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Finley Solar Project: Biodiversity Assessment Report

December 2017

Finley Solar Project

Biodiversity Assessment Report

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Version 5 *– 10 December 2017 (following receipt of comments from OEH)*	
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Abbreviations

BAR	Biodiversity Assessment Report
TSC Act	*Biodiversity Conservation Act 2016*
BOS	Biodiversity Offset Strategy
CEMP	Construction Environmental Management Plan
CMA	Catchment Management Authority
Cwlth	Commonwealth
DBH	diameter at breast height
DOE	Department of Environment (Cwlth)
DPI	Department of Primary Industries (NSW)
EIS	environmental impact statement
EPBC Act	*Environmental Protection and Biodiversity Conservation Act 1999*
EP&A Act	*Environmental Planning and Assessment Act 1979*
FBA	Framework for Biodiversity Assessment
FM Act	*Fisheries Management Act 1994* (NSW)
GIS	Geographic Information System
Ha	hectares
IBRA	Interim Biogeographic Regionalisation for Australia
km	kilometre
kV	kilovolt
LGA	Local Government Area
m	metre
MNES	Matters of National Environmental Significance (under the EPBC Act)
MW	megawatts
OEH	Office of Environment and Heritage (NSW)
PCT	plant community type
SEARs	Secretary's environmental assessment requirements
SSD	State significant development
TPZ	tree protection zone

Executive summary

ESCO Pacific proposes to construct and operate a 170 megawatt utility-scale solar photovoltaic (PV) farm located west of the township of Finley in New South Wales (NSW), in the Berrigan Local Government Area.

This Biodiversity Development Assessment Report (BAR) has been prepared by Accent Environmental on behalf of ESCO Pacific to address the biodiversity-related matters in the Secretary's Environmental Assessment Requirements (SEARs). The SEARs require that an assessment of the likely biodiversity impacts of the development be conducted, having regard to the NSW Biodiversity Offsets Policy for Major Projects, and in accordance with the Framework for Biodiversity Assessment (FBA).

Consultation with the NSW Office of Environment and Heritage was undertaken to discuss the condition of the development site and its appropriate assessment.

The assessment of landscape features, native vegetation, and threatened species in this report has been undertaken to inform the location of the proposed development site.

All areas within the development site are regionally mapped as non-native vegetation. Field surveys identified that native vegetation in the development site is limited to planted native vegetation associated with woodlots and windrows, and scattered paddock trees in the pasture and cropped land. In total the project is expected to require the removal of up to 4.06 ha of native vegetation and up to two hollow-bearing trees.

The development site is unlikely to provide habitat important to any threatened or migratory species protected under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).and *Threatened Species Conservation Act 1995* (TSC Act).

The proposed footprint is predominantly located on pastures and cropped land (Zone 1), which occupy more than 90% of the development site and were calculated with a site value of less than 17. Under the FBA, native vegetation with a site value of <17 does not require ecosystem credits offsetting.

The remaining proposed footprint area contains a planted woodlot and windrows, which comprise planted native and exotic species. These plantings have not yet reached maturity, do not contain tree hollows, and are not representative of native plant communities.

Initial survey results (Ecolink 2017a) indicate that native vegetation on the development site that would be removed do not provide habitat important to any threatened or migratory species protected under the EPBC Act and TSC Act. Therefore offsetting for threatened or migratory species would also not be required.

The development site avoids areas considered to be of high habitat value within the local landscape. This avoidance of habitat, in combination with appropriate environmental safeguards during construction of the project (which would be set out in the project's Construction Environmental Management Plan), is expected to ensure that the development meets the requirements to avoid and minimise impacts on biodiversity values as set out in Chapter 8 of the FBA.

No offset requirements have been generated for this project and therefore a Biodiversity Offset Strategy under Stage 3 of the BAR is not required.

This BAR has been updated from the version appended to the Finley Solar Project EIS, in response to comments received from the Office of Environment and Heritage (OEH). Key changes to the report are listed in Appendix A.

1 Introduction

1.1 Project overview

The proposed Finley Solar Project (the project) is a 170 megawatt (MW) utility-scale renewable energy development that would be located west of the township of Finley in New South Wales (NSW). Finley has been chosen as the location for the project because of the relatively high solar irradiance in the region and the capacity of the Essential Energy and TransGrid electricity networks to transmit the power generated.

General information about the project is provided in Table 1.1 and the proposed development site in relation to Finley is shown in Figure 1.1.

Table 1.1. Project details

Name	Finley Solar Project
Address	198 Canalla Road, Finley, NSW, 2713
Applicant	ESCO Pacific
Council	Berrigan Shire Council
Titles	• Lot 133 on Plan 752299 (Landowner #1) • Lot 134 on Plan 752299 (Landowner #2) • Lot 136 on Plan 752299 (Landowner #3)
Total indicative area	Secured land tenure: 500 hectares (ha) Area required for solar energy generation: 385 ha
Land use	Grazing, cropping (irrigated and drained land)
Capacity	Up to 170 MW
Connection	Finley 132 kilovolt (kV) substation (TransGrid)

1.2 Site description

The project would be located approximately 6 km west of Finley and 140 km west of Albury, within the Berrigan Local Government Area (LGA). The development site is bounded to the north by Broockmanns Road, and to the south by Broughans Road. The nearest major roads are the Riverina Highway located approximately 1.5 km to the north and Newell Highway which passes through Finley approximately 6 km to the east (see Figure 1.1).

The land comprises flat-lying open paddocks crossed by a network of irrigation and drainage channels, and a waterway crossing the westernmost paddock that supplies water to a farm dam. Due to a long history of agriculture and grazing, the development site is highly modified.

The proposed development site is shown in Figure 1.2. The development site crosses the properties of three landholders who are currently engaged in routine agricultural and grazing activities.

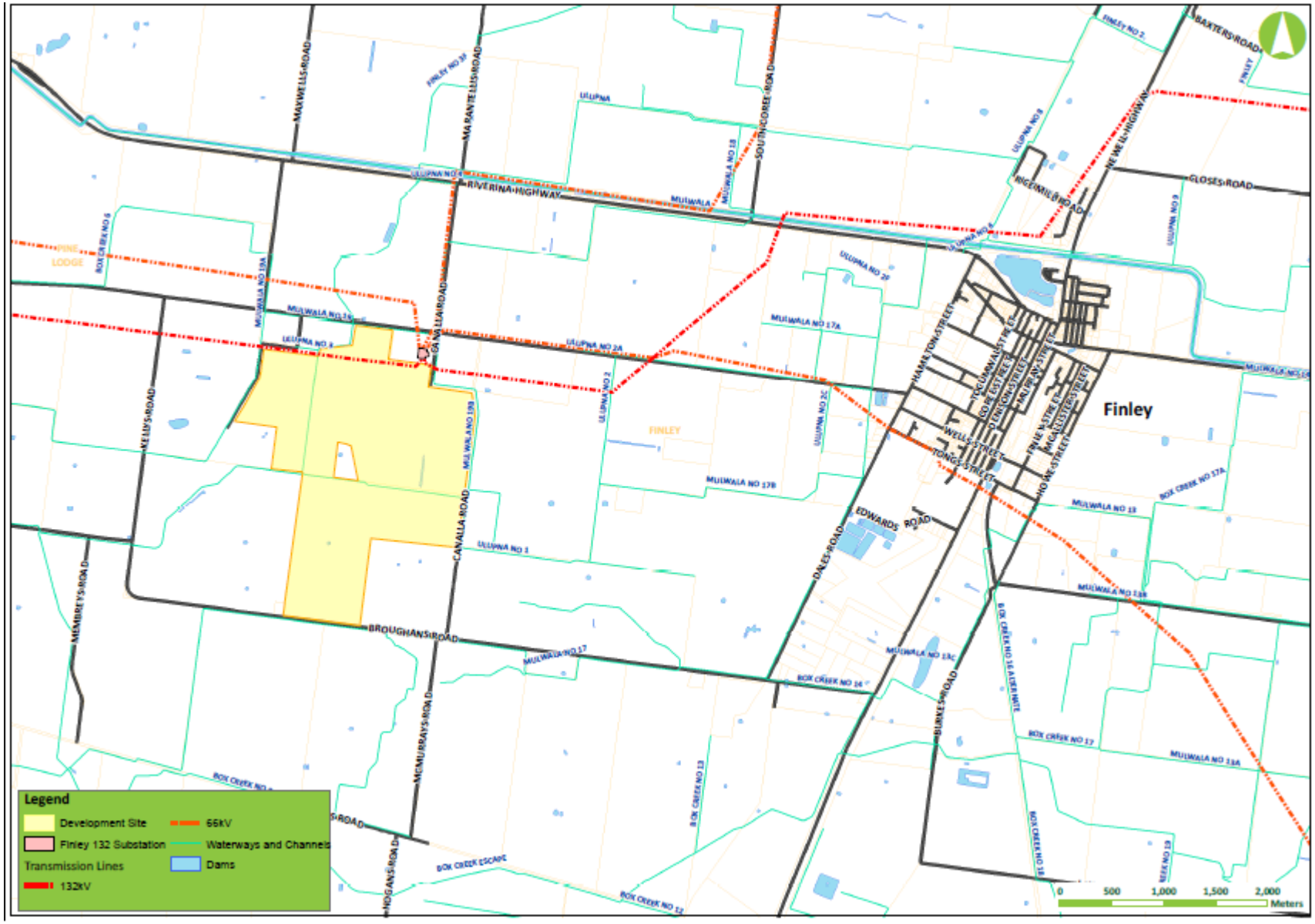


Figure 1.1. Project location

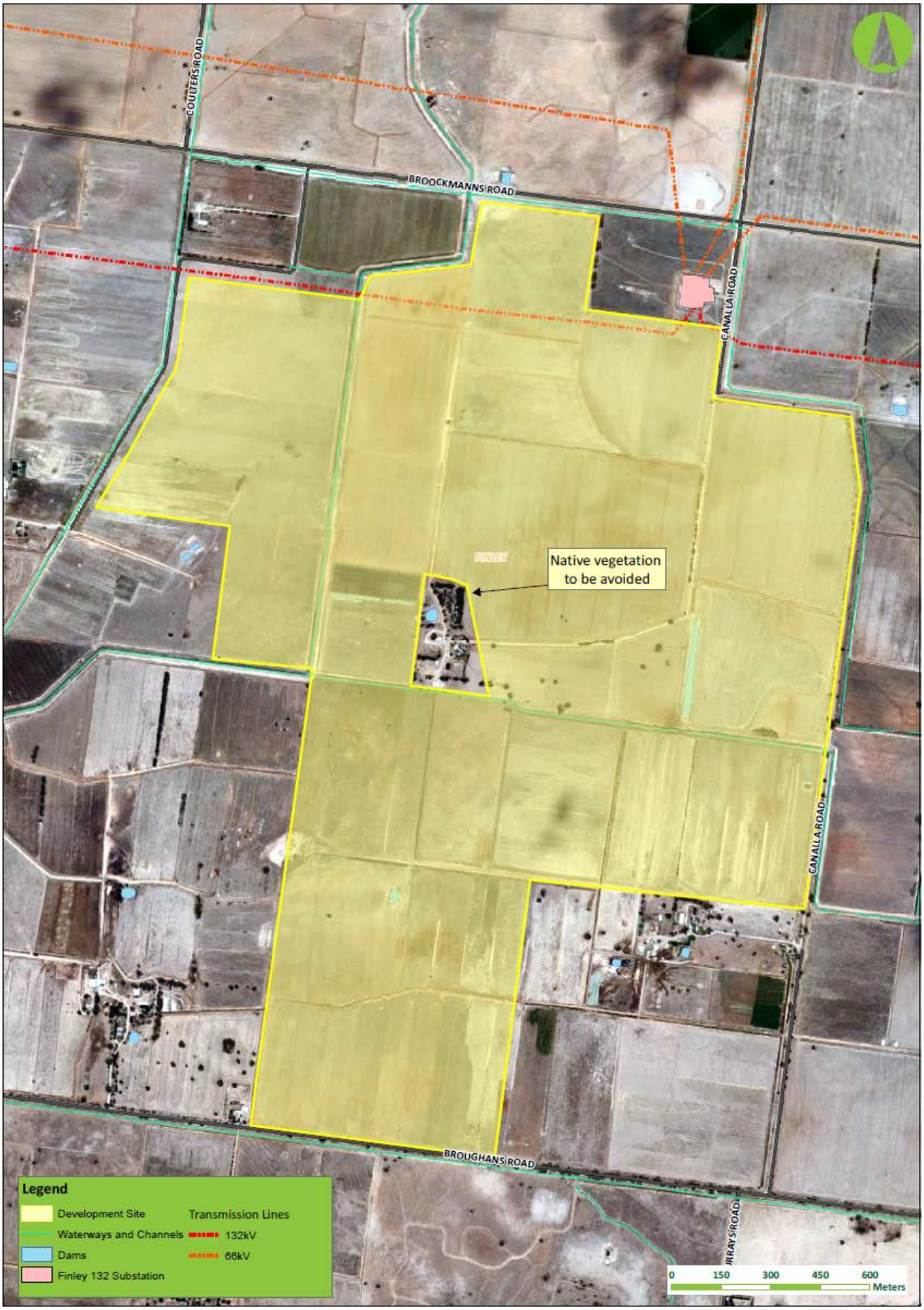


Figure 1.2. Development site

1.3 Secretary's Environmental Assessment Requirements

An Environmental Impact Statement (EIS) is being prepared to address the Secretary's Environmental Assessment Requirements (SEARs), which were provided to ESCO Pacific on 4 July 2017 by the Department of Planning and Environment.

The SEARs require that an assessment of the likely biodiversity impacts of the development be conducted, having regard to the NSW Biodiversity Offsets Policy for Major Projects (OEH 2014a), and in accordance with the Framework for Biodiversity Assessment (FBA) (OEH 2014b).

Attachment 1 of the SEARs provide a list of some of the environmental planning instruments, guidelines, policies, and plans that may be relevant to the environmental assessment of this development. Those relevant to this biodiversity assessment include:

- NSW Biodiversity Offsets Policy for Major Projects, Office of Environment and Heritage, 2014.
- Threatened Species Assessment Guidelines - Assessment of Significance, Office of Environment and Heritage, 2007.
- Policy and Guidelines for Fish Habitat Conservation and Management, Department of Primary Industries, 2013.

The FBA comprises three stages that set out the biodiversity assessment requirements and offset practices for major projects.

Stage 1 – Biodiversity assessment requirements and survey methods that must be undertaken by a proponent to identify, map and describe the native plant community types (PCTs), threatened species and threatened species' habitat on the development site and an offset site.

Stage 2 – Impact assessment requirements for demonstrating how any impacts on biodiversity values have been avoided and minimised at the planning, construction and operational phases of the development.

Stage 2 measures the loss to biodiversity caused by the remaining direct and indirect impacts of the development. The FBA quantifies the loss and gain in biodiversity values through the determination of biodiversity credits. The loss of biodiversity values caused by the project is expressed as a biodiversity credit requirement (i.e. the number and type of biodiversity credits that would be required to offset the impact of development).

Both Stage 1 and Stage 2 are documented in this biodiversity assessment report (BAR), which is required to accompany the EIS.

Stage 3 – A biodiversity offset strategy (BOS) which addresses how any impacts as a result of the project (as assessed and valued as biodiversity credits in Stage 2) will be managed by the proponent.

As a result of the current investigations for Stage 1 and Stage 2 (this report) it is anticipated that offsetting would not be required. This is due to the Applicant (ESCO Pacific) locating the proposed development to avoid areas of potential habitat.

This BAR has been updated from the version appended to the Finley Solar Project EIS, in response to comments received from the Office of Environment and Heritage (OEH). Key changes to the report are listed in Appendix A.

1.4 Sources of information used

The following information sources were used in the preparation of this report:

- Imagery:
  - Aerial imagery: NearMap 22 January 2010; Google Earth 24 October 2014
  - Finley_LAY_008_01_Irrigation map, provided by ESCO Pacific
- Australian Government Department of the Environment and Energy:
  - Protected Matters Search Tool http://www.environment.gov.au/epbc/pmst/index.html
  - Species Profiles and Threats Database (SPRAT) http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl
  - Significant Impact Guidelines 1.1 - Matters of National Environmental Significance (Department of the Environment, Water, Heritage and the Arts, 2013 EPBC Act Policy Statement)
  - Interim Biogeographic Regionalisation for Australia (IBRA) version 7.0
  - The Directory of Important Wetlands of Australia
- NSW OEH:
  - BioNet - the database for the Atlas of NSW Wildlife,
  - Threatened species database http://www.threatenedspecies.environment.nsw.gov.au/index.aspx
  - NSW (Mitchell) Landscapes - version 3.1
  - NSW Vegetation Information System (VIS) Classification – version 2.1
  - Riverina Regional Native Vegetation PCT Map Version v1.0 - VIS_ID 4469
- NSW Department of Primary Industries (DPI):
  - Policy and guidelines for fish habitat conservation and management (updated 2013)
  - Freshwater threatened species distribution maps - http://www.dpi.nsw.gov.au/fishing/species-protection/threatened-species-distributions-in-nsw/freshwater-threatened-species-distribution-maps
  - Key Fish Habitat maps – Berrigan http://www.dpi.nsw.gov.au/fishing/habitat/publications/pubs/key-fish-habitat-maps
- NSW Land and Property Information:
  - 7926-N BLIGHTY 1:50,000 topographic map
  - 8026-N BERRIGAN 1:50,000 topographic map.

1.5 Legislative context

1.5.1 Environmental Planning and Assessment Act 1979

The NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) is the core legislation relating to planning and development activities in NSW. It is the principal law overseeing the assessment and determination of development proposals, and all development in NSW is assessed in accordance with the provisions of the EP&A Act.

Part 4 of the EP&A Act

Part 4 of the EP&A Act provides for the control of development that requires development consent from a consent authority. Depending on the circumstances of the proposal, the consent authority may be the local Council or the Minister.

Part 4, Division 4.1 of the EP&A Act establishes an approval regime for development that is declared to be State significant development by either a State Environmental Planning Policy (SEPP) or Ministerial Order. In accordance with Section 89E of the EP&A Act, the Minister is the consent authority for State significant development (SSD). Pursuant to sub-section 78A(8) of the EP&A Act, an EIS is required to support a development application for an SSD.

The NSW biodiversity offsets policy for major projects applies to SSD and state significant infrastructure. The policy is underpinned by the FBA which provides the methodology for assessing impacts and determining biodiversity offsets for major projects.

Under the biodiversity offsets policy, the SEARs for the project require ESCO Pacific to apply the FBA to assess impacts on biodiversity values. The FBA is also to be applied to the project to identify reasonable measures and strategies that can be taken to avoid and minimise impacts on biodiversity.

1.5.2 Threatened Species Conservation Act 1995

The *Threatened Species Conservation Act 1995* (TSC Act) provides the statutory framework for biota of conservation significance in NSW. The TSC Act aims to, inter alia, 'conserve biological diversity and promote ecologically sustainable projects'. It provides for:

- the listing of threatened species, populations and ecological communities, with endangered species, populations and communities listed under Schedule 1, critically endangered species and communities listed under Schedule 1A, vulnerable species and communities under Schedule 2
- the listing of Key Threatening Processes (under Schedule 3 of the TSC Act)
- the preparation and implementation of Recovery Plans and Threat Abatement Plans.

The TSC Act has been addressed in the current assessment through:

- desktop review to identify threatened biota (threatened species, populations or ecological communities) listed under the TSC Act that have been previously recorded within the locality of the site and consequently could occur subject to the habitats present
- a preliminary site assessment (19 May 2017) and more detailed site assessment (that identified the extent and quality of potential habitat for any Matters of National Environmental Significance) undertaken from 27th to the 29th June 2017 by Ecolink Consulting (Ecolink) (see Accent 2017 and Ecolink 2017a).

1.5.3 Fisheries Management Act 1994

DPI administers the *Fisheries Management Act 1994* (FM Act) and associated Regulations (FM Regulations). The broad objective of the FM Act is to conserve, develop and share the fishery resources of the State for the benefit of present and future generations.

To meet the objectives the FM Act, Part 7 of the Act deals with the protection of aquatic habitats and Part 7A deals with threatened species conservation. When assessing and either approving or refusing proposals for developments (including State Significant Development and Infrastructure projects) or other activities affecting fish habitats, DPI take into account their Policy and Guidelines for Fish Habitat Conservation and Management (2013).

Unless known to provide habitat for threatened species, for the purposes of these policy and guidelines the following are not considered key fish habitat:

- farm dams constructed on unmapped gullies and first and second order streams
- purpose built irrigation and other water supply channels and off-stream storages
- irrigation, agricultural or urban drains.

The development site and surrounding locality contains artificially constructed irrigations channels and canals and dams as shown on Figure 1.1, Figure 1.2 and the 1:50,000 topographic maps for Berrigan and Blighty.

The likelihood of freshwater threatened species to occur within the locality was considered by way of an assessment of DPI's indicative distribution maps of threatened species in NSW. Distribution maps indicate that freshwater threatened species are likely to be found as follows:

- approximately 15 km to the south in the Murray River
- over 30 km to the north in Billabong Creek and Wangamong Creek
- approximately 30 km to the southeast in an unnamed watercourse
- over 40 km to the west in the Edward River.

Therefore under DPI policy the development site does not contain key fish habitat and is not known to provide habitat for threatened species.

1.5.4 Commonwealth legislation

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is the Australian Government's central piece of environmental legislation. It provides a legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities and heritage places — defined in the EPBC Act as Matters of National Environmental Significance (MNES).

The purpose of the EPBC Act is to ensure that actions likely to cause a significant impact on MNES undergo an assessment and approval process. Under the EPBC Act, an 'action' includes a project, undertaking, or activity. An action that 'has, will have or is likely to have a significant impact on a matter of national environmental significance' is deemed to be a 'controlled action' and may not be undertaken without prior approval from the Commonwealth Minister for the Environment (the Minister).

The nine MNES to which the EPBC Act applies are:

- world heritage properties
- national heritage places
- wetlands of international importance (listed under the Ramsar Convention)
- threatened species and ecological communities
- migratory species
- Commonwealth marine areas
- the Great Barrier Reef Marine Park
- nuclear actions (including uranium mining)

- a water resource, in relation to coal seam gas development and large coal mining development.

A detailed desktop assessment was undertaken to determine which MNES could potentially be impacted by the project. The assessment included a search of the PMST to identify MNES that have potential to occur within 10 km of the study area (a 10 km radius around a point located at -35.64864°, 145.50021°) and a review of previous records of threatened flora and fauna within and around the study area.

Subsequently, a preliminary site assessment was undertaken by Ecolink on 19 May 2017 (Accent 2017) and more detailed site assessment (that identified the extent and quality of potential habitat for any MNES) was undertaken from 27 to 29 June 2017 by Ecolink (Ecolink 2017a).

The potential for the project to significantly impact on any MNES is discussed in Section 5.5.

2 Methods

2.1 Assessment area

Preliminary assessments undertaken to support the request for SEARs (Accent 2017) and later habitat assessment (Ecolink 2017a) covered an area of 500 ha. This area comprised the total area of land secured by ESCO Pacific across the three properties.

In discussion with ESCO Pacific, and consistent with their commitment in the Preliminary Environmental Assessment – Scoping Report (Accent 2017) to avoid and minimise biodiversity impacts, a smaller (385 ha) maximum project footprint was identified within the area of land secured by ESCO Pacific. This 385 ha area (the development site – see Figure 1.2) is the subject of this BAR.

2.2 Desktop assessment

A desktop review was undertaken to identify:

- threatened flora and fauna species, populations and ecological communities (biota) listed under the TSC Act and FM Act
- biodiversity-related MNES listed under the EPBC Act which have potential to occur in the locality, based on previous records, known distribution ranges, and habitats present.

2.3 Field survey

2.3.1 Habitat assessment

A site assessment of habitat was undertaken from 27 to 29 June 2017 by Principal Ecologists Dr Stuart Cooney and Simon Scott of Ecolink Consulting.

The entire 500 ha area of land secured was walked or driven to assess the location and quality of habitats that were present. Key parameters of the habitats (such as the presence/absence of shelter, foraging, and nesting resources) were recorded to determine the quality of the habitats present. Areas with the highest likelihood of containing native fauna, including threatened species, were inspected more closely in an attempt to inform the presence of these species based on the habitat quality. Active searches were undertaken underneath debris and leaf litter, and signs, tracks and scats were recorded to confirm the presence of particular species or fauna groups. Incidental observations of all fauna species were recorded throughout the assessment and combined with the list of species observed during a preliminary site assessment conducted in May 2017 (Accent 2017).

2.3.2 Plot/transect surveys

A total of seventeen plot/transects were assessed during the field habitat assessment by Ecolink (June 2017) to confirm plant community types (PCTs) within the area of land secured by ESCO Pacific. Data collected from six of these plot/transects within the 385 ha development site were used in accordance with the data requirements of the BioBanking calculator to assess site values within the site. RPS also provided supplementary data based on site observations.

Plot data was used to investigate the appropriate PCTs present on site using the Plant Community Type Identification Tool software program (NVIS v.2.1).

As most of the development site has been historically cleared and used for agriculture, the BioBanking Paddock Tree Calculator was used to assess the site values of land used for crops and pastures.

The BioBanking Paddock Tree Calculator is used as a tool for estimating percent foliage covers where trees are very sparse and survey data taken from plot/transects are therefore not practical. As outlined in the FBA (2014) the BioBanking Paddock Tree Calculator can be used to:

(i) Determine whether the per cent foliage cover over-storey is <25% of the PCTs lower benchmark.
(ii) Calculate the effective clearing area for a vegetation zone or a polygon (where the groundcover is in low condition (i.e. < 50% of the groundcover is native vegetation or >90% of the groundcover is cleared).
(iii) Determine the number of trees with hollows for a vegetation zone.

To establish the area of the paddock trees using GIS, concave polygons were drawn around small clumps of trees and individual polygons drawn around isolated trees (that are more than three times as far from the nearest trees as the majority of the trees in a clump are from each other). Polygon areas of outlier trees are included in the zone by drawing an area around them similar to the distance between the trees in the clump.

The aggregation of these polygons was combined to form one zone (approximately 1.4 ha in extent) for use in the paddock tree calculator (see Appendix B - Figure B1).

Paddock trees within the development site are limited to groups of two or groups of three (in a combination of live and dead trees). The trees grouped together ranged in distance from each other. The average of these distances was used as the distance around outlying trees (see Table 2.1 and Appendix B - Figure B1).

Table 2.1. Distance between paddock trees

Tree no's.	Distance (m)	Average used
1 and 2	6	7
6 and 7	1	
9 and 10	4	
14 and 15	9	
17 and 19	14	

2.3.3 Limitations and qualifications

The following limitations and qualifications apply to this report:

- Surveys were undertaken in autumn and winter, which does not cover the survey requirements for many flora and fauna species. Most flora species lack distinguishing features (e.g. flowers, seeds) which is used for identification purposes.
- Grazing on some paddocks increased the difficulty in identifying some plant species, especially grasses. Some species were unable to be identified to species level because of the lack of diagnostic features.
- Some fauna species may only be recorded during certain times or seasons (e.g. nocturnal mammals and birds, migratory birds, or fauna identified through seasonal breeding calls such as some frog species).
- An informed decision about the likely presence of threatened species that may be present, or that may utilise habitats within the wider area of land secured by ESCO Pacific, was made by Ecolink based on a detailed desktop assessment, a review of the species' biology, and an understanding of the ecological values of the local area.

3 Landscape features

For all analyses of landscape features within this report a 200 ha inner and 2000 ha outer assessment circle has been used in accordance with Appendix 4, Table 8 of the FBA using the GIS layers and aerial imagery referred to in Section 1.4.

3.1 IBRA bioregions and subregions

3.1.1 Bioregion

The development site and outer assessment circle occur wholly within the Riverina Bioregion. The Riverina Bioregion lies in southwest NSW, extending into central-north Victoria, and is approximately 9,576,964 ha, with 7,090,008 ha (or 74.03%) of it within NSW.

The Riverina Bioregion extends from Ivanhoe in the Murray Darling Depression Bioregion, south to Bendigo, and from Narrandera in the east to Balranald in the west. Within its boundaries lie the towns of Hay, Coleambally, Deniliquin, Leeton, Mossgiel, Hillston, Booligal and Wentworth, while Griffith, Ivanhoe, Narrandera and Albury lie just outside its boundary in neighbouring bioregions.

The bioregion also includes outlying remnants of the Murray Darling Depression Bioregion in its western boundary, and the Victorian Midlands Bioregion in the south.

The Murray and Murrumbidgee Rivers and their major tributaries, the Lachlan and Goulburn Rivers, flow from the highlands in the east, westward across the Riverina plain.

3.1.2 Subregions

The development site and outer assessment circle occur wholly within the Murray Fans Subregion, which is broadly described in Table 3.1.

Table 3.1. Murray Fans Subregion

Geology	Quaternary alluvial sediments. Clay and sand with source bordering dunes, lakes and swamps.
Characteristic landforms	Relatively confined alluvial fan constrained by sediments from northern Victorian rivers, the Murrumbidgee fan and the Cadell fault. Meandering channels, floodplains, source-bordering dunes, overflow lakes and swamps.
Typical soils	Red brown earths, grey clays and deep sands.
Vegetation	Extensive River Red-gum forests with river cooba on channels and low floodplains. Yellow Box and Black Box with saltbush on high floodplains and terraces. White Cypress Pines on dunes, sandy levees and lunettes. Common Reed, Cumbungi and grasses in swamps.

3.2 Mitchell Landscapes (NSW landscape regions)

Two Mitchell landscapes occur within the outer assessment circle, the Murray Depression Plains and Murray Scalded Plains. The inner assessment circle is located within the Murray Depression Plains landscape region, whereas approximately 59.9 ha of the 385 ha development site (15.6%) lies within the Murray Scalded Plains (Table 3.2).

Table 3.2. Mitchell Landscapes

Mitchell Landscape	Description	Percent of development site	Percent of outer assessment circle	Percent cleared within Catchment Management Area
Murray Depression Plains	Quaternary alluvial plains with numerous circular depressions interpreted as high floodplains or low terraces beyond the reach of average floodwaters. Grey and brown cracking and non-cracking clays often with gilgai on the plains. Sandy rises and levees trace ancestral streams and stand above the general plain, relief 1 to 3 m. Sands and red or brown texture-contrast soils on the higher ground. Murray Channels and Floodplains ecosystem includes parts of four land systems: Canally, Murrumbidgee, Riverland and Wentworth.	84.4	52	93
Murray Scalded Plains	Quaternary alluvial plains with extensive scalding interpreted as relic floodplains, terraces or part of the Cadell tilt block. Red brown texture-contrast soils with extensive scalds. Prior stream channels of deep coarse sands with sandy levees and grey, brown and red cracking clays in depressions, relief 5 to 15 m.	15.6	48	92

3.3 Rivers, streams and estuaries

No natural water courses occur within or adjacent to the development site. The nearest natural water courses are located as follows:

- approximately 15 km to the south (Murray River)
- over 30 km to the north (Billabong Creek and Wangamong Creek)
- approximately 30 km to the southeast (unnamed watercourse)
- over 40 km to the west (Edward River).

No impacts to these waterways will result from the project and therefore no further consideration is required.

3.4 Wetlands

No important local wetlands, national wetlands (i.e. as listed in The Directory of Important Wetlands of Australia (Environment Australia 2001)) or international wetlands (e.g. Ramsar listed) are located within the vicinity of the development site.

Wetlands nearest to the development site are Ramsar wetlands and include:

- NSW Central Murray State Forests – 10-20 km upstream
- Hattah-Kulkyne lakes – 200-300 km upstream
- Banrock Station Wetland Complex – 400-500 km upstream
- Riverland – 400-500 km upstream
- the Coorong and Lakes Alexandrina and Albert Wetland – 500-600 km upstream.

No impacts to these wetlands will result from the project and therefore no further consideration is required.

3.5 Native vegetation extent

Mapping of vegetation within the inner and outer assessment circles was undertaken using aerial photographic interpretation and Riverina Regional Native Vegetation PCT Map Version v1.0 - VIS_ID 4469 and site assessments (within the development site).

Regional mapping does not identify any native vegetation within the development site or the inner assessment circle. Regional mapping identifies 15.87 ha of native vegetation within the outer circle (Table 3.3 and Figure 3.1).

Site surveys found 5.06 ha of planted native vegetation (2.97 ha of woodlots and 2.09 ha of windrow) within the development site. These areas have been included within the sum of areas for the inner and outer assessment circles for consistency in the assessment of native vegetation extent between the inner and outer assessment circles and development site (Table 3.3).

Table 3.3. Vegetation in the inner and outer assessment circles and development site

Vegetation communities	Outer circle	Inner circle	Development site
Native vegetation			
Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions (PCT 76) – from regional mapping	15.65	0.00	0.00
Woodlots within the development site (mapped for this assessment)	2.97	2.97	2.97
Native planted windrows and road reserve vegetation (mapped for this assessment)	15.41	2.30	2.09
Sub total	***34.03***	***5.27***	***5.06***
Not native (exotic or cleared land)			
Not Native (from regional mapping) / cleared	1965.53	194.73	379.94
Riverine Western Grey Box grassy woodland of the semi-arid (warm) climate zone (PCT 237) – from regional mapping, now cleared	0.22	0.00	0.00
Sub total	***1965.97***	***194.73***	***379.94***
Total	**2000**	**200**	**385**

3.6 State or regionally significant biodiversity links

The development site does not support any of the following, which are identifiers of state or regionally significant biodiversity links:

- an area identified as being part of a state significant biodiversity link
- a riparian buffer 50 m either side of a 6th order stream
- a riparian buffer 50 m around an important wetland or estuarine area
- an area identified as being part of a regionally significant biodiversity link
- a riparian buffer 20 m either side of a 4th or 5th order stream.

Therefore, the proposed development will not impact on any state or regionally significant biodiversity links.

3.7 Landscape value assessment

3.7.1 Requirements

A BioBanking Credit Assessment was undertaken to determine the landscape value of the development site, in accordance with Appendix 4 of the FBA, *Assessing landscape value for site-based developments*.

3.7.2 Percent native vegetation cover

Table 3.4 and Table 3.5 provide a summary of the extent of native vegetation (including planted native vegetation) estimated to occur within the inner and outer assessment circles, before and after development, as part of the landscape value assessment.

Table 3.4. Extent of native vegetation cover before and after development

Assessment circle	Before development		After development	
	Area (ha)	%	Area (ha)	%
Outer assessment circle	34.03	1.70	29.97	1.50
Inner assessment circle	5.27	2.63	1.49	0.74

Table 3.5. Score for percent native vegetation cover after development

Percent native vegetation cover in the landscape – inner and outer assessment circle (%)	Score for percent native vegetation cover in the landscape – inner assessment circle	Score for percent native vegetation cover in the landscape – outer assessment circle
≤5	0.75	1.25

3.7.3 Connectivity value

As defined in the FBA, native vegetation on a development site is part of a connecting link when it is linked to adjoining vegetation and the native vegetation on the development site, and meets the following conditions:

- is in moderate to good condition
- has a patch size >1 ha
- is separated by a distance of <100 m (or <30 m for non-woody ecosystems)
- is not separated by a large water body, dual carriageway, wider highway or similar hostile link.

There are no connecting links within the development site or the inner and outer assessment circles. All areas of native vegetation within and adjacent to the development site are separated by distances greater than 100 m.

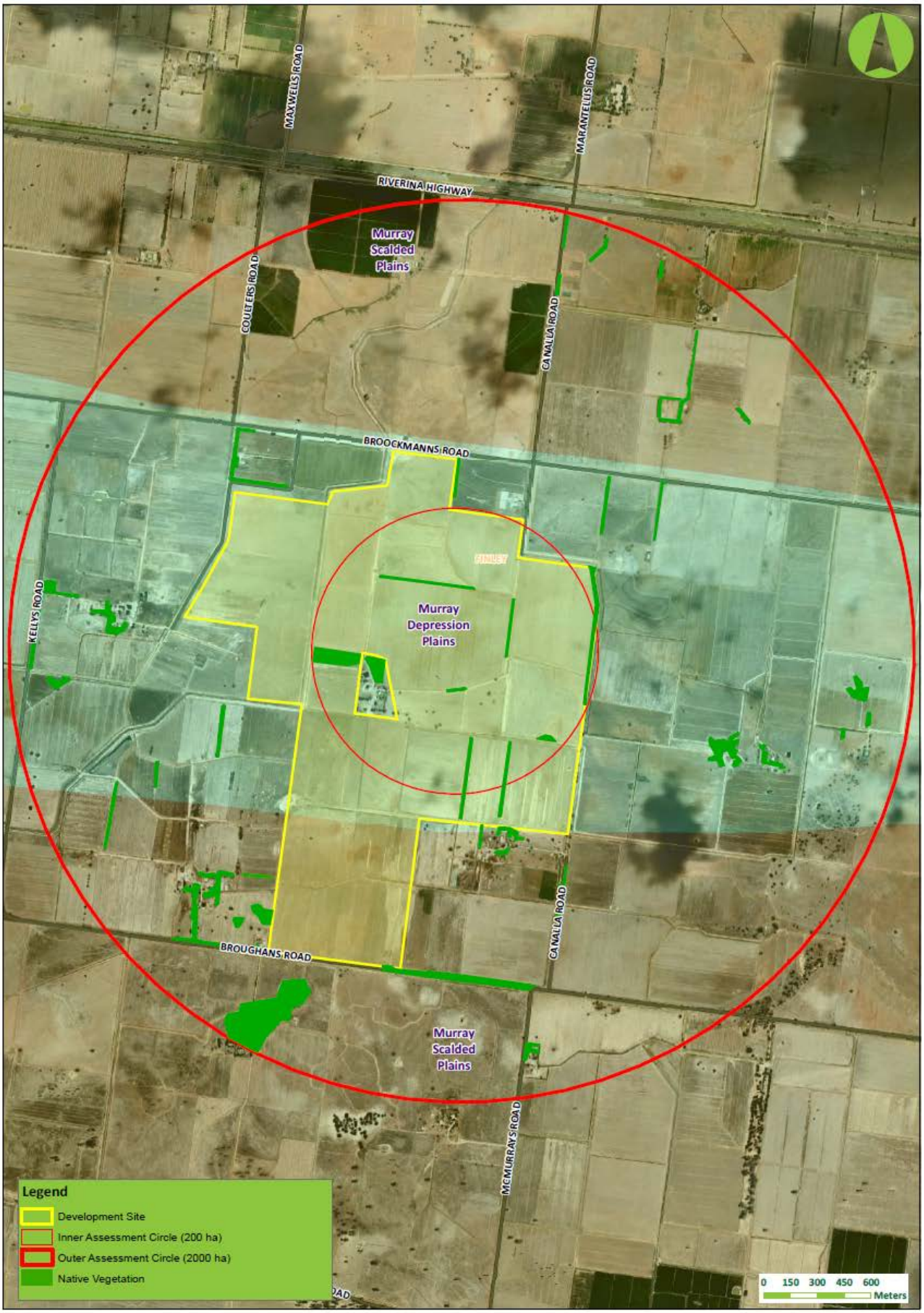


Figure 3.1. Inner (200 ha) and outer (2000 ha) assessment circles

3.7.4 Patch size

As defined in the FBA, patch size is an area of native vegetation that meets the following criteria:

a) occurs on the development site or offset site

b) is in moderate to good condition

c) includes native vegetation that has a gap of less than 100 m from the next area of moderate to good condition native vegetation (or ≤30 m for non-woody ecosystems).

Patch size may extend onto adjoining land that is not part of the development site.

The patch size score is determined by using the following:

- percent native vegetation cleared in the Mitchell landscape in which most of the development occurs
- size (ha) of the largest area of native vegetation within the development site that meets patch size criteria.

The criteria for assessing patch size are shown in Table 3.6.

Table 3.6. Criteria for assessing patch size

Patch size class	Percent native vegetation cleared in the Mitchell landscape in which most of the Major Project occurs				Patch size score
	<30%	30-70%	>70-90%	>90%	
Extra large	>1000 ha	>200 ha	>100 ha	>50 ha	12
Very large	>500-1000 ha	>100-200 ha	>50-100 ha	>20 – 50 ha	9
Large	>200-500 ha	>50-100 ha	>20-50 ha	>10-20 ha	6
Medium	>100-200 ha	>20-50 ha	>10-20 ha	>1-10 ha	3
Small	≤100 ha	≤20 ha	≤10 ha	≤1 ha	1
Nil	0	0	0	0	0

There is no native vegetation within the development site that meets the definition of patch in the FBA.

In order to operate the BioBanking calculator to obtain site values, a patch size of 2.97 ha (derived from planted woodlot vegetation within the development site) was used.

The development site is mainly located within the Murray Depression Plains Mitchell landscape, which is >90% cleared of native vegetation.

The patch size is calculated to be Medium (>1-10 ha) and consequently has a patch size score of 3.

4 Native vegetation

4.1 Vegetation description

The majority of the development site is currently used for pasture and cropping, with remaining native vegetation and fauna habitats substantially modified through past disturbances.

Native vegetation occurs as scattered paddock trees (within land still used for grazing and cropping) and native plantings in woodlots and windrows. Additional native trees occur within the road reserves adjacent to the development site.

4.2 Plant community types

Native vegetation within the development site does not readily translate to any PCT as the residual/remnant native vegetation is limited to scattered paddock trees and vegetation which has been planted (i.e. woodlots and windrows which are not representative of native PCTs).

For the purposes of the FBA, native flora identified during surveys undertaken by Ecolink (Ecolink 2017a) were entered into the OEH NSW Vegetation Information System Classification database to identify the PCT most likely to have occurred pre-clearing and from where the remnant native paddock trees may be considered derived from. The results of the Vegetation Information System search are summarised in Table 4.1.

As is evident from the limited (3 or 4) species matches shown in Table 4.1, there is not sufficient remnant vegetation diversity to determine the most appropriate PCT based on floristic data and overlapping similarities in landform characteristics.

Of the four PCTs listed in Table 4.1, PCT 237 is the most similar based on limited floristic data, whereas PCT 76 is the most commonly mapped PCT within the outer assessment circle. Both PCTs are listed as endangered communities under the TSC Act and EPBC Act.

Comparison of landscape and site values for both PCT76 and PCT 237 was undertaken with little difference in BioBanking calculations. Using PCT 76 was also thought to be a more conservative approach as it is 95% cleared within the Murray River CMA compared to PCT 237 which is 75% cleared.

All areas within the 200 ha inner assessment circle (including the development site) are regionally mapped as non-native. The benchmark data for PCT 76 was therefore used to assess the paddock tree data collected. Areas of planted native vegetation (i.e. woodlots and windrows) have not been assigned to a PCT. This is due to:

- surveys/observations undertaken by Ecolink (Ecolink 2017a)
- anecdotal evidence provided by the landowners (e.g. the origin and intent of native plantings in woodlots)
- discussion with OEH during a site inspection with Ecolink and ESCO Pacific (June 2017) prior to collecting flora survey data.

However, in accordance with requirements, the potential for the planted native vegetation to provide habitat for threatened has still been considered.

Table 4.1. Vegetation Information System Classification 2.1 search results

PCT	Formation	Class	Vegetation	Description*	No. of matches
74	Grassy Woodlands	Floodplain Transition Woodlands	Yellow Box - River Red-gum tall grassy riverine woodland of NSW South Western Slopes Bioregion and Riverina Bioregion	*Landscape position:* Floodplain. *Landform patterns*: Floodplain, meander plain. *Landform elements:* Terrace flat, plain. *Substrate mass:* Eolian sediment, alluvium. *Lithology*: Alluvium loams and clays. *Great soil group* Grey clay, alluvial soil, black earth. *Soil texture:* Silty clay loam, clay loam, clay loam-sandy, loam, silty loam, light clay. *Upper stratum: Eucalyptus melliodora* (Yellow Box), ***Eucalyptus camaldulensis*** **(River Red-gum)**, ***Eucalyptus mIcrocarpa*** **(Western Grey Box)**, *Eucalyptus populnea* subsp*. bimbil* (Bimble Box), ***Allocasuarina luehmannii*** **(Bulloak)**, *Casuarina cristata* (Belah), *Callitris glaucophylla* (White Cypress Pine). *Ground stratum:* ***Oxalis perennans*** **(Yellow Wood-sorrel)**.	4
237	Grassy Woodlands	Floodplain Transition Woodlands	Riverine Western Grey Box grassy woodland of the semi-arid (warm) climate zone	*Landscape position:* On terrace flats on the floodplain. *Landform patterns*: Floodplain. *Landform elements:* Terrace plain, plain. *Substrate mass:* Alluvium. *Lithology*: Clay. *Great soil group*: Grey clay, grey earth. *Soil texture:* Clay loam, heavy clay, medium clay. *Upper stratum*: ***Eucalyptus microcarpa*** **(Western Grey Box)**, ***Eucalyptus camaldulensis*** **(River Red-gum)**, *Eucalyptus largiflorens* (Black Box), ***Allocasuarina luehmannii*** **(Bulloak)** *Ground stratum*: ***Oxalis perennans*** **(Yellow Wood-sorrel)**.	4

PCT	Formation	Class	Vegetation	Description*	No. of matches
76	Grassy Woodlands	Floodplain Transition Woodlands	Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions	*Landscape position:* On undulating alluvial plains of south-central western NSW. Mainly restricted to the eastern section of the Riverina Bioregion and the western section of the NSW South Western Slopes Bioregion. *Landform patterns:* Floodplain, alluvial plain. *Landform elements*: Levee, valley flat, plain. *Substrate mass*: Alluvium. *Lithology*: Shale, alluvial loams and clays. *Great soil group*: Grey clay, red-brown earth, red clay. *Soil texture*: Clay loam, clay loam-sandy, loam. *Upper stratum*: ***Eucalyptus microcarpa*** **(Western Grey Box)**, *Callitris glaucophylla* (White Cypress Pine), ***Allocasuarina luehmannii*** **(Bulloak)**. *Ground stratum*: ***Oxalis perennans*** **(Yellow Wood-sorrel)**.	3
80	Grassy Woodlands	Floodplain Transition Woodlands	Western Grey Box - White Cypress Pine tall woodland on loam soil on alluvial plains of NSW South Western Slopes Bioregion and Riverina Bioregion	*Landscape position:* On alluvial or stagnant alluvial plains in the predominantly winter rainfall belt of southern-central NSW. Mainly restricted to the eastern section of the Riverina Bioregion and the western section of the NSW South Western Slopes Bioregions. *Landform patterns:* Stagnant alluvial plain, alluvial plain. *Landform elements*: Plain. *Substrate mass*: Plutonic rocks, colluvium, alluvium. *Lithology*: Sandstone, granite, alluvial sand, alluvial loams and clays, Eolian sand or loam. *Great soil group*: Grey-brown podzolic soil, red-brown earth. *Soil texture*: Clay loam, sandy, sandy clay loam. *Upper stratum*: ***Eucalyptus microcarpa*** **(Western Grey Box)**, *Callitris glaucophylla* (White Cypress Pine), Yellow Box (*Eucalyptus melliodora*), ***Allocasuarina luehmannii*** **(Bulloak)**, *Pittosporum angustifolium* (Butterbush), *Brachychiton populneus subsp. populneus* (Kurrajong). *Ground stratum*: ***Oxalis perennans*** **(Yellow Wood-sorrel)**.	3

*Species shown in bold match species found on site

4.3 Vegetation zones and site value (condition)

Vegetation zones identified within the development site are summarised in Table 4.2 and shown in Figure 4.1

Table 4.2. Vegetation zones within the development site

Zone	Name	Total Area (ha)
1	Derived PCT 76 – low condition pasture and cropped land (to be cleared)	379.94
2	Planted woodlot – low condition (to be cleared)	1.97
3	Planted woodlot – moderate-good condition (to be retained)	1.00
4	Planted windrows – native trees planted as windbreaks (to be cleared)	2.09
	Total	**385.00**

4.3.1 Pasture and cropped zones (Zone 1)

Zone 1 includes scattered paddock trees and crops of Wheat *Triticum aestivum*, Rice *Oryza sativa* and Lucerne *Medicago sativa* subsp. *sativa*. These species were at different stages of their lifecycle or consisted of bare ground in preparation for the seeding and growing season (Plate 4.1 and Plate 4.2). None of the crops were advanced at the time of the assessment.

Plate 4.1. Bare ground in a paddock in preparation for crop sowing

Plate 4.2. Early stages of a wheat crop

Figure 4.1. Vegetation zones within the development site

Pasture areas were grazed by cattle during the current assessment. The vegetation was dominated by exotic species, including a range of pasture grasses and environmental weeds such as Paspalum *Paspalum dilatatum*, Couch *Cynodon dactylon* var. *dactylon*, Kikuyu *Cenchrus clandestinus*, Perennial Rye-grass *Lolium perenne* and Barley Grass *Hordeum* sp. The height of the vegetation was generally low (less than 5 cm in height) due to grazing pressure (Plate 4.3 and Plate 4.4).

The pastured areas of the development site supported the largest number of scattered paddock trees (Plate 4.3 and Plate 4.4).

A total of 26 scattered paddock trees were recorded within the development footprint. Trees comprised six species, dominated by Grey Box *Eucalyptus microcarpa*, Black Cypress Pine *Callitris endlicheri* and Bull Oak *Allocasuarina luehmannii.* All of these trees were mature specimens with no sign of recruitment observed.

Site value

Zone 1 was assessed by using the BioBanking Paddock Tree Calculator. Several plot / transects were also conducted to characterise the ground layer. Tree survey and plot data for the development site is provided in Appendix A.

Paddock tree survey and plot / transects resulted in site values of below 17, as a result of:

- the calculated per cent foliage cover over-storey of 0.00 which is <25% of the lower benchmark of 14 for PCT 76
- the finding that <50% of the groundcover is native vegetation or >90% of the groundcover is cleared.

In accordance with the FBA, vegetation zones with a Site Value score equal to or below 17 (low condition) do not trigger a requirement for ecosystem credit offsetting. However the potential for this zone to provide habitat for threatened species must still be considered.

Plate 4.3. Heavily grazed paddock, with scattered trees in the background

Plate 4.4. Scattered paddock tree area in south of development site

4.3.2 Planted woodlot (Zone 2)

Zone 2 covers an estimated 1.97 ha and comprises immature native shrubs (predominantly Acacia species) and an exotic understorey (Plate 4.5 and Plate 4.6). In March 2007, this area was ripped and direct seeded with native species and fenced. Prior to this time, it is understood that the area did not contain native vegetation (based on landholder discussions). The woodlot suffered through several initial dry years before showing improved growth following a wet year, but is currently subject to grazing.

Zone 2 would be cleared for the project. Although this zone was not assigned a PCT, it still requires consideration for its potential to provide habitat for threatened species.

Plate 4.5. Woodlot - Zone 2

Plate 4.6. Woodlot - Zone 2

4.3.3 Planted woodlot (Zone 3)

Zone 3 covers approximately 1 ha and comprises a number of planted indigenous, Australian native and exotic species, with an emerging native understorey due to relief from grazing pressure (Plate 4.7 and Plate 4.8).

Species present included planted canopy species: River Red-gum *Eucalyptus camaldulensis*, a number of non-endemic sheoak spp. (*Allocasuarina littoralis* and *A.verticillata*) and introduced Pepper Tree *Schinus molle.* The groundlayer was dominated by introduced grasses (plot/transect data for this zone is provided in Appendix A).

This woodlot would be avoided due to its higher ecological value and would not be cleared for the project but still requires consideration for its potential to provide habitat for threatened species.

Plate 4.7. Woodlot – Zone 3

Plate 4.8. Woodlot – Zone 3

4.3.4 Planted windrows (Zone 4)

Zone 4 comprises linear planting of trees in several locations within the development site (see Figure 4.1).

The species planted are predominantly *Eucalyptus camaldulensis* (River Red-gum) along with *Eucalyptus cladocalyx* (Sugar gum). All trees were reaching maturity, but do not support hollows, nor were any nests evident during site investigations undertaken by Ecolink (2017a).

5 Threatened species

5.1 Assessment requirements

The BioBanking calculator returns species that are predicted to occur in the development site based on geographical and habitat features, and PCTs present. The biodiversity values of threatened species returned by the BioBanking calculator must be assessed using information from the Threatened Species Profile Database.

Project specific assessment requirements (OEH SEARs) are listed in Table 5.1 along with the relevant section of this report in which they are assessed.

Table 5.1. Project specific assessment requirements

Common name	Comment / Section reference
Vegetation communities	
Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South Western Slopes Bioregions	Areas of mapped native vegetation occur only in the outer 2000 ha outer assessment circle. All areas within the 200 ha inner assessment circle (and the development site) are regionally mapped as non-native. Native vegetation within the development site does not readily translate to any PCT as the residual/remnant native vegetation is limited to scattered paddock trees and vegetation which has been planted (i.e. woodlots and windrows which are not representative of native PCTs).
Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt Bioregions	
Allocasuarina luehmannii Woodland in the Riverina and Murray-Darling Depression Bioregions	
Sandhill Pine Woodland in the Riverina, Murray-Darling Depression and NSW South Western Slopes Bioregions	
Acacia melvillei Shrubland in the Riverina and Murray-Darling Depression Bioregions	
Threatened flora	
Amphibromus fluitans (Floating Swamp Wallaby Grass)	Section 5.4. Other
Austrostipa wakoolica (A spear grass)	Section 5.3. Species Credit Species
Eucalyptus leucoxylon subsp. *pruinosa* (Boland yellow gum)	Section 5. 3. Species Credit Species
Pterostylis despectans (Lowly Greenhood)	Section 5.4. Other
Swainsona sericea (Silky Swainson-pea)	Section 5.4. Other
Threatened fauna	
Anthochaera phrygia (Regent Honeyeater)	Section 5.4. Other
Circus assimilis (Spotted Harrier) – nest trees only	Section 5.4. Other
Falco hypoleucos (Grey falcon) – nest trees only	Section 5.4. Other
Falco subniger (Black Falcon) – nest trees only	Section 5.4. Other

Common name	Comment / Section reference
Hieraaetus morphnoides (Little Eagle) – nest trees only	Section 5.4. Other
Lophochroa leadbeateri (Major Mitchell's Cockatoo) – nest trees only	Section 5.2. Ecosystem credit species
Lophoictinia isura (Square-tailed Kite) – nest trees only	Section 5.4. Other
Ninox connivens (Barking Owl) – nest trees only	Section 5.4. Other
Polytelis swainsonii (Superb Parrot) – nest trees only	Section 5.4. Other
Tyto novaehollandiae (Masked Owl) – nest trees only	Section 5.4. Other

5.2 Ecosystem credit species

The credit calculator reports the suite of threatened fauna species that are predicted to be associated with ecosystem credits generated for the proposal. That is, the threatened fauna species that are predicted to use habitat within the vegetation types in the proposal site. Each of these species has a 'threatened species multiplier' that feeds into the ecosystem credit calculations. If that fauna species or specific habitat resources for that species are not present at the proposal site, then the threatened species multiplier score may be adjusted (OEH 2014).

The suite of threatened species associated with ecosystem credits for the proposal is shown in Table 5.2 along with an assessment of whether habitat components for these species are present within the development site. See Appendix D for more information on the preferred habitat of these species.

Table 5.2. Threatened ecosystem species reliably predicted by credit calculator to utilise the site

Common name	Scientific name	TS multiplier	Habitat present	Justification
Grey-crowned Babbler (eastern subspecies)	*Pomatostomus temporalis* subsp. *temporalis*	1.3	YES	May forage on occasion in paddock trees in the development site.
Little Pied Bat	*Chalinolobus picatus*	2.1	NO	No native woodland present in the development site.
Major Mitchell's Cockatoo	*Lophochroa leadbeateri*	1.9	YES	May forage on the ground or roost on occasion in paddock trees in the development site.
Swift Parrot	*Lathamus discolor*	1.3	YES	May forage on occasion in paddock trees in the pro development site.

5.3 Species credit species

Threatened species that cannot reliably be predicted to occur on a development site based on PCT, distribution and habitat criteria are identified by the Threatened Species Profile Database as species credit

species. In some circumstances, the particular habitat components of species assessed for ecosystem credit species, such as the breeding habitat of a cave roosting bat, are also assessed for species credits (OEH 2014b). The credit calculator references geographic, vegetation and habitat data for the development footprint to generate a list of the species credit-type threatened species (candidate species) predicted to occur and requiring targeted survey.

A candidate species is not considered to be present on the development site where:

- after carrying out an assessment of the habitat components the assessor determines that the habitat is substantially degraded such that the particular species is unlikely to utilise the development site, or
- an expert report states that the species is unlikely to be present at the development site, or
- the species is a vagrant species and unlikely to use habitat on the development site, or
- records of the species presence in relation to the location of the development site are at least 20 years old or, in the opinion of the assessor, have doubtful authenticity (OEH 2014b).

Candidate species identified in the credit calculator are shown in Table 5.3 along with an assessment of whether habitat components for these species are present within the development site. See Appendix D for more information on the preferred habitat of these species.

Table 5.3. Threatened species not reliably predicted that may require survey

Common name	Scientific name	Likelihood of occurring	Justification
Threatened flora			
A spear grass	*Austrostipa wakoolica*	Unlikely	No native woodland present in the development site. Due the long history of disturbance and land use for cropping, pasture / grazing, it is unlikely a viable seed bank is present within the development site.
Austral Pillwort	*Pilularia novae-hollandiae*	Unlikely	Habitat absent: Grows in shallow swamps and waterways, often among grasses and sedges. The development footprint has been sited to avoid swamp/wetland habitat.
Boland Yellow Gum	*Eucalyptus leucoxylon* subsp. *pruinosa*	Unlikely	Was not recorded during field assessments (including paddock tree data collected for 106 trees in the wider area of land secured by ESCO).
Mossgiel Daisy	*Brachysome papillosa*	Unlikely	Preferred habitat absent: Bladder Saltbush and Leafless Bluebush plains. Southern most records of species near Jerilderie from 1961 and 1993, >35 km to the north of the site.
Sand-hill Spider Orchid	*Caladenia arenaria*	Unlikely	Habitat absent: Woodland with sandy soil, especially that dominated by White Cypress Pine. The common feature at all extant populations is the presence of White Cypress Pine, which is absent from the site.
Winged Peppercress	*Lepidium monopocoides*	Unlikely	Habitat absent: Occurs on seasonally moist to waterlogged sites, on heavy fertile soils in open woodlands with ground-cover dominated by tussock grasses. The species requires periodically flooded and

Common name	Scientific name	Likelihood of occurring	Justification
			waterlogged habitats and does not tolerate grazing disturbance.
Threatened fauna			
Brush-tailed phascogale	*Phascogale tapoatafa*	Unlikely	Habitat absent: Prefers dry sclerophyll open forest with sparse groundcover of herbs, grasses, shrubs or leaf litter. Also inhabits heath, swamps, rainforest and wet sclerophyll forest.
Koala	*Phascolarctos cinereus*	Unlikely	Habitat absent: Inhabits eucalypt woodlands and forests. There are no historical records of this species near the development site, nor were any signs of Koala activity detected during field surveys.
Squirrel Glider	*Petaurus norfolcensis*	Unlikely	Habitat absent: Inhabits mature or old growth Box, Box-Ironbark woodlands and River Red-gum forest west of the Great Dividing Range. Prefers mixed species stands with a shrub or Acacia midstorey. Requires abundant tree hollows for refuge and nest sites.

5.4 Other threatened species

Fauna surveys and habitat assessment undertaken by Ecolink (Accent Environmental 2017, Ecolink 2017a) identified a number of threatened and/or migratory species (not predicted through the BioBanking calculator) with a moderate chance of occurring within the development site on at least an occasional basis. These species are shown in Table 5.4 along with additional project-specific vegetation communities and threatened species (identified in the SEARS).

Table 5.4 provides an assessment of whether habitat components for these threatened species are present within the development site and information on these species preferred habitat is provided in Appendix D.

Table 5.4. Other threatened species

Common name	Scientific name	Likelihood of occurring	Justification
Threatened flora			
Floating Swamp Wallaby Grass	*Amphibromus fluitans*	Unlikely	Habitat absent: Grows mostly in permanent swamps. The species needs wetlands which are at least moderately fertile and which have some bare ground: conditions which are produced by seasonally-fluctuating water levels. There are no historical records of this species near the development site.
Lowly Greenhood	*Pterostylis despectans*	Unlikely	Habitat absent: Natural forb-rich grassland on flat alluvial plains Known only from a single population discovered in 2005 near Moama, of between 20

Common name	Scientific name	Likelihood of occurring	Justification
			and 60 individual plants, despite intensive surveys in other potentially suitable habitat elsewhere.
Silky Swainson-pea	*Swainsona sericea*	Unlikely	Habitat absent: Box-Gum Woodland in the Southern Tablelands and South West Slopes. There are no historical records of this species near the development site.
Threatened fauna			
Dusky Woodswallow	*Artamus cyanopterus cyanopterus*	Unlikely	Woodland species that forage over open areas, often at very high altitudes (Pizzey and Knight 2012). No previous records of the species within 10 km of the development site.
Flame Robin and Scarlet Robin	*Petroica phoenicea* and *Petroica boodang*	High	Flame Robins were recorded during each of the two recent assessments and Scarlet Robins are also expected to occur within the development site. Both of these species move from forests and woodland in higher altitudes in summer, to open farmland throughout southern Australia in winter.
Regent Honeyeater	*Anthochaera phrygia*	Unlikely	Habitat absent: Dependent on nectar and insects from Box-Ironbark Eucalypt forests. There are no historical records of this species near the development site.
Threatened fauna – nest only			
Spotted Harrier	*Circus assimilis*	Unlikely	Spotted Harriers range over large territories of open country in search of food and build large stick nests in large trees. There are no previous records within 10 km of the development site for this species. No nests were observed during the recent field assessments within the development site that would be suitable for this species.
Grey Falcon	*Falco hypoleucos*	Unlikely	Habitat for the species included lightly treed inland plains, gibber deserts, and pastoral lands, generally of inland Australia. There are no historical records of this species near the development site. No nests were observed during the recent field assessments within the development site that would be suitable for this species.
Black Falcon	*Falco subniger*	Unlikely	Black Falcons nest in stick nests in trees, and are often exposed, or along creeklines. They nest in winter, through to early spring. There are no historical records of this species near the development site.

Common name	Scientific name	Likelihood of occurring	Justification
			No nests were observed during the recent field assessments within the development site that would be suitable for this species.
Little Eagle	*Hieraaetus morphnoides*	Unlikely	Little Eagles range over large territories in search of food and build large stick nests in large trees. There are no previous records within 10 km of the development site for this species. No nests were observed during the recent field assessments within the development site that would be suitable for this species.
Square-tailed Kite	*Lophoictinia isura*	Unlikely	Square-tailed Kites are found in a variety of timbered habitats including dry woodlands and open forests, with a preference for timbered watercourses. There are no historical records of this species near the development site. No nests were observed during the recent field assessments within the development site that would be suitable for this species.
Barking Owl	*Ninox connivens*	Unlikely	Barking Owls generally hunt for insects within woodlands, limiting the amount of habitat for this species within the project area. Their nest site is within a hollow tree with an entrance between 20 and 46cms in diameter, and a depth of between 20 and 300cm. There are no historical records of this species near the development site. No nests were observed during the recent field assessments of hollows within the development site.
Superb Parrot	*Polytelis swainsonii*	Possible	Core habitat absent: Riparian woodlands and forests of the Murrumbidgee and Murray Rivers (usually located near water) but will disperse into the open woodlands of the surrounding plains. Non- core habitat present: They are regularly found in crops, including cereal crops, as well as grazing land where scattered trees persist. Superb Parrots nest in the hollow spouts of large Eucalyptus trees—predominantly River Red-gums, but also Grey Boxes.
Masked Owl	*Tyto novaehollandiae*	Unlikely	Masked Owls generally occur within forests and woodlands, however they are often located close to cleared areas, such as pasture (rather than crops), grasslands or wetlands. Their nest site is within a hollow within a tree with an entrance at

Common name	Scientific name	Likelihood of occurring	Justification
			least 30cm in diameter, and a depth of between 45cm and 400cm. There are no historical records of this species near the development site. No nests were observed during the recent field assessments of hollows within the development site and none of the impacted hollow bearing trees support hollow entrances that are large enough to support this species.

5.5 EPBC Act Referral Assessment

5.5.1 Overview

During the planning phase for the proposal ESCO Pacific, the potential for impacts on MNES was a key consideration in locating the proposed development site. The EPBC Act protected matters online search tool returned 38 species listed as threatened and/or migratory, five threatened ecological communities and five Wetlands of International Importance (Ramsar) that are either known, or have the potential to occur, within a 10 km radius of the site (refer Appendix D).

Vegetation within the development site is limited to scattered paddock trees and vegetation which has been planted (i.e. woodlots and windrows which are not representative of native PCTs). The potential for native vegetation communities to occur within the development site is discussed in Sections 4.2 and 5.1.

5.5.2 Threatened and migratory species

Of the 38 species that were identified as having the potential to occur within the study area, only nine have at least a moderate likelihood of occurrence within the study area based on their biology, behaviour, habitat preferences compared with the habitats available within the study area (Appendix D). None of these species have been previously recorded within the study area, and none were recorded during the field surveys of the development site (Accent Environmental 2017; Ecolink Consulting Pty Ltd 2017).

Preliminary advice from the OEH suggest that the Superb Parrot may also occur near the study area, and there are recent records near Barmah Forest National Park approximately 30 km south-west of the study area. This species is also threatened in NSW and considered in Section 5.4.

Three migratory bird species are considered as likely to occur within the study area: Fork-tailed Swift *Apus pacificus*; White-throated Needletail *Hirundapus caudacutus*; and Rainbow Bee-eater *Merops ornatus*. Each of these species spend the summer months in southern Australia and may pass through the landscape during their migration. Despite this, the development site does not provide important or limiting habitat for any of these species. Fork-tailed Swifts and White-throated Needletails are aerial insectivores that are likely to forage above the study area, in advance of low-pressure fronts. The proposal is unlikely to have any impact on these movements.

Rainbow Bee-eaters may pass through, and around the study area, favouring higher quality woodland remnants within the road reserves, but also foraging over more sparsely vegetated paddocks. The development site is highly disturbed and fragmented and considered unlikely to provide habitat of any importance to this species. This is also likely to be true of the Superb Parrot and Satin Flycatcher *Myiagra*

cyanoleuca as these species are more likely to be confined to higher quality woodlands, which are absent from the development site.

The remaining five species are animals that live in wetland habitats, which is absent from the development footprint.

5.5.3 Wetlands

No Wetlands of International Importance (Ramsar) occur within or close to the development site. Five Ramsar wetlands are located downstream of the study area, but would not be impacted by the proposal. The closest of the five wetlands is the NSW Central Murray State Forests wetlands, approximately 20km downstream of the development site. The remaining four wetlands are in excess of 200 km from the. The proposed development is unlikely to impact upon the hydrology of the local area once operational, and the potential for construction impact would be mitigated through the implementation of best practice sediment and erosion control measures.

5.5.4 Potential for significant impact on an MNES

The assessments outlined above identified that the project is unlikely to significantly impact on any MNES providing that areas of wetland habitat are avoided and protected during both the construction and operation of the project (see Section 6.1).

6 Impact assessment

6.1 Avoid and minimise impacts

The highest quality habitat within the wider area of land secured by ESCO Pacific is associated with the wetland on Lot 136 on Plan 752299, and the irrigation channels located along the western boundary of the Lots 133, 134 and 136. These wetland/aquatic habitats have the highest cover abundance and diversity of native plant species. These locations also supported the highest diversity of native birds, with a range of species from diverse foraging guilds recorded (Ecolink 2017a).

Consistent with Chapter 8 of the FBA the areas with the highest quality habitat have been avoided by the Applicant (e.g. wetland/aquatic habitats and a planted woodlot).

Other habitat features with identified ecological value are the 106 large, scattered, paddock trees distributed throughout the wider area of land secured by ESCO Pacific, some containing hollows that are likely to be a valuable and limiting resource in the landscape for a range of bird and arboreal mammal species. These trees are also likely to provide foraging habitat for a range of bird species.

Consistent with Chapter 8 of the FBA, potential impacts to scattered paddock trees has been avoided/minimised with the development footprint containing 26 of the 106 total paddock trees assessed.

Up to 21 trees are likely to require removal, which includes two hollow bearing trees, and five trees will be retained, which include four hollow bearing trees (see Figure 4.1).

The remainder of the development site is generally degraded, lacking natural vegetation and of low ecological value to most native species.

6.2 Potential impacts

The proposed development of the Finley Solar Farm may result in both direct and indirect impacts on biodiversity. The direct impacts of the project are expected to comprise:

- the removal of up to 4.06 ha of native vegetation within the development site
- the removal of up to two hollow-bearing trees.

The indirect impacts of the project potentially may include:

- erosion of disturbed areas leading to sedimentation affecting any downgradient habitat or habitat within drainage channels
- water quality impacts (e.g. increased turbidity and suspended solids) affecting any downgradient habitat or habitat within drainage channels
- disturbance of fauna during construction due to noise generated by vehicles, equipment and construction activities.

6.3 Recommendations to avoid, minimise and mitigate impacts

ESCO Pacific has sought to reduce impacts on biodiversity values within the study area by avoiding and minimising the removal of native vegetation and disturbance of fauna habitat. The site has been selected in part due to its high level of disturbance from a long history of primary production and its distance from areas of high environmental sensitivity. However, to mitigate residual impacts after initial avoidance and minimisation has been implemented, a number of management measures are proposed.

Site selection and planning

Site access for construction and operation will be from the north via Canalla Road to minimise vegetation removal.

Access roads within the site should be located, where possible, along existing tracks currently used for agricultural purposes.

Construction

No direct impacts are expected to occur as a result of the construction phase other than the removal of native vegetation and hollow-bearing trees described in Section 6.2.

Mitigation measures to avoid and minimise impacts should be outlined in a Construction Environmental Management Plan (CEMP) and include:

- The removal of hollow-bearing trees will not be undertaken during the spring to early summer period to avoid the main breeding period for hollow-dependent fauna.
- Pre-clearance surveys will be undertaken to ensure that nests and hollows identified in paddock trees are inactive.
- A licenced wildlife salvage team will be on-site during vegetation removal to catch and relocate (if appropriate) any wildlife encountered in vegetation or hollow-bearing trees.
- Demarcation and exclusion fencing should be installed around trees and vegetation to be retained in, or directly adjacent to, the development site, as follows:
  - tree protection zones (TPZs) should be clearly defined.
  - the radius of the TPZ should be calculated for each tree by multiplying its diameter at breast height (DBH) by 12 (i.e. TPZ = DBH x 12) in accordance with the Australian Standard – Protection of trees on development sites AS 4970-2009 (Standards Australia Committee 2009)
  - a TPZ should not be less than 2 m or greater than 15 m, except where crown protection is required (Standards Australia Committee 2009)
  - appropriate signage such as 'No Go Zone' or 'Environmental Protection Area' should be installed around retained trees and vegetation
  - the location of any 'No Go Zones' should be identified in site inductions
  - fencing should comprise star pickets with high visibility bunting.
- All material stockpiles, vehicle parking and machinery storage will be located within cleared areas or areas proposed for clearing, and not in areas of retained native vegetation.
- Where practical, all paddock and hollow-bearing trees to be removed should be placed in areas of retained vegetation to provide additional fauna habitat.
- Where appropriate native vegetation cleared from the development site should be mulched for re-use on the site, to stabilise bare ground.
- Sediment and erosion control measures (e.g. silt fences, sediment traps) should be implemented prior to construction works commencing, to protect drainage channels and any downgradient habitat. These should conform to relevant guidelines, such as outlined in *Managing Urban Stormwater: Soils & Construction* (Landcom 2004).
- Standard noise controls should be implemented during construction to minimise disturbance to fauna, including:
  - using well-maintained vehicles and equipment

- using and maintaining noise-suppression devices (such as mufflers) on vehicles and equipment.

Operation

The impacts arising from the operation of the project are expected to be negligible due to the inherently low impact nature of solar farm operation.

6.4 Residual impacts

As outlined in Section 6.2, the Finley Solar Farm is expected to result in the removal of up to 4.06 ha of native vegetation and up to two hollow-bearing trees within the development site.

The thresholds for assessment and offsetting of unavoidable impacts of development in accordance with Section 9 of the FBA are considered below.

6.4.1 Impacts on biodiversity requiring further consideration

Impacts on biodiversity that require further consideration in accordance with Section 9.2 of the FBA are considered below.

Landscape features

The study area does not support any 4th, 5th or 6th order streams, estuarine areas, important wetlands, or state or regional biodiversity links. The study area does not support any important wetlands.

There are no impacts to landscape features requiring further consideration.

Native vegetation

The majority of the development site is currently used for pasture and cropping, with remaining native vegetation and fauna habitats substantially modified through past disturbances. Native vegetation occurs as scattered paddock trees (within land still used for grazing and cropping) and native plantings in woodlots and windrows. Additional native trees occur within the road reserves adjacent to the development site.

Scattered paddock trees within the pasture and cropped land zone (Zone 1) have been classified as derived PCT 76. Zone 1 is assessed as being in low condition.

The woodlots and windrows (Zone 2 and Zone 4 respectively) are planted and are not representative of any PCT.

Threatened species

There are no areas of critical habitat within the development site.

No impacts on critically endangered or endangered species are expected to result from the project.

6.4.2 Impacts requiring offsets

The impacts for which the assessor is required to determine an offset requirement is considered below in accordance with Section 9.3 of the FBA.

Native vegetation

The proposed development site will result in removal of the following:

- 4.06 ha of native vegetation within the development site
- up to two isolated hollow bearing paddock trees.

Impacts on these two PCTs will not require offsetting. The remainder of the development site supports non-native vegetation and disturbed land. No further consideration of these areas is required.

Species and populations

The project will not result in removal of habitat that is considered to be important for any threatened species and populations and it is considered unlikely that threatened species or populations would be significantly impacted as a result of the project.

6.5 Cumulative impacts

In addition to the above assessment of impacts at a development site level, the following consideration of cumulative impacts is provided to place the development within the context of other developments within the region.

6.5.1 Berrigan LGA

No other known developments are occurring or planned in the immediate vicinity of the proposed Finley Solar Farm.

A search of the NSW DPE planning website uncovered only one other major project (from 2004), which involved a road crossing replacement over the Murray River between Cobram (in Victoria) and Barooga (in NSW), approximately 33 km southeast of the development site.

Approximately 0.8 ha of River Red Gum forest was to be removed. This vegetation type is not present within the proposed development, nor is the fauna habitat of concern (*Myotus adversus* Large-footed bat).

6.5.2 Adjoining LGAs

LGAs adjoining Berrigan include the Murray River Council, Edward River, Murrumbidgee Council and Federation Council LGAs.

A search of the NSW DP&E planning website uncovered several projects within these adjoining LGAs. Table 6.1 provides a summary of each project and relevant biodiversity considerations.

Table 6.1. Developments in adjoining Local Government Areas

LGA / Project	Project area and distance from Finley Solar Farm	Status	Biodiversity impacted
Murray River			
SSD 8025 Limondale Solar Farm	1,025 ha >200 km northwest of proposal site	Approved 31/08/2017	Clearing of: • 5.32 ha of Black Box grassy open woodland (PCT 16) and Western Rosewood open woodland (PCT 58), being offset through the retirement of 158 ecosystem credits • The project would also remove 18 hollow bearing trees from the site, however none of these are likely to provide key habitat for any listed threatened species.

LGA / Project	Project area and distance from Finley Solar Farm	Status	Biodiversity impacted
Edward River			
SSD 17_8437 Currawarra Solar Farm 1385 Mayrung Road Deniliquin	750 ha Approximately 35 km northwest of the proposal site	SEARs issued 02/06/2017	Potential impacts to remnant Grey Box Grassy Woodlands (EPBC Act), or the Sandhill Pine Woodland EEC (TSC & EPBC Acts). Paddock trees potentially derived from the NSW EEC Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions.
SSD 17_8436 Tarleigh Park Solar 260 Parfreys Road Deniliquin	250 ha Approximately 25 km west of the proposal site	SEARs issued 02/06/2017	Potential impacts to remnant Grey Box Grassy Woodlands (EPBC Act). Paddock trees potentially derived from the NSW EEC Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions.
SSD 6281 Deniliquin Ethanol Plant Barmah Road Deniliquin	120 ha Approximately 50 km west of the proposal site	Approved July 01/07/2016	Clearing of: • 101.1 ha derived native tussock grassland • 1.3 ha Black Box Woodland • 2.2 ha open sedgeland • 1.8 ha low open forest of River Red Gum regrowth • 17.3 ha habitat for the Plains Wanderer. BOS to be prepared as a consent condition.
Murrumbidgee			
SSD 8208 Coleambally Solar Ercildoune Road Coleambally	570 ha Approximately 100 km northeast of the proposal site	Approved 13/10/2017	Clearing of 0.74 ha of the Black Box woodland and Weeping Myall woodland requiring 27 ecosystem credits be retired. Impacts also being offset for *Calotis moorei* A Burr-Daisy, *Convolvulus tedmoorei*, *Leptorhynchos orientalis* and *Petaurus norfolcensis* Squirrel Glider.

6.5.3 Discussion

Of the six major projects within Berrigan and adjoining LGAs, the total area of vegetation clearing and / or impacts on threatened flora and fauna can only be discussed for four projects as two are yet to be assessed. None of the flora and fauna species impacted on have the potential to occur within the proposed Finley Solar Farm development site.

Vegetation that has or will be cumulatively cleared within the Berrigan and adjoining LGAs as a result of the above developments comprises approximately 10 ha of remnant native woodland (7.36 ha of Black Box woodland and 2.6 ha of River Red Gum), 2.2 ha of open sedgeland, and 101.1 ha of derived native tussock grassland.

None of these vegetation types occur within the proposed development site or would be impacted on as a result of the project.

All areas within the development site are regionally mapped as non-native vegetation. Native vegetation identified in the development site is limited to planted native vegetation associated with woodlots and windrows, and scattered paddock trees in the pasture and cropped land. In total the project is expected to require the removal of up to 4.06 ha of planted native vegetation (woodlots and windrows) and up to twenty one trees scattered paddock trees, which includes two hollow bearing trees.

Therefore it is considered unlikely that the proposal would contribute to any cumulative impacts of vegetation clearing, habitat fragmentation, loss of habitat and degradation in the Berrigan and adjoining LGAs.

7 Conclusion and recommendations

7.1 Biodiversity Credit Report

A Biodiversity Credit Report is provided in Appendix B, which indicates that no ecosystem credits are required for the removal of native and exotic vegetation within the development site.

The Biodiversity Credit Report is based on the survey data collected (Ecolink 2017a) and the following assumptions:

- Trees within public road reserves will be avoided, protected and not indirectly impacted.
- Planted native vegetation within the development site (planted woodlots and windrows) do not provide habitat for threatened species.

7.2 Conclusions

The development site avoids areas considered to be of high habitat value. This avoidance of habitat, in combination with appropriate environmental safeguards during construction of the project (which would be set out in the project's Construction Environmental Management Plan), is expected to ensure that the development meets the requirements to avoid and minimise impacts on biodiversity values as set out in Chapter 8 of the FBA.

All areas within the development site are regionally mapped as non-native vegetation. Native vegetation identified in the development site is limited to planted native vegetation associated with woodlots and windrows, and scattered paddock trees in the pasture and cropped land. In total the project is expected to require the removal of up to 4.06 ha of native vegetation and up to two hollow-bearing trees.

The proposed footprint is predominantly located on pastures and cropped land (Zone 1), which occupy more than 90% of the development site and were calculated with a site value of less than 17. Under the FBA, native vegetation with a site value of <17 does not require ecosystem credits offsetting.

The remaining proposed footprint area contains a planted woodlot and windrows, which comprise planted native and exotic species. These plantings have not yet reached maturity, do not contain tree hollows, and are not representative of native plant communities.

Initial survey results (Ecolink 2017a) indicate that the development site native vegetation, that would be removed, does not provide habitat important to any threatened or migratory species protected under the EPBC Act and TSC Act. Therefore offsetting for threatened or migratory species would also not be required.

The development site avoids areas considered to be of high habitat value within the local landscape. This avoidance of habitat, in combination with appropriate environmental safeguards during construction of the project (which would be set out in the project's Construction Environmental Management Plan), is expected to ensure that the development meets the requirements to avoid and minimise impacts on biodiversity values as set out in Chapter 8 of the FBA.

The assessments identified that the project is unlikely to significantly impact on any MNES providing that areas of wetland habitat are avoided and protected during both the construction and operation of the project (see Section 6.1).

No offset requirements have been generated for this project and therefore a Biodiversity Offset Strategy under Stage 3 of the BAR is not required.

8 References

Accent (2017). Finley Solar Farm Preliminary Environmental Assessment – Scoping Report. Prepared by Accent Environmental Pty Ltd for ESCO Pacific Pty Ltd. AE1067.0_D1. Version 3, 6 June 2017.

Australian Government Department of the Environment and Energy (2013) Matters of National Environmental Significance Significant impact guidelines 1.1 *Environment Protection and Biodiversity Conservation Act 1999.* https://www.environment.gov.au/system/files/resources/42f84df4-720b-4dcf-b262-48679a3aba58/files/nes-guidelines_1.pdf

DPI (2013) Policy and guidelines for fish habitat conservation and management. Department of Primary Industries, June 2013. http://www.dpi.nsw.gov.au/__data/assets/pdf_file/0005/634694/Policy-and-guidelines-for-fish-habitat.pdf

Ecolink (2017a). Flora and Fauna Habitat Assessment, Finley Solar Farm. Prepared by Ecolink Consulting Pty Ltd for ESCO Pacific Pty Ltd. Draft report. July 2017.

Ecolink (2017b). Finley Solar Farm, EPBC Act Referral Assessment. Letter report from Ecolink Consulting Pty Ltd to ESCO Pacific Pty Ltd, dated 3 July 2017.

Environment Australia (2001). A Directory of Important Wetlands in Australia. Third Edition. Environment Australia, Canberra.

Higgins (1999). Handbook of Australian, New Zealand and Antarctic Birds: Volume 4 Parrots to Dollarbird. Oxford University Press, Melbourne. ISBN 0-19-553071-3.

Landcom (2004). *Managing Urban Stormwater: Soils & Construction*. Landcom, New South Wales Government. 4th edition. ISBN 0-9752030-3-7. March 2004.

OEH (2007) Threatened species assessment guidelines. The assessment of significance. Published by: Department of Environment and Climate Change NSW ISBN 978 1 74122 551 8 DECC 2007/393 August 2007.

OEH (2014a) NSW Biodiversity Offsets Policy for Major Projects. Published by NSW Office of Environment and Heritage ISBN 978 1 74359 751 4 /0672 September 2014.

OEH (2014b) Framework for Biodiversity Assessment NSW. Biodiversity Offsets Policy for Major Projects. Published by NSW Office of Environment and Heritage ISBN 978 1 74359 754 5 OEH 2014/0675 September 2014.

OEH (2017c). Dusky Woodswallow – profile. Available at http://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=20303. Accessed 7 July 2017. NSW Office of Environment and Heritage, Sydney.

Pizzey G and Knight F (2012). 'The Field Guide to the Birds of Australia.' (Harper Collins: Sydney).

Standards Australia Committee (2009) Australian Standard – Protection of trees on development sites, AS 4970-2009. Standards Australia Committee. August 2009.

Appendices

Appendix A: Changes to the BAR from version 3

This BAR has been updated from the version appended to the Finley Solar Project EIS, in response to comments received from the Office of Environment and Heritage on 20 October 2017 and 17 November 2017. Key changes to the report are listed in Table A1.

Table A1. Key changes to the BAR (from version 3)

Section	Key change
General	The area of native (planted) vegetation within the development site has been reduced based on a reduction to the estimated area occupied by paddock trees (as outlined below).
	The number of hollow-bearing trees to be removed has been corrected from 'up to four' to 'up to two'.
	An assessment of significance of the Flame Robin and Scarlett Robin which was added as Appendix E into version 4 of the BAR has been removed.
2.3.2 Plot/transect surveys	Explanation added of how the area of paddock trees was calculated. This version of the BAR assumes a smaller area for paddock trees.
3.5 Native vegetation extent	The area of planted vegetation within the development site has been changed from 2.97 ha to 5.06 ha. Table 3.3 has been expanded to include the area of vegetation communities in the inner assessment circle and the development site.
3.7.2 Percent native vegetation cover	The values provided in Table 3.4 (extent of native vegetation cover before and after development) have been amended.
3.7.4 Patch size	Text amended to make clear that there is no native vegetation within the development site that meets the definition of patch in the FBA and to explain the inclusion of planted vegetation as native vegetation for the purpose of operating the Biobanking calculator.
4.3 Native vegetation	In Table 4.2, the total area for Derived PCT 76 changed to 379.94 ha, and to 2.09 ha for planted windrows.
5 Threatened species	Section has been re-organised and new sections added. Additional threatened species have been added to cover all species generated by the Biobanking calculator and all those requested in the project specific assessment requirements provided by OEH with the SEARs.
5.1 Assessment requirements	New section added listing the project specific assessment requirements provided by OEH with the SEARs and showing where they are addressed within the BAR.
5.2 Ecosystem credit species	Amended list and information provided regarding ecosystem credit species.
5.3 Species credit species	Amended list and information provided regarding species credit species.
5.4 Other threatened species	Amended list and information provided regarding other threatened species.
5.5 EPBC Act Referral Assessment	Section added to discuss the project in relation to MNES.
6.3 Recommendations to avoid, minimise and mitigate impacts	Additional recommendations added that pre-clearance surveys are undertaken, and that the removal of hollow-bearing trees will not be undertaken during the spring to early summer period.

Section	Key change
Appendix D	A new appendix with a threatened species habitat summary table has been added to provide as additional information on threatened species habitat.

Appendix B: Plot/transect data

Table B1. Plot data

Zone	Plot	Species name	Common name	Strata	Estimated % cover	Easting	Northing
1	1	*Allocasuarina luehmannii*	Bulloak	1 x paddock tree	NOT IN PLOT	6053641	364415
			WEED COVER	groundcover exotic	100		
1	2		WEED COVER	groundcover exotic	80	6053545	364750
			BARE GROUND				
1	3		WEED COVER	groundcover exotic	100	6053272	365518
1	4		WEED COVER	groundcover exotic	84	6054132	363841
			BARE GROUND		16		
1	5		WEED COVER	groundcover exotic	24	6054885	364662
			BARE GROUND		86		
1		refer paddock tree data					
2	1*		Data not collected	groundcover exotic	100	6054037	364575
		Anecdotal area previously bare no vegetation, direct seeded with trees, shrubs and saltbush					
3	1	*Eucalyptus camaldulensis*	River Red-gum (planted)	tree	10	6054110	364339
		Melaleuca sp.	Paperbark (not endemic planted)	tree	5		
		Allocasuarina littoralis	Sheaok (not endemic planted)	tree	5		
		Allocasuarina verticillata	Sheaok (planted)	tree	5		
		Schinus molle	Pepper tree*	tree exotic	<5		
		Rytidospermum setacea ?	Smallflower Wallaby Grass	groundcover grass	5		
		Anthosachne scabra	Wheatgrass, Common Wheatgrass	groundcover grass	10		
		Cynodon dactylon	Common couch	groundcover grass	5		
		Oxalis sp.		groundcover herb	<5		
		Lolium perenne	Rye grass*	groundcover exotic	<5		
		Dactylis glomerata	Cocksfoot*	groundcover exotic	<5		
		Agrostis capillaris	Brown-top Bent*	groundcover exotic	<5		
		Paspalum dilatatum	Paspalum*	groundcover exotic	<5		
		Hordeum sp.	Barley grass*	groundcover exotic	10		
			Bare ground/ leaf litter		45		

*Inferred. Note, Zone 4 (windrows) was assessed based on field observations.

Table B2. Transect data

Zone	Plot	NPS	NOS	NMS	NGCG	NGCS	NGCO	EPC	NTH	OR	FL	Easting	Northing	Zone
1	1	1	3.2	0	0	0	0	100	0.46	0	0	6053641	364414.8	55
1	2	1	3.2	0	0	0	0	80	0.46	0	0	6053545	364749.8	55
1	3	0	3.2	0	0	0	0	100	0.46	0	0	6053272	365518.4	55
1	4	0	3.2	0	0	0	0	84	0.46	0	0	6054132	363840.8	55
1	5	0	3.2	0	0	0	0	24	0.46	0	0	6054885	364661.8	55
2*	1	5	0	0	0	0	0	100	0	0	0	6054110	364339	55
3	1	5	60	0	10	0	0	36	0	1	20	6054037	364575.3	55

*Inferred. Note, Zone 4 (windrows) was assessed based on field observations.

Key:

Zone 1	Cropped and pasture
Zone 2	Planted woodlot (low condition)
Zone 3	Planted woodlot (moderate-low condition)
NPS	Native plantspecies richness 1
NOS	Native over-storey cover (%)
NMS	Native mid-storey cover (%)
NGCG	Native ground cover (grasses) (%)
NGCS	Native ground cover (shrubs) (%)
NGCO	Native ground cover (other) (%)
EPC	Exotic plant cover
NTH	Number of trees with hollows
OR	Over-storey regeneration
FL	Total length of fallen logs (m)

Table B3. Paddock Tree Calculator (Zone 1)

BioBanking Paddock Tree Calculator

The BioBanking Paddock Tree Calculator is a tool for estimating per cent foliage cover where trees are very sparse and survey data taken from transects/plots are therefore not practical. The BioBanking Paddock Tree Calculator can only be used on a development site where the groundcover vegetation is in low condition. It must be used in accordance with Appendix 3 of the Operational Manual.

The BioBanking Paddock Tree Calculator can be used to:
(i) determine whether the per cent foliage cover over-storey is <25% of the lower benchmark
(ii) calculate the effective clearing area for a vegetation zone or a polygon (this can only be used where the groundcover vegetation is in low condition (i.e. < 50% of the groundcover is native vegetation or greater than 90% of the groundcover is cleared)
(iii) calculate the average number of trees with hollows for a vegetation zone

To use the Paddock Tree Calculator, the assessor should transcribe the result obtained here into the BioBanking Credit Calculator for every transect/plot that has been measured within the vegetation zone or polygon for which these calculations were made.

Per cent foliage cover of paddock trees

Average crown diameter of paddock trees (m)	8.3	
Average per cent foliage cover taken from a sample of paddock trees (%)	32	
Number of paddock trees within a sample area	26	
Sample area in which the number of paddock trees were counted (ha)	1.423	
Per cent foliage cover (%) =	**3.20**	Record this value in each transect/plot measured within this vegetation zone

Does the over-storey meet the low condition definition?

What is the lower benchmark over-storey per cent foliage cover (%)?	14	
Is over-storey per cent foliage cover (estimated above) <25% of benchmark?	**Yes**	If the groundcover is <50% native then this vegetation is likely to meet the low condition definition

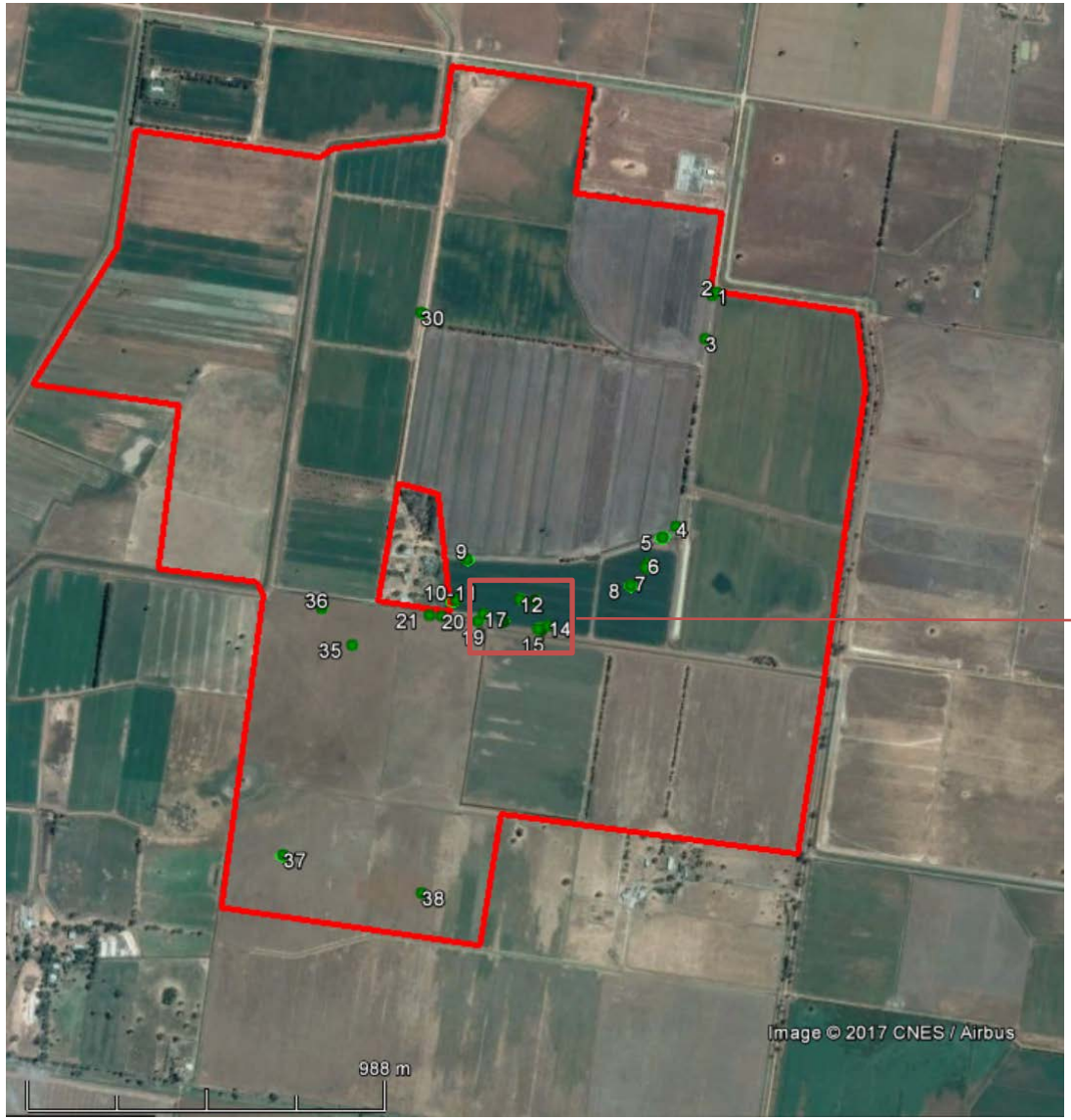
Calculation of the effective clearing area (only where groundcover is in low condition)

Effective clearing area (ha)	**1.3**	The effective clearing area must only be used where the groundcover vegetation is in low condition i.e. < 50% of the groundcover is native vegetation or greater than 90% of the groundcover is cleared

Calculation of average number of trees with hollows

Number of hollow bearing trees in the sample area	6	
Average number of trees with hollows	**0.46**	Record this value in each transect/plot measured within this vegetation zone

Paddock trees within the development site are limited to groups of two or groups of three (in a combination of live and dead trees). The trees grouped together ranged in distance from each other. The average of these distances was used to as the distance around outlying trees (see Table 2.1 and Figure B1).



Polygon measurements

7m average distance used

Figure B1. Paddock tree measurements

Table B4. Tree data (Zone 1) (see Figure 4.1 in main report)

ID	Species	DBH (cm)	TPZ (m)	Radius (m)	Diam. (m)	Projected Foliage Cover (%)	Extent (m2)	Hollows	Nests	Polygon area	Latitude	Longitude
1	River Red Gum	71	8.52	3.5	7	0.6	23.09	N	N		-35.642724	145.51327
2	River Red Gum	68	8.16	6	12	0.5	56.55	N	N	673	-35.642779	145.51317
3	River Red Gum	63	7.56	3	6	0.7	19.79	N	N	340	-35.643862	145.51295
4	River Red Gum	53	6.36	7	14	0.6	92.36	N	N	576	-35.648482	145.51209
5	Grey Box	80	9.6	7.5	15	0.5	88.36	N	N	1,054	-35.648742	145.51163
6	Grey Box	109	13.08	10	20	0.5	157.08	N	N		-35.649408	145.51119
7	Grey Box	113	13.56	6	12	0.4	45.24	N	N	967	-35.649494	145.51119
8	Grey Box	90	10.8	7	14	0.5	76.97	N	N	856	-35.649939	145.51066
9	River Red Gum (Forest)	106	12.72	6	12	0.6	67.86	N	N	791	-35.649302	145.5057
10	River Red Gum	96	Dead		0	0		N	N		-35.650308	145.5053
11	River Red Gum	49	5.88	4	8	0.3	15.08	N	N	1,052	-35.650321	145.50534
12	Grey Box	139	15	6	12	0.3	33.93	Y	N	605	-35.650271	145.50732
13	Buloke	110	13.2	6	12	0.5	56.55	N	N	786	-35.650384	145.50771
14	Grey Box	95	Dead		0	0		Y	N		-35.650991	145.50806
15	Grey Box	82	Dead		0	0		Y	N		-35.651079	145.50795
16	Grey Box	86	10.32	5	10	0.5	39.27	N	Y	1,428	-35.651008	145.50787

ID	Species	DBH (cm)	TPZ (m)	Radius (m)	Diam. (m)	Projected Foliage Cover (%)	Extent (m2)	Hollows	Nests	Polygon area	Latitude	Longitude
17	Unknown	55	Dead		0	0		Y	N		-35.650914	145.50641
18	Grey Box	83	9.96	9	18	0.2	50.89	Y	N		-35.65068	145.50625
19	Buloke	49	5.88	5	10	0.3	23.56	N	N	1,350	-35.650881	145.50605
20	Buloke	40	Dead		0	0		N	N	404	-35.650718	145.50493
21	Buloke	37	4.44	3	6	0.3	8.48	N	N	402	-35.650702	145.50452
30	River Red Gum	80	9.6	6	12	0.4	45.24	Y	Y	657	-35.643217	145.50432
35	Buloke	78	Dead		0	0		N	N	497	-35.65149	145.50214
36	Buloke	65	Dead		0	0		N	N	492	-35.650556	145.50127
37	Grey Box	83	9.96	8	16	0.6	120.64	N	N	970	-35.656636	145.50007
38	Buloke	58	Dead		0	0		N	N	343	-35.657502	145.5044
				Average	**8.3**	**32%**	**Total**	**6**	**2**	**14,243**		

Appendix C: Biodiversity Credit Report

BioBanking Credit Calculator

Ecosystem credits

Proposal ID :	195/2017/4516MP
Proposal name :	Finley Solar Project
Assessor name :	Kathryn Duchatel
Assessor accreditation number :	195
Tool version :	v4.0
Report created :	05/11/2017 20:04

Assessment circle name	Landscape score	Vegetation zone name	Vegetation type name	Condition	Red flag status	Management zone name	Management zone area	Current site value	Future site value	Loss in site value	Credit required for bio diversity	Credit required for TS	TS with highest credit requirement	Average species loss	Species TG Value	Final credit requirement for management zone
1	3.00	MU555_Low	Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions	Low	No	1	1.40	10.42	0.00	10.42	12	0		0.00	0.00	0

BioBanking Credit Calculator

Species credits

Proposal ID :

Proposal name :

Assessor name :

Assessor accreditation number :

Tool version : v4.0

Report created : 05/11/2017 20:04

Scientific name	Common name	Species TG value	Identified population?	Can Id. popn. be offset?	Area / number of loss	Negligible loss	Red flag status	Number of credits
			No					

Appendix D: Threatened species habitat summary table

The following table assesses threatened species listed under the TSC Act and the EPBC Act that are previously recorded or predicted to occur within the study area. The table provides a summary of their likelihood to occur in the subject site and the risk of significant impact from the proposed project.

Table D1. Threatened species habitat summary

Species name	Status		Distribution and habitat[2]	Likelihood to occur[3]	Significance assessment?[4]
	EPBC Act	TSC Act			
Threatened flora					
Amphibromus fluitans Floating swamp wallaby grass	V	V	Many historic collections in the City of Greater Albury. Recorded recently in lagoons beside the Murray River near Cooks Lagoon (Shire of Greater Hume), Mungabarina Reserve, East Albury, at Ettamogah, Thurgoona (CSU Campus), near Narranderra, further west along the Murray River (near Mathoura), near Laggan in Upper Lachlan Shire and in Victoria. Grows mostly in permanent swamps, requiring wetlands which are at least moderately fertile and which have some bare ground (conditions which are produced by seasonally-fluctuating water levels).	Medium - potential habitat on neighbouring land	No, proposal has avoided potential habitat
Austrostipa wakoolica A spear grass	E	E	Grows on floodplains in open woodland on grey, silty clay or sandy loam soils; habitats include the edges of a lignum swamp with box and mallee; creek banks in grey, silty clay; mallee and lignum sandy-loam flat; open Cypress Pine forest on low sandy range; and a low, rocky rise. Seed dispersal is mainly by wind, rain and flood events; the awn and sharp point of the floret appear to be an adaptation for burying the seed into the soil; grass seed is traditionally believed to be viable for three to five years, so a long-lived seed bank is considered unlikely for this species.	Low - habitat absent and viable seedbank improbable due to years of grazing and cropping	No
Brachyscome papillosa *Mossgiel daisy*	V	V	Endemic to NSW and chiefly occurs within the Riverina Bioregion, from Mossgiel in the north, Murrumbidgee Valley (Yanga) National Park in the south west to Urana in the south east. Recorded primarily on clay soils in Bladder saltbush and leafless bluebush plains but can also occur in grasslands of box woodlands. It flowers June to December however it is a perennial and would be present all year round. Survey times were inadequate for detecting flowers of this species however no evidence of any Brachyscome species or similar forbs were present within the development site.	Low, habitat absent and no records of the species found within a 10km search radius from the site.	No

Species name	Status		Distribution and habitat[2]	Likelihood to occur[3]	Significance assessment?[4]
	EPBC Act	TSC Act			
Caladenia arenaria Sand-hill Spider Orchid	E	E	Caladenia arenaria is found mostly on the south west plains and western south west slopes. The original description is of a plant from Nangus, west of Gundagai (1865) and there is a report of the species from Adelong near Tumut. A record near Cootamundra needs verifying. The Sand-hill Spider Orchid is currently only known to occur in the Riverina between Urana and Narranderra. Occurs in woodland with sandy soil, especially that dominated by White Cypress Pine (Callitris glaucophylla).	Low, habitat absent and no records of the species found within a 10km search radius from the site.	No
Eucalyptus leucoxylon subsp. *pruinosa* Boland yellow gum	V	NL	In NSW, occurs at the bases of sandy rises and on loamy clay flats on the floodplains of the Murray River and its tributaries in the Riverina Bioregion (Thackway and Creswell 1995). Currently known from several localities along the Murray River valley, including a concentration of six stands to the west of Moulamein, and small scattered occurrences between Barham and Euston. A disjunct occurrence of the species reported from near Boorowa on the central western slopes has been investigated and refuted.	Low, not found during tree surveys of all trees in development site	No
Lepidium monoplocoides Winged Peppercress	E	E	Widespread in the semi-arid western plains regions of NSW. Collected from widely scattered localities, previously recorded from Bourke, Cobar, Urana, Lake Cargelligo, Balranald, Wanganella and Deniliquin, the Hay Plain, south-eastern Riverina, and from near Pooncarie. Occurs in periodically flooded and waterlogged habitats and does not tolerate grazing disturbance. Predominant vegetation is usually an open woodland dominated by Allocasuarina luehmannii (Bulloak) and/or eucalypts, particularly Eucalyptus largiflorens (Black Box) or Eucalyptus populnea (Poplar Box).	Medium, potential habitat on neighbouring land	No, proposal has avoided potential habitat

Species name	Status		Distribution and habitat[2]	Likelihood to occur[3]	Significance assessment?[4]
	EPBC Act	TSC Act			
Pilularia novae-hollandiae Austral pillwort	E	NL	In NSW, 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. The populations at Lake Cowal and Oolambeyan NP are the only known extant populations in NSW, although the species is obscure and has possibly been overlooked elsewhere. Grows in shallow swamps and waterways, often among grasses and sedges. It is most often recorded in drying mud as this is when it is most conspicuous. Most of the records in the Albury-Urana area were from table drains on the sides of roads. This species is probably ephemeral appearing when soils are moistened by rain.	Medium, potential habitat on neighbouring land	No, proposal has avoided potential habitat
Pterostylis despectans	CE	E	In NSW the species is known only from a single population discovered in 2005 near Moama in the Riverina district (Murray LGA). Several surveys of Riverina grassland and regional Travelling Stock Reserves did not record P. despectans and it seems likely that the species is extremely rare in NSW. The plant remains dormant underground as a tuber in late summer into early winter. In winter it develops a rosette of six to ten leaves. The flower stem is produced between late October and December and the leaves shrivel up by the time the flowers mature. Like most Australian terrestrial orchids the species is believed to be partly or fully dependent on a mycorrhizal symbiont. The NSW population occurs in natural forb-rich grassland on flat alluvial plains and not derived from Acacia pendula woodland.	Low, habitat absent, and years of cropping and grazing likely to limit suitable mycorrhizae.	No
Swainsona sericea Silky Swainson-pea	V	NL	Recorded from the Northern Tablelands to the Southern Tablelands and further inland on the slopes and plains. There is one isolated record from the far north-west of NSW. Its stronghold is on the Monaro. In the Riverina associated with Upper Riverina Dry Sclerophyll Forests, Riverine Plain Grasslands, Grassy woodlands, and Riverine Sandhill Woodlands. Regenerates from seed after fire.	Low, vegetation associations absent, fire absent, and no records of the species found within a 10km search radius from the site.	No

Species name	Status		Distribution and habitat[2]	Likelihood to occur[3]	Significance assessment?[4]
	EPBC Act	TSC Act			
Threatened fauna					
Anthochaera phrygia Regent honeyeater	CE	CE	Regent Honeyeaters inhabit woodlands that support a significantly high abundance and species richness of bird species. These woodlands have significantly large numbers of mature trees, high canopy cover and abundance of mistletoes. There are only three known key breeding regions remaining: north-east Victoria (Chiltern-Albury), and in NSW at Capertee Valley and the Bundarra-Barraba region. In NSW the distribution is very patchy and mainly confined to the two main breeding areas and surrounding fragmented woodlands.	Low, habitat, particularly food resources, absent	No
Artamus cyanopterus cyanopterus Dusky Woodswallow	V	NL	Primarily inhabit dry, open eucalypt forests and woodlands, including mallee associations, with an open or sparse understorey of eucalypt saplings, acacias and other shrubs, and 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. Depending on location and local climatic conditions (primarily temperature and rainfall), the dusky woodswallow can be resident year round or migratory. In NSW, after breeding, birds migrate to the north of the state and to southeastern Queensland, while Tasmanian birds migrate to southeastern NSW after breeding.	Low, habitat absent. Not recorded in 10km search radius from site	No
Chalinolobus picatus Little Pied Bat	V	NL	Found in inland Queensland and NSW (including Western Plains and slopes) extending slightly into South Australia and Victoria. Occurs in dry open forest, open woodland, mulga woodlands, chenopod shrublands, cypress pine forest and mallee and Bimbil box woodlands. Roosts in caves, rock outcrops, mine shafts, tunnels, tree hollows and buildings. Can tolerate high temperatures and dryness but need access to nearby open water. Feeds on moths and possibly other flying invertebrates.	Low, habitat absent. Not recorded in 10km search radius from site	No

Species name	Status		Distribution and habitat[2]	Likelihood to occur[3]	Significance assessment?[4]
	EPBC Act	TSC Act			
Circus assimilis Spotted harrier	V	NL	The Spotted Harrier occurs throughout the Australian mainland, except in densley 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. Builds a stick nest in a tree and lays eggs in spring (or sometimes autumn), with young remaining in the nest for several months. Preys on terrestrial mammals (eg bandicoots, bettongs, and rodents), birds and reptile, occasionally insects and rarely carrion.	Low, habitat, food resources and stick nests absent	No
Falco hypoleucos Grey falcon	E	NL	Widely but sparsely distributed in woodland, shrubland and grassland in the arid and semi-arid zones, especially wooded watercourses, of mainland Australia. In NSW it occurs on the plains of the Murray-Darling Basin, and particularly west of the Darling River. Falcons (including the Grey) are highly mobile, commonly travelling over hundreds of kilometres (Marchant & Higgins 1993). The Grey Falcon uses old stick nests, typically built by crows or ravens or sometimes other raptor species, in the top of an emergent tree in riparian woodland. Occasionally, Grey Falcons will nest on an artificial structure such as a telecommunications tower (J. Schoenjahn in litt. 2009).	Low, habitat absent and no stick nests observed during field surveys	No
Falco subniger Black falcon	V	NL	The Black Falcon is widely, but sparsely, distributed in New South Wales, mostly occurring in inland regions. Some reports of 'Black Falcons' on the tablelands and coast of NSW are likely to be referrable to the Brown Falcon. Black Falcons nest along tree-lined creeks and rivers of inland drainage systems. Eggs are laid in the abandoned stick nests of other birds, usually high in a tree.	Low, habitat absent and no stick nests observed during field surveys	No
Hieraaetus morphnoides Little eagle	V	NL	The Little Eagle is found throughout the Australian mainland excepting the most densely forested parts of the Dividing Range escarpment. It occurs as a single population throughout NSW. Occupies open eucalypt forest, woodland or open woodland. Sheoak or Acacia woodlands and riparian woodlands of interior NSW are also used. Nests in tall living trees within a remnant patch, where pairs build a large stick nest in winter. Lays two or three eggs during spring, and young fledge in early summer. Preys on birds, reptiles and mammals, occasionally adding large insects and carrion.	Low, habitat absent and no stick nests observed during field surveys	No

Species name	Status		Distribution and habitat[2]	Likelihood to occur[3]	Significance assessment?[4]
	EPBC Act	TSC Act			
Lathamus discolor Swift Parrot	E	CE	Breeds in Tasmania during spring and summer, migrating in the autumn and winter months to south-eastern Australia from Victoria and the eastern parts of South Australia to south-east Queensland. In NSW mostly occurs on the coast and south west slopes.On the mainland they occur in areas where eucalypts are flowering profusely or where there are abundant lerp (from sap-sucking bugs) infestations. Favoured feed trees include winter flowering species such as Swamp Mahogany, Spotted Gum, Red Bloodwood, Mugga Ironbark and White Box.	Low, habitat absent	No
Lophochroa leadbeateri Major Mitchell's Cockatoo	V	NL	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. 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. Normally found in pairs or small groups, though flocks of hundreds may be found where food is abundant. 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.	Low, habitat absent. Not recorded in 10km search radius from site	No
Lophoictinia isura Square-tailed kite	V	NL	The Square-tailed Kite ranges along coastal and subcoastal areas from south-western to northern Australia, Queensland, NSW and Victoria. In NSW, scattered records of the species throughout the state indicate that the species is a regular resident in the north, north-east and along the major west-flowing river systems. It is a summer breeding migrant to the south-east, including the NSW south coast, arriving in September and leaving by March. Found in a variety of timbered habitats including dry woodlands and open forests. Shows a particular preference for timbered watercourses. Is a specialist hunter of passerines, especially honeyeaters, and most particularly nestlings, and insects in the tree canopy, picking most prey items from the outer foliage.	Low, habitat and preferred prey absent	No

Species name	Status		Distribution and habitat[2]	Likelihood to occur[3]	Significance assessment?[4]
	EPBC Act	TSC Act			
Ninox connivens Barking owl	V	NL	Wide but sparse distribution in NSW. Core populations exist on the western slopes and plains and in some northeast coastal and escarpment forests. Inhabits woodland and open forest, including fragmented remnants and partly cleared farmland. It is flexible in its habitat use, and hunting can extend in to closed forest and more open areas. Sometimes able to successfully breed along timbered watercourses in heavily cleared habitats (e.g. western NSW) due to the higher density of prey on these fertile soils. Roost in shaded portions of tree canopies, including tall midstorey trees with dense foliage such as Acacia and Casuarina species. Requires very large permanent territories in most habitats due to sparse prey densities. Living eucalypts are preferred for nesting though dead trees are also used.	Low, habitat. Not recorded in 10km search radius from site	No
Petaurus norfolcensis Squirrel Glider	V	NL	The species is widely though sparsely distributed in eastern Australia, from northern Queensland to western Victoria. Inhabits mature or old growth Box, Box-Ironbark woodlands and River Red Gum forest west of the Great Dividing Range and Blackbutt-Bloodwood forest with heath understorey in coastal areas. Prefers mixed species stands with a shrub or Acacia midstorey. Require abundant tree hollows for refuge and nest sites.Diet varies seasonally and consists of Acacia gum, eucalypt sap, nectar, honeydew, manna, invertebrates and pollen.	Low, habitat absent. Not recorded in 10km search radius from site	No
***Petroica phoenicea* Flame Robin**	**V**	**NL**	**Refer Significance of Impact Assessment (Appendix E)**	**High, habitat present**	**YES** – concluded that the proposal will not adversely impact on the species
***Petroica boodang* Scarlet Robin**	**V**	**NL**	**Refer Significance of Impact Assessment (Appendix E)**	**High, recorded during field surveys**	**YES**– concluded that the proposal will not adversely impact on the species

Species name	Status		Distribution and habitat[2]	Likelihood to occur[3]	Significance assessment?[4]
	EPBC Act	TSC Act			
Phascogale tapoatafa Brush-tailed Phascogale	V	NL	In NSW is mainly found east of the Great Dividing Range although there are occasional records west to the divide. Prefer dry sclerophyll open forest with sparse groundcover of herbs, grasses, shrubs or leaf litter. Also inhabit heath, swamps, rainforest and wet sclerophyll forest. Agile climber foraging preferentially in rough barked trees of 25 cm DBH or greater. Feeds mostly on arthropods but will also eat other invertebrates, nectar and sometimes small vertebrates. Nest and shelter in tree hollows with entrances 2.5 - 4 cm wide and use many different hollows over a short time span.	Low, habitat absent. Not recorded in 10km search radius from site	No
Phascolarctos cinereus Koala	V	V	The Koala has a fragmented distribution throughout eastern Australia. In NSW it mainly occurs on the central and north coasts with some populations in the west of the Great Dividing Range. Inhabit eucalypt woodlands and forests. Feed on the foliage of more than 70 eucalypt species and 30 non-eucalypt species, but in any one area will select preferred browse species. Spend most of their time in trees, but will descend and traverse open ground to move between trees.	Low, habitat absent. Not recorded in 10km search radius from site	No
Polytelis swainsonii Superb parrot	V	V	Found throughout eastern inland NSW. Their core breeding area is on the South-western Slopes with other main breeding sites in the Riverina along the corridors of the Murray, Edward and Murrumbidgee Rivers (where birds are present all year round). Inhabit Box-Gum, Box-Cypress-pine and Boree Woodlands and River Red Gum Forest. In the Riverina the birds nest in the hollows of large trees (dead or alive) mainly in tall riparian River Red Gum Forest or Woodland. May forage up to 10 km from nesting sites, primarily in grassy box woodland. Feed in trees and understorey shrubs and on the ground and their diet consists mainly of grass seeds and herbaceous plants. Also eaten are fruits, berries, nectar, buds, flowers, insects and grain. They are regularly found in crops, including cereal crops, as well as grazing land where scattered trees persist.	Moderate, potential for rare occurrences of individuals passing through the landscape in search of higher quality habitat	No, the development site is near the eastern extent of their core range. The site lacks high quality habitat. No nests were observed during the recent field assessments of hollows within the development site.

Species name	Status		Distribution and habitat[2]	Likelihood to occur[3]	Significance assessment?[4]
	EPBC Act	TSC Act			
Pomatostomus temporalis subsp. *temporalis* Grey-crowned Babbler (eastern subspecies)	V	NL	In NSW, the eastern sub-species occurs on the western slopes of the Great Dividing Range, and on the western plains reaching as far as Louth and Balranald. Inhabits open Box-Gum Woodlands on the slopes, and Box-Cypress-pine and open Box Woodlands on alluvial plains. Flight is laborious so birds prefer to hop to the top of a tree and glide down to the next one. Feed on invertebrates, either by foraging on the trunks and branches of eucalypts and other woodland trees or on the ground, digging and probing amongst litter and tussock grasses. Build and maintain several conspicuous, dome-shaped stick nests about the size of a football. A nest is used as a dormitory for roosting each night. Nests are usually located in shrubs or sapling eucalypts, although they may be built in the outermost leaves of low branches of large eucalypts. Nests are maintained year round, and old nests are often dismantled to build new ones.	Low, habitat absent, no nests were observed during the recent field assessments	No
Tyto novaehollandiae Masked owl	V	NL	Extends from the coast where it is most abundant to the western plains. Overall records for this species fall within approximately 90% of NSW, excluding the most arid north-western corner. There is no seasonal variation in its distribution. Lives in dry eucalypt forests and woodlands from sea level to 1100 m. A forest owl, but often hunts along the edges of forests, including roadsides. The typical diet consists of tree-dwelling and ground mammals, especially rats. Pairs have a large home-range of 500 to 1000 hectares. Roosts and breeds in moist eucalypt forested gullies, using large tree hollows or sometimes caves for nesting.	Low, habitat absent. Not recorded in 10km search radius from site	No

Notes:

[1] Threatened species status under the BC and EPBC Acts: CE = critically endangered; E = endangered; V = vulnerable.

[2] Distribution and habitat information based on OEH Threatened Species Profile Database.

[3] The likelihood to occur in the study area based on species' distribution, habitat requirements and previous records (ranked as low, medium or high).

[4] The decision to undertake an assessment of significance is based on consideration of the likelihood of occurrence within the subject site and possible direct and indirect impacts (yes or no).