for each IBRA subregion in Appendix F-1, Appendix F-2, Appendix F-3, Appendix F-4 and Appendix F-5.

12.4.1.2 Species credit options – like for like

In the case of impacts on threatened species that are species credit species, like-for-like biodiversity credits represent the same threatened species. Like for like species may be sourced from anywhere in NSW. In circumstances where like for like species credits options are not available, variations rules may be applied that include:

- if the impacted species is a plant-they represent a plant, and
- if the impacted species is an animal-they represent an animal, and
- they represent a species that has the same or a higher category of listing under Part 4 of the Act as a threatened species, and
- they represent a location that is in:
  - the same or an adjoining Interim Biogeographic Regionalisation of Australia subregion as the impacted site, or
  - any such subregion that is within 100 kilometers of the outer edge of the impacted site.

12.4.2 General principles in establishing a Biodiversity Stewardship Sites

Biodiversity and landscape characteristics are important consideration in the identification and securing of appropriate Biodiversity Stewardship Sites. The following characteristics have been used in guiding the preferred offset strategy for the proposal:

- presence of relevant threatened biodiversity and conservation values
- distance from the Proposal
- current condition and potential for improvement
- connectivity.

These characteristics are described in detail below.

12.4.2.1 Presence of relevant biodiversity values

Offsets must be targeted and offset the impacts on a ‘like for like’ or ‘better’ basis. From the clearing of Mallee vegetation in the west of the alignment (Border to Balranald) to the likely unavoidable clearing of White Box – Yellow Box Woodland near Wagga Wagga, it will be necessary to develop an overall BOS that addresses the complexities and variabilities of biodiversity values across a large portion of the width of NSW.

12.4.2.2 Distance from the proposal

Biodiversity offsets should be located appropriately and offset the impact in the same region. Ideally, offset habitat areas should be located within the region of the Proposal. For example, the Proposal offsets for the Mallee vegetation in the west of the alignment (Border to Balranald) should be located in the South Olary Plain sub-region of the Murray Darling Depression Interim Biogeographic Regionalisation for Australia (IBRA) Bioregion where possible.

Choosing offsets within the region of the Proposal is also consistent with the need to provide compensatory habitat or similar type and quality to that being removed. The integrity of the habitat network and biodiversity values of the locality should be retained, habitat secured, and existing corridors consolidated for local flora and fauna populations.

In addition to the ecological benefits, by choosing offsets located within the region of the Proposal, conservation planning can be integrated with development planning and this is also likely to benefit the reputation of the proponent, particularly with local stakeholders.

12.4.2.3 Current condition and potential for improvement

Habitat condition gives an indication of the quality for flora and fauna habitat and long-term variability. The condition of a remnant is a result of several factors including weed invasion, fragmentation, pollution and disturbances including clearing, fire and grazing. The condition provides an index of a site's potential to support threatened species, populations and communities. Although it is preferable that the condition/habitat quality of offset areas exceeds or matches that of the habitat being removed, this is not always achievable. Where the condition or quality of the offset is not equivalent to that of the area being cleared, a greater area of offset may be required.

Where the condition of habitats can be improved through changes in the management (for example the cessation of grazing and weed control), this improvement in condition can be used to offset a development.

12.4.2.4 Connectivity

Connectivity of habitats is essential for the long-term survival of many species because it facilitates the movement on a local scale, for foraging and sheltering, as well as on a regional or even national scale as a wildlife corridor for dispersal and migration. Remnants with habitat linkages are more likely to maintain their biodiversity in the long-term because wildlife corridors:

- provide increased foraging area for wide-ranging species
- provide cover for movement between habitat patches, particularly for cover-dependent species and species with poor dispersal ability and enhance the movement of animals through sub-optimal habitats
- reduce genetic isolation
- facilitate access to mix of habitats and successional stages to those species which require them for different activities (for example foraging or breeding)
- provide refuge from disturbances such as fire
- provide habitat in itself
- link wildlife populations and maintain immigration and re-colonisation between otherwise isolated patches. This is turn may help reduce the risk of population extinction (Wilson and Lindenmayer 1995).

Offsets are likely to be of greater biodiversity value where they are located adjacent to remnant vegetation creating a larger remnant or where they provide linkages within an otherwise fragmented landscape. Connectivity of habitats creates larger remnants that are likely to be of higher quality and support higher biodiversity. Compensatory habitat should act to consolidate existing corridors or, occur adjacent to existing area of native vegetation in order to maintain or increase their habitat quality and long-term viability

12.4.2.5 Regulatory requirements

Section 6.3 of the BC Regulations outlines that the like for like biodiversity credits are considered appropriate if they represent:

- the same Threatened Ecological Community (if applicable) or for non-threatened vegetation be in the same vegetation class and in the same or higher offset trading group
- are located in the same or an adjoining IBRA subregion as the proposal site or
- are located in a subregion that is within 100 kilometres of the proposal site
- must contain hollow-bearing trees if the proposal impacts on vegetation with hollow-bearing trees.

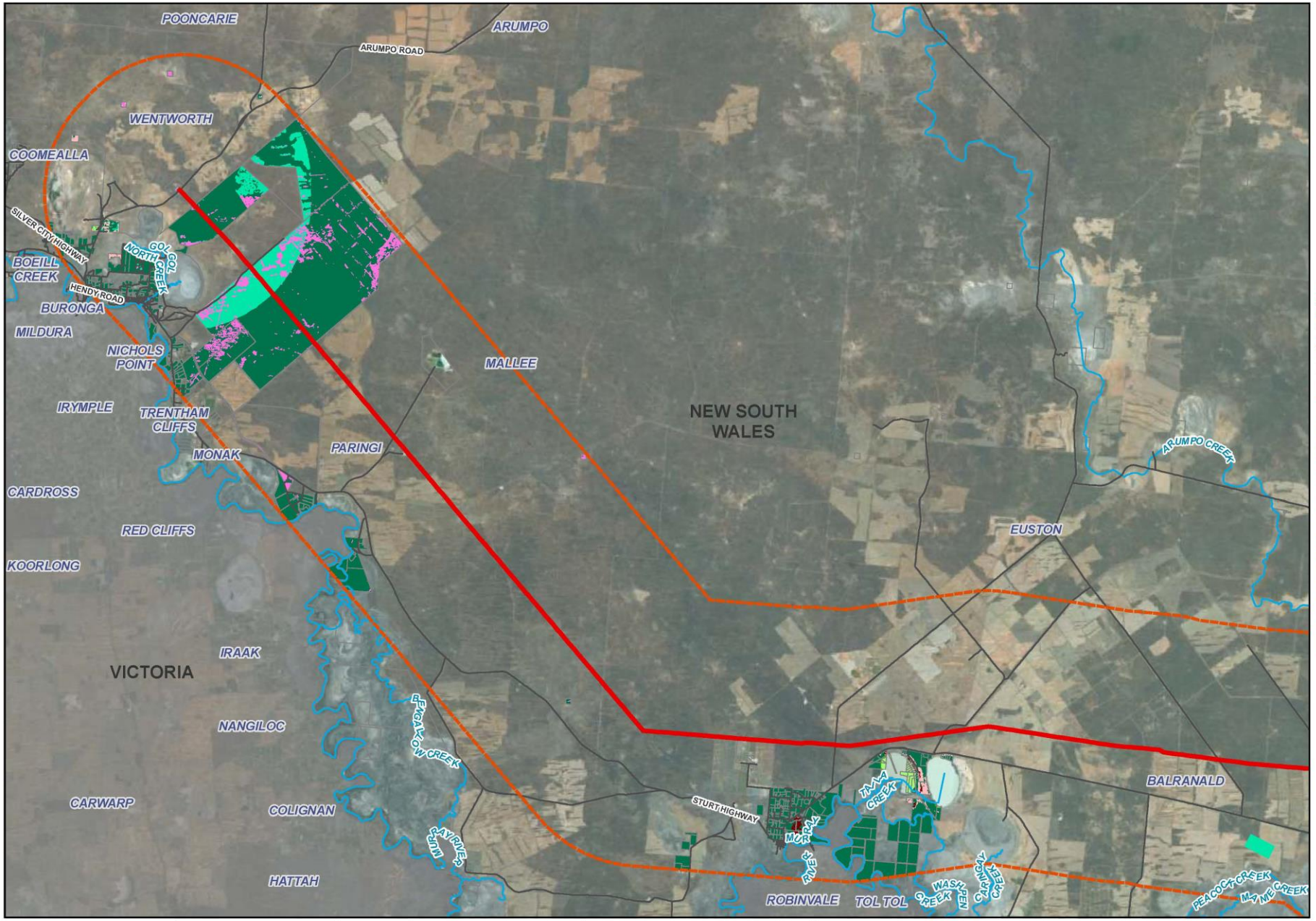
Section 6.4 of the BC Regulations outlined the variation rules for Threatened Ecological Communities and indicate that appropriate offsets include those that:

- represent the same vegetation formation, and they are in the same or a higher offset trading group
- are located in the same or an adjoining IBRA subregion as the proposal site or
- are located in a subregion that is within 100 kilometres of the proposal site
- must contain hollow-bearing trees if the proposal impacts on vegetation with hollow-bearing trees.

12.4.3 Potential opportunities available for BSAs

Using the above offset principles and regulations approach, a GIS desktop study was completed to identify biodiversity credits in accordance with Section 6.3 and 6.4 of the BC Regulations which may be secured through a BSA. Analysis shows that there are available like for like PCT's for offsetting in the locality and region, refer to Table 12-17 and Figure 12-1 below.

This process was used to identify a shortlist of properties to be investigated for suitability as additional BSA sites.



Buronga to Wagga Wagga
10km buffer
Road
River/creek
Cadastre
Semi-arid Woodlands (Shrubby sub-formation) (≥50%-<70% cleared)
Grasslands (≥50%-<70% cleared)
Freshwater Wetlands (≥50%-<70% cleared)
Forested Wetlands (≥50%-<70% cleared)
Arid Shrublands (Chenopod sub-formation) (≥70%-<90% cleared)
Semi-arid Woodlands (Grassy sub-formation) (≥50%-<70% cleared)
Semi-arid Woodlands (Shrubby sub-formation) (<50% cleared)
Saline Wetlands (<50% cleared)
Grasslands (<50% cleared)
Freshwater Wetlands (<50% cleared)
Forested Wetlands (<50% cleared)
Arid Shrublands (Chenopod sub-formation) (≥50%-<70% cleared)
Arid Shrublands (Chenopod sub-formation) (<50% cleared)

Map: PS117658_BDAR_F1201_LikeForLikeEcoCreditClasses_A2

Author: Robert.Suansri

Date: 21/05/21

Approved by: - T.Lambert

0 5 10 km

1:300,000

Coordinate system: GDA 1994 MGA Zone 55

Scale ratio correct when printed at A3

Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase,

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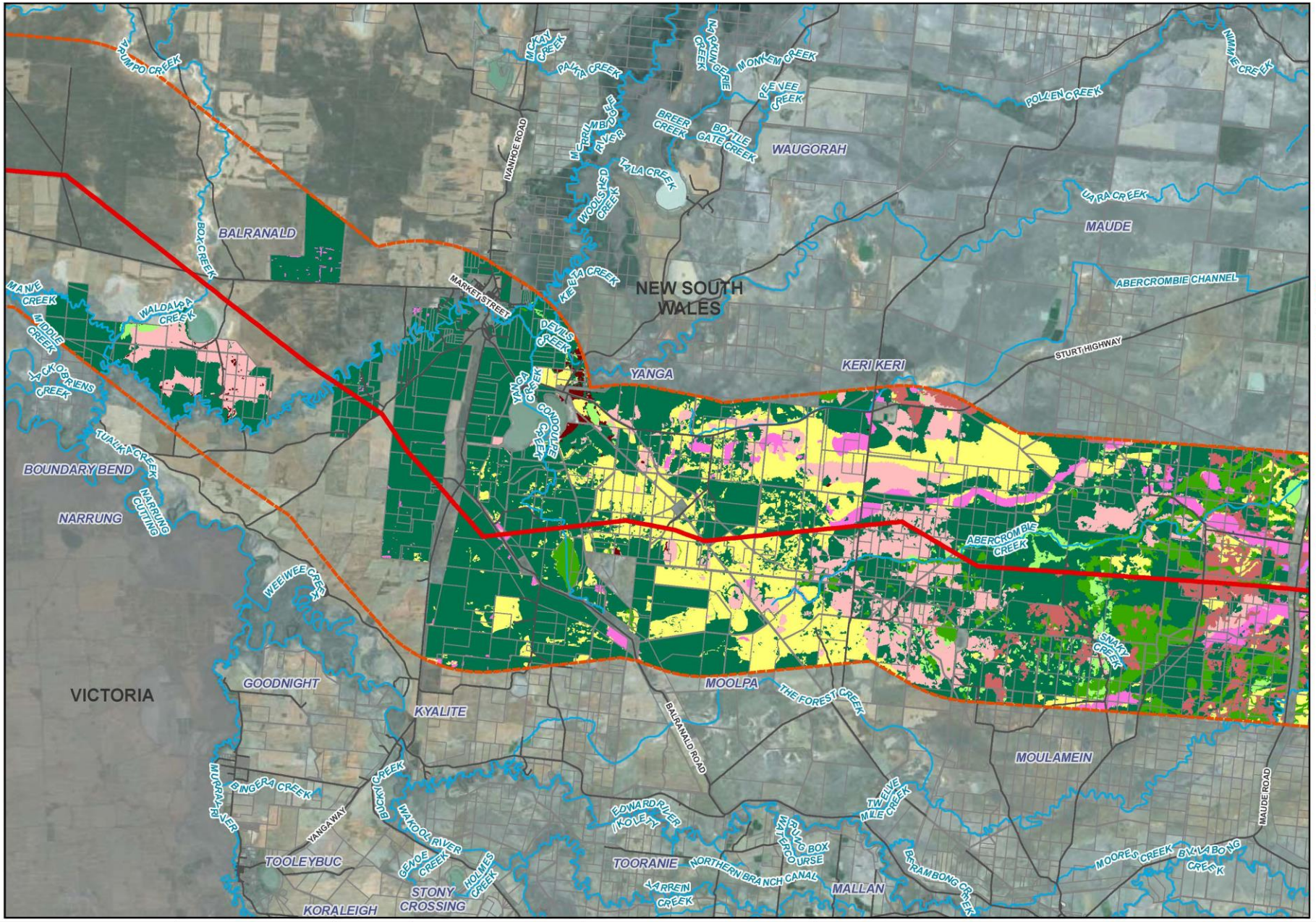
Figure 12.1a
Like for like ecosystem credit classes availability



Map: PS117658_BDAR_F1201_LikeForLikeEcoCreditClasses_A2

Author: Robert.Suansri

Date: 21/05/21

Approved by: - T.Lambert

Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase,

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Coordinate system: GDA 1994 MGA Zone 55

Scale ratio correct when printed at A3

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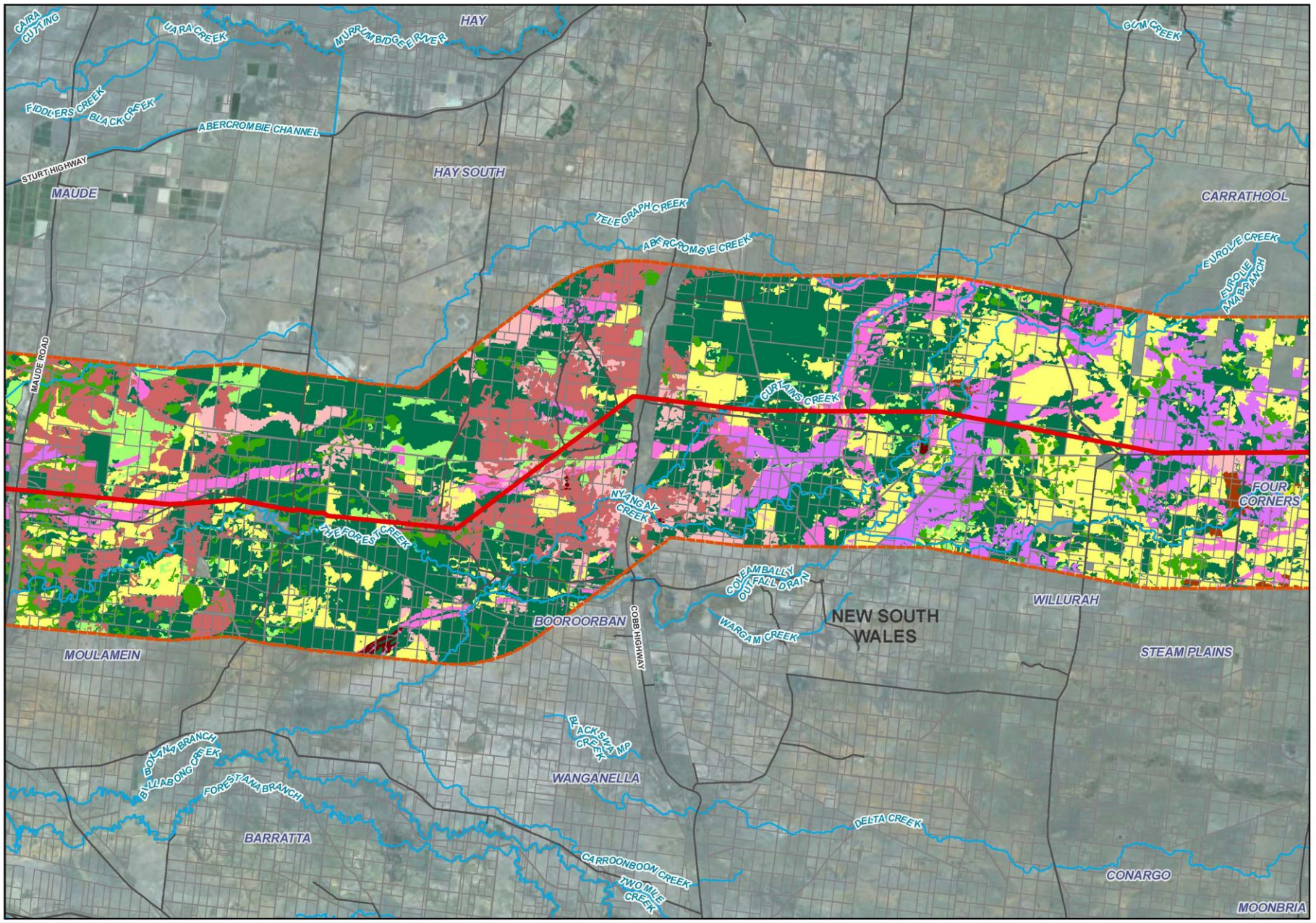
Figure 12.1b
Like for like ecosystem credit classes availability



Map: PS117658_BDAR_F1201_LikeForLikeEcoCreditClasses_A2

Author: Robert.Suansri

Date: 21/05/21

Approved by: - T.Lambert

0 5 10 km

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Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase,

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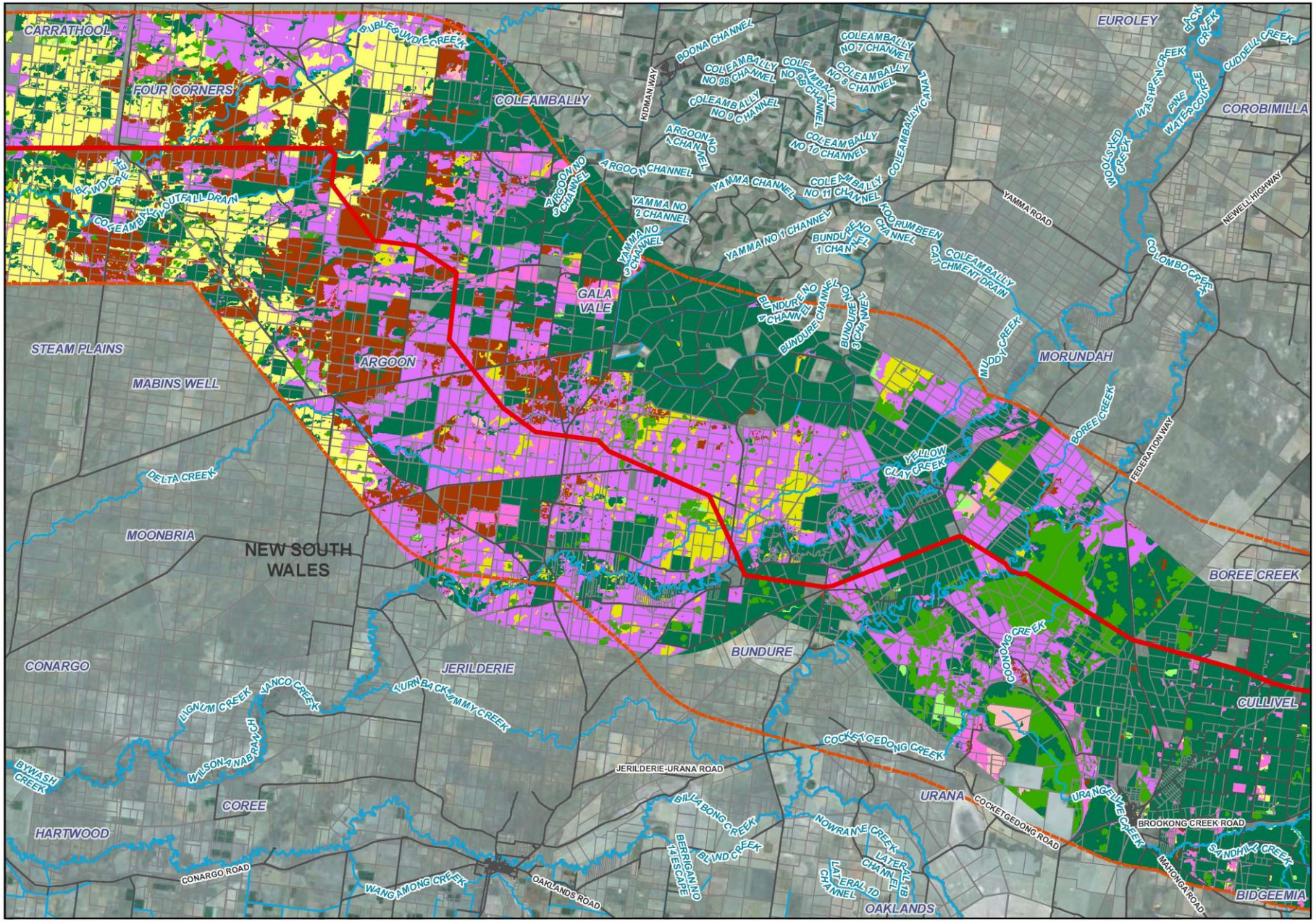
Figure 12.1c
Like for like ecosystem credit classes availability



Map: PS117658_BDAR_F1201_LikeForLikeEcoCreditClasses_A2

Author: Robert.Suansri

Date: 21/05/21

Approved by: - T.Lambert

0 5 10 km

1:300,000

Coordinate system: GDA 1994 MGA Zone 55

Scale ratio correct when printed at A3

Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase,

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Transgrid

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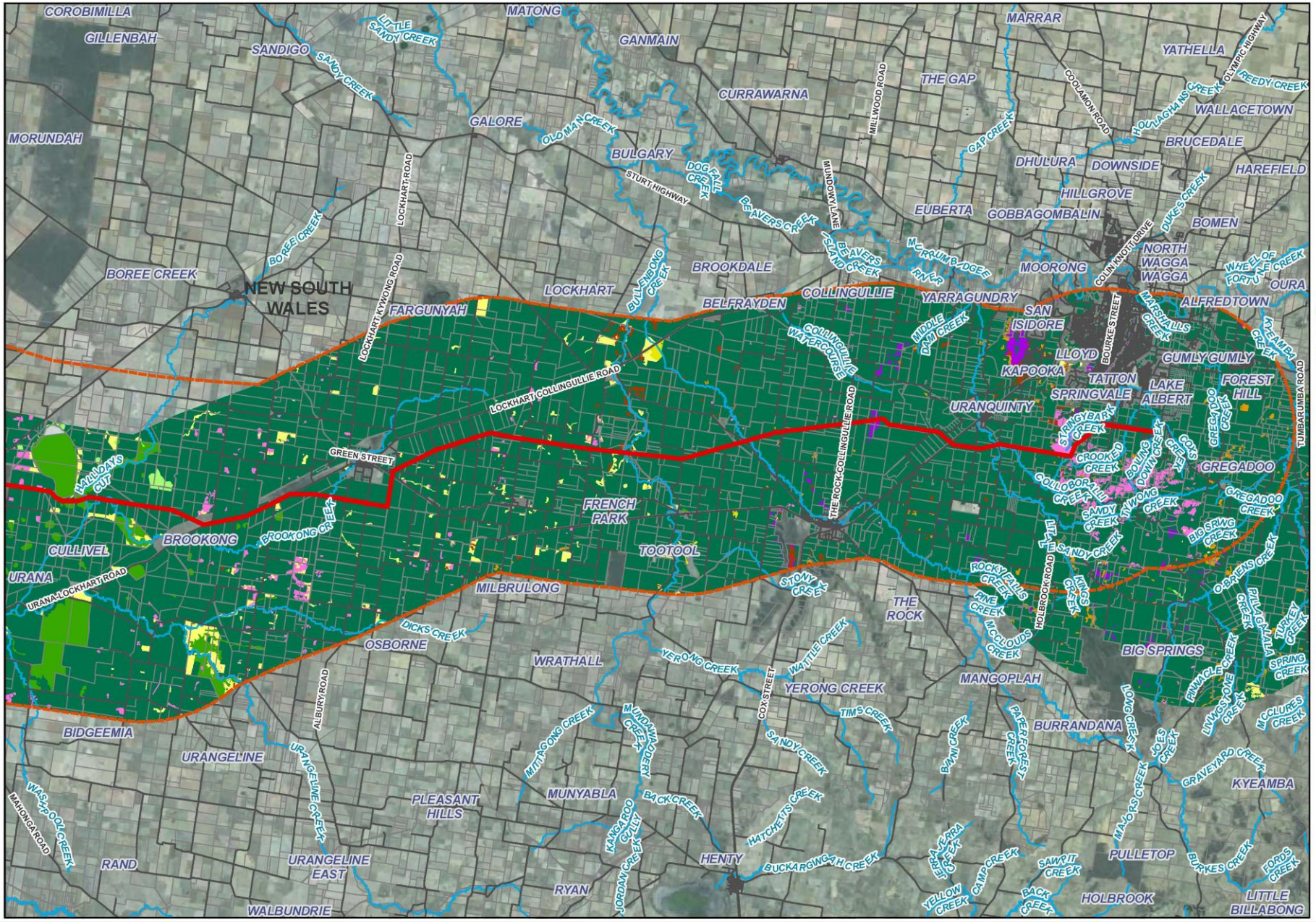
Figure 12.1d
Like for like ecosystem credit classes availability



Map: PS117658_BDAR_F1201_LikeForLikeEcoCreditClasses_A2

Author: Robert.Suansri

Date: 21/05/21

Approved by: - T.Lambert

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1:300,000

Coordinate system: GDA 1994 MGA Zone 55

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Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase,

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Figure 12.1e
Like for like ecosystem credit classes availability

Table 12-17 Like for like ecosystem credit classes availability

TRADING GROUP	IMPACTED PCTS	IMPACT AREA (HA)	LIKE FOR LIKE OFFSETS			
			PCTs within 10 km	Area within 10 km (ha)	PCTs within 100 km	Area within 100 km (ha)
Threatened Ecological Communities						
Acacia melvillei Shrubland[1]	PCT 23	0.00	–	–	-	–
Non-threatened vegetation types						
Aeolian Chenopod Shrublands (<50% Cleared)	PCT 153; 154	84.19	PCT 152; PCT 154	171.22	PCT 152; PCT 154	116,736,784.17
Gibber Chenopod Shrublands (≥50%-<70%)	PCT 156	1.82	–	-	–	–
Inland Floodplain Shrublands (<50% Cleared)	PCT 160	0.40	PCT 24; 160; 247	69.21	PCT 17; 24; 160; 240; 247	15,044,429.52
Inland Floodplain Woodlands (≥50%-<70% Cleared)	PCT 13; 15; 630	52.11	PCT 13; 15; 16	5,960.11	PCT 13; 15; 16	368,505,235.25
Inland Riverine Forests (<50% Cleared)	PCT 11	7.17	PCT 11	581.25	PCT 8; 11	94,188,108.32
Inland Saline Lakes (<50% Cleared)	PCT 64	1.74	PCT 64; 65; 166	247.72	PCT 63; 64; 65; 166; 198	29,571,798.77
Riverine Chenopod Shrublands (≥70%-<90% Cleared)	PCT 158	0.19	–	–	PCT 158; 159	1,798,182.36
Riverine Chenopod Shrublands (≥50%-<70% Cleared)	PCT 157	2.08	PCT 157	28.87	PCT 157; 158; 159	56,470,948.61
Riverine Chenopod Shrublands (<50% Cleared)	PCT 165	0.06	PCT 157; 163; 165; 254	30.63	PCT 157; 158; 159; 163; 165; 168; 236; 254	57,416,904.88
Sand Plain Mallee Woodlands (<50% Cleared)	PCT 170	28.96	PCT 170; 193	2,618.88	PCT 170; 193	85,286,407.62

TRADING GROUP	IMPACTED PCTS	IMPACT AREA (HA)	LIKE FOR LIKE OFFSETS			
			PCTs within 10 km	Area within 10 km (ha)	PCTs within 100 km	Area within 100 km (ha)
Sand Plain Mulga Shrublands (≥50%-<70% Cleared)	PCT 139	13.03	PCT 139	100.73	PCT 128; 139	5,384,137.97
Semi-arid Floodplain Grasslands (≥50%-<70% Cleared)	PCT 43	0.24	PCT 43	164.62	PCT 43	13,822,924.20
Semi-arid Sand Plain Woodlands (<50% Cleared)	PCT 221	0.87	PCT 57; 58; 221; 252	1,380.80	PCT 57; 58; 221; 252	43,332,177.68
Total		**192.86**	**–**	**11,354.04 ha**	**–**	**887,558,039.35**

12.4.4 Establishment of biodiversity stewardship agreements

Under the BC Act, land with biodiversity values can be established under a biodiversity stewardship agreement to allow for in-perpetuity conservation and management. BSAs allow the landholder to create biodiversity credits that can be traded to offset development impacts. Transgrid are actively progressing a number of potential BSAs that have been identified to contain like for like biodiversity values to those identified within the disturbance area.

The main stages in developing the BSA are conceptually shown in the diagram below.

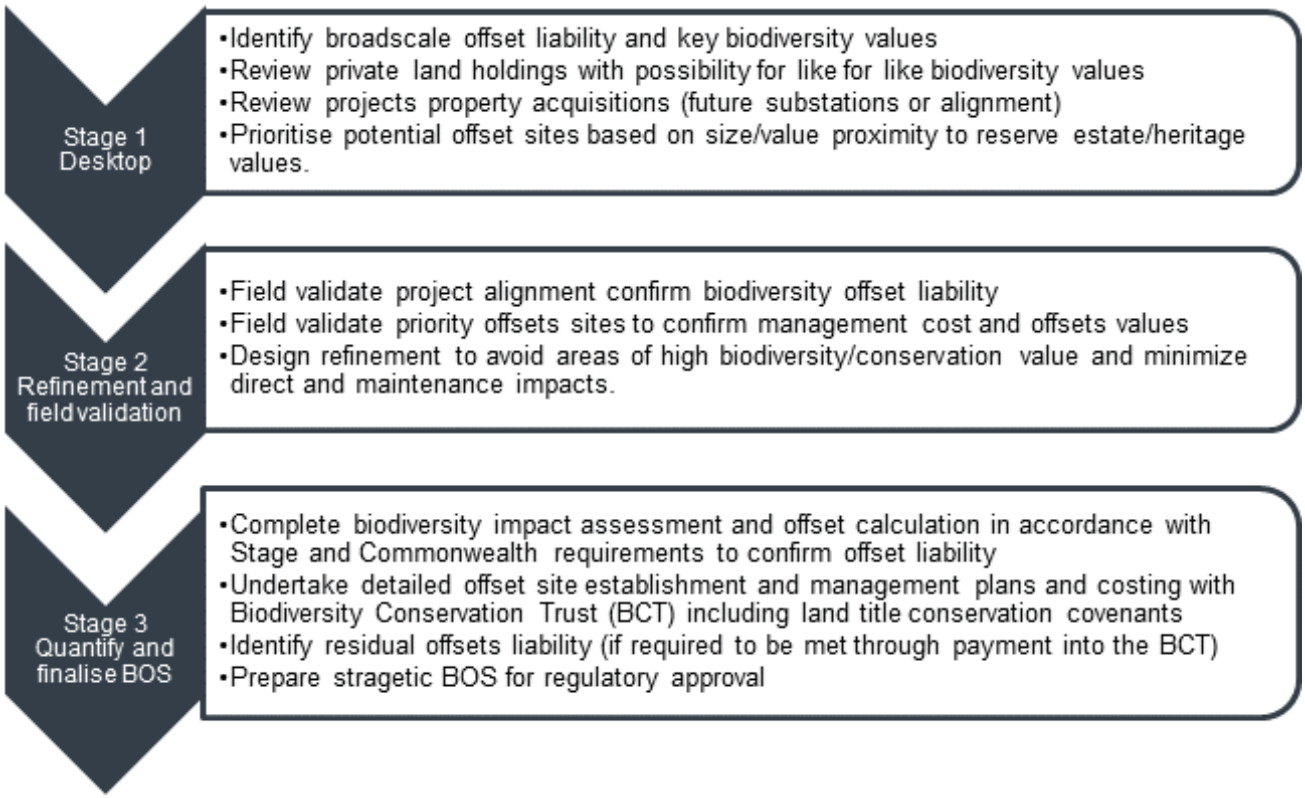


Figure 12-2 Biodiversity Stewardship Agreement process

At present the assessment process lies in between Stage 2 and 3. There has been field validation of the PCTs between the SA Border and Balranald and two candidate BSA sites being subject to targeted field surveys, which has been used to inform the initial establishment of a least one preferred BSA on the Big Bend property. A summary of the initial BSA for the Big Bend property is provided below.

12.4.4.1 Big Bend Property

Given the lack of available biodiversity credits for many of the PCTs that are required to offset the impacts of the proposal, development of Biodiversity Stewardship Sites (via BSA's) is the preferred option. Most of the offset liability for impact to non-threatened Mallee vegetation in the west of the alignment can be met with the establishment of BSAs.

Based on current investigations and a preliminary review of potential offset properties including the Big Bend property it is likely the proposal will be able to establish suitable BSA's to offset for the non-threatened Mallee and associated vegetation liabilities.

This section describes the process taken to identify the suitability of the Big Bend as one of the proposed BSAs and identifies the potential offset liability that could be met by creating a BSA across this (and other) properties.

A detailed field inspection of the Big Bend property, incorporating previous field validations of broad scale mapping of PCTs, general habitat observation and potential habitat assessment of locally occurring threatened species likely to occur within the candidate lands was undertaken on 19–23 December 2019 and 19 February 2020. The field inspections covered a majority of the property portions.

Preliminary discussions have been held with Biodiversity Conservation Trust (BCT) on the suitability of Big Bend and other properties for creation of BSA's for this proposal.

A summary of the key features and conservation outcomes of the Big Bend BSA is provided below.

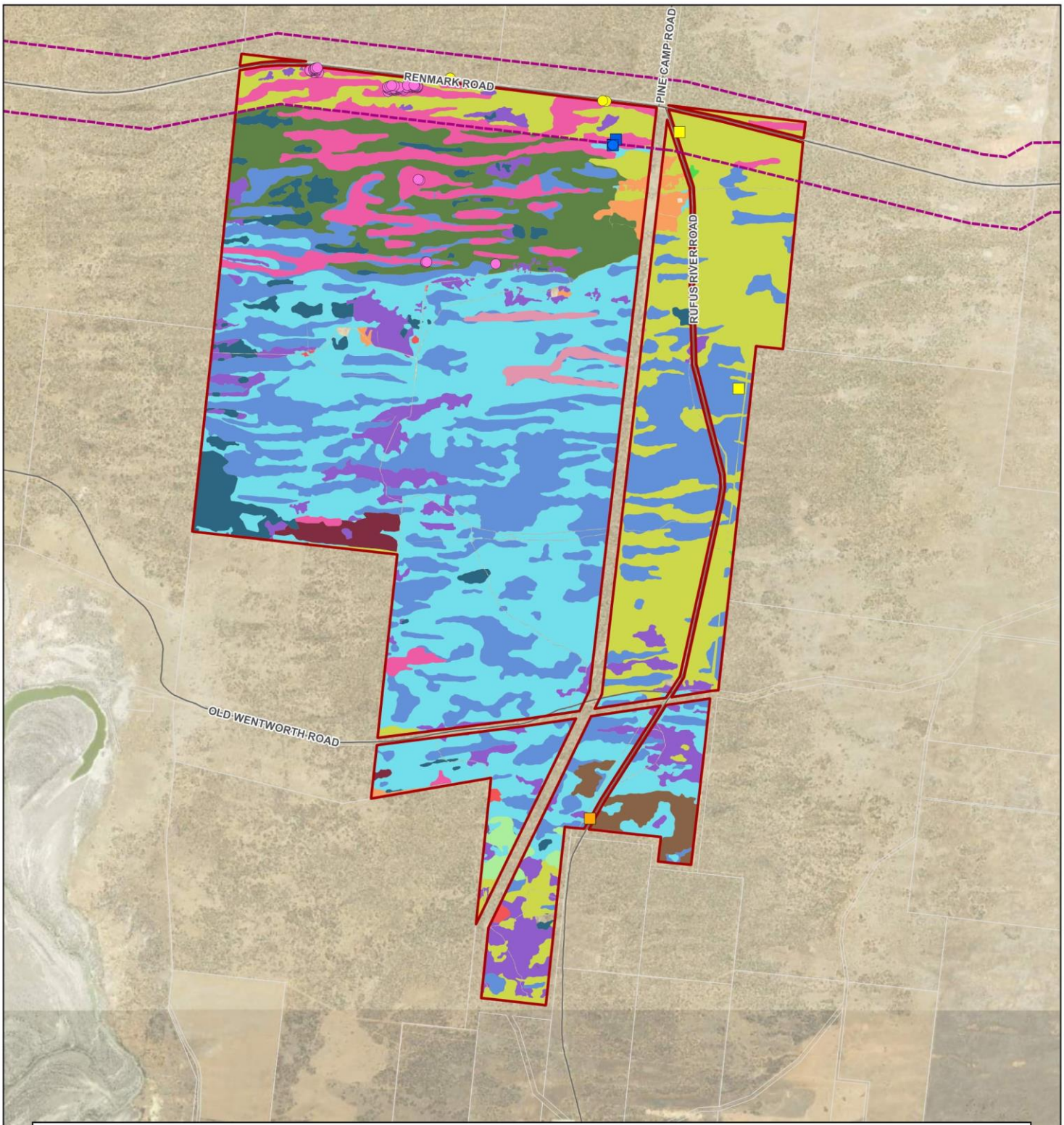
Vegetation and PCTs

The field verification confirmed the presence of at least 12 PCTs across Big Bend consistent with the broad scale mapping (refer to Table 12-18 below). The vegetation was predominantly regrowth "whipstick" mallee, however substantial areas of old growth hollow producing Mallee were also observed. The general condition of the PCTs inspected were characterised by a relatively intact understorey with high native species diversity. The distribution of PCTs within the site is shown in the Figure 12-3 below.

The initial credit generation potential of this BSA when combined with adjoining additional BSAs being progressed is over 40,000 ecosystem credits that will satisfy like for like credit requirement for over 50% of the Energy Connect Western Section credit liability.

Table 12-18 Field verification of PCTs at Big Bend property

PCT NO.	PLANT COMMUNITY TYPE NAME	BIG BEND
21	Slender Cypress Pine – Sugarwood – Western Rosewood open woodland on sandy rises mainly in the Riverina Bioregion and Murray Darling Depression Bioregion	Absent
28	White Cypress Pine open woodland of sand plains, prior streams and dunes mainly of the semi-arid (warm) climate zone	Present
53	Shallow freshwater wetland sedgeland in depressions on floodplains on inland alluvial plains and floodplains	Present
58	Black Oak - Western Rosewood open woodland on deep sandy loams mainly in the Murray Darling Depression Bioregion	Present
70	White Cypress Pine woodland on sandy loams in central NSW wheatbelt	Present
143	Narrow-leaved Hopbush – Scrub Turpentine – Senna shrubland on semi-arid and arid sandplains and dunes	Present
153	Black Bluebush low open shrubland of the alluvial plains and sandplains of the arid and semi-arid zones	Present
170	Chenopod sandplain mallee woodland/shrubland of the arid and semi-arid (warm) zones	Present
171	Spinifex linear dune mallee mainly of the Murray Darling Depression Bioregion	Present
172	Deep sand mallee of irregular dunefields of the semi-arid (warm) zone	Present
178	Broombush – Green Mallee – Blue Mallee very tall shrubland on stony rises in the NSW South Western Slopes Bioregion	Absent
252	Sugarwood open woodland of the inland plains mainly Murray Darling Depression Bioregion	Present



Threatened flora (WSP)

- Acacia acanthoclada
- Dodonaea stenozyga
- Santalum murrayanum

Scientific

- Acacia acanthoclada
- Cratystylis conocephala
- Santalum murrayanum
- 1km corridor
- Offset boundary
- Cadastre
- Road

PCT, Condition

- PCT143 - Narrow-leaved Hopbush - Scrub Turpentine - Senna shrubland on semi-arid and arid sandplains and dunes., moderate to good
- PCT153 - Black Bluebush low open shrubland of the alluvial plains and sandplains of the arid and semi-arid zones, moderate to good
- PCT170 - Chenopod sandplain mallee woodland/shrubland of the arid and semi-arid (warm) zones, derived
- PCT170 - Chenopod sandplain mallee woodland/shrubland of the arid and semi-arid (warm) zones, moderate to good
- PCT170 - Chenopod sandplain mallee woodland/shrubland of the arid and semi-arid (warm) zones, moderate to good_bull
- PCT170 - Chenopod sandplain mallee woodland/shrubland of the arid and semi-arid (warm) zones, moderate to good_bull
- PCT170 - Chenopod sandplain mallee woodland/shrubland of the arid and semi-arid (warm) zones, moderate to good_whip
- PCT171 - Spinifex linear dune mallee mainly of the Murray Darling Depression Bioregion, moderate to good
- PCT171 - Spinifex linear dune mallee mainly of the Murray Darling Depression Bioregion, moderate to good
- PCT171 - Spinifex linear dune mallee mainly of the Murray Darling Depression Bioregion, moderate to good_bull
- PCT171 - Spinifex linear dune mallee mainly of the Murray Darling Depression Bioregion, moderate to good_whip
- PCT172 - Deep sand mallee of irregular dunefields of the semi-arid (warm) zone, moderate to good_whip
- PCT252 - Sugarwood open woodland of the inland plains mainly Murray Darling Depression Bioregion, moderate to good
- PCT21 - Slender Cypress Pine - Sugarwood - Western Rosewood open woodland on sandy rises, moderate to good
- PCT53 - Shallow freshwater wetland sedgeland in depressions on floodplains on inland alluvial plains and floodplains, moderate to good
- PCT58 - Black Oak - Western Rosewood open woodland on deep sandy loams mainly in the Murray Darling Depression Bioregion, moderate to good

Map: PS117658_BDAR_F1202_BigBendBiodiversityValues_1

Author: - R.Suansri

Date: 21/05/21

Approved by: - T.Lambert

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Data source: © Department of Customer Service 2020

Coordinate system: GDA 1994 MGA Zone 54

Scale ratio correct when printed at A3

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Figure 12.3
Big Bend Biodiversity Values

12.4.4.2 Habitat values for threatened flora

One locally occurring-threatened species *Santalum murrayanum* was observed and confirmed from within Big Bend. *Dodonaea stenozyga* was found within Big Bend. Based on the relatively high native species diversity, limited evidence of grazing pressures and general condition of PCTs, it is likely to provide good potential for a range of threatened flora species, including *Acacia acanthoclada* which has been found in the proposal study area.

12.4.4.3 Habitat values for threatened fauna

The potential for candidate lands to provide old-growth Mallee vegetation, important for breeding habitat requirements for a range of threatened species, which will require offsetting by the Proposal, was confirmed. The general condition of the PCTs observed during the limited field inspection are likely to provide habitat values for a range of threatened fauna species, confirmation of which will be subject to targeted field surveys.

12.4.4.4 Presence of relevant biodiversity values

Offsets must be targeted and offset the impacts on a 'like for like' or 'better' basis. Given the Proposal includes the clearing of Mallee vegetation in the west of the alignment it is necessary to develop Biodiversity Stewardship Site/s in this area. The potential offset properties including Big Bend would be able to provide a suitable offset for the non-threatened Mallee and associated vegetation liabilities.

12.4.4.5 Distance from the proposal

Biodiversity offsets should be located appropriately and offset the impact in the same region. Ideally, offset habitat areas should be located within the region of the development. For example, the proposal offsets for the Mallee vegetation in the west of the alignment should be located in the South Olary Plain sub-region of the Murray Darling Depression Interim Biogeographic Regionalisation for Australia (IBRA) Bioregion where possible.

12.4.4.6 Current condition and potential for improvement

Big Bend is large but has been subject to a long history of farming. The vegetation is generally still high quality although there are varying levels of disturbance and weed incursion.

The establishment of one or more BSA's over this and potentially other properties will enable an enduring in-perpetuity conservation outcome within the local area that will directly benefit the impacted biodiversity values of the proposal.

12.4.4.7 Connectivity

Such BSA's will provide for the strategic benefits of consolidating Chowilla and Danggali Regional Reserves in the west and north-west, with the intention of recreating a consolidated habitat linkages within a Regional Wildlife Corridor to increase the overall biodiversity values of the area. The establishment of this Regional Wildlife Corridor will facilitate the movement of threatened species throughout the region and provide for the conservation of large areas of consolidated "Mallee" communities with the NSW Murray river floodplain in the south-east.

12.4.4.8 Payment into the Biodiversity Conservation Fund

Payments for the proposal offset obligations could be paid into the BCF although it should be noted that payment for offsets are subject to change and that credit payment prices are reviewed quarterly.

12.4.4.9 Timing of Biodiversity Offset provision

The calculations in this BDAR are based on disturbance areas only, as design refinement for the proposal has not yet been completed.

Accordingly, the final biodiversity offset liability is subject to the timing of detailed design refinements and would be determined at that stage.

The proposed BOS will deliver retirement of the proposals credit liability, through the establishment of a series of BSAs and /or purchase of existing credits from the market. Any residual credit liability not met through these offset strategies would met through the payment into the BCF.

The credits necessary to retire the credit obligation for the proposal:

- will preferentially be sourced from biodiversity stewardship sites already proposed for consideration, which will likely provide a majority of the credits required; and / or
- remaining credit liability would be sourced from available credits on the market now (no to limited availability at present). Any use of variation and trading rules would be in accordance with these rules; and / or
- the residual credit obligation not satisfied by the above mechanisms would be met by paying into the BCF.

Due to the time required to finalise BSAs and establish biodiversity stewardship sites, Transgrid would not be in a position to retire the full offset credit liability for the proposal prior to the commencement of construction. Transgrid anticipates that the full credit liability of EnergyConnect (NSW – Eastern Section) would be retired by the end of 2025, and would confirm timing when all proposed biodiversity stewardship sites are confirmed.

Prior to the commencement of construction, Transgrid would provide the NSW Department of Planning, Industry and Environment with security for the biodiversity offset strategy. The security would reflect EnergyConnect (NSW – Eastern Section) liability to be used by the Department to address any residual credit liabilities if Transgrid does not implement the proposed biodiversity offset measures within appropriate timeframes.

A summary of the proposals credit liability and estimated generation from the initially proposed BSAs, including surplus credit generation is provided in Table 12-19. The timing of the proposed staged disturbance and delivery of the BOS for the EnergyConnect (NSW – Eastern Section) outlined in Table 12-19.

Table 12-19 Indicative staging of Proposal Impacts and Biodiversity Offsets

Timing (Year)				2021		2022				2023				2024				2025			
Proposal Phase	**Proposal Stage**			**3rd**	**4th**	**1st**	**2nd**	**3rd**	**4th**	**1st**	**2nd**	**3rd**	**4th**	**1st**	**2nd**	**3rd**	**4th**	**1st**	**2nd**	**3rd**	**4th**
Target Approval and disturbance commencement	**EnergyConnect (NSW - Western Section)**			10,715																	
	EnergyConnect (NSW - Eastern Section)							42,426													
Proposed BSA establishment	**Big Bend BSA**																				
	BSA 2 - TBC																				
	Additional BSA 3																				
	Additional EnergyConnect BSAs																				
Estimated credit Relinquishment	**Ecosystem Credits**	**BSA**						**11,083**					3,318								**39,305**
		BCF																			
	Species Credits	**BSA and or BCF Direct**						**79**					1,334								**33,503**
Total offset liability met (NSW -Western Section) CoA D26																					
Total offset liability met (NSW -Eastern Section)																					

KEY	
	Target Proposal Approval and Credit Liability estimate
	Total offset liability retirement
	BSA establishment
	Proposal disturbances commence

13 Conclusion

Transgrid (electricity transmission operator in New South Wales (NSW)) and ElectraNet (electricity distributor in South Australia (SA)) are currently investigating the proposed construction and operation of a new electrical interconnector and network support options between NSW and SA, with an added connection to north-west Victoria.

The proposal, focussing on the eastern section of EnergyConnect in NSW, would include the construction and operation of new high voltage transmission lines between the existing Buronga substation and existing Wagga Wagga substation, a new 330kV substation (referred to as the proposed Dinawan 330kV substation), upgrade and expansion of the existing Wagga Wagga substation as well as other ancillary infrastructure.

This report provides an assessment of significance on threatened species, ecological communities or their habitats listed under applicable legislation. It specifically:

- provides an assessment of biodiversity values within the proposal study area and disturbance area as it is currently understood for the proposal
- demonstrates the proposal's effort to avoid and minimise impacts on biodiversity values
- provides mitigation and management of impacts on biodiversity values
- calculates the offset requirement for impacts on biodiversity values that are unable to be avoided
- provides an assessment of significance on threatened species, ecological communities or their habitats listed under the FM Act and EPBC Act.

13.1 Avoidance and design refinements

The proposal has been refined to avoid and minimise potential impacts on biodiversity values including:

- positioning of preferred corridor to co-locate where possible with existing infrastructure (i.e. Buronga electrical substation to Four Corners and Lockhart to Wagga Wagga substation)
- design refinements such as proposed transmission line realignment near Bundure Siding, micrositing of tower locations, re-routing of access tracks and adoption of location specific bespoke construction phase stringing methodologies to avoid where possible any direct impacts to mapped Plain Wanderer habitat.
- relocation of preferred corridor north at Gums Lane to avoid high biodiversity value areas that contains the critically endangered Box Gum Woodland
- targeting narrow crossing points of waterways and flood out areas (and their associated riparian habitats such as around the Murrumbidgee River, the Coleambally irrigation channels, Yanco Creek, Columbo Creek and Lake Cullivel)
- identification and focus on the use of existing access tracks to minimise additional disturbance to the transmission line easement wherever possible. This would include the use of existing farm track, alternative property access points and similar existing infrastructure. This has now been accounted for in the definition of disturbance area A
- reduction in the use of longitudinal access tracks where existing roads are located adjacent to the proposed transmission line alignment
- changes to the categorisation of disturbance along the transmission line alignment to reflect refinements to the vegetation clearing strategy.

Ongoing commitment to avoid and minimise impacts on biodiversity values would be further achieved through micro siting new transmission line structures, brake/winch sites and access tracks during the design refinement phase.

13.2 Impacts summary

The impact assessment presented is based on the current understanding of design and construction methodology and the associated disturbance area for these items. The disturbance area is identified based on realistic proposal component locations and areas however it is indicative at this stage. The area would be confirmed during finalisation of design and construction methodology and would be developed as part of the consideration of avoidance and impact minimisation.

Impacts on biodiversity values resulting from the proposal and the disturbance area are:

- The proposal would directly impact on 39 native vegetation PCTs and six threatened ecological community listed under the BC Act and seven threatened ecological communities listed under the EPBC Act. Direct impacts on native vegetation would include:
  - direct impacts on 1,554.88 hectares of native vegetation
  - direct impacts on up to 204.11 hectares of threatened ecological community listed under the BC Act in the form of:
    - 5.18 hectares of *Acacia melvillei* Shrubland in the Riverina and Murray-Darling Depression bioregions listed as endangered under the BC Act
    - 2.93 hectares of *Allocasuarina luehmannii* Woodland in the Riverina and Murray-Darling Depression Bioregions listed as endangered under the BC Act
    - 26.94 hectares of Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions listed as endangered under the BC Act
    - 101.20 hectares of Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South Western Slopes bioregions listed as endangered under the BC Act
    - 26.42 hectares of Sandhill Pine Woodland in the Riverina, Murray-Darling Depression and NSW South Western Slopes bioregions listed as endangered under the BC Act
    - 41.44 hectares of White Box Yellow Box Blakely's Red Gum grassy woodland and derived native grassland listed as critically endangered under the BC Act.
- Indirect impacts on native vegetation are considered unlikely due to the retention of shrub and ground stratum native vegetation retention to a height of between four and 10 meters (in growth heights) in areas buffering direct permanent loss.
- Indirect impacts to avifauna due to the potential increased risk of collision and electric and magnetic fields with the new infrastructure are considered possible. A total of five threatened fauna species potentially affected by the proposal due to potential operational indirect impacts include:
  - 11.31 hectares for *Hieraaetus morphnoides* (Little Eagle)
  - 8.33 hectares for *Lophochroa leadbeateri* (Major Mitchell's Cockatoo)
  - 0.41 hectares for *Polytelis anthopeplus monarchoides* (Regent Parrot (eastern subspecies))
  - 14.70 hectares for *Polytelis swainsonii* (Superb Parrot).
- The proposal would not impact on groundwater and is considered unlikely to lead to any adverse impact on the groundwater availability or status for groundwater dependent ecosystems.

- Impacts on threatened species have been considered in accordance with the BAM based on ecosystem credit species and species credit species. Impacts resulting from the proposal on threatened species includes:
  - loss of habitat for 81 threatened fauna species identified and/or predicted as ecosystem credit species
  - a total of nine threatened flora species credit species affected by the proposal. These include impacts to:
    - 71.17 hectares of habitat for *Brachyscome papillosa* (Mossgiel Daisy) – listed as vulnerable under the BC Act and EPBC Act
    - 50.31 hectares of assumed habitat for *Cullen parvum* (Small Scurf-pea) – listed as endangered under the BC Act
    - 7 hectares of habitat for *Lepidium monoplocoides* (Winged Peppercress) – listed as endangered under the BC and EPBC Act.
    - 15.32 hectares of habitat for *Leptorhynchos orientalis* (Lanky Buttons) – listed as endangered under the BC Act
    - 109.68 hectares of habitat for *Maireana cheelii* (Chariot Wheels) – listed as vulnerable under the BC Act and EPBC Act
    - 8.62 hectares of habitat for *Pilularia novae-hollandiae* (Austral Pillwort) – listed as endangered under the BC Act
    - 1.70 hectares of habitat for *Pimelea serpyllifolia* subsp. *serpyllifolia* (Thyme Rice-Flower) – listed as endangered under the BC Act
    - 232.35 hectares of habitat for *Swainsona murrayana* (Slender Darling Pea) – listed as vulnerable under the BC Act and EPBC Act
    - 109.17 hectares of habitat for *Swainsona sericea* (Silky Swainson-pea) – vulnerable
  - a total of six threatened fauna species credit species affected by the proposal due to direct impacts. This includes impacts to:
    - 32.36 hectares of habitat for *Lophochroa leadbeateri* (Major Mitchell's Cockatoo) – listed as vulnerable under the BC Act
    - 4.77 hectares of habitat for *Myotis macropus* (Southern Myotis) – listed as vulnerable under the BC Act
    - 0.41 hectares of habitat for *Pedionomus torquatus* (Plains-wanderer) – listed as endangered under the BC Act and EPBC Act
    - 52.70 hectares of habitat for *Petaurus norfolcensis* (Squirrel Glider) – listed as vulnerable under the BC Act
    - 32.36 hectares of habitat for *Polytelis anthopeplus monarchoides* (Regent Parrot (eastern subspecies)) – listed as Endangered under the BC Act
    - 36.57 hectares of habitat for *Polytelis swainsonii* (Superb Parrot).
- The proposal is considered unlikely to lead to a significant impact on any threatened aquatic species, ecological communities or their habitats.

The design refinement design for the proposal has not been completed and as a result the disturbance area is indicative only to enable assessment of the likely quantum and type of impacts of the proposal. These would be confirmed following design refinement design.

In terms of impacts on Matters of National Environmental Significance the proposal would:

- impact on known or assumed habitat for seven threatened ecological communities
- impact on known or assumed habitat for four threatened flora species listed under the EPBC Act
- impact on known or potential habitat for 31 threatened fauna species comprising of one insect, three amphibians, two reptiles, 14 birds, five mammals and six fish listed under the EPBC Act
- impact on potential habitat for 12 migratory species listed under the EPBC Act.

The impact assessment outcomes for Matters of National Environmental Significance conclude that:

- the proposal is likely to lead to a significant impact on three threatened flora species and four threatened ecological communities and/or their habitat listed under the EPBC Act
- the proposal is considered unlikely to substantially modify, destroy or isolate an area of important habitat for any EPBC Act listed migratory species or listed fish species and is unlikely to seriously disrupt the lifecycle of an ecologically significant proportion of a population of migratory birds
- the proposal would not impact on any wetlands of national or international importance.

13.3 Mitigation and management

The specific performance outcomes for the proposal regarding biodiversity include:

- minimising or where possible avoiding impacts to threatened flora and fauna species, and ecological communities listed under the BC Act and EPBC Act through the design refinement and construction methodology refinement processes
- offsetting impacts to threatened ecological communities and species.

A Construction Environmental Management Plan (CEMP) describes the approach to environmental management, monitoring and reporting during construction. Specifically, it lists the requirements to be addressed by the construction contractor including sub-plans, and other supporting documentation for each specific environmental aspect.

A specific sub-plan from the CEMP that would be developed to address biodiversity values would include a Biodiversity Management Plan and Connectivity Strategy.

For clarity, approaches to operational maintenance and the biodiversity impacts from the proposal will be in accordance with the detail provided in this report and the EIS.

13.4 Offsetting biodiversity impacts

Residual impacts that are not able to be managed through mitigation would be offset in accordance with BAM calculations for both ecosystem and species credits. The proposal offset obligation based on the disturbance area has been calculated to require the following biodiversity credits:

- 42,426 ecosystem credits
- 33,503 species credits.

The calculations in this BDAR are based on current identified disturbance areas only, as design refinement for the proposal has not yet been completed. Accordingly, the final biodiversity offset liability is subject to the timing of design and construction methodology refinements and would be determined at that stage.

The proposal offset obligations would be met through implementing a combination of the following offset delivery options, being:

- the purchase and retirement of existing biodiversity credits currently available on the biodiversity credit register
- establishing biodiversity stewardship site(s) on lands with like for like biodiversity values to those impacted by the proposal
- making a payment into the Biodiversity Conservation Fund (BCF) for residual credits not sourced from the preferred approach to established BSAs
- alternative strategic offset outcomes.

Delivery of the Biodiversity Offset Scheme (BOS) is proposed to be prepared for the combined EnergyConnect (Eastern and Western) proposals as follows:

- The proposed program provides a commitment to establish additional BSAs and/or meet residual EnergyConnect (NSW – Eastern Section) full credit liability prior to the completion of construction of EnergyConnect (NSW – Eastern Section) by end of 2025.
- It sees Transgrid meet approximately 10% of its EnergyConnect (NSW – Eastern Section) estimated liability and at least 25% of combined proposal liability prior to EnergyConnect (NSW – Eastern Section) commencement of disturbance.

14 Limitations

This Report is provided by WSP Australia Pty Limited (WSP) for Transgrid (Client) in response to specific instructions from the Client and in accordance with WSP's proposal dated September 2019 and agreement with the Client dated 31 October 2020 (Agreement).

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14.5 Field survey limitations

No sampling technique can eliminate the possibility that a species is present on a site. For example, some species of plant may be present in the soil seed bank and some fauna species use habitats on a sporadic or seasonal basis and may not be present on-site during surveys. The conclusions in this report are based upon previous studies, data acquired for the site and the biodiversity field surveys and are, therefore, merely indicative of the environmental condition of the site at the time of preparing the report, including the presence or otherwise of species. Also, it should be recognised that site conditions, including the presence of threatened species, can change with time.

Some sections of the study area, due to the nature and/or access restrictions, were not able to be inspected. Where access was not available biodiversity values were extrapolated from desktop assessment. In areas that were unable to be surveyed due access restrictions, existing mapping undertaken as part of the State vegetation mapping of the western region (Department of Planning 2016) and Riverina region (Department of Planning 2016) was adopted.

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