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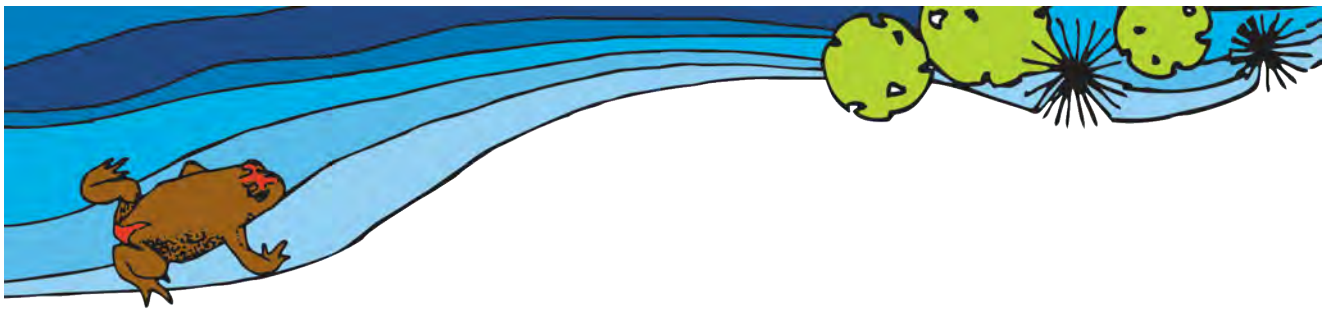

Biodiversity Development Assessment Report (BDAR)

For

Health Infrastructure NSW

Griffith Base Hospital, Noorebar Ave, Griffith NSW 2680
Lot 2, DP1043580

Proposed Griffith Base Hospital Redevelopment

Prepared for:	Health Infrastructure NSW
Offer No:	AE21-REP-2092-ISS 4
Prepared by:	Abel Ecology
Date:	16 August 2021

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Document History

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Biodiversity Assessment Method Accreditation (BAM)

Reviewed by	BAM Assessor Accreditation Number	Date
Dr Alison Hewitt	BAAS19044	17 June 2020
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Dr Alison Hewitt	BAAS19044	09 July 2021
Dr Daniel McDonald	BAAS17056	

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List of Abbreviations

APZ	Asset Protection Zone
BAM	Biodiversity Assessment Method
BC Act	*Biodiversity Conservation Act 2016*
BCR	Biodiversity Conservation Regulation 2017
BCT	Biodiversity Conservation Trust
BDAR	Biodiversity Development Assessment Report
d.b.h.	Diameter at breast height (~1.4 metres)
EEC	Endangered Ecological Community
LEP	Local Environmental Plan
LGA	Local Government Area
PCT	Plant Community Type
REF	Review of Environmental Factors

Note regarding maps in this report
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Executive summary Biodiversity Development Assessment Report

The proposal is to redevelop the Griffith Base Hospital.

A biodiversity development assessment was carried out at Lot 2 DP1043580, Griffith Base Hospital to assess the likely impacts of the proposal on species and ecological communities present on the site, to ascertain opportunities to minimise impacts and to assess the credit requirement with this proposal within the Biodiversity Offsets Scheme identified in s. 7.4 of the *Biodiversity Conservation Act 2016*.

The *Biodiversity Conservation Act 2016 Part 7 Division 2 Section 7.9* states that any application to carry out State significant development or infrastructure is to be accompanied by a biodiversity development assessment report unless the Planning Agency Head and the Environment Agency Head determine that the proposed development is not likely to have any significant impact on biodiversity values and issues a waiver. This biodiversity development assessment report is to accompany the Environmental Impact Statement.

The redevelopment of the hospital is a staged process as follows: Demolition of Building 25, Construction of new Clinical Services Building, Construction of new western car park, then Demolition of Buildings 1, 2, 6, 15, 16, 17, 19, 20, 22, 28, 29, 31 and 35, Landscaping work, Construction of new main car park then demolition of temporary car park

The site comprises clinical and service buildings, roads, car parks, gardens and lawns with some native trees and scant native groundcover persisting in pockets across the site and on perimeters. Habitat features such as litter cover, woody debris, streams or wetlands are absent ruling out large numbers of native fauna species recorded in the wider area.

Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions is present on site as fragmented single or groups of remnant trees over an understorey dominated by exotic species, suppressed as a lawn and a simplified vegetation integrity classification of 'highly disturbed'. Garden beds have been established around some remnant trees and alongside buildings with exotic landscape species planted.

The provisions of the EPBC Act 1999 potentially apply to this proposal. However, the remnant vegetation present on the site does not meet the Commonwealth listing advice ecological community thresholds.

There are hollow bearing trees on site (Appendix 4) and works must be undertaken to ensure there are no impacts on these trees as part of the development. The three

native hollow bearing trees located on site during BDAR assessment have been identified for retention within the proposal plan overlay (Appendix 2, Tree Location Plan, of the Arboricultural Impact Assessment Report). An arborist is required to implement tree protection measures prior to works commencing in the vicinity of these and other native trees to be retained on site (Figure 5).

Recommendations for this proposal include:

1. All trees outside of the development footprint (Figure 5) are to be retained.
2. An arborist is to be engaged to implement tree protection measures for the hollow bearing trees and other native trees to be retained on site (Appendix 4 and Figure 5) prior to commencement of building works.
3. Project materials are to be stacked in areas already cleared e.g., the car parks.

Credit requirements
The current credit purchase requirements for the project are:

One ecosystem credit for the EEC (See Section 8.2). Any of the following PCTs can be purchased to meet the like-for-like option: PCTs 76, 80, 81, 82, 101, 110, 237 or 248. They must be from one of the following two IBRA regions: 1. Lower Slopes, Bogan-Macquarie, Inland Slopes, Lachlan Plains, Murray Fans Murrumbidgee and Nymagee; or 2. Any IBRA subregion that is within 100 kilometres of the outer edge of the impacted site. The credit must be an HBT credit.

One species credit for the Superb Parrot.

Special considerations

a) Site vegetation conditions detailed in this report are subject to change over time due to various factors, e.g. germination from seed bank, bushfire.

b) This report does not authorise any clearing of native vegetation on the property,

c) It is the responsibility of the landowner to obtain all required permissions from local and statutory authorities for the proposal.

Figure 1. Locality map for Griffith Base Hospital.

Figure 2. 1984 Aerial photo of the locality.

Griffith Hospital location.

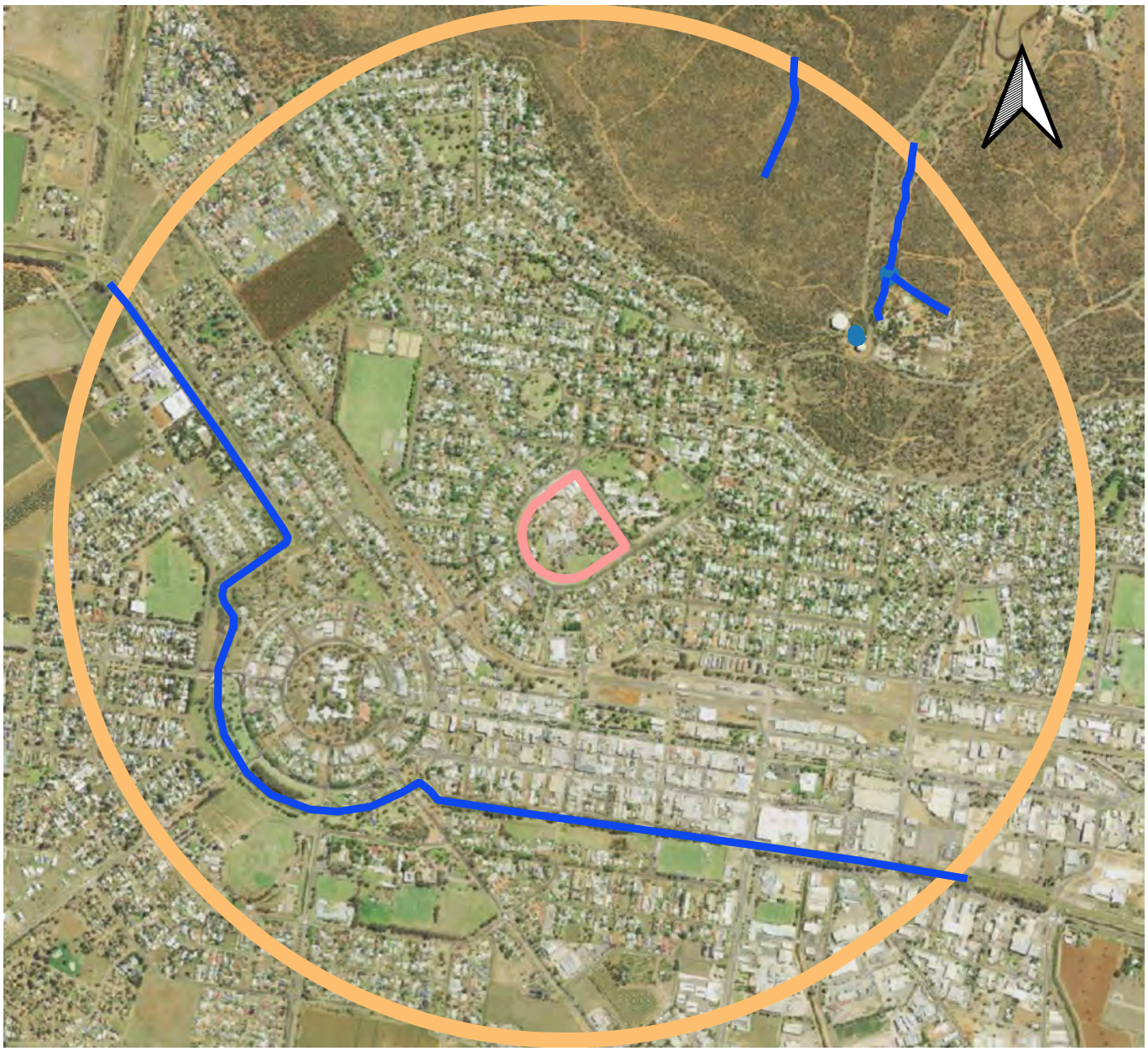


Figure 3. Landscape features for the locality and 1500 m buffer.

IBRA bioregion: NSW South Western Slopes; IBRA subregion: Lower Slopes

NSW BioNet (Mitchell) landscape: Cocopara Ranges and Footslopes

The site is not part of any obvious biodiversity connectivity corridor.

Scenic Hill Reserve is NE of the site. It contains areas of geological significance such as rock overhangs and caves.

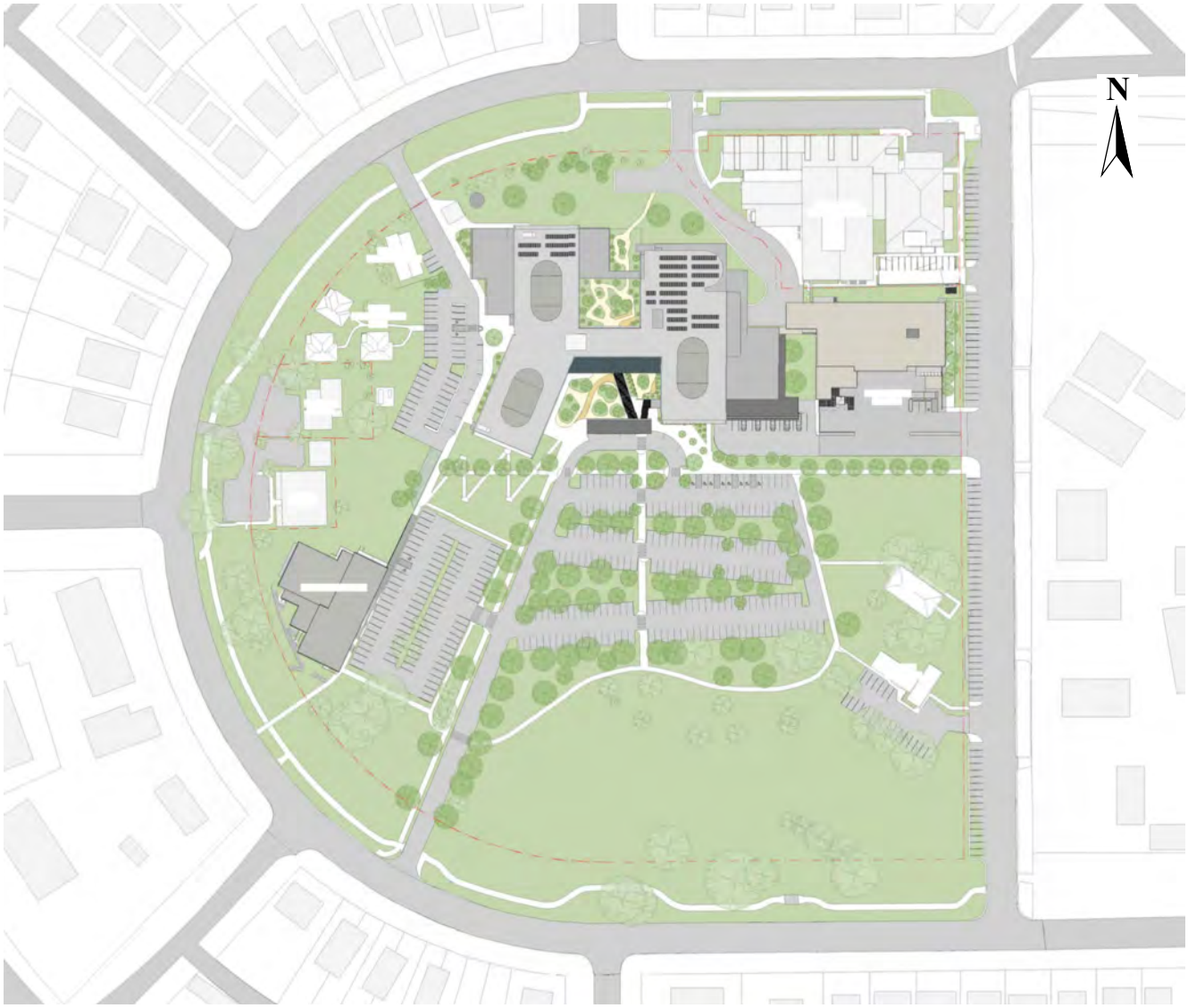


Figure 4. Proposal Diagram/site map.

Proposal diagram supplied by CBRE Health infrastructure NSW, Jan 2021.

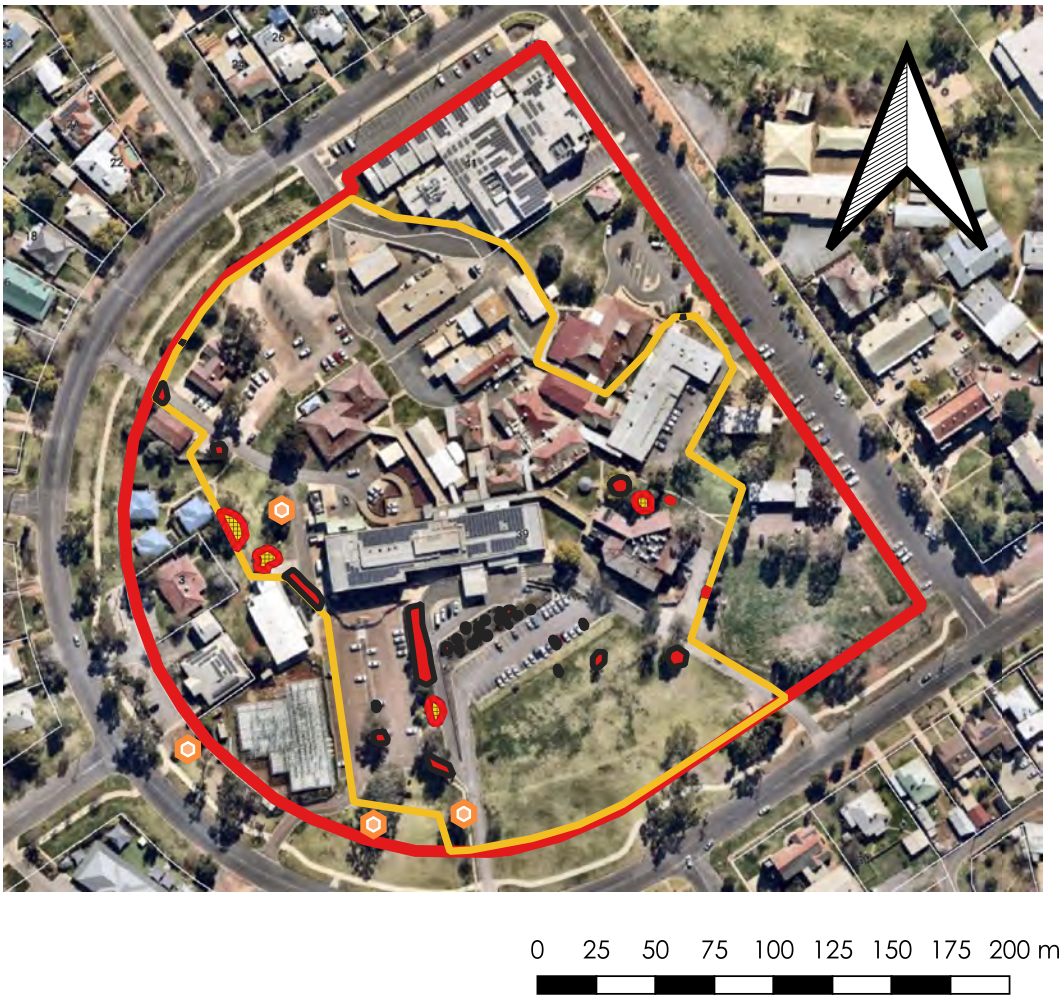


Figure 5. Proposal diagram showing development footprint and proposed remnant and planted NSW vegetation clearing and locations of hollow bearing trees.

Figure 6. Biodiversity Values map for the locality: close view.

Key

Areas shaded mauve are areas mapped by the NSW Government as having Biodiversity Values

Source. https://www.lmbc.nsw.gov.au/Maps/index.html?viewer=BVMap

Note: There are no mapped areas of Biodiversity value on the site or near to the site.

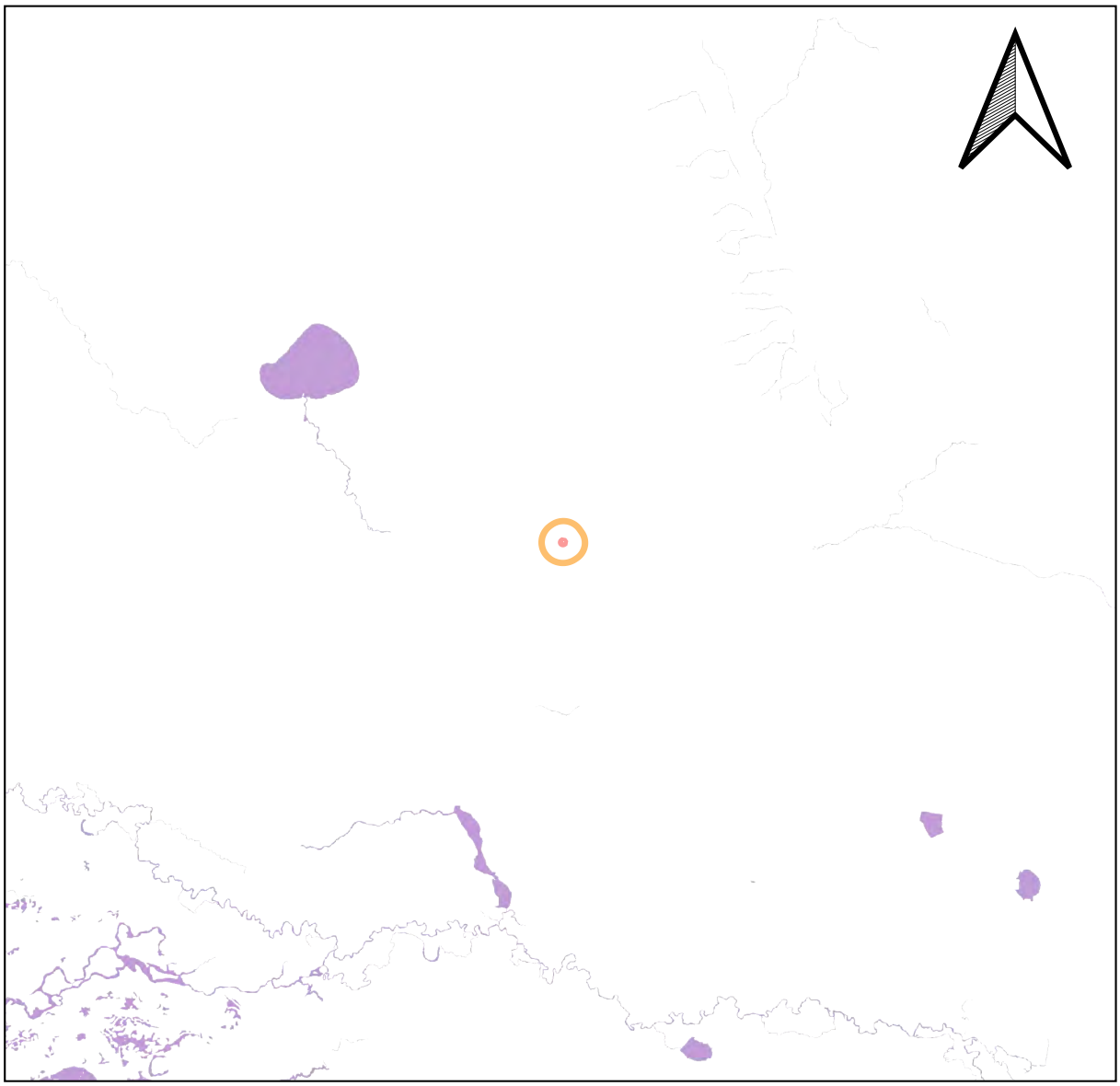


Figure 7. Biodiversity Values map for the locality: wide view.

Source. https://www.lmbc.nsw.gov.au/Maps/index.html?viewer=BVMap

No areas of mapped biodiversity values are on the site or within 1.5 km of the site. The closest areas of mapped biodiversity values appear to be approximately 10 - 15 km from the site.

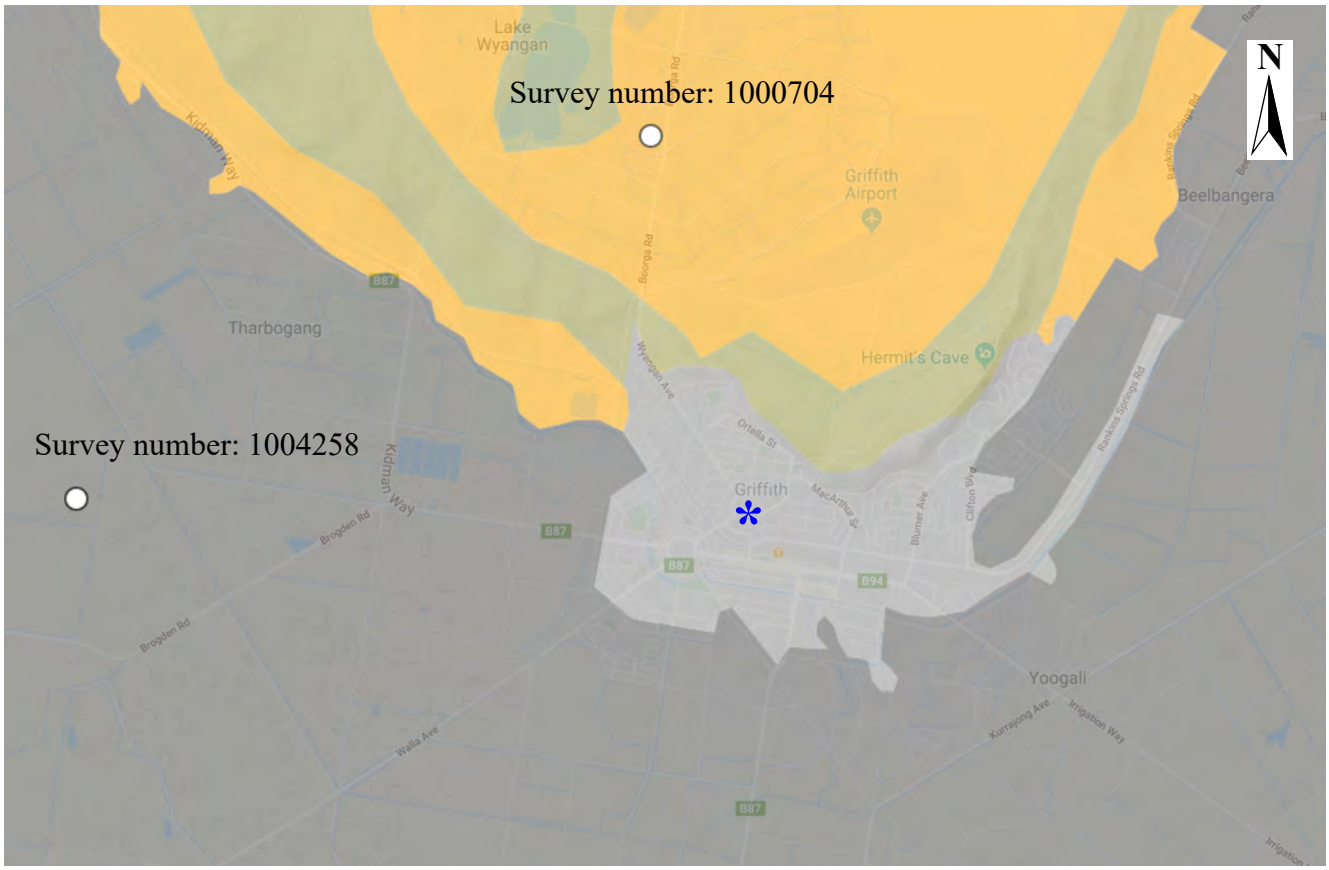


Figure 8. Soil map for site and surrounding area.

✻ Approximate Site location

KEY

Not assessed

Grey, brown & red clays

Lithosols

Calcereous red earths

The two white circles indicate the locations of the two nearby soil profiles (each profile is provided with a survey number.

Source: NSW eSpade website https://www.environment.nsw.gov.au/eSpade2Webapp. The map uses the Australian Great Soil Groups classification (Stace *et al.* 1968).

The NSW eSpade website was accessed on 22 January 2021.

Figure 9. Vegetation map for the site and surrounding area.

Figure 10. Site vegetation map and BAM plot locations.

Legend

- Hollows
- Plot
- Site boundary
- Remnant vegetation
- Planted NSW vegetation
- Exotic and non-NSW vegetation
- Exotic lawn & groundcovers

Base Map: Nearmaps 24 August 2019

Figure 11: Zone 3 Exotic Vegetation Not Requiring Assessment

Figure 12: Areas of vegetation requiring offset and areas not requiring offset

Note. We deemed areas requiring offset (Zone 1 above) to comprise remnant vegetation and planted NSW vegetation (as delineated in Figure 10) because the combined area added up to less than the minimum calculator assessment threshold of 0.1 ha.
No areas of native vegetation were deemed as not requiring offset

1 Introduction

A biodiversity survey using the Biodiversity Assessment Method of the proposed development site at Griffith Base Hospital ('the site' Figure 1) was undertaken on 9th and 10th Dec 2019.

The redevelopment of the hospital is a staged process as follows: Demolition of Building 25, Construction of new Clinical Services Building, Construction of new western car park, then Demolition of Buildings 1, 2, 6, 15, 16, 17, 19, 20, 22, 28, 29, 31 and 35, Landscaping work, Construction of new main car park then demolition of temporary car park.

This BDAR assesses these State Significant works which include building and demolition works as well as vegetation clearing.

Digital shape files are not included in the printed version of this report. These digital files must and will be uploaded to the OEH website when the final report is delivered to the consent authority.

1.1 Legislative context

If any of the following four Biodiversity Offset Scheme Development Thresholds are triggered, then a Biodiversity Development Assessment Report (BDAR) must be prepared by an accredited assessor for the Authority to issue a consent or an approval.

Threshold Trigger 1: Exceeding the clearing threshold on an area of native vegetation
Threshold Trigger 2: Development or an activity is carried out on land included in the Biodiversity Values Land Map.
Threshold Trigger 3: A "significant effect" on threatened species or ecological communities
Threshold Trigger 4: A prescribed impact on biodiversity values forms part of the proposal.

While the proposal at Griffith Base Hospital does not trigger a need for a Biodiversity Development Assessment Report by any of these thresholds (above) it does represent 'State Significant Development'.

The *Biodiversity Conservation Act 2016 Part 7 Division 2 Section 7.9* states that any application to carry out State significant development or infrastructure is to be accompanied by a BDAR unless the Planning Agency Head and the Environment Agency Head determine that the proposed development is not likely to have any

significant impact on biodiversity values. The BDAR is to accompany the Environmental Impact Statement.

1.2 The proposal

Heath Infrastructure NSW proposes undertaking redevelopment works at Griffith Base Hospital to increase its capacity and range of services. The redevelopment of the hospital is a staged process as follows: Demolition of Building 25, Construction of new Clinical Services Building, Construction of new western car park, then Demolition of Buildings 1, 2, 6, 15, 16, 17, 19, 20, 22, 28, 29, 31 and 35, Landscaping work, Construction of new main car park then demolition of temporary car park.

Figure 1 and Figure 5 display the vegetation within the proposal area. This diagram has been used along with discussions with the planning team to determine which trees are proposed to be removed and which to be retained. The native hollow bearing trees within the proposal area (Figure 5) are to be retained and all trees outside of the proposal area are to be retained. Appendix 2 of the Arboricultural Impact Assessment (Creative Planning Solutions 2020) clearly shows the trees for retention with tree numbers and a proposal overlay.

The proposal (Figure 4) is to demolish some existing buildings and rebuild and modify the site to increase the capacity and service provision of Griffith Base Hospital.

Table 1. Details of lot size and size of proposed native vegetation clearing.

Component of site	Area m^2	Proportion of the site %
Whole site	64000	100
Extent of proposed native vegetation clearing	902	1.4

This report describes two different types of lot size:

1. The lot size is the measured area of the actual site.

2. The other type of lot size is the Minimum lot size. The minimum lot size is the smallest lot size that can be created consistent with current legislation when undertaking a subdivision of an area of land. The Minimum lot size for land in NSW can be found on the NSW Planning and Environment Planning Portal website https://www.planningportal.nsw.gov.au/find-a-property.

   The NSW Biodiversity Conservation Regulation 2017 requires that the minimum lot size is used for an assessment of vegetation clearing.

Some areas of land do not have a minimum lot size and the lot size can be used to determine the threshold of clearing as displayed in Table 3.

Native vegetation is defined as remnant NSW vegetation and species that are native to NSW. The DA footprint includes 666 m^2 of planted NSW vegetation and 236 m^2 of remnant native vegetation. The total of these two amounts is 902 m^2.

It is noted that the proposed clearing does not include activities or clearing on land displayed on the NSW Biodiversity Values Map (Figure 6).

1.3 General description of the site

For the purposes of this report, the site (Figure 1) is defined by the property boundaries of lot 2 DP1043580. It is approximately 6.4 ha. in size and the elevation is approximately 139 m above sea level. The site is zoned RU1 residential and is surrounded by a low-density urban area of a large NSW country town.

The site is generally D shaped with a footpath and council nature strip, paved kerb and gutter roads ringing the perimeters. A private hospital occupies the northeastern corner and private pathology clinic sits within a western segment of the D shape. Adjacent properties (Figure 1) are a school, several churches and residential lots. The land is generally flat with overland flow to kerb and gutter.

The vegetation (Figure 10) is described in detail in Section 4 below and fauna habitat is detailed in Section 4 below.

1.4 History of the site

Griffith Base Hospital, formerly Griffith District Hospital has occupied the site since 1922. Older local residents report that prior to this the site was a fettler's camp with yards and blacksmith pits set up for the horses and their handlers involved in the nearby railway works.

1.5 Sources of information used in this assessment

Literature reviewed in order to assess possible issues relating to this site include:
Air photo (NearMap)
Survey map (CBRE supplied)
Vegetation map (Griffith Local Government Area mapping)
Schedules to the BC Act 2016
Schedules to the EPBC Act 1999
OEH Atlas of NSW Wildlife
Inland Grey Box Woodland OEH profile
https://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=20072

Inland Grey Box Woodland NSW Scientific Committee Final Determination
Commonwealth Government Protected Matters Report
OEH eSpade website
NSW Planning Portal website
NSW VIS Plant Community Profiles
NSW Biodiversity Values Map

Creative PLANNING SOLUTIONS (2021) Arboricultural Impact Assessment – Rev A. Note: This document has been relied upon to determine the extent of tree retention and tree removal.

2 Landscape features

The site is located within the NSW Mitchell Landscape 'Cocopora Ranges and Footslopes, in the IBRA region 'NSW South Western Slopes', IBRA subregion 'Lower Slopes'.
There are no waterways or streams on site.

There is approximately 165 ha of native vegetation within the 1500 m buffer area (native vegetation extent), thus approximately 19% (Figure 2) of the buffer area still contains remnant vegetation. The 1500 m buffer area is approximately 830 ha in size.

The Scenic Hill lookout area to the north of town is some 700 m from the site (Figure 3). This area is a relatively large undisturbed remnant with structurally diverse habitat such as shrubs, saplings, native grasses, fallen timber and diverse tree species and a number of rare woodland birds have been recorded in the Scenic Hills area.

Only a portion of the vegetation within the proposal area is remnant vegetation. Vegetation within the proposal area is a mix of remnant vegetation and planted vegetation (landscape and gardens) and this is discussed in Section 4.1. Connectivity for most fauna is poor apart from highly mobile species present in urban areas.

Griffith sits within the wider Murrumbidgee Irrigation Area with the Murrumbidgee River 32 km south of the site. Main Canal runs roughly east-west 900 m to the south of the hospital. Water bodies in the wider area include Lake Wyangan 4.75 km to the northwest, Barren Box Swamp 21 km northwest, Mirrool Creek 9 km southeast and Gum Creek Lagoon 21 km southwest. No rivers, streams or wetlands are present within the site or adjacent properties.

Some rock outcrops are evident to the northeast of the site in the reserve within the 1500 m buffer of the site (NearMap) and caves may be present. This information was put into the BAM calculator.

2.1 Site Soils

The NSW government's eSpade website https://www.environment.nsw.gov.au/eSpade2Webapp was used to investigate existing information about soils in the locality. No Soil Landscape mapping or Soil and Land Resources mapping is available for the locality.

The two closest soil profiles are located approximately 4 km North of the site (Survey Number: 1000704) and approximately 7.7 km West of the site (Survey Number: 1004258) (Figure 8). Both of these profiles describe the soil as a *Red-brown Earth* (Australian Great Soil Groups - Stace *et al.* 1968).

The eSpade Statewide land and soil mapping for Australian Great Soil Groups does not classify the soil within and near the Griffith township. It is described as "Not Assessed". Nearby mapping on areas with similar topography describes the soils as either: *Calcareous red earths*; or *Grey, brown and red clays*.

No soil profile assessment was undertaken during the site survey. A visual assessment of the soil surface recorded that the soil was red in colour and that the composition of the soil included sand.

A review of the potential nearby Australian Great Soil Groups both mapped and profile reports was undertaken by referring to the descriptions in Stace *et al.* 1968. Brief extracts of each description are provided below:

Grey, Brown and Red Clays
Morphology. The grey, brown, and red clays form a very broad group of soils whose common properties are determined by their high clay contents.

Red-Brown Earths
Morphology. The characteristic features of the red-brown earths are grey-brown to red-brown loamy A horizons, weakly structured to massive, an abrupt to clear boundary between A and B horizons, and brighter brown to red clay B horizons with well-developed medium prismatic to blocky structure.

Calcareous Red Earths
Morphology. Essentially the calcareous red earths are red, massive, sandy to loam soils, porous and "earth" in fabric, with some free carbonates in the lower part of the profile.

As the soil did not appear to have a high clay content it is unlikely that the soil is a *Grey, Brown or Red Clay.* Based upon the soil field assessment it is not possible to determine if the site soil is a *Red-brown Earth* or a *Calcareous Red Earth*, but it is likely that the site soil type is one of these Australian Great Soil Groups.

Soil hazards

Red-Brown Earths – Stace *et al*. (1968) provides the following information: "*They are liable to erosion and serious damage has occurred when they are cropped on a narrow rotation."* and "*There have been some problems from rising watertables and waterlogging following continued over-watering.'*

Calcareous Red Earth – Stace *et al.* (1968) does not provide any information about soil hazards. They state that this Great Soil Group is often found in dryer drought-prone areas and the land-use is grazing. It is likely that if these soils are without adequate vegetation cover wind and water erosion are likely to be a risk.

2.2 Site context components

2.2.1 Description of the field assessment (identification of the method applied)

A site based assessment was undertaken. Species composition of garden beds, lawn areas and nature strips were recorded across the entire site. Every tree and shrub on site was recorded documenting its location and a photograph taken.

Per the NSW Biodiversity Assessment Method, plots were laid out on site with tape measures. Their location is shown in Figure 10. Plots were located in such a way to assess areas of better quality remnant vegetation on site.

Recorded flora species and other characteristics such as vegetation structure and soils were used to classify the vegetation community on site. The plant community on site was classified according to the NSW VIS.

2.2.2 Native vegetation cover (percentage) and patch size

Figure 10 indicates the local remnant vegetation present on site. The proposal will require the removal of some of the remnant trees on the site. Figure 5 displays this area, which is approximately 0.024 ha in size. This area (rounded up to 0.1 ha) was used as the input for the area of remnant vegetation to be cleared for the proposal. If the additional area of planted NSW vegetation on site to be removed for the proposal (0.067 ha) is also included and added to the total clearing area, then the total clearing area is 0.09 ha. This total area also rounds to 0.1 ha as used in the BAM calculator.

Note 1. We deemed areas requiring offset (Zone 1 in Figure 12) to comprise remnant vegetation and planted NSW vegetation because the combined area added up to the minimum calculator assessment threshold of 0.1 ha.

Note 2. No areas of native vegetation were deemed as not requiring offset

An assessment of the patch size is also required as an input for the Biodiversity Assessment Method calculator. Patch size is defined as an area of intact vegetation that:

a) occurs on the development site or biodiversity stewardship site, and
b) 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).

The vegetation within 100 m of the proposal is not "intact", it consists primarily of lawns and planted gardens with scattered remnant trees and scant local indigenous groundcovers. The remnant shrub layer is largely non-existent. The patch size is confined within the site boundaries and the patch size used as an input to the BAM calculator was the minimum whole number permissible = 1 ha.

3 Field survey methods

3.1 Field work effort

Over the two days of fieldwork a total of 15 hours were spent undertaking survey work on the site and surrounding habitat areas.

Table 2. Survey dates and weather conditions.

Date	Time	Temperature (°C)	Task	Hours (hrs x no. people)
9Dec2019	07:00-17:00	46	Random meander method of site survey was used to collect list of flora species found on site. Incidental fauna observations recorded.	(9 x 1) = 9
10Dec2019	07:00-13:00	42	Vegetation plot survey. Incidental fauna observations recorded.	(6 x 1) = 6

Survey effort was concentrated within the site boundaries, although adjacent surrounding vegetation was noted (Figure 9).

3.2 Flora survey method, vegetation community and habitat classification

A flora survey was conducted to collect the data required for the NSW Biodiversity Assessment Methodology calculator.

This included:

- Species present;
- foliage cover;

- the number of large trees;
- tree stem size diversity;
- tree regeneration;
- presence of hollows;
- length of fallen logs and litter cover.

Vegetation descriptions and species lists were also compiled for the proposal area.

The BAM requires a plot of 400 m^2 for the recording of plant species and a 1000 m^2 plot for the recording of other habitat features. Griffith Hospital is a disturbed site. It was not possible to locate a single plot that was reasonably representative of the site. Consequently, the plot assessment was split into two sub-plots to sample the vegetation on the site.
Each plot measured 500 m^2 for the habitat feature assessment and 200 m^2 for the plant species assessment. The sub-plots were added together to achieve the required total plot size, being 1000 m^2 and 400 m^2

The two smaller plots allowed the site vegetation assessment to be undertaken on areas where soil was present and capable of growing plants. Figure 10 indicates the location of the plots.

All species within each 200 m^2 subplot were recorded. The percentage foliage cover for each species (live plants only) was estimated including canopy overhanging the plot, even if the plant's stem was rooted outside the plot.

The diameter at breast height over bark (DBH in centimetres) was measured for each tree within each 500 m^2 plot with an arborist DBH tape. For multi-stemmed trees, only the largest living stem was included in the DBH measurement. The presence of hollows and lengths of any fallen logs were recorded.

Litter (and other matter) cover was recorded from five 1 m x 1 m plots placed evenly along a central transect of each 500 m^2 plot.

Growth form codes, such as 'Tree', 'Shrub', 'Forb', 'Grass' or 'Other', were applied to each species using the 'Native Species by Growth Form Reference' provided to course participants of the Biodiversity Assessment Method (BAM) training course. All species were additionally coded as Native (a species indigenous to NSW), Exotic (including Australian native species that are not indigenous to NSW) or High Threat Exotic.

The following were derived from the data:

1. Composition (native plant species richness for each growth form);

2. Structure (native and non-native plant % foliage cover within each growth form); and
3. Vegetation function scores. A 'litter cover' score was calculated as the average percentage of ground cover of litter recorded from the five 1 m x 1 m plots. Tree stem size diversity scores were tallied after allocating the DBH data to stem size classes in centimetres: < 5, 5 – 9, 10 – 19, 20 – 29, 30 – 49, 50 – 79 and 80+.

Recorded flora species and other characteristics such as vegetation structure and soils were used to classify the vegetation community on site. The plant community on site was classified according to the NSW VIS.

Composite field data sheets are provided in Appendix 2. BAM field data.

3.3 Threatened species generated by the Biodiversity Assessment Method calculator

The online Biodiversity Assessment Method Calculator (BAM Calculator) was used to generate a list of threated species that potentially used the site as habitat. Tab 4 'Habitat suitability' in the BAM Calculator generated the lists displayed in tables in Sections 3.3.1 and 3.3.2 below. A consideration of whether the habitat on site and the features of the locality are suitable for each threatened species is provided in the third column in each table. The fourth column in the tables indicates if the species was included in the assessment.

3.3.1 The Biodiversity Assessment Method calculator displayed the following Predicted threatened species (Ecosystem credits):

Common Name	Scientific Name	Presence onsite or Habitat on site	Included in Assessment
Little Pied-bat	*Chalinolobus picatus*	Potential occasional foraging habitat.	Yes
Yellow-bellied Sheathtail-bat	*Saccolaimus flaviventris*	Potential occasional foraging habitat.	Yes
Corben's Long-eared Bat	*Nyctophilus corbeni*	Potential occasional foraging habitat.	Yes
Glossy Black-Cockatoo (foraging)	*Calyptorhynchus lathami*	No foraging habitat in the proposal area, prefers larger	No

Common Name	Scientific Name	Presence onsite or Habitat on site	Included in Assessment
		areas of vegetation.	
Pied Honeyeater		Site lacks Eremophila, wattle, mistletoe species	No
Swift Parrot	*Lathamus discolor*	Potential occasional foraging habitat.	Yes
Superb parrot	*Polytelis swainsonii*	Potential occasional foraging habitat.	Yes
Dusky Woodswallow	*Artamus cyanopterus cyanopterus*	Site lacks fallen woody debris, shrubs and saplings for invertebrates	No
White-bellied Sea Eagle (foraging)	*Haliaeetus leucogaster*	Site is more than 1 km from waterways, dams	No
Major Mitchell's Cockatoo (foraging)	*Lophochroa leadbeateri*	May forage under Cypress pines	Yes
Koala	*Phascolarctos cinereus*	Not generally present in the locality.	No
Little Eagle	*Hieraaetus morphnoides*	Potential occasional foraging habitat.	Yes
Masked Owl (foraging)	*Tyto novaehollandiae*	Potential occasional foraging habitat.	Yes
Brolga	*Grus rubicunda*	No wetland on site	No
Grey Falcon	*Falco hypoleucos*	Inland species	No

Common Name	Scientific Name	Presence onsite or Habitat on site	Included in Assessment
Spotted Harrier	*Circus assimilis*	Rarely present in this habitat, lack of prey species and shrub cover	No
Speckled Warbler	*Chthonicola sagittata*	Requires relatively undisturbed remnants, nests on the ground amongst fallen branches.	No
Painted Honeyeater	*Grantiella picta*	Site lacks mistletoes	No
Varied Sittella	*Daphoenositta chrysoptera*	Requires dead branches, rough barks and acacias	No
Hooded Robin	*Melanodryas cucullata*	Requires structurally diverse habitats	No
Turquoise Parrot	*Neophema pulchella*	Could potentially forage and nest on site	Yes
Scarlet Robin	*Petroica boodang*	Requires abundant fallen timber and logs	No
Flame Robin	*Petroica phoenicea*	Could visit the site	Yes
Grey-crowned Babbler (eastern subspecies)	*Pomatostomus temporalis temporalis*	Requires structurally diverse habitats	No
Diamond Firetail	*Stagonopleura guttata*	Requires structurally diverse habitats	No

3.3.2 The Biodiversity Assessment Method calculator displayed the following Candidate threatened species (Species credits):

Common Name	Scientific Name	Presence onsite or Habitat on site	Included in Assessment
White-browed treecreeper population in Carrathool local government area south of the Lachlan River and Griffith local government area	*Climacteris affinis – endangered population*	Disturbed site - no suitable habitat on site.	No
Sloane's Froglet	*Crinia sloanei*	No suitable habitat on site.	No
Masked Owl (breeding)	*Tyto novaehollandiae*	No breeding habitat on site.	No
Squirrel Glider	*Petataurus norfolcensis*	No	No
Swift Parrot (breeding)	*Lathamus discolor*	No breeding habitat on site.	No
Superb parrot (breeding)	*Polytelis swainsonii*	Potential breeding habitat on site	Yes
Glossy Black-Cockatoo, Riverina population	*Calyptorhynchus lathami – endangered population*	No suitable habitat	No
Glossy Black-Cockatoo (breeding)	*Calyptorhynchus lathami*	No breeding habitat on site.	No
White-bellied Sea Eagle (breeding)	*Haliaeetus leucogaster*	No breeding habitat on site.	No
Major Mitchell's Cockatoo (breeding)		No breeding habitat on site.	No
Koala (breeding)	*Phascolarctos cinereus*	Not generally present in the locality.	No

Common Name	Scientific Name	Presence onsite or Habitat on site	Included in Assessment
Little Eagle (breeding)	*Hieraaetus morphnoides*	No breeding habitat on site.	No
Barking Owl (breeding)	*Ninox connivens*	No breeding habitat on site.	No
Pine Donkey Orchid	*Diuris tricolor*	Not observed during the survey	No
Lanky Buttons	*Leptorhynchos orientalis*	Not observed during the survey – disturbed habitat.	No
Slender Darling-pea	*Swainsona murrayana*	Not observed during the survey – disturbed habitat.	No
Silky Swainson-pea	*Swainsona sericea*	Not observed during the survey – disturbed habitat.	No
A spear grass	*Austrostipa metatorsis*	Not observed during the survey	No
A spear grass	*Austrostipa wakoolica*	Not observed during the survey	No
Bush Stone-curlew	*Burhinus grallarius*	No suitable habitat on site	No

3.3.3 Diurnal fauna searches

Searching, opportunistic observations and call recording provides an indication of types of species using a site. These methods are used to identify and record live animals or record indirect evidence of animal presence on the site. On occasions,

specific surveys may be conducted for a targeted group or species, such as searching the margins of a dam for frogs.

Generally though, birds, reptiles, frogs and mammals, or evidence of them, may all be present in the same habitat at the time of survey, therefore searching for these faunal groups is generally run concurrently. This involved:

a) Searching shelter sites, basking sites, opportunistic observation, and assessment of shelter site diversity suitability for reptiles.
b) Opportunistic observations and identification of calls of species, and search for indirect evidence such as nests, feathers, scratchings and feeding signs for birds.
c) Searching for indirect evidence, such as diggings, droppings, runways and burrows, and opportunistic observations for mammals.

While rigorous surveys are likely to find more species, high species richness for birds can be recorded in a relatively short amount of time. Bird surveys are used as a simple indicator of other parameters, such as biodiversity and the functioning of the ecosystem.

3.4 Limitations of the survey

This survey was conducted in the summer season. This was not suitable for winter migrants or species of winter-flowering orchids that lose their aerial stems after fruiting.

The weather conditions were very hot and dry, clear and still, reaching 42 degrees by noon, climbing into the higher 40s by mid-afternoon, the heat persisting until late in the day.

Species that may use the site were not detected during the survey for the following reasons:
a) The species was present during the survey but was not detected due to dormancy, inactivity or cryptic habits.
b) The species use the site at other times of the year but was not present during the survey due to being nomadic or migratory.

Table 3. Staff associated with field work and analysis of field work.

	Field work	Analysis of field work
Name	Dr Alison Hewitt	Dr Alison Hewitt, Dr Daniel McDonald and Mark McKinnon

4 Survey Results: Vegetation and habitat description

4.1 Site vegetation and habitat zone descriptions

The site consists of a mixture of:

1. Remnant vegetation;
2. Planted vegetation comprising plant species indigenous to NSW; and
3. Exotic vegetation and non-NSW native plant species.

This final group includes planted Australian species that are not native to NSW, planted exotic species, lawn areas and weeds.

The site conditions were very dry and consequently much of the ground cover layer was absent or the plants were shrivelled. During seasons when rainfall was moderate to high it is likely that a greater abundance of species would be recorded on the site. However, it is unlikely that the overall distribution of plant communities would be significantly different.

The site generally lacks woody debris, rocks or litter, with garden beds, lawn areas, car parks and walkways maintained for pedestrian access. Appendix 1shows the list of flora found on the site.

4.1.1 Vegetation and Habitat Zone 1/ Remnant vegetation

Figure 10 indicates the vegetation that has been mapped as remnant vegetation. It consists of scattered individual trees or clumps of trees. A precautionary approach has been undertaken in this assessment and some plants that are indigenous to the locality, such as Kurrajong (*Brachychiton populneus*) which may have been planted in some locations within the site have been mapped as remnant vegetation.

The remnant canopy trees include: Poplar Box (*Eucalyptus populnea*), Yellow Box (*Eucalyptus melliodora*), White Cypress Pine (*Callitris glaucophylla*) and Kurrajong (*Brachychiton populneus*). Local indigenous groundcovers recorded include: *Einadia nutans* and *Sida corrugata*.

A review of local and regional mapping and vegetation classification including: the Griffith Shire Council GIS vegetation mapping, Sivertsen and Metcalfe 1995 and the NSW Bionet vegetation classification http://www.bionet.nsw.gov.au/ was undertaken.

The remnant vegetation formation is a Grassy Woodland and the class is Floodplain Transition Woodland (Keith 2004). Local indigenous plant species were used to determine the likely plant community type (PCT). See Appendix 3 for further details

on vegetation community diagnosis and EEC alignment. The two most likely candidates identified using the BioNet Vegetation Classification system were:

- PCTID 80 *Western Grey Box – White Cypress Pine tall woodland on loam soil on alluvial plains of NSW South Western Slopes Bioregion and Riverina Bioregion.*
- PCTID 82 *Western Grey Box – Poplar Box – White Cypress Pine tall woodland on red loams mainly of the eastern Cobar Peneplain Bioregion.*

PCTID 82 *Western Grey Box – Poplar Box – White Cypress Pine tall woodland on red loams mainly of the eastern Cobar Peneplain Bioregion* was chosen as the mostly likely PCT to be primarily present as scattered trees or clumps of trees on the site (See Appendix 3).

Both these PCTs are described in the BioNet Vegetation Classification to be forms of the vegetation map unit P4 as described by Silvertsen and Metcalfe (1995). PCT 80 and 82 both include the canopy species Western Grey Box (*Eucalyptus microcarpa*) as a representative tree species. However, Western Grey Box (*Eucalyptus microcarpa*) was not recorded on the site.

While the remnant vegetation on the site is classified as PCTID82, it is unclear why the site lacks Western Grey Box (*Eucalyptus microcarpa*). Sivertsen and Metcalfe (1995) state there is "*Varying dominance of the main eucalypt species".* Alternatively, Cunningham *et al.* (1981) state "*The timber is very heavy, hard, tough and durable, but not easily sawn; it is used extensively for fence posts and makes good fuel".* Perhaps one of these reasons or a combination of both reasons explains the absence of Western Grey Box (*Eucalyptus microcarpa*) on the site.

The condition of the community is generally poor as it is fragmented, generally lacks shrubs and an indigenous groundcover layer. None of the native shrub species associated with PCT82 are present due to a history of disturbance, mowing and use of the grounds as a hospital for almost 100 years. These would ordinarily typically comprise *Dodonaea viscosa* subsp. *spatulata*, *Geijera parviflora*, *Acacia deanei* subsp. *paucijuga*, *Pimelea microcephala* subsp. *microcephala*, *Eremophila mitchellii*, *Eremophila glabra*, *Acacia montana* and *Olearia pimeleoides*.

Likewise, native groundcovers usually present in PCT 82 such as *Calotis cuneifolia*, *Calotis lappulacea*, *Vittadinia cuneata*, *Oxalis perennans*, *Dichondra repens*, *Austrostipa scabra*, *Eragrostis lacunaria*, *Austrodanthonia caespitosa* and *Eneteropogon acicularis* were entirely replaced by exotic garden and lawn species. The value of the community is low.

Important habitat features that have significance for fauna occupation of the site are discussed below. These include both site disturbance and natural features.

Table 4. Significant features and observations for Habitat Zone 1.

Significant features	Observations
Frequency of large trees (approx. > 50 cm DBH)	18 large remnant trees are present on the site. Two of these native trees were noted with hollows: Trees 108 and 106.
Tree regeneration and Tree stem-size diversity	Remnant trees on the site are generally larger than 50 cm DBH. Natural tree regeneration appears extremely rare and appears to be absent for White Cypress Pine (*Cupressus glaucophylla)* and Bimbil Box (*Eucalyptus populnea)*.
Logs, woody debris and litter cover	Natural logs and coarse woody debris are absent. All of the grassed areas are periodically mown with very low numbers of indigenous shrubs and forbs surviving very close to the bases of remnant trees.
Food resources	*Eucalyptus* and *Brachychiton* are present and would provide food resources of blossoms and seeds. A low to negligible cover of fallen and rotting material is present near the base of remnant trees.

4.1.2 Vegetation and Habitat zone 2/ Planted vegetation of species indigenous to NSW

Garden plantings of species indigenous to NSW include: *Callistemon viminalis, Eucalyptus nicholi, Grevillea arenaria, Callistemon saligna, Lophostemon confertus, Corymbia maculata, Hymenosporum flavum, Angophora costata, Westringa fruticosa, Melia azedarach, Melaleuca armillaris, Melaleuca hypericifolia, Grevillea juniperina, Banksia integrifolia, Dianella caerulea* var. *producta.*

Table 5. Significant features and observations for this zone.

Significant features	Observations
Frequency of large trees (approx. > 50 cm DBH)	Three large planted other NSW trees are present in this zone. One of these was noted with hollows: Tree 89.
Tree regeneration and Tree stem-size diversity	While stem size diversity in this zone might indicate a range of age classes of trees in this zone, this stem size diversity reflects trees planted into garden beds at different times in the past.
Logs, woody debris and litter cover	Natural logs and coarse woody debris are absent. All of the grassed areas are periodically mown. Some garden beds have been mulched.

Food resources	*Corymbia, Melia, Grevillea, Melaleuca, Angophora* and *Callistemon* are present and would provide food resources of blossoms and seeds. A low to negligible cover of fallen and rotting material is present near the base of remnant trees.

Note 1. We deemed areas requiring offset to comprise remnant vegetation (Zone 1) and planted NSW vegetation (Zone 2). The combined area added up to the minimum BAM calculator assessment threshold of 0.1 ha. Zone 3 below did not require offset.

4.1.3 Vegetation and Habitat zone 3/ Exotic vegetation and non-NSW native plant species

Exotic planted trees and shrubs recorded on the site include: Mediterranean Cypress (*Cupressus sempervirens),* Canary Island Date Palm (*Phoenix canariensis),* Pin Oak (*Quercus palustris),* Pepper Trees *(Schinus areira),* Elms (*Ulmus parvifolia), Pyrus calleryana* and Simon's Poplar (*Populus simonii).* Naturalised or weed species present on the site include: *Avena fatua*, *Arctotheca calendula, Capsella bursa-pastoris* and *Euphorbia peplus.* Large lawn areas are mainly mown exotic grass and pasture species.

Species recorded on the site that are native to Australia but not indigenous to NSW include: *Corymbia citriodora* and *Eucalyptus lansdowneana*.

Table 6. Significant features and observations for the site this zone.

Significant features	Observations
Frequency of large trees (approx. > 50 cm DBH)	Fifteen large exotic trees are present in this zone.
Tree regeneration and Tree stem-size diversity	While stem size diversity might indicate a range of age classes of trees in this zone, this stem size diversity reflects trees planted into garden beds at different times in the past.
Logs, woody debris and litter cover	Natural logs and coarse woody debris are absent. All of the grassed areas are periodically mown.
Food resources	Non NSW Australian *Eucalyptus* and *Corymbia* are present and would provide food resources of blossoms and seeds. A low to negligible cover of fallen and rotting material is present near the base of remnant trees.

4.1.4 Vegetation integrity

Vegetation and habitat zones 1 and 2 were added together to include as clearing area for the BAM calculator to reach the minimum assessable input area of 0.1 ha. The BAM calculator provided the following values for vegetation integrity (Table 8).

Table 7. Current vegetation integrity score and components for zones 1 and 2.

Vegetation zone	Composition condition score	Structure condition score	Function condition score	Current vegetation integrity score
Remnant vegetation and planted NSW vegetation Zones 1 & 2	26	17.5	44.3	27.2

4.2 Species and Communities of conservation concern

The Endangered Ecological Community *Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions* occurs on site. As a precautionary approach and because of a minimum clearing area of 0.1 ha required as input for the offset calculator the two native vegetation zones on site – 'remnant vegetation' and 'planted NSW native vegetation' were added together and treated as the EEC in the BAM calculator.

The condition of the community is generally poor as it is fragmented, generally lacks shrubs and an indigenous groundcover layer replaced as lawn, mulched garden beds and paved areas.

The site may provide habitat for a range of native species including threatened fauna species (See section 5 below).

4.3 Weeds

The *NSW Noxious Weeds Act 1993* has been repealed and the *Biosecurity Act 2015* has replaced it. The Biosecurity Act 2015 states that each landholder and/or occupier has a General Biosecurity Duty for the management of weeds on their property.

The General Biosecurity Duty (GBD) is imposed on any person who deals with biosecurity matter (weeds), and who knows (or ought reasonably to know) of the

biosecurity risk posed (or likely to be posed), has a biosecurity duty to ensure that the risk associated with those weeds is prevented, eliminated or minimised - so far as is reasonably practicable. A requirement is that all public and private landowners or managers and all other people who deal with weed species (biosecurity matter) must use the most appropriate approach to prevent, eliminate or minimise the negative impact (biosecurity risk) of those weeds.

Council may issue a Biosecurity Direction when any owner/occupier fails in their biosecurity duty to control weeds on their land. The owner/occupier must comply with this biosecurity direction. A penalty notice or prosecution may follow if the owner/occupier fails to comply with the Biosecurity Direction.

High Threat Exotic Weeds on site comprised:

* *Phoenix canariensis*
* *Paspalum dilatatum*
* *Tamarix (aphylla)*
* *Pyracantha crenatoserrata*
* *Cotoneaster glaucophyllus*
* *Ochna serrulata*
* *Triadica sebifera*

5 Threatened species

5.1 Threatened species and details of flora and fauna surveys

Details of ecosystem credit species associated with the PCT are displayed in Section 3.3.1. The authors of this BDAR stated that the proposal area did not provide habitat for some species sometimes associated with the PCT. The reasons for exclusion are provided in Sections 3.3.1 and 3.3.2.

5.1.1 Species polygons

Appendix 1 provides a list of flora and fauna recorded during the proposal area survey. The area of remnant vegetation and the area of landscape and gardens was considered to represent the species polygon for each species.

5.1.2 Biodiversity risk weighting

Appendix 7 of the BAM method 2017 provides a background to Biodiversity risk weighting.

Biodiversity risk weightings apply to both ecosystems (vegetation types/PCTs) and threatened species. One Plant Community Types is assessed in this BDAR: *Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions* and it is listed as an Endangered Ecological Community. It has a high sensitivity to loss as displayed in Table 5. The area of planted NSW vegetation on site has also been assigned to PCT 82 because the total area of the two vegetation types does not add to more than 0.1 ha or the minimum area for the BAM calculator.

Table 8. List of habitats on site and their sensitivity classes.

PCT/Habitat/Ecosystem	Sensitivity to loss class
Western Grey Box – Poplar Box – White Cypress Pine tall woodland on red loams mainly of the eastern Cobar Peneplain Bioregion	High sensitivity

Table 9. Listing of threatened species that potentially use the site and sensitivity to gain weighting.

Species	Sensitivity to gain class
Major Mitchell's Cockatoo	Moderate
Superb Parrot (foraging)	Moderate
Superb Parrot (breeding)	High
Flame Robin	Moderate
Turquoise Parrot	High
Masked Owl	High
Swift Parrot	Moderate
Little Pied-bat	High
Corben's Long-eared Bat	High
Yellow-bellied Sheathtail-bat	High
Little Eagle	Moderate
Diuris tricolor	Moderate

5.1.3 Threatened species survey

The inputs for webpage 4 'Habitat suitability' of the BAM Calculator are provided in Sections 3.3.1 and 3.3.2. These inputs were used in the BAM Calculator. The output from the BAM calculator indicated that no specialised fauna survey was required. It is assumed this output was generated as the area of remnant vegetation proposed for removal is small (approximately 0.1 ha) and the habitat quality was not high.

Based upon the information in Section 3.3.2:

- No species credit species polygons were required as part of this assessment.

- No table detailing species credit species and their abundance and the associated habitat features is provided.

5.1.4 Wind farm developments

A wind farm is not included in the proposal. A map of habitual flight paths for nomadic and migratory species likely to fly over the site or a map of threatened aerial species resident on the site is not required.

6 Survey Results: Fauna

6.1 Species recorded

A total of 3 species were detected, all of them birds.

Table 10. List of birds detected on the site.

Birds		
Blue-faced Honeyeater	*Entomyzon cyanotis*	Observed
Pied Currawong	Cracticus nigrogularis	Observed
Ringneck Parrot	Barnardius zonarius	Observed
N =	3	

6.2 Species of conservation concern

No threatened species of fauna were recorded during the proposal area survey.

The site does not contain suitable habitat for any of the following locally recorded threatened species: Glossy Black-Cockatoo, Spotted Harrier, Painted Honeyeater, Brolga, Koala, Magpie Goose, Blue-billed Duck, Freckled Duck, Australasian Bittern, or White-bellied Sea-Eagle. It is possible that some of these species fly may over the site and perhaps on rare occasions briefly land on site. However, the site does not provide habitat for these species.

The suitable habitat on site is highly fragmented and generally would be considered poor quality for the following species: Speckled Warbler, Dusky Woodswallow, Varied Sitella, Hooded Robin, Scarlet Robin, Diamond Firetail, White-fronted Chat, Grey Falcon, Pied Honeyeater, Grey-crowned Babbler (eastern subspecies) and the Grey-headed Flying-fox.

The site potentially provides habitat for the following threatened species:

- Superb Parrot
- Swift Parrot
- Turquoise Parrot
- Flame Robin
- Major Mitchell's Cockatoo
- Corben's Long-eared Bat
- Little Pied Bat
- Yellow-bellied Sheathtail-bat
- Little Eagle
- Masked Owl

Potential breeding habitat of Superb Parrot (Species Credit Species) in the form of hollow bearing trees (Appendix 4 and Figure 5) was noted during the proposal survey.

7 Avoid and minimising impacts

The BAM provides the following guidance on Avoid and minimise impacts.

> *Demonstration of efforts to avoid and minimise impact on biodiversity values in accordance with Chapter 8.*
> *Assessment of direct and indirect impacts unable to be avoided at the development site in accordance with Sections 9.1 and 9.2. The assessment would include but not be limited to: type, frequency, intensity, duration and consequence of impact.*

An analysis of the remnant trees representing the original vegetation community on the site and adjacent to the site is displayed in Figure 10. The tree species considered to represent remnant Western Grey Box-Poplar Box-White Cypress Pine tall woodland on red loams at this location are Bimbil Box (*Eucalyptus populnea)*, White Cypress (*Callitris glaucophylla*) and Kurrajong (*Brachychiton populneus*).

All trees outside of the development footprint (Figure 4) are to be retained including native *Callitris glaucophylla* tree numbers 51-53 and 55-57 and native *Eucalyptus populnea* tree numbers 42, 72, 75-78, 106, 108, 110, 11, 118, 121-122, 132 and 136 in the Arboricultural Impact Assessment.

An arborist is to be engaged to implement tree protection measures for the native hollow bearing trees on site (Appendix 4 and Figure 5) prior to commencement of building works. The protection of hollow-bearing trees is an example of avoiding a potential impact.

Project materials must be stacked in areas already cleared e.g., the car park.

8 Impact summary

8.1 Maps & data

Submitted proposal in the Credit Calculator – The data must be directly submitted to OEH when the final report has been approved by the client and the report will be submitted to the consent authority.

8.2 Impact summary

The proposal will require the removal of approximately 0.1 ha of PCTID 82 *Western Grey Box – Poplar Box – White Cypress Pine tall woodland on red loams mainly of the eastern Cobar Peneplain Bioregion* which has an associated EEC *Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions*

The threshold for potential Serious And Irreversible Impacts (SAII) for PCTID 82 (Western Grey Box-Poplar Box-White Cypress Pine woodland) is not breached by this proposal. Neither 'Western Grey Box-Poplar Box-White Cypress Pine woodland' nor the EEC name '*Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions'* are listed threatened entities at risk of serious and irreversible impact

https://www.environment.nsw.gov.au/topics/animals-and-plants/biodiversity/biodiversity-offsets-scheme/serious-and-irreversible-impacts#:~:text=Serious%20and%20irreversible%20impacts%20of%20development%20are%20determined%20to%20protect,of%20extinction%20from%20potential%20development.).

The clearing of 0.1ha of PCTID 82 (Western Grey Box-Poplar Box-White Cypress Pine woodland) is not considered a SAII. One offset Species Credit Species is required for Superb Parrot with this proposal. None of the threatened species possible in the proposal area for this project are listed threatened entities requiring assessment of serious and irreversible impacts.

Table 11. PCTs requiring offset and the number of ecosystem credits required.

PCTs requiring offset	Number of ecosystem credits required
PCT82	1

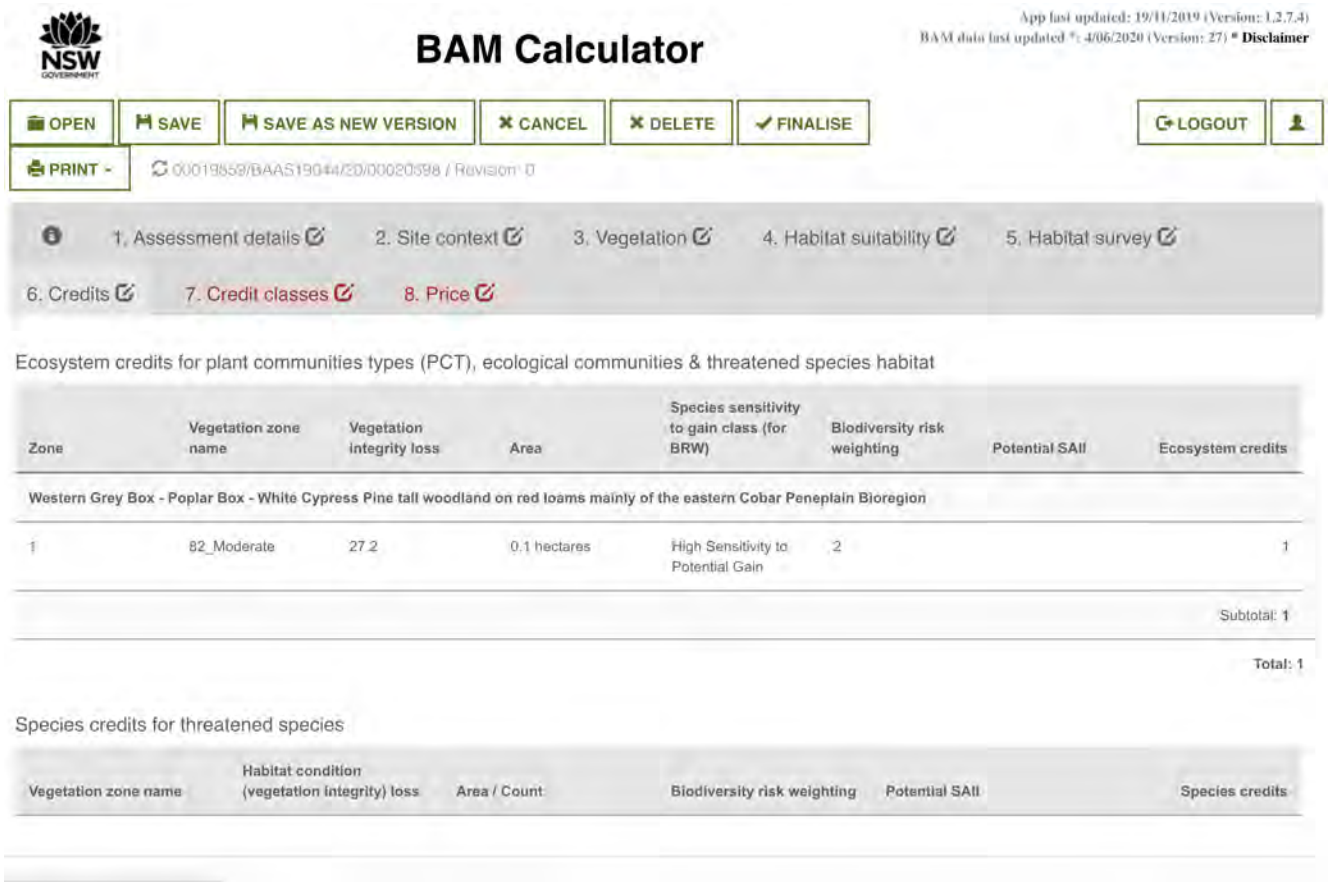
Table 12. Threatened species requiring offset and number of species credits required.

Threatened species requiring offset	Number of species credits required
Superb parrot (potential breeding habitat)	1

9 Biodiversity credit report

9.1 Credit classes for ecosystem credits and species credits at the development site.

Ecosystem credit classes
One ecosystem credit is generated by this proposal (see below screenshot).



BAM Calculator

App last updated: 19/11/2019 (Version: 1.2.7.4)
BAM data last updated *: 4/06/2020 (Version: 27) * Disclaimer

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1. Assessment details | 2. Site context | 3. Vegetation | 4. Habitat suitability | 5. Habitat survey | 6. Credits | 7. Credit classes | 8. Price

Ecosystem credits for plant communities types (PCT), ecological communities & threatened species habitat

Zone	Vegetation zone name	Vegetation integrity loss	Area	Species sensitivity to gain class (for BRW)	Biodiversity risk weighting	Potential SAII	Ecosystem credits
Western Grey Box - Poplar Box - White Cypress Pine tall woodland on red loams mainly of the eastern Cobar Peneplain Bioregion							
1	82_Moderate	27.2	0.1 hectares	High Sensitivity to Potential Gain	2		1
						Subtotal:	1
						Total:	1

Species credits for threatened species

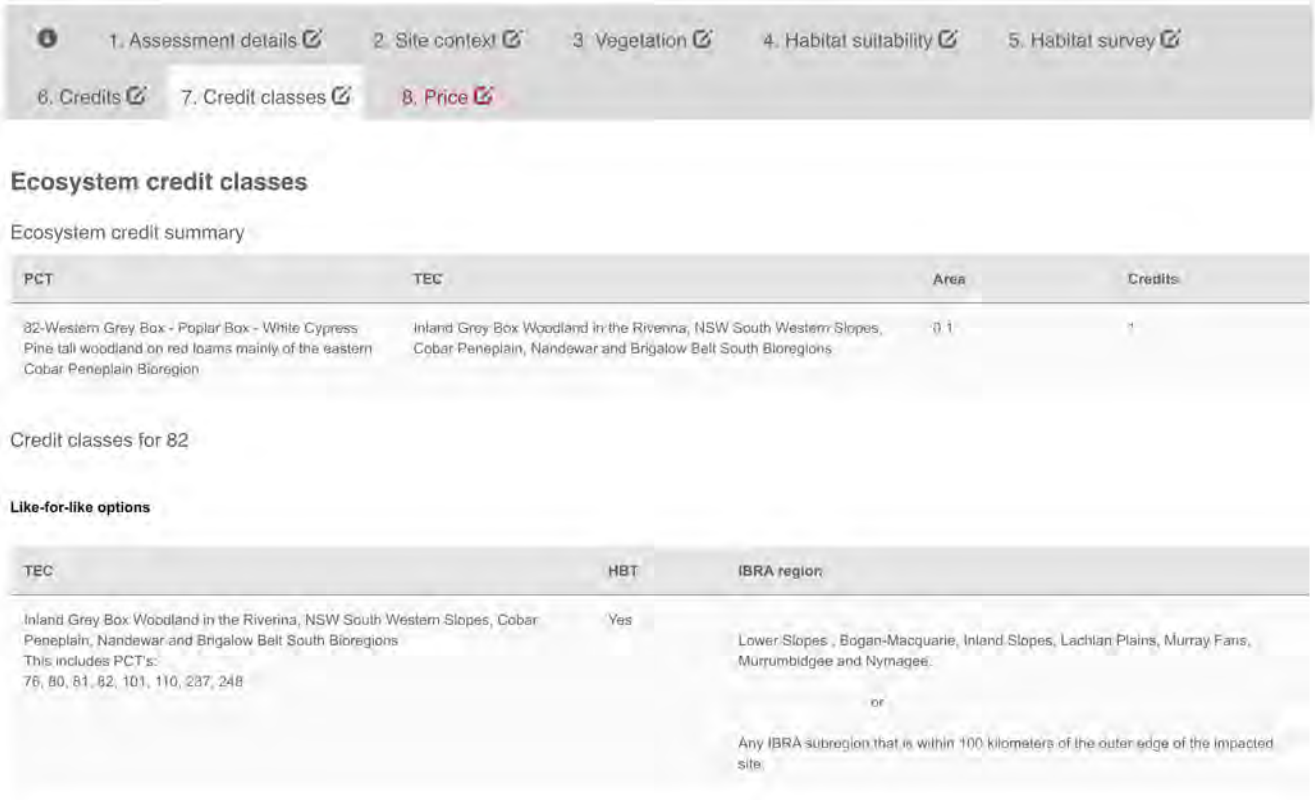
Vegetation zone name	Habitat condition (vegetation integrity) loss	Area / Count	Biodiversity risk weighting	Potential SAII	Species credits

Species credit classes.
One species credit is generated for Superb Parrot breeding habitat

Species credits for threatened species

Vegetation zone name	Habitat condition (vegetation integrity) loss	Area / Count	Biodiversity risk weighting	Potential SAII	Species credits
Polytelis swainsonii / Superb Parrot (Fauna)					
82_Moderate	27.2	0.1 hectares	2.00	False	1
				Subtotal:	1

9.2 Table of credit class and matching credit profile



1. Assessment details 2. Site context 3 Vegetation 4. Habitat suitability 5. Habitat survey
6. Credits 7. Credit classes 8. Price

Ecosystem credit classes

Ecosystem credit summary

PCT	TEC	Area	Credits
82-Western Grey Box - Poplar Box - White Cypress Pine tall woodland on red loams mainly of the eastern Cobar Peneplain Bioregion	Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions	0.1	1

Credit classes for 82

Like-for-like options

TEC	HBT	IBRA region
Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions This includes PCT's: 76, 80, 81, 82, 101, 110, 237, 248	Yes	Lower Slopes , Bogan-Macquarie, Inland Slopes, Lachlan Plains, Murray Fans, Murrumbidgee and Nymagee. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

9.3 Environment Protection and Biodiversity Conservation Act 1999

9.3.1 Protected matters

The Protected Matters Search Tool was used to find relevant Matters of National Environmental Significance (MNES) on or within 5 km of the site. The outputs are summarised below.

World Heritage Properties	None
National Heritage Places	None
Wetlands of International Importance	4
Great Barrier Reef Marine Park Authority	None
Commonwealth Marine Areas	None
Listed Threatened Ecological Communities	5
Listed Threatened Species	15
Listed Migratory Species	10
Commonwealth Land	5
Commonwealth Heritage Places	None
Listed Marine Species	16
Whales and Other Cetaceans	None
Critical Habitats	None
Commonwealth Reserves Terrestrial	None
Australian Marine Park	None
State and Territory Reserves	None
Regional Forest Agreements	None
Invasive Species	26
Nationally important Wetlands	None

The Commonwealth Listed Threatened Ecological Communities likely to be present within five kilometres of the site are:

1. Buloke Woodlands of the Riverina and Murray-Darling Depression Bioregions;
2. Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of southeastern Australia;
3. Poplar Box Grassy Woodland on Alluvial Plains;
4. Weeping Myall Woodlands; and
5. White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland.

To determine if the remnant vegetation on the site met the Commonwealth description of *Grey Box (Eucalyptus microcarpa) Grassy Woodlands and Derived*

Native Grasslands of South-Eastern Australia the listing advice to the Minister of Environment was reviewed.

The advice is available from: http://www.environment.gov.au/biodiversity/threatened/communities/pubs/86-listing-advice.pdf

The listing advice includes the following information about condition thresholds:

Table 1. Condition thresholds for the Grey Box (E. microcarpa) Grassy Woodlands and Derived Native Grasslands of South-Eastern Australia ecological community

Category and rationale	**Thresholds**
Criteria that are broadly applicable	**1a.** The minimum patch size is 0.5 hectare; **AND** **1b.** The canopy layer contains Grey Box (*E. microcarpa*) as the dominant or co-dominant tree species; **AND** **1c.** The vegetative cover[7] of non-grass weed[8] species in the ground layer is less than 30% at any time of the year.
Additional criteria that apply to smaller woodland patches (0.5 to <2 ha in area) with tree crown cover >10%	**2a.** At least 50% of the vegetative cover in the ground layer comprises perennial native species at any time of the year; **AND** **2b.** 8 or more perennial native species[9] (6 or more in the Flinders Lofty Block Bioregion of South Australia) are present in the mid and ground layers at any time of the year.
Additional criteria that apply to larger woodland patches with a well developed canopy (2 ha or more in area)	**3a.** At least 8 trees/ha are hollow bearing or have a diameter at breast height of 60 cm or more[10]; **AND** **3b.** at least 10% of the vegetative ground cover comprises perennial native grasses at any time of the year;
	OR
	4a. At least 20 trees/ha have a diameter at breast height of 12 cm or more; **AND** **4b.** at least 50% of the vegetative cover in the ground layer comprises perennial native species.
Additional criteria that apply to patches where the canopy is less developed or absent (derived grassland) (≥0.5 ha in area)	**5a.** Woodland density does not meet criteria 3a or 4a, or is a derived grassland with clear evidence that the site formerly was a woodland with a tree canopy dominated or co-dominated by *E. microcarpa*; **AND** **5b.** At least 50% of the vegetative cover in the ground layer is made up of perennial native species at any time of the year; **AND** **5c.** 12 or more native species are present in the ground layer at any time of the year.

Comment
The total area of remnant vegetation on the site is less than 0.1 ha. Moreover, the remnant vegetation is comprised of scattered trees or clumps of trees. The total area of remnant vegetation is less than the threshold of 0.5 ha (Threshold 1a).

The listing advice also includes the following text:

> *Although significantly degraded patches will not be a part of the ecological community listed under the EPBC Act, it is recognised that patches that do not meet the condition thresholds may still retain important natural values. Therefore, these patches should not be excluded from recovery and other management actions (also see The surrounding environmental and landscape context below).*

Thus, while the remnant vegetation on the site is not part of the listed EPBC Act community it does retain some important natural values.

To determine if the remnant vegetation on the site met the Commonwealth description of *Poplar Box Grassy Woodlands on Alluvial Plains* the listing advice to the Minister of Environment was reviewed.

The advice is available from:

http://www.environment.gov.au/biodiversity/threatened/communities/pubs/141pb-conservation-advice.pdf

The listing advice includes the following information about condition thresholds:

Category and rationale	Native cover and diversity thresholds	Minimum patch size thresholds*
CLASS A HIGHEST QUALITY		
Category A1. Little to no perennial weeds and diverse native understorey	The crown cover of canopy trees in the patch is ≥10% **AND** ≥ 90% of perennial vegetation cover in the ground layer** is native **AND** ≥ 30 native plant species per patch in the ground layer	≥ 1 ha
Category A2. A large patch with low perennial weeds and diverse native understorey	The crown cover of canopy trees in the patch is ≥10% **AND** ≥70% of perennial vegetation cover in the ground layer** is native **AND** ≥ 30 native plant spp. per patch in the ground layer	≥ 5 ha
CLASS B GOOD QUALITY		
Category B. A large patch with good quality native understorey or with mature trees	The crown cover of canopy trees in the patch is ≥10% **AND** ≥ 50% of perennial vegetation cover in ground layer** is native **AND EITHER** ≥ 20 perennial native plant species per patch in the ground layer **OR** ≥ 10 mature trees+ per ha with ≥ 30cm dbh*** (and/or hollows)	≥ 5 ha
CLASS C MODERATE QUALITY		
Category C A large patch with low native cover but retains good native understorey diversity and habitat features of mature trees	The crown cover of canopy trees in the patch is ≥10% **AND** **If** < 50% of perennial vegetation cover in ground layer** is native, then the patch **must** have: ≥ 20 native plant spp. per patch in the ground layer **AND** ≥ 10 mature trees+ per ha with ≥ 30cm dbh*** (and/or hollows) **AND** smaller trees+, saplings or seedlings suggestive of periodic recruitment	≥ 5 ha

Comment
The total area of remnant vegetation on the site is less than 0.1 ha. Moreover, the remnant vegetation is comprised of scattered trees or clumps of trees. The total area of remnant vegetation is less than the threshold of 1 ha (Threshold 1a).

The vegetation on site also does not fit the key diagnostic characters for Commonwealth listed *Poplar Box Grassy Woodlands on Alluvial Plains* because the mid layer is absent from the structure, there is less than 90% native vegetation in the ground cover and less than 20 native plant species in the ground layer.

Thus, while the remnant vegetation on the site is not part of the listed EPBC Act community it does retain some important natural values

Scattered trees were noted with hollows (see Appendix 4). One was noted as occupied by ringneck parrots. These could potentially provide breeding habitat for Superb Parrot. One species credit offset was generated for Superb Parrot.

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Appendix 1. Flora species list

The grid reference for this locality is 412001 East, 6206154 North (GDA94, MGA55)

Note: the flora species list below is for the Hospital and the adjacent roadside areas.

CONIFEROPSIDA

CUPRESSACEAE
Callitris glaucophylla
* *Cupressus macrocarpa*
* *Cupressus sempervirens*

MAGNOLIOPSIDA

DICOTYLEDONS

ANACARDIACEAE
* *Schinus molle* var. *areira*

APIACEAE
* *Apium graveolens*

APOCYNACEAE
* *Nerium oleander*

ASTERACEAE
* *Arctotheca calendula*
* *Conyza bonariensis*
* *Erigeron karvinskianus*

BERBERIDACEAE
* *Nandina domestica*

BIGNONIACEAE
* *Jacaranda mimosifolia*

BORAGINACEAE
* *Echium (plantagineum)*

BRASSICACEAE
* *Capsella bursa-pastoris*

CHENOPODIACEAE
Atriplex semibaccata
Einadia nutans

CONVOLVULACEAE
(* *Convolvulus arvensis*)

EUPHORBIACEAE
* *Euphorbia peplus*
* *Triadica sebifera* HTE

FABACEAE
FABOIDEAE
* *Bauhinia alba*
Hardenbergia violacea # - presumably planted but locally indigenous

FABACEAE
MIMOSOIDEAE
Acacia oswaldii
Acacia podalyriifolia #

FAGACEAE
* *Quercus palustris*

GENTIANACEAE
* *Centaurium erythraea*

LAMIACEAE
* Stachys arvensis
Westringia fruticosa #

LYTHRACEAE
* *Lagerstroemia indica*

MALVACEAE
Brachychiton populneus
Sida corrugata

MELASTOMATACEAE
* *Tibouchina granulosa*

MELIACEAE
Melia azedarach # - presumably planted but indigenous to NSW

MORACEAE
Ficus benjamina +

MYRTACEAE
Angophora costata #
Sannantha (Baeckea) (virgata) #
Callistemon salignus #
Callistemon viminalis #
Corymbia citriodora +
Corymbia maculata #
Eucalyptus (lansdowneana) +
Eucalyptus leucoxylon # - presumably planted but locally indigenous
Eucalyptus (melliodora)
Eucalyptus nicholii #

Eucalyptus populnea
Lophostemon confertus #
Melaleuca armillaris #
Melaleuca hypericifolia #

OCHNACEAE
* *Ochna serrulata* HTE

OLEACEAE
* *Fraxinus griffithii*

PITTOSPORACEAE
Hymenosporum flavum #

PROTEACEAE
Banksia integrifolia #
Grevillea arenaria #
Grevillea juniperina #

ROSACEAE
* *Cotoneaster glaucophyllus* HTE
* *Photinia glabra* 'Rubens'
* *Prunus sericifera nigra italica*
* *Pyracantha crenatoserrata* HTE
* *Pyrus calleryana*
* *Rosa* sp.

RUBIACEAE
* *Gardenia angustifolia*

RUTACEAE
Murraya paniculata +

SALICACEAE
* *Populus simonii*

SAPINDACEAE
* *Acer palmatum*

TAMARICACEAE
* *Tamarix (aphylla)* HTE

THEACEAE
* *Gordonia axillaris*

ULMACEAE
* *Ulmus parvifolia*

MONOCOTYLEDONS

ARECACEAE
* *Phoenix canariensis* HTE

LOMANDRACEAE
Lomandra 'Tanaka' +

VIOLACEAE
* *Viola odorata*

PHORMIACEAE
Dianella caerulea var. *producta* #

POACEAE
* *Avena fatua*
* *Paspalum dilatatum* HTE
* *Pennisetum clandestinum*

Key
* = Exotic species
# = Presumably planted NSW endemic species
+ = Native Australian species (but native outside NSW) or hybrid cultivar
HTE = High Threat Exotic (listed in the BAM Method)

Appendix 2. BAM field data

400 m² plot: Sheet ___ of ___		Survey Name	Plot Identifier	Recorders
Date	10/12/19	Griffith Hospital	combined data fr	Ahewitt

GF Code	*Top 3 native species in each growth form group: Full sp*	N, E or H.T.E	Cover	A
	All other native and exotic species: Full species name wher practicable			
Tree	Callitris glaucophylla	N	5	
Tree	Jacaranda mimosifolia	E	2	
Tree	Brachychiton populneus	N	2	
Shrub	Gardenia angustifolia	E	0.25	
Shrub	Grevillea arenaria	N	0.1	
Shrub	Grevillea juniperina	N	0.2	
Shrub	Rosa sp.	E	0.1	
Shrub	Pyracantha crenatoserrata	E	0.05	
Grass	Pennisetum clandestinium	E	15	
Forb	Oxalis	E	0.05	
Forb	Conyza bonariensis	E	0.05	
Forb	Einadia nutans	N	0.5	
Shrub	Ochna serrulata	E	0.05	
Forb	Euphorbia peplus	E	0.001	
Forb	Apium graveolens	E	0.001	
Forb	Centaurium erythraea	E	0.05	
Shrub	Nandina domestica	E	0.1	
Forb	Viola odorata	E	0.2	
Tree	Corymbia citriodora	E	1.25	
Tree	Eucalyptus populnea	N	5	
Tree	Acacia oswaldii	N	0.1	
Grass	Paspalum dilatatum	High Threat Exot	2.5	
Forb	Plantago lanceolata	E	0.5	
Forb	Echium (plantagineum)	E	0.5	
Forb	Sida corrugata	N	0.05	
Shrub	Photinia glabra	E	0.5	
Shrub	Nerium oleander	E	0.5	
Tree	Ulmus parvifolia	E	1	
Forb	Arctotheca calendula	E	0.05	
Shrub	Hymenosporum flavum	N	0.2	

		Survey Name	Plot Identifier	Recorders			
Date	10th Dec 2019	Griffith Hospital	1 & 2 combined	A Hewitt			
Zone MGA 55	Datum GDA94	IBRA region	NSW SW Slopes	Photo #		Zone ID	
Easting: 412001	Northing: 6208154.0	Dimensions	20 x 50		Orientation of midlinefrom the 0 m point		
Vegetation Class	Floodplain Transition Woodland						Confidence: H M L
Plant Community Type	80		Western Grey Box - White Cypress Pine tall woodland on loam soil on alluvial plains of NSW South Western Slopes Bioregion and			EEC	Confidence: H M L

Record easting and northing from the plot marker. If applicable, orient picket so that perforated rib points along direction of midline.
Dimension (Shape) of 0.04 ha base plot inside 0.1 ha FA plot should be identified, magnetic bearing taken along midline.

BAM Attribute (400 m² plot)		Sum values
	Trees	4
Count of Native Richness	Shrubs	3
	Grasses etc.	0
	Forbs	2
	Ferns	0
	Other	0
Sum of Cover of native vascular plants by growth form group	Trees	17.1
	Shrubs	0.5
	Grasses etc.	0
	Forbs	0.35
	Ferns	0
	Other	0
High Threat Weed cover		2.5

BAM Attribute (20 x 50 m plot)	# Tree Stems Count		
dbh	Euc*	Non Euc	Hollows
large trees for Euc* & Non Euc 80 + cm	1	0	1
50-79 cm	1	3	0
30 - 49 cm	4	2	0
20 - 29 cm	3	1	0
10 - 19 cm	0	0	0
5 - 9 cm	0	1	n/a
< 5 cm	0	0	n/a
Length of logs (m) (≥ 10 cm diameter, ≥50 cm in length)	zero		

Record number of living eucalypt* (Euc*) and living native non-eucalypt (Non Euc) stems separately.

*includes all species of *Eucalyptus*, *Corymbia*, *Angophora*, *Lophostemon* and *Syncarpia*.

Record total number of stems by size class with hollows (including dead stems / trees)

total

[illegible]

BAM Attribute (1 x 1 m plots)	Litter cover (%)	Bare ground cover (%)	Cryptogam cover (%)	Rock cover (%)
Subplot score (% in each)	a b c d e	a b c d e	a b c d e	a b c d e
Average of the 5 subplots	12	33	0	0

szdxfghs

Appendix 3. Vegetation PCT & community analysis

The floristic data collected from Plot 1 was used to assist in determining which vegetation community occurs on site, by the following three criteria:

1. Filtering the site and survey data through the NSW VIS PCT spreadsheet narrowing first by IBRA region, then IBRA subregion, then dominant tree species. This produced two possible results:

- PCTID 80 *Western Grey Box – White Cypress Pine tall woodland on loam soil on alluvial plains of NSW South Western Slopes Bioregion and Riverina Bioregion.*
- PCTID 82 *Western Grey Box – Poplar Box – White Cypress Pine tall woodland on red loams mainly of the eastern Cobar Peneplain Bioregion.*

PCTID 82 *Western Grey Box – Poplar Box – White Cypress Pine tall woodland on red loams mainly of the eastern Cobar Peneplain Bioregion* was chosen as the mostly likely PCT to be primarily present as scattered trees or clumps of trees on the site by analysis (see Appendix 3).

PCT 80 and 82 both include Western Grey Box *Eucalyptus microcarpa* as representative tree species. However, Western Grey Box *Eucalyptus microcarpa* was not recorded on the site. Both these PCTs are described in the BioNet Vegetation Classification to be forms of the vegetation map unit P4 as described by Silvertsen and Metcalfe (1995).

While the remnant vegetation on the site is classified as PCTID82, it is unclear why the site lacks Western Grey Box *Eucalyptus microcarpa.* Sivertsen and Metcalfe (1995) state there is "*Varying dominance of the main eucalypt species".* Alternatively, Cunningham *et al.* (1981) state "*The timber is very heavy, hard, tough and durable, but not easily swan; it is used extensively for fence posts and makes good fuel".* Perhaps one of these reasons or a combination of both reasons explains the absence of Western Grey Box *Eucalyptus microcarpa* on the site.

2. Correlation of the species assemblage with the NSW Scientific Committee's determinations on locally occurring EECs:

	Final determination Inland Grey Box Woodland EEC	Final determination White Box Yellow Box Blakely's Red Gum Woodland EEC
Plot 1 recorded NSW native species		
Eucalyptus populnea	Listed	

	Final determination Inland Grey Box Woodland EEC	Final determination White Box Yellow Box Blakely's Red Gum Woodland EEC
Acacia oswaldii		
Sida corrugata	Listed	Listed
Hymenosporum flavum		
Plot 2 recorded NSW native species		
Callitris glaucophylla	Listed	Listed
Brachychiton populneus	Listed	Listed
Grevillea arenaria		
Grevillea juniperina		
Einadia nutans	Listed	
Total	5	3
Possible Total	74	95
	6.75%	3.15%

Appendix 4. Hollow bearing trees on site for protection

Tree species	Tree number per the arborist report	GPS Location (GDA94-MGA55)	DBH (cm)	Approximate height (m)	Comments
Eucalyptus populnea	108	411875.529 E 6206055.682 N	93	18	With *Apis mellifera* at 8m
Eucalyptus populnea	106	411935.114 E 6206020.851 N	75	18	2 hollows at 7m and 9m, used by native Ringneck parrots
Eucalyptus leucoxylon	89	411980.559 E 6206019.312 N	50	16	2 hollows at 10m.

Appendix 5 Ecosystem credit prices screenshot

The Biodiversity Offset Payments Calculator on 3rd June 2020 gave the price per credit to offset PCT 82 with an offset trading group 'like for like' as $4, 123.00 and with one credit to offset plus GST and admin costs a total cost of approximately $4, 535.00.

Biodiversity Offset Payment Calculator

Version: 2.0.1
Last updated: 12/02/202

Credit Offset Payment Calculator | Payments

Ecosystem credits for plant communities types (PCT), ecological communities & threatened species habitat

IBRA sub region	PCT common name	Threaten status	Offset trading group	Risk premium	Administrative cost	Methodology adjustment factor	Charge per credit	No. of ecosystem credits	Final credits charge
Lower Slopes	82 - Western Grey Box - Poplar Box - White Cypress Pine tall woodland on red loams mainly of the eastern Cobar Peneplain Bioregion	Yes	Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions	15.97%	$137.47	1.9760	$4,123.14	1	$4,123.14
								Subtotal (excl. GST)	$4,123.14
								GST	$412.31
								Total ecosystem credits (incl. GST)	$4,535.45
Calculated as on: 03/06/2020 15:57:46								Grand total	$4,535.45

Using the BAM calculator gave the same result.

IBRA subregion: Lower Slopes

PCT list

Include	PCT common name	Credit
☑	82 - Western Grey Box - Poplar Box - White Cypress Pine tall woodland on red loams mainly of the eastern Cobar Peneplain Bioregion	1

CALCULATE

Ecosystem credits for plant communities types (PCT), ecological communities & threatened species habitat

IBRA sub region	PCT common name	Threat status	Offset trading group	Risk premium	Administrative cost	Methodology adjustment factor	Price per credit	No. of ecosystem credits	Final credits price
Lower Slopes	82 - Western Grey Box - Poplar Box - White Cypress Pine tall woodland on red loams mainly of the eastern Cobar Peneplain Bioregion	Yes	Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions	15.97%	$137.47	1.9760	$4,123.14	1	$4,123.14
								Subtotal (excl. GST)	$4,123.14
								GST	$412.31
								Total ecosystem credits (incl. GST)	$4,535.45
Calculated as on: 10/06/2020 12:57:23								Grand total	$4,535.45

Appendix 6. Company Profile

Abel Ecology has been in the biodiversity consulting business since 1991, starting in the Sydney Region, and progressively more statewide in New South Wales since 1998, and now also in Victoria. During this time extensive expertise has been gained with regard to Master Planning, Environmental Impact assessments including flora and fauna, bushfire reports, Vegetation Management Plans, Management of threatened species, Review of Environmental Factors, Species Impact Statements, Biodiversity Development Assessment Reports and as Expert Witness in the Land and Environment Court. We have done consultancy work for industrial and commercial developments, golf courses, civil engineering projects, tourist developments as well as residential and rural projects. This process has also generated many connections with relevant government departments and city councils in NSW. Our team consists of four scientists and two administrative staff, plus casual assistants as required.

Licences
NPWS s132C Scientific licence number is SL100780 expires 31 July 2021
NPWS GIS data licence number is CON95034
DG NSW Dept of Primary Industries Animal Care and Ethics Committee Approval expires 8 November 2021
DG NSW Dept of Primary Industries Animal Research Authority expires 8 November 2021

The Consultancy Team

Dr Danny Wotherspoon
Grad Dip Bushfire Protection (University of Western Sydney 2012)
PhD (researching Cumberland Plain vegetation and fauna habitat, at Centre for Integrated Catchment Management, University of Western Sydney, 2008)
Planning for Bushfire Protection Certificate course (University of Technology, 2006)
Consulting Planners Bushfire Training Course (Planning Institute of Australia, 2003)
MA (Macquarie University, 1991)
Wildlife Photography Certificate (Sydney Technical College, 1987)
Herpetological Techniques Certificate (Sydney Technical College, 1986)
Applied Herpetology Certificate (Sydney Technical College, 1980)
Dip Ed (University of New England, 1978)
BSc (Zoology, Ecology) University of New England 1974)

Dr Daniel McDonald
B. Ag Sc; M. Agr; PhD (The University of Sydney)
Cert IV – GIS (Riverina TAFE)
Daniel is an accredited Biobanking Assessor (0075) and an accredited BAM assessor (BAAS17056)
Quantified Tree Risk Assessment (QTRA) and Visual Tree Assessment (VTA), White Card

Daniel is an experienced ecologist with expertise in fauna, plant species identification, vegetation assessment, agriculture, arboriculture, conservation genetics and seed collection and preservation. He is accredited both for BAM assessments, BioBanking assessments and Biodiversity Certification. His present research interest is in Eastern Suburbs Banksia Scrub and fragmented endangered ecological communities.

Mark Mackinnon
Qualifications: B Env. Sci. (Hons),

MEIANZ, White Card

Graduate Diploma of Bushfire Protection (enrolled)

Mark is a passionate and enthusiastic scientist who thrives in the field of natural resource management. In the last 6 years, Mark has worked for a number of inter-state government agencies and environmental consultancies. He has experience in threatened species, fire ecology, bushfire management, pest plant and animals, and landscape restoration. In particular he specializes in ornithology and bushfire management. Mark has a number of specialized field-based skills including: simple and complex tree climbing, working at heights, general firefighter departmental fire accreditation, venomous snake and reptile handling, immunization to handle bat species, and an A - class bird banding licence with mist-net endorsement. Mark is also skilled in ArcGIS mapping, first-aid, four -wheel-driving.

Dr Alison Hewitt
B. Sc. (Hons), PhD.
MESA, MAPS, MASBS, Snr 1st Aid cert, White card.
Alison has researched and published on the reproductive biology and ecology of Australian Melaleuca species, native plant responses to fire and the vegetation of western Sydney. Alison's interests include plant ecology and flora survey methodology, bush regeneration, plant identification and gardening. Alison teaches Botany and Ecology sessionally with Western Sydney University.