Biodiversity Offset Management Plan

NYNGAN SOLAR PLANT

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ACRONYMS AND ABBREVIATIONS

BBAM	BioBanking Assessment Methodology
BBCC	BioBanking Credit Calculator
CMA	Catchment Management Authority
COA	Condition of approval
DECC	Refer to OEH
DP&I	(NSW) Department of Planning and Infrastructure
EEC	Endangered ecological community – as defined under relevant law applying to the proposal
EIS	Environmental Impact Statement
EPBC Act	*Environmental Protection and Biodiversity Conservation Act 1999* (Cwth)
ha	Hectares
HBT	Hollow-bearing tree
km	Kilometres
kV	Kilovolt
m	Metres
MW	Megawatt
NSW	New South Wales
OEH	(NSW) Office of Environment and Heritage, formerly Department of Environment, Climate Change and Water (DECC or DECCW)
PV	Photovoltaic
TSC Act	*Threatened Species Conservation Act 1995* (NSW)

1 INTRODUCTION

1.1 BACKGROUND

AGL Energy Limited (AGL) has approval to construct a solar photovoltaic (PV) power station with a nominal capacity of up to 106 megawatts (MW) at Nyngan in Central West New South Wales (NSW). The solar plant will be located approximately 10 kilometres west of the Nyngan township. The solar plant will occupy approximately 300 hectares of privately owned agricultural land. The site is largely cleared with some small remnant patches of degraded native vegetation and scattered trees. It is currently used for agriculture (cropping and grazing). A transmission line and easement will be constructed over a length of approximately 3 kilometres to the south of the solar plant site to connect the solar plant with the existing Nyngan – Cobar 132 kilovolt (kV) transmission line. The location of the development site and the proposed access and transmission easements are shown on Figure 1-1.

The project will result in the permanent loss of approximately 10 hectares of native vegetation ranging from poor to good condition. The Biodiversity Assessment for the project (**ngh**environmental 2013) determined that no threatened ecological communities or flora species would be impacted by the project. The development site does, however, contain known breeding habitat for the threatened Grey-crowned Babbler (listed as Vulnerable under the *Threatened Species Conservation Act 1995*) with a number of family groups and active nests identified at the development site during field surveys for the Biodiversity Assessment. A strategy to offset the residual impacts of the project, including habitat for the Grey-crowned Babbler, was included in the Biodiversity Assessment.

The project was approved by the Department of Planning and Infrastructure (DP&I) on 15 July 2013 under Section 89E of the *Environmental Planning and Assessment Act 1979*. It is a condition of approval (COA) that a Biodiversity Offset Management Package be developed to offset the ecological values lost as a result of the project (COA C5 detailed in Appendix A). In addition to this condition of consent, the proponent also committed to the following mitigation measures relating to offsets within the Nyngan Solar Plant Submissions Report (**ngh**environmental June 2013):

- An Offset Plan would be developed with input from OEH and the CMA and according to the strategy provided in Appendix G of the Biodiversity Assessment (which included a proposed 1:5 offset ratio). It would be finalised prior to any construction impacts, as outlined in the Biodiversity Assessment. The objective of offsetting is to ensure that an overall 'maintain or improve' outcome is met for the project; where impacts cannot be avoided, or sufficiently minimised, the residual impact would be offset in perpetuity.
- Prior to finalising the Offset Site boundaries, the proponent would validate the area impacted by construction to ensure that the actual, not estimated, impacted area is offset.
- The offset site management actions and their outcomes would be reported annually to the Department of Planning and Infrastructure for the duration of the project (up to 30 years) to demonstrate that a 'maintain or improve' outcome has been met.

AGL have identified a proposed Offset Site located approximately 10 km southwest of the solar plant site. The proposed site is approximately 50 hectares (ha) in area and is located in the north-western corner of Lot 30 DP 752879 (Figure 1-1). As an additional compensatory measure, AGL also propose to revegetate approximately five hectares of degraded farmland within the development site to further mitigate the loss of habitat for the Grey-crowned Babbler.

1.2 PURPOSE AND SCOPE OF THIS REPORT

This report documents how the proponent will meet its obligations under COA C5. Specifically this report provides:

- An overview of the development site and the values that require offsetting.
- Details of the methodologies employed in assessing the values of the Offset Site.
- A description of the Offset Site and the biodiversity values it contains.
- Details of the method for securing the Offset Site and recommendations for its future management and monitoring.
- Details of proposed additional compensatory measures.
- A discussion of the suitability of the proposed offset and additional compensatory measures.

The location of the proposed Offset Site was refined during consultation between the landowner and the Central West Catchment Management Authority (CMA). The NSW Office of Environment and Heritage (OEH, Liz Mazzer) has been consulted throughout the preparation of this report.

1.3 OBJECTIVES AND OUTCOMES

The overarching objectives of this plan and the biodiversity outcomes to be achieved are to:

- Provide a 'like for like' offset with regard to vegetation types and threatened species habitats impacted by the development.
- Ensure offsets are consistent with the *Principles for the use of Biodiversity Offsets in NSW.*
- Achieve a net improvement in the biodiversity values within the Offset Site and maintain this for the long-term.

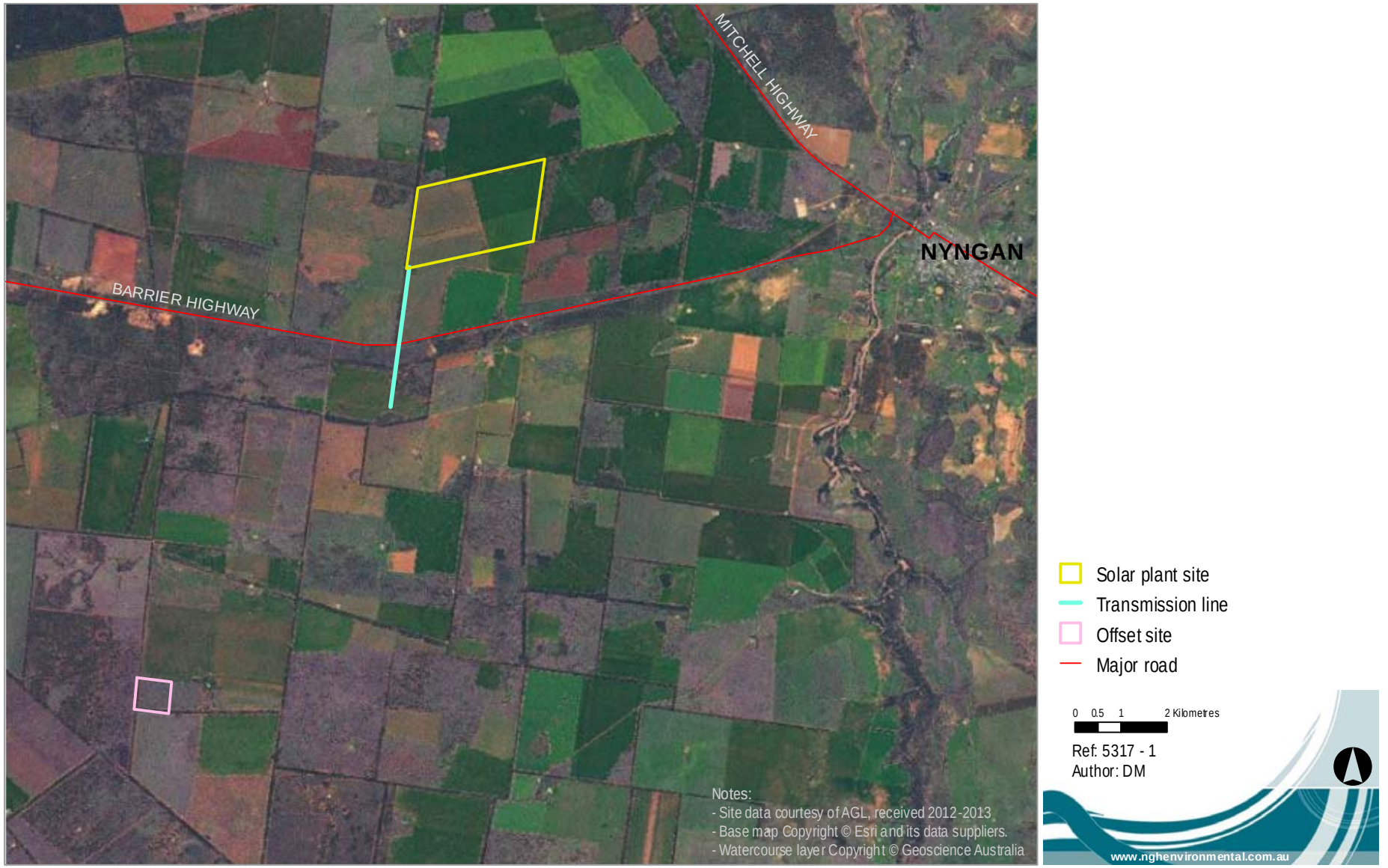

Figure 1-1 Location of the proposed development and Offset Site

2 DEVELOPMENT SITE: OVERVIEW

2.1 VEGETATION TYPES

The 'development site' is defined as the areas that would be impacted by the solar plant and transmission line, illustrated in Figure 1-1. A Biodiversity Assessment for the development site was prepared by **ngh**environmental as part of the Environmental Impact Statement (EIS) for the project. Vegetation communities were classified as described in *New South Wales Vegetation Classification and Assessment: Part 1 Plant communities of the NSW Western Plains* by Benson (2006)[1]. Native vegetation within and surrounding the development site consists of, or is derived from, Poplar Box - Gum-barked Coolabah - White Cypress Pine Shrubby Woodland (Veg ID 103). It is dominated by Poplar Box (*Eucalyptus populnea* subsp. *bimbil*) and co-dominated by White Cypress Pine (*Callitris glaucophylla*) with scattered individuals of Gum-barked Coolibah (Inland Red Box, *E. intertexta*).

The majority of native vegetation within the solar plant site is in moderate or poor condition with a degraded understorey and is restricted to narrow strips of vegetation dividing otherwise cleared and cropped paddock areas. Vegetation in good condition with a more intact understorey occurs south of the Barrier Highway within the transmission line corridor.

The cleared paddock areas consist of mostly exotic species and are no longer representative of any native vegetation type. These areas are dominated by Lucerne with dense patches of Stinkgrass (**Eragrostis cilianensis*) scattered across these areas.

No endangered ecological communities (EECs) or threatened flora species listed under State or Commonwealth legislation were recorded or considered likely to occur within the development site.

2.2 FAUNA HABITATS

Habitat in the project area can be defined as open Poplar Box Woodland. The structure of woodland is generally simple with the open canopy dominated by eucalypts, a grassy groundcover with fallen timber and leaf litter.

Generally the fauna habitat quality was higher in the southern portion of the study area (south of the Barrier Highway, where the transmission easement is located) where patches of open woodland with an intact understorey and some connectivity exist. North of the Barrier Highway, the site is of less value to fauna being more degraded due to past and present land management practices. A history of disturbance is evident across the majority of the site with vast paddocks of cleared land and existing vehicle tracks.

Hollow-bearing trees (HBTs) are an important fauna habitat, providing refuge and breeding habitat for a suite of native fauna. HBTs were abundant within woodland areas. Tree heights ranged from 6 metres to 15 metres with DBH (Diameter at Breast Height) ranging from 30 cm up to 120 cm. Hollows within the trees to be impacted ranged from small (<5cm entrance width) to large (>15cm entrance width).

A total of five threatened fauna species were identified during field surveys, including two species of threatened bird (Superb Parrot and Grey-crowned Babbler), and three species of microbat (Yellow-bellied Sheathtail Bat, Little Pied Bat and Inland Forest Bat).

[1] This classification has been used to describe vegetation communities throughout this report.

2.3 IMPACTS OF THE DEVELOPMENT

Approximately 10 ha of native Poplar Box - Gum-barked Coolabah - White Cypress Pine Shrubby Woodland will be cleared for the project. Anticipated biodiversity impacts during the construction, operation and decommissioning phases of the Nyngan Solar Plant project are summarised in Table 2-1 below (sourced from the Biodiversity Assessment for the project; **ngh**environmental June 2013).

Table 2-1 Potential impacts of the proposed solar plant and transmission line

	Construction and decommissioning	Operation phase
Solar plant		
Flora	• Clearing and disturbance during construction and installation of the array and associated infrastructure. • Total footprint of approximately 300 ha of which 5.7 ha (1.9%) is native Poplar Box Woodland vegetation. • Risk of noxious and environmental weed introduction and spread.	• Microclimate impacts under the PV array (shading, temperature, humidity). • Weed growth and spread.
Fauna	• Clearing of habitat for construction and installation of the solar plant and associated infrastructure (such as tree food sources, tree hollows, rock habitats). Includes loss of habitat connectivity and nest sites. • Potential entrapment of fauna from trenching. • Disturbance to local fauna from noise, light and vibration. • Vehicle collision risks to fauna.	• Loss of or alteration to grassland habitat for macropods, birds, reptiles and insects due to shading, changed microclimate and reduced productivity. • Movement barrier and collision hazard created by perimeter fencing. • Habitat avoidance due to presence of infrastructure. • Vehicle collision risks to fauna.
Transmission line		
Flora	• Clearing and disturbance during establishment of the easement and construction and installation of the line. • Total footprint of approximately 14 ha of which 4.2 ha (30%) is native Poplar Box Woodland vegetation. • Risk of noxious and environmental weed introduction and spread	• Vegetation maintenance within the easement • Weed growth and spread
Fauna	• Clearing of habitat for the transmission line easement (such as tree food sources, tree hollows, rock habitats). Includes loss of habitat connectivity. • Disturbance to local fauna from noise, light and vibration • Vehicle collision risks to fauna	• Movement barrier and collision hazard created by transmission lines • Vehicle collision risks to fauna

3 OFFSET SITE ASSESSMENT METHODOLOGY

In order to offset the impacts identified in Section 2, AGL have identified an Offset Site approximately 10 kilometres south-west of the development site. The selection of the offset area was informed by advice provided to the landowner by the Central West CMA. The NSW OEH was then consulted with regard to the preferred site's potential suitability. The proposed Offset Site is approximately 50 hectares in area. The methods used to assess it biodiversity values are explained in this section. The results are provided in Section 4.

3.1 DESKTOP ASSESSMENT

Prior to field work, the following database searches were carried out to obtain lists of threatened and migratory flora and fauna species that have the potential to occur at the Offset Site:

- The OEH threatened species database was searched in relation to the Canbelego Downs and Bogan - Macquarie sub-regions of the Western Catchment Management Authority (October 2013). This search identified species listed as threatened under the NSW *Threatened Species Conservation Act 1995* (TSC Act).
- The DSEWPC protected matters search tool was used to search an area approximately 10 kilometres in radius from the study area (May 2013). This search identified species listed as threatened or migratory under the Commonwealth *Environment Protection Biodiversity Conservation Act 1999* (EPBC Act)

Habitats for threatened species with the potential to occur at the site were targeted during the field survey to further refine the likelihood of their occurrence.

3.2 FIELD SURVEY

A field survey of the Offset Site was undertaken by a senior ecologist on the 9 October 2013. A total of 10 person hours was spent on the field survey.

3.2.1 Mapping of vegetation types

The majority of the site was traversed either on foot or by vehicle. Dominant species were recorded sufficient to identify the vegetation types present across the site. Boundaries of vegetation types were recorded using a Garmin GPSmap 62s hand held GPS to an accuracy of ±3 metres. Vegetation mapping was completed using ArcGIS v10.0. Waypoints recorded in the field were overlayed onto georectified aerial imagery to determine the spatial location of vegetation type boundaries. Where different vegetation types were evident on the aerial imagery, the boundaries between types were further extrapolated from the field data.

3.2.2 Vegetation condition assessment and establishment of monitoring plots

BioBanking plots were conducted according to the BioBanking Assessment Methodology (BBAM, DECC 2009) to collect baseline data on vegetation structure and quality. The location of the plots is shown on Figure 4-2. In the field, plots were marked using 1650mm star pickets to facilitate the replication of the plots. The ends of the star pickets were painted white to enable easy identification in the field (Figure 3-1).

Star pickets were placed at the start and end of the 50 metre transect required by the BBAM and their coordinates recorded (Table 3-1). To delineate the start point of transects, orange flagging tape was tied to the top of the appropriate picket. The 20 x 20 metre quadrat required by the BBAM was conducted within an area bounded by the first 20 metres of the transect and extending 10 metres either side as shown on Figure 3-2.

Photo points were established at each of the start points of the transects, with views along the length of the transect.

Table 3-1 Coordinates for each of the monitoring plots

	Transect start		Transect end	
Plot name	Easting*	Northing*	Easting*	Northing*
M01	501365.4948	6498409.989	501388.4344	6498371.304
M02	501144.511	6498635.457	501106.7714	6498605.313
M03	500822.2086	6498302.868	500820.4033	6498254.1
M04	501271.0288	6498145.767	501221.3488	6498151.204

* Coordinates are in MGA zone 55 relative to the GDA94 datum

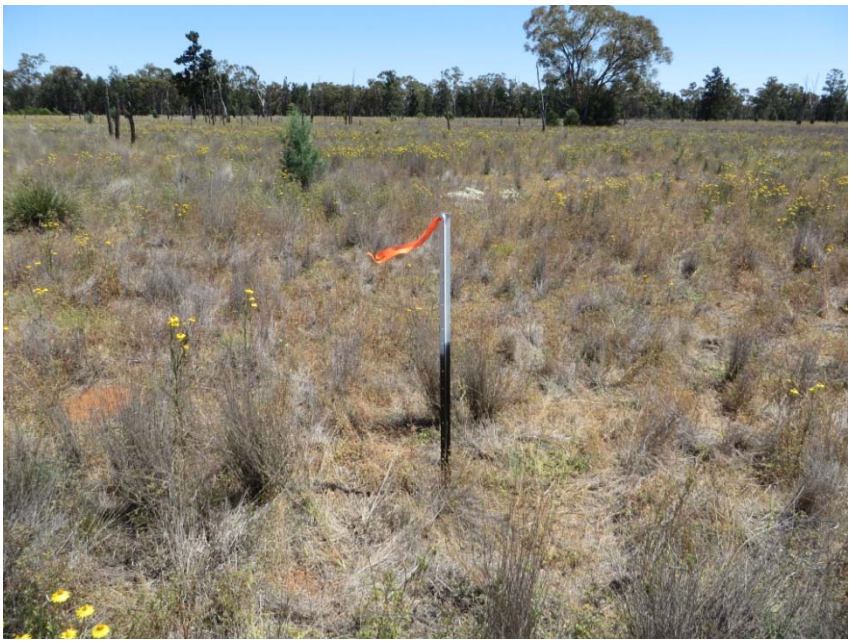

Figure 3-1 Star pickets used to identify the monitoring plots in the field

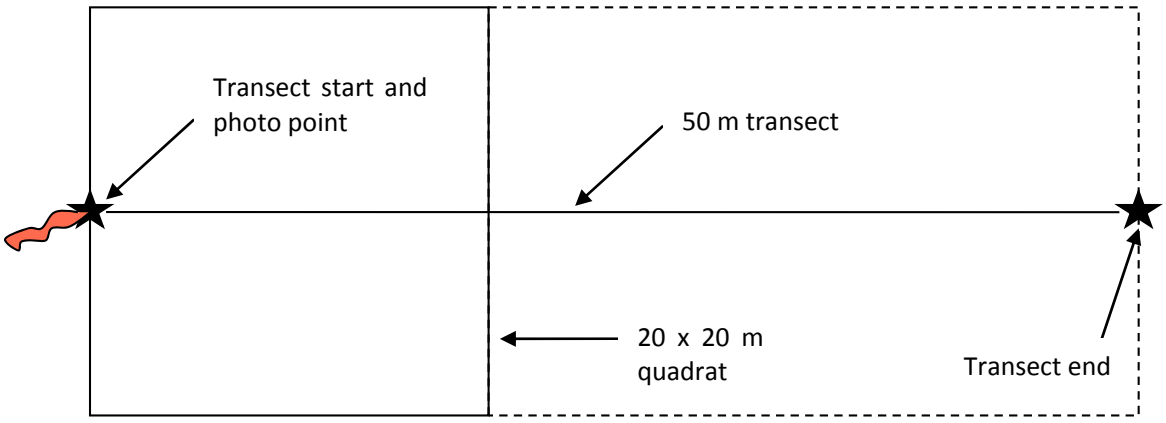

Figure 3-2 Monitoring plot layout

Data evaluation

Data recorded from the BioBanking monitoring plots were compared with the benchmark data for the Poplar Box - Gum-barked Coolabah - White Cypress Pine shrubby woodland community as provided in the BioBanking vegetation types benchmark database (DECC 2008). Monitoring plot data was also entered into the BioBanking Credit Calculator (BBCC) version 2 to obtain a baseline site value score for each of the two dominant vegetation formations at the site. As only two plots were conducted per formation, data from each plot was duplicated (four plots per formation) to achieve the minimum number of plots required by the BBCC given the areas of each formation within the Offset Site (41.55 and 8.55 hectares requiring a minimum of 4 and 3 plots respectively).

3.2.3 Fauna habitat evaluation

General notes on fauna habitats present were taken across the broader site during the site traverses for the vegetation mapping. At each of the monitoring plot locations, detailed notes were taken with regard to the habitats present.

Particular attention was paid to areas that may provide habitat for threatened fauna species listed under the *Threatened Species Conservation Act 1995* (NSW) (TSC Act) or the *Environmental Protection and Biodiversity Conservation Act 1999* (Cwth) (EPBC Act).

3.2.4 Targeted surveys

Flora

Targeted surveys were undertaken for the Pine Donkey Orchid (*Diuris tricolor*) and Red Darling Pea (*Swainsona plagiotropis*) during the foot and vehicle based traverses which covered the majority of the open Cypress Pine woodland within the Offset Site. In addition, foot based random meanders (according to Cropper 1993) were undertaken through the entire area of the White Cypress Pine – Poplar Box woodland targeting these species.

Fauna

Hollow-bearing trees (HBTs) were identified and recorded using a handheld GPS during the random meanders through the White Cypress Pine – Poplar Box woodland. Mature trees were examined from all angles to determine the number, size and structural characteristics of hollows (if present) in each tree. If

hollows were not able to be conclusively identified from the ground, but a tree was bearing structures that were likely to be hollow-bearing, the tree was identified as a 'potential' hollow-bearing tree. Hollow-bearing trees were given a class according to the criteria outlined in Table 3-2 below.

Table 3-2 Hollow-bearing tree quality criteria

HBT class	Criteria
1	Small hollows (<5cm entrance) or fissures present only
2	One or two medium hollows (5 – 15cm entrance) with or without small hollows
3	One or more large hollows (> 15cm entrance) or more than two medium hollows

Active searches were also undertaken throughout the random meander surveys for nests of the threatened Grey-crowned Babbler which was recorded at the development site. The tree canopy was examined in detail for evidence of the stick nests constructed by this species.

Throughout the survey all incidental fauna sightings were recorded.

3.3 LIMITATIONS

3.3.1 Survey timing

The spring timing of the survey was considered suitable for identifying the vegetation types and fauna habitats present at the site and determining the general quality of the site with regard to species diversity. However, prolonged dry weather preceding the survey during late winter and early spring also meant that many plant individuals were dead or stressed (particularly grasses) making them difficult to identify. It is likely that there are species present that were not evident or identifiable during the survey. Weather during the survey was warm with a maximum of 30.5˚C and light to moderate winds which would have maximised fauna activity.

3.3.2 GIS mapping

High resolution georeferenced aerial imagery was not available for mapping. Aerial imagery used for mapping was sourced from Google Earth and then georectified by comparison with georeferenced topographic layers (Topoview 2006) mostly on the basis of the locations of roads and features such as farm dams. As such, there are small discrepancies in the spatial accuracy of the vegetation layer, however this is only relevant if the layer were to be utilised in other GIS environments where georeferenced aerial imagery is available. All mapping as displayed in this document is accurate.

4 OFFSET SITE VALUES

4.1 VEGETATION TYPES

Native vegetation within the Offset Site consists of, or is derived from, a single vegetation type: Poplar Box - Gum-barked Coolabah - White Cypress Pine shrubby woodland (Veg ID 103) (Benson *et al.* 2006). The vegetation also shows characteristics of White Cypress Pine - Poplar Box woodland on footslopes and peneplains (ID 72), particularly with regard to the dominance of White Cypress Pine (*Callitris* glaucophylla) and the presence of particular groundcover species. However, the species composition of the groundcover shows greater affinity for Poplar Box - Gum-barked Coolabah - White Cypress Pine Shrubby Woodland. The Biometric benchmarks for these vegetation types are the same. The dominance of White Cypress Pine may be a factor resulting from past disturbance or altered fire regimes. The conservation status of this vegetation community is listed in Table 4-2.

Table 4-1 Conservation status of vegetation identified within the Offset Site

Vegetation type	Pre-1750 extent (ha)	Extant area (ha)	Reserved in Bioregion (ha)	Reservation status	Cleared (OEH 2012)	Threat category
Vegetation ID 103 Poplar Box - Gum-barked Coolabah - White Cypress Pine shrubby woodland	800,000 ±30%	500,000 ±30% (62.5% of 1750 extent)	12,995 (1.62% of 1750 extent)	Inadequate	10%	Near threatened

Differences in structure and species composition occur across the Offset Site, most likely due to past disturbance and land management which have resulted in two main forms of the community being present:

1. Open White Cypress Pine Woodland
2. White Cypress Pine Poplar Box woodland

A small area (0.66 hectares) dominated by Budda (*Eremophila mitchellii*) also occurs in the east of the site (Figure 4-1). Budda is a common species within the Poplar Box - Gum-barked Coolabah - White Cypress Pine community and dominates this small area possibly due to the removal of other overstorey and or midstorey species (thus eliminating competition) or other past disturbance such as a localised fire. Budda is sometimes considered a woody (native) weed by land owners in the area.

Figure 4-1 Budda dominated area in the east of the Offset Site

The distribution of the forms of Poplar Box - Gum-barked Coolabah - White Cypress Pine shrubby woodland at the site is shown on Figure 4-2. The characteristics and condition of each of the two dominant forms along with the results of the monitoring plots are discussed individually for each form below. The monitoring plot data is presented along with the benchmarks for each vegetation type for comparative purposes. All vegetation within the Offset Site is considered to be in moderate to good condition according to the Biometric definitions (DECC 2009).

A list of species recorded during the survey is provided as Appendix B. Vegetation condition classes are the same as described in the Biodiversity Assessment for the development site (**ngh**environmental June 2013) and are as listed in Table 4-2 below.

Table 4-2 Vegetation condition classes used within the biodiversity assessment for the development site

Condition	Description
Exotic	Groundlayer dominated by exotics (exotics > natives), no native overstorey present.
Poor	Groundlayer dominated by exotics, native overstorey present (>25% of benchmark)
Moderate	Some exotics present in the groundlayer but mostly native dominated (low diversity).
Good	Groundlayer dominated by native species (high diversity), few exotics present.

Figure 4-2 Forms of Poplar Box - Gum-barked Coolabah - White Cypress Pine shrubby woodland within the Offset Site and the location of monitoring plots

4.1.1 Open White Cypress Pine Woodland

This form is the dominant form of vegetation within the Offset Site (41.55 hectares). The overstorey is generally very sparse and comprised of scattered patches of White Cypress Pine with the occasional mature Poplar Box (*Eucalyptus populneus* subsp. *bimbil*). The midstorey is also very sparse and mostly comprised of regenerating White Cypress Pine. Isolated Wilga (*Geijera parvifolia*) and Budda (*Eremophila mitchellii*) individuals also occur. A dense, predominately grassy, understorey is present dominated by Number 9 Wiregrass (*Aristida jerichoensis* var. *subspinulifera*), Corkscrew Grass (*Austrostipa scabra* ssp *falcata*) and Mulga Mitchell Grass (*Thyridolepis mitchelliana*). A relatively high diversity of forbs is also present.

Cut-leaf Medic (**Medicago laciniata*) is a common weed within the groundcover. Other exotic species present include occasional Saffron Thistle (**Carthamus lanatus*) and Milk Thistle (**Sonchus oleraceus*). Although a low diversity of exotic annual species are present, the vegetation is predominately native with a good diversity of groundcover species and considered to be in good condition.

The monitoring plot data along with the benchmarks for this vegetation type (DECC 2008) are shown in Table 4-3. In summary, species richness (which is the number of native species, shown in the table below as 'Native Spp. #') is considerably above the benchmark for this value which may be due to the modified structure of the vegetation. No overstorey or midstorey cover was recorded as these strata have been predominately cleared. Grass cover is well above benchmark which again is likely due to the modified structure of the community. Shrub and other native cover within the ground layer are within benchmark. No hollow bearing trees were recorded given the lack of overstorey trees and that those present within the open woodland were mostly White Cypress Pine, which generally does not form hollows. The amount of fallen timber was variable across the site and the values recorded are indicative of this range although still below benchmark. Overstorey regeneration was observed for White Cypress Pine but not for Poplar Box or Gum-barked Coolabah.

The data from the monitoring plots return a site value score of 64.67 when entered into the BioBanking Credit Calculator.

Table 4-3 Benchmark and monitoring plot data comparison for open White Cypress Pine woodland at the Offset Site

	Native	Native cover				Native ground cover						HBTs	Logs
	Spp. #	Overstorey		Midstorey		Grasses		Shrubs		Other			
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max		
Benchmark	15	3%	22%	0%	30%	5%	30%	2%	10%	2%	30%	0.1	20
Plot M01	28	0%		0%		58%		4%		24%		0	5
Plot M02	29	0%		0%		50%		2%		30%		0	17

Benchmark variables:

Native Spp. #: number of native species (species richness)
HBT: number of hollow bearing trees
Logs: linear length of fallen logs.

Figure 4-3 Open White Cypress Pine woodland at monitoring plot M01 (top) and M02 (bottom)

4.1.2 White Cypress Pine - Poplar Box Woodland

This form occurs as linear strips approximately 45 to 75 metres wide along the western and southern boundaries of the site and occupies approximately 8.5 hectares (Figure 4-4). The overstorey is dominated by White Cypress Pine with mature Poplar Box scattered throughout. In more open areas, Poplar Box is dominant. Gum-barked Coolabah (*Eucalyptus intertexta*) is also present to a lesser extent occurring as occasional individuals. Dense White Cypress Pine recruits form a distinct small tree layer across much of the area.

The midstorey shrub layer is generally sparse and restricted to occasional individuals of Budda, Berrigan (*Eremophila longifolia*) and Sticky Hopbush (*Dodonaea viscosa* subsp. *mucronata*). Climbing saltbush (*Einadia nutans* subsp. *nutans*) is a common low shrub along with Galvanised Burr (*Sclerolaena birchii*), Grey Copperburr (*S. diacantha*) and Eastern Cottonbush (*Maireana microphylla*). The ground cover is patchy and predominately grassy being mostly comprised of Mulga Mitchell Grass, Curly Windmill Grass (*Enteropogon asicularis*), Number 9 Wiregrass and Corkscrew Grass. Native forbs are common but generally sparser than the adjacent open White Cypress Pine woodland.

The exotic forb species London Rocket (**Sisymbrium irio*) dominates the groundcover in patches, generally where White Cypress Pine regrowth is denser. In areas where London Rocket is dominant, native groundcover diversity tends to be lower and these areas are considered to be in moderate condition. Generally a high diversity of species is present in other areas which are considered to be in good condition.

The monitoring plot data along with the benchmarks for this vegetation type (DECC 2008) are shown in Table 4-4. In summary, species richness is above the benchmark for this value. Overstorey cover is at the maximum benchmark value or slightly above it. No midstorey cover was recorded, however this is within the benchmark for this vegetation type. Grass cover is within or slightly above benchmark and shrub and other native cover within the ground layer are within benchmark. Hollow bearing trees are common throughout as is fallen timber and these values exceed the benchmark. Overstorey regeneration was observed for White Cypress Pine but not for Poplar Box or Gum-barked Coolabah.

The data from the monitoring plots return a site value score of 82 when entered into the BioBanking Credit Calculator.

Table 4-4 Benchmark and monitoring plot data comparison for White Cypress Pine – Poplar Box woodland at the Offset Site

	Native	Native cover				Native ground cover						HBTs	Logs
	Spp. #	Overstorey		Midstorey		Grasses		Shrubs		Other			
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max		
Benchmark	15	3%	22%	0%	30%	5%	30%	2%	10%	2%	30%	0.1	20
Plot M03	24	28.5%		0%		32%		6%		10%		2	35
Plot M04	21	22%		0%		18%		10%		6%		1	36

Figure 4-4 White Cypress Pine – Poplar Box woodland at monitoring plot M03 (top) and M04 (bottom)

4.2 WEEDS AND DISTURBANCE

Historically, the site has been utilised for grazing although information from the property owner suggests that grazing has not occurred for many years. Clearing of overstorey and midstorey vegetation has occurred in the past and there is extensive evidence of cut stumps and ring-barked trees particularly within the White Cypress Pine open woodland (Figure 4-5).

Figure 4-5 Evidence of past logging and ring-barking at the site

No noxious weeds were recorded within the Offset Site. Common weeds such as Saffron Thistle and Milk Thistle were widespread across the more open areas of the site in low numbers. Cut-leaf Medic formed a common component of the groundcover particularly in more disturbed areas (Figure 4-6). London Rocket formed patchy dense swathes within the denser woodland seemingly with a preference for the more shaded areas. All of these weeds are annual species that would not be present at other times of the year.

There was extensive evidence of feral pig activity across the site (Figure 4-6). A large male was disturbed from undergrowth during the survey within the White Cypress Pine Poplar Box woodland. Numerous European Rabbits were also observed across the site.

Figure 4-6 Evidence of feral pig activity at the site and dense colonisation of pig disturbed areas by Cut-leaf Medic (right)

4.3 FAUNA HABITATS

The dominant fauna habitat at the site consists of sparse open woodland with a dense grassy groundcover. Habitat values with this habitat type are limited. Scattered fallen timber occurs variably across the area (Figure 4-7) and may provide shelter for a range of small ground dwelling mammals and reptiles. The open nature of the habitat and scattered dead and living trees provides foraging opportunities for birds of prey. A single Nankeen Kestrel was observed perching within a White Cypress Pine during the survey.

Figure 4-7 Fallen timber within the open and denser woodland habitats at the site

The denser woodland along the western and southern boundaries of the site provides a range of habitat values. Fallen timber is abundant (Figure 4-7) and the regular dense to open overstorey provides nesting and roosting opportunities for a range of woodland birds. Numerous mature Poplar Box and Gum-barked Coolabah trees are hollow-bearing (Figure 4-8). The distribution of hollow-bearing trees at the site is shown on Figure 4-9. Details for each tree are provided in Appendix C. The majority of the hollow-bearing trees support large and medium sized hollows which provide habitat for a wide range of bats, woodland birds, owls and arboreal mammals such as gliders.

No rocky habitats are present at the site.

Figure 4-8 Examples of hollow-bearing trees at the site

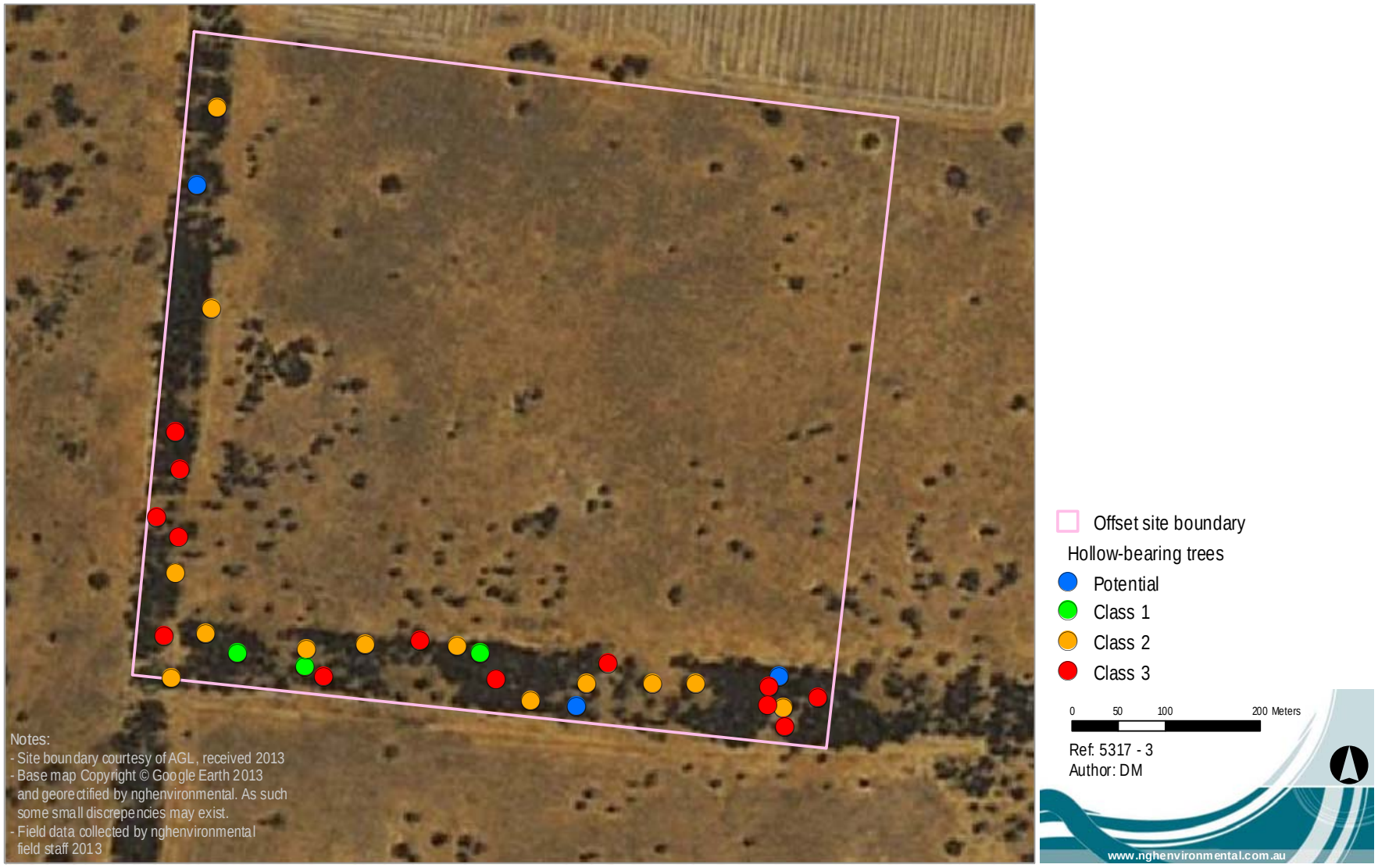

Figure 4-9 Hollow-bearing trees recorded at the Offset Site

4.4 HABITAT CONNECTIVITY

The proposed Offset Site is located adjacent to a larger area of more continuous native vegetation to the west. Management of the offset will contribute to the biodiversity values of this larger area by ultimately providing a connected adjacent area with high habitat values. Linear corridors containing connected vegetation extend to the north, east and south of the proposed Offset Site and the proposed offset will enhance sections of the corridors to the north and east and provide a refuge between these corridors.

A farm dam is located approximately 750 metres east of the north-east corner of the proposed offset which also has some more intact native vegetation surrounding it. Farm dams provide an important water source for native fauna in semi-arid environments. The proposed offset will enhance connectivity between the dam and the more extensive native vegetation to the west.

4.5 HABITAT FOR THREATENED SPECIES

The results of the database searches and field studies at the Offset Site were considered to determine what habitats may be available for threatened species and communities. Table 4-5 lists the threatened species known to occur within the Canbelego Downs and Bogan – Macquarie sub-regions of the Western CMA for which there is suitable habitat within the Offset Site and which may occur given the proximity of nearest records. Conspicuous flora species not detected during the survey of the Offset Site have not been included. No threatened ecological communities are considered to occur at the site.

Table 4-5 Threatened species of the Canbelego Downs and Bogan- Macquarie sub-regions, which have habitat requirements met by the Offset Site

Common Name	Scientific name	Status	Likelihood of occurrence
Flora			
Pine Donkey Orchid	*Diuris tricolor*	Vulnerable (TSC Act)	Low
Red-darling Pea	*Swainsona plagiotropis*	Vulnerable (TSC & EPBC Acts)	Low
Birds			
Bush Stone-curlew	*Burhinus grallarius*	Endangered (TSC Act)	Low
Red-tailed Black-Cockatoo (Inland subspecies)	*Calyptorhynchus banksii samueli*	Vulnerable (TSC Act)	Moderate
Pied Honeyeater	*Certhionyx variegatus*	Vulnerable (TSC Act)	Moderate
Speckled Warbler	*Chthonicola sagittata*	Vulnerable (TSC Act)	Low
Spotted Harrier	*Circus assimilis*	Vulnerable (TSC Act)	Moderate
Varied Sittella	*Daphoenositta chrysoptera*	Vulnerable (TSC Act)	Moderate
Grey Falcon	*Falco hypoleucos*	Endangered (TSC Act)	Moderate
Black-breasted Buzzard	Hamirostra melanosternon	Vulnerable (TSC Act)	Low
Little Eagle	Hieraaetus morphnoides	Vulnerable (TSC Act)	Moderate
Pink Cockatoo	*Lophochroa leadbeateri*	Vulnerable (TSC Act)	Moderate
Square-tailed Kite	*Lophoictinia isura*	Vulnerable (TSC Act)	Moderate
Turquoise Parrot	*Neophema pulchella*	Vulnerable (TSC Act)	Low

Common Name	Scientific name	Status	Likelihood of occurrence
Flame Robin	*Petroica phoenicea*	Vulnerable (TSC Act)	Low
Superb Parrot	*Polytelis swainsonii*	Vulnerable (TSC & EPBC Acts)	Low
Grey-crowned Babbler (eastern subspecies)	*Pomatostomus temporalis temporalis*	Vulnerable (TSC Act)	High
Diamond Firetail	*Stagonopleura guttata*	Vulnerable (TSC Act)	Low
Masked Owl	*Tyto novaehollandiae*	Vulnerable (TSC Act)	Low
Mammals			
Little Pied Bat	*Chalinolobus picatus*	Vulnerable (TSC Act)	Moderate
South-eastern Long-eared Bat	*Nyctophilus corbeni*	Vulnerable (TSC & EPBC Acts)	Moderate
Yellow-bellied Sheathtail-bat	*Saccolaimus flaviventris*	Vulnerable (TSC Act)	Moderate
Inland Forest Bat	*Vespadelus baverstocki*	Vulnerable (TSC Act)	Moderate
Striped-faced Dunnart	*Sminthopsis macroura*	Vulnerable (TSC Act)	Low

Targeted searches for the Pine Donkey Orchid and Red-darling Pea did not detect these species within the Offset Site. The timing of the survey was considered suitable and it is therefore considered unlikely that they occur. No other threatened flora species were detected during the survey.

One threatened fauna species was detected during the survey. A group of five Grey-crowned Babblers were observed crossing the south-west corner of the Offset Site. Targeted searches failed to locate any nests of this species and it is considered unlikely that they are utilising the site for breeding. This may be due to an abundance of Noisy Miners at the site and this is discussed more in Section 4.6 below.

The other species listed in Table 4-5 also have the potential to occur at the site, although no surveys have been specifically conducted to identify these species and their presence or absence cannot be confirmed. The likelihood of these species to occur at the site has been provided in Table 4-5 based on habitat quality and structure at the site.

4.6 KEY THREATS TO BIODIVERSITY VALUES

The vegetation and habitats at the site have been subject to modification due to a range of disturbances including past clearing and grazing. Two key threatening processes are currently in operation that pose a risk to biodiversity values at the site:

- Predation, habitat degradation, competition and disease transmission by feral pigs
- Aggressive exclusion of birds from woodland and forest habitat by abundant Noisy Miners

Feral pig activity was widespread at the site and one individual was observed. Within open areas across the site, common weeds such as Cut-leaf Medic and Saffron Thistle were colonising areas disturbed by pigs. It is likely that pigs are also preying on native fauna.

Noisy Miners were abundant at the site and were observed actively hunting other birds away from occupied areas. The Noisy Miner favours open, lightly timbered areas and habitat edges (NSW SC 2013) so has likely benefitted from the past clearing at the site and linear strips of vegetation along the western and

southern boundaries. Reducing the edge effects by increasing the general density of vegetation across the more open areas may counteract this effect by reducing the preferred habitat of Noisy Miners. It would also provide additional habitat for other native bird species to compete with Noisy Miners. Re-introducing nectar producing shrubs would also attract a greater diversity of native bird species.

The Grey-crowned Babbler is listed as a species that may be adversely affected by Noisy Miners (NSW SC 2013). Although they were detected on the site, no Grey-crowned Babbler nests were observed despite suitable habitat similar to that at the development site where numerous nests were detected. It is possible that Noisy Miners are preventing Grey-crowned Babblers from breeding at the Offset Site.

Additionally, indirect impacts such as the exclusion of fire may also be impacting on the structure of vegetation communities at the site. Anecdotal evidence from the landowner suggests that a fire event may not have occurred at the site for up to 150 years. Extensive regeneration of White Cypress Pine was observed (a fire sensitive species) while no regeneration of the two Eucalypt species was seen (which may be promoted by fire). Fire may also promote diversity within the midstorey and groundcover strata and assist in controlling weeds.

Predation by feral cats and foxes may also be impacting on populations of native fauna with both species recorded in the local area.

The issues identified above form the focus for the management measures recommended in Section 5.2 of this report.

5 SECURITY AND MANAGEMENT OF THE OFFSET SITE

5.1 IN PERPETUITY SECURITY

A Conservation Property Vegetation Plan (CPVP) will be implemented by AGL. The CPVP will include management actions associated with the offset area that will apply in perpetuity. It is the intention of this report to detail management actions that will be carried over into the CPVP (specified in Section 5.2 below).

To ensure that the CPVP is binding on successors in title, an abstract of the CPVP will be registered with the NSW Office of Land and Property Information under the *Real Property Act 1900.* The CPVP will be a legally binding agreement under both the *Native Vegetation Act 2003* and the *Threatened Species Conservation Act 1995*. The terms of the CPVP will not be affected by any changes to local or state planning rules or new listings of threatened species. A CPVP can be varied at the landholder's request, provided the variation will still improve or maintain environmental outcomes.

As the CPVP is attached to the land title, the landowner is ultimately responsible for funding the management actions required at the Offset Site and monitoring the effectiveness of their implementation. However the Proponent will take responsibility for management and will ensure the landowner has sufficient resources and information to implement the management actions for the operational life of the solar plant as this forms a condition of the solar plant's consent.

Even though a CPVP is binding in perpetuity, it is acknowledged that there is less incentive to manage the Offset Site after the decommissioning of the solar plant. Therefore, it is proposed that the bulk of the management actions be focused in the early years of the project.

5.2 MANAGEMENT MEASURES

Offset site management measures are outlined in Table 5-1. These measures aim to result in an improvement in the biodiversity values of the site and are designed to be adaptive, informed by the monitoring regime outlined in Section 5.2. These management measures will be incorporated into a management plan for the Offset Site. The management plan will be prepared prior to establishment of the Offset Site. The removal of any timber, fallen logs or rocks will also be prohibited within the Offset Site.

All management measures will be the responsibility of, and funded by, AGL. At the end of the operational life of the solar plant, the ongoing management will be the responsibility of the landowner. It is expected that by this time the majority of the required management actions will have been undertaken and ongoing management tasks will largely coincide with routine agricultural activities. Land use restrictions will remain in place on the Offset Site so that any activities undertaken on the Offset Site must be compatible with the site's overall function as a conservation area.

Table 5-1 Offset site management measures

Management measure	Objective	Justification	Action	Timing
Prior to establishment				
Validate offset area	To ensure that offsets are appropriate for the actual impacts of the development	The current offset area is based on an estimation of impacts. Impacts may differ from those estimated. Offsets need to be adequate to offset the final impacts.	• Validate the area impacted by construction to ensure that the actual, not estimated, impacted area is offset.	• Prior to establishment of Offset Site
General measures				
Exclusion of stock	To prevent overgrazing and encourage regeneration of native vegetation	The Offset Site has not been subject to grazing for a number of years. Reintroduction of grazing would be likely to degrade habitat.	• Install stock proof fencing around the perimeter of the Offset Site.	• At establishment of the Offset Site. • Ongoing repairs as required.
Weed control	To minimise the occurrence of weeds within the Offset Site particularly Weeds of National Significance (WoNS) and listed noxious weeds.	Weeds compete with native species and degrade habitats. The Offset Site has occurrences of common weeds that have the potential to be invasive.	• Survey to identify target locations for weed control. • Weed control using appropriate methodologies considering target species and landscape context.	• At establishment of the Offset Site. • Ongoing as required.
Exclusion of feral pigs	To exclude feral pigs.	Feral species can degrade habitat, compete for resources with native fauna and introduce disease.	• Install and maintain preventative fencing suitable for the target species. • Remove pigs (by trapping or other means) if detected within the Offset Site.	• At establishment of the Offset Site. • Ongoing as required.

Management measure	Objective	Justification	Action	Timing
Cat and/or fox control	To minimise the presence of cats and foxes within the Offset Site.	Predation by cats and foxes can have serious impacts on the populations of native fauna, particularly threatened species.	• Monitor for presence of cats and foxes. • Conduct baiting or trapping if cats or foxes are detected within the offset area. • Where possible, coordinate baiting or trapping with adjacent landowners to maximise effects	• Consideration given to action on the basis of monitoring results.
Rabbit control	To minimise the risk of the Offset Site becoming a refuge for rabbits.	Increased rabbit numbers can reduce native regeneration and support higher numbers of pest animals such as cats and foxes. Overgrazing by herbivores can prevent the successful ongoing establishment and persistence of native vegetation and lead to degradation.	• Monitor for presence of rabbits. • Conduct baiting or controlled grazing to reduce the ability of the site to act as a refuge to rabbits. • Where possible, coordinate baiting with adjacent landowners to maximise effects	• Consideration given to action on the basis of monitoring results.
Monitoring	To determine the effectiveness of management measure	Monitoring is required to determine whether current management is appropriate and to inform ongoing management.	• Conduct monitoring as detailed in Section 5.3 of this report • Adapt management measures where required	• Annually

Management measure	Objective	Justification	Action	Timing
Specialised measures				
Adapt measures to resident native fauna	To ensure that resident native fauna are not adversely impacted by management actions.	While monitoring is restricted to vegetation and habitat parameters and will not include fauna survey, evidence of fauna activity may be detected. Some actions such as weed spraying may adversely affect resident fauna (e.g., ground nesting birds. In these cases, actions should be adapted (postponed or excluded from certain areas) to avoid adverse impacts.	• If resident native fauna may be impacted by management actions, adapt actions as required to address the risk of impact.	• Ongoing as required.

5.3 MONITORING AND REPORTING

Monitoring plots have been established at the site as described in Section 3. It is recommended that the methodologies undertaken in this report be repeated at these sites annually. As a part of monitoring surveys, the locations and extent of weeds across the entire site will also be recorded. Surveys will be conducted to determine the presence of cats, foxes, rabbits and feral pigs. Consideration will be given to control methods in coordination with broader control programs on adjacent land and in the local area. Fences will be inspected and maintenance carried out if required.

The Offset Site monitoring, management actions and their outcomes will be reported annually to the Department of Planning and Infrastructure for the duration of the project (up to 30 years) to demonstrate that a 'maintain or improve' outcome has been met. The report will also be submitted to OEH. Management measures may be altered to reflect the results of monitoring. A decision to reduce or continue annual reporting may also be made by DPI or OEH following submission of each report.

6 ADDITIONAL COMPENSATORY MEASURES

Although the proposed offset site contains vegetation suitable for breeding and foraging for Grey-crowned Babblers and a group were recorded at the proposed offset site, no evidence of the use of the site for breeding by this species (evidenced by active or old nests) was detected. As discussed in Section 4.6, Noisy Miners may be preventing Grey-crowned Babblers from breeding at the site. It is uncertain whether improvements in the Offset Site resulting from management over time will reduce the adverse effects of Noisy Miners and whether the site can adequately compensate for the loss of Grey-crowned Babbler breeding habitat at the development site.

It is a condition of approval for the project that visual screening be provided along the southern boundary of the solar plant site to reduce visual impacts. It is proposed to incorporate the provision of visual screening with habitat restoration of approximately 5 hectares of farmland at the development as an additional compensatory measure. In the long-term this will provide additional habitat for the Grey-crowned Babbler in the immediate area where habitat is being lost and where the species is known to occur and breed. A Landscape Plan has been prepared for the project (First Solar 2013) and planting would be undertaken as outlined in this plan. The area proposed to be revegetated is shown on Figure 6-1. Key features of the plan are summarised below. Measures, additional to the landscape plan, that have the objective of enhancing habitat for the Grey-crowned Babbler are also included below (see section 6.4).

6.1 SPECIES TO BE PLANTED

Species to be planted are those which are native to the Nyngan area and found on the development site. The Landscape Plan lists a number of suitable species. These and the recommended planting densities are listed in Table 6-1.

Table 6-1 Species recommended for revegetation activities within the development site

Stratum	Suitable species	Suggested planting density
Trees and tall shrubs	*Acacia excelsa* *Acacia melvillei* *Callitris glaucophylla* *Capparis mitchellii* *Eremophila mitchellii* *Eucalyptus intertexta* *Geijera parviflora* *Hakea tephrosperma* *Eucalyptus populnea* ssp *bimbil*	Approximately 3m spacing in rows spaced a minimum of approximately 3m apart. Trees and tall shrubs would be alternated with shrubs and sub-shrubs
Shrubs and sub-shrubs	*Dodonaea viscosa* subsp. *mucronata* *Eremophila longifolia* *Senna* form taxon *'zygophylla'*	

6.2 PLANTING METHODS

The Landscape Plan proposes the use of tubestock to maximise the chances of planting success. Tube stocks should be planted in a hole slightly longer than the root mass and potting mix. Soil should then be placed over the potting mix to prevent rapid drying after planting. For weed control, anchored jute matting should

be used around the seedling. Matting also helps to conserve soil moisture, improves water infiltration and soil structure, and moderates soil temperatures, thereby improving plant growth. Contact between the matting and the seedling should be avoided to minimise the risk of collar rot, although this is not likely to be a high risk at Nyngan. The use of tree guards is also recommended, as they protect against grazing by wildlife and pests such as rabbits and hares, as well as providing protection from drying winds. Standard plastic sleeve guards held away from the seedling by three stakes would be utilised as far as practicable to protect new plantings. Landscape plantings would be enclosed within a stock proof fence where practicable to protect the new plantings from larger grazing herbivores including wildlife and livestock.

6.3 MAINTENANCE

Maintenance of the plantings would be conducted for approximately two years. Key maintenance activities described in the Landscape Plan include:

- Regular checks of fences to ensure stock do not gain access.
- Checks of tree guards to ensure they are correctly in place and/or undamaged. Tree guards should be removed when plants are well established and at a stage where the viability of the plant will not be compromised by pest animal activity.
- Rainfall and soil moisture levels should be monitored for the first six months. If necessary young plants should be watered if it becomes very dry. However, if the conditions are good at the time of planting additional watering can be minimised.
- Checks for weed competition. Spot spraying of weeds with selective herbicides would be undertaken if weeds start to overpower seedlings. The need for weed spraying will be minimised as far as practicable with pre-planting site preparation.
- Checks for evidence of browsing by wildlife such as hares and wallabies. Additional measures to prevent browsing should be employed. Measures may include wire cages or branches strategically placed around seedlings.
- Unviable plants should be replaced as soon as practicable e.g. after the first autumn rains or in the following spring.

6.4 ADDITIONAL MEASURES TO ENHANCE HABITAT VALUES

In addition to the planting outlined in the management plan the following measures will also be implemented to enhance the habitat values of the planted area for Grey-crowned Babblers:

- Where possible, tubestock and seed used for revegetation would be of local provenance.
- Stock would be excluded from the revegetation area for the life of the solar plant.
- Groundcover revegetation would be conducted focusing on establishing a grassy understorey suitable for foraging by the Grey-crowned Babbler. It is proposed to utilise grass species that are known to occur on the site and are considered suitable for revegetation as outlined in Table 6-2.
- Larger logs that are cleared from other activities within the development site would be placed within the revegetation area to provide additional habitat features.
- Ongoing weed control within the revegetation area would be carried out as described for the development site in the projects Operational Environmental Management Plan.

Table 6-2 Species to be utilised in groundcover revegetation activities

Stratum	Suitable species	Suggested planting density
Groundcover (direct seeding)	*Austrostipa scabra* ssp *falcata* *Austrostipa verticillata* *Bothriochloa macra* *Chloris ventricosa* *Digitaria brownii* *Enteropogon acicularis* *Leptochloa digitata* *Panicum laevinode* *Themeda australis* *Thyridolepis mitchelliana*	3 kilograms of seed per hectare

6.5 MONITORING AND REPORTING

Monitoring of the success of the plantings conducted as part of the Landscape Plan would be conducted monthly until the end of the construction phase as outlined in the Landscape Plan. Monitoring of the habitat values of the revegetation area and reporting would occur annually in conjunction with the monitoring and reporting requirements for the offset site. The aim of monitoring would be to determine whether the area was being utilised by Grey-crowned Babblers and to identify any factors that may be limiting habitat values. During each monitoring period the revegetation area would be searched for the presence of Grey-crowned Babbler nests and the number of individual birds within the area recorded. Survey effort would be consistent for each monitoring event to facilitate accurate comparisons. Additional measures that may improve habitat values would be identified if considered necessary and included as recommendations within the report.

In conjunction with the monitoring conducted for the Offset Site, the results of monitoring of the revegetation area will be reported annually to the Department of Planning and Infrastructure for the duration of the project (up to 30 years) and also submitted to OEH. Management measures may be altered to reflect the results of monitoring. A decision to reduce or continue annual reporting may also be made by DPI or OEH following submission of each report.

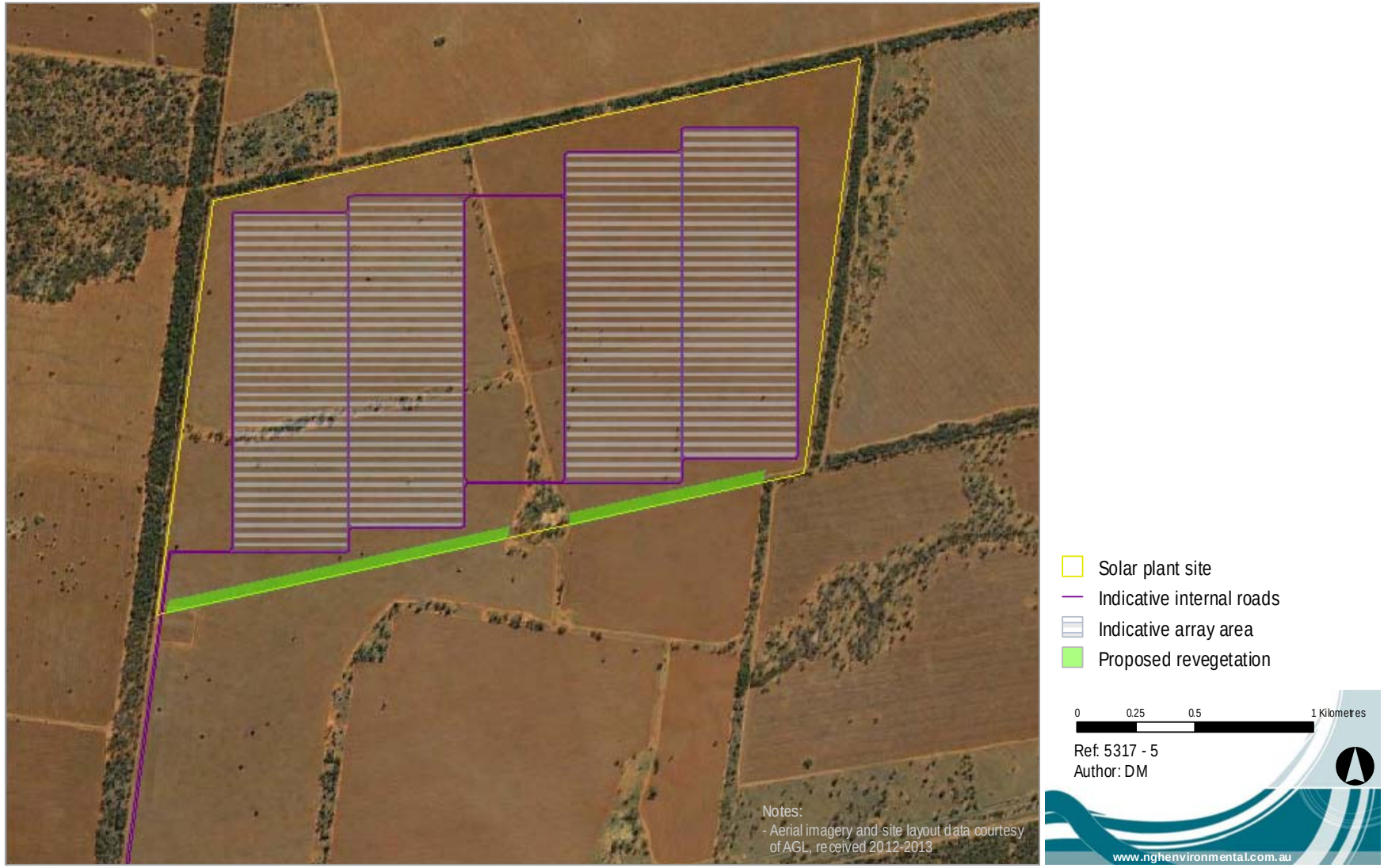

Figure 6-1 Proposed revegetation area within the development site

7 SUITABILITY OF PROPOSED OFFSETS

The proposed Offset Site and additional compensatory measures provide a 'like for like' offset with respect to the vegetation type and threatened species habitats that are to be impacted by the development. Overall the proposed offset presents a 1:5 area impacted to area offset ratio. The Offset Site contains 29 hollow-bearing trees and three that are likely to be hollow-bearing, providing a ratio of approximately 1:3 hollow-bearing trees impacted to offset. The majority of the hollow-bearing trees within the Offset Site are considered to be of high quality.

Opportunities exist for improvement with appropriate management of the Offset Site. Recommended management measures have been outlined in Section 5 along with a monitoring regime to determine whether the objectives are being met. A gain in the biodiversity value of the site is anticipated which would meet the 'maintain or improve' standard. With appropriate management, the proposed offset is considered to meet the *Principles for Biodiversity Offsets in NSW*. A detailed assessment against these principles is provided as Appendix C.

The proposed offset is considered to be suitable on the basis of the vegetation types and habitats it conserves, the potential improvements to be realised and consistency with NSW offset principles. The conservation status of the Offset Site will be attached to the title of the land which will ensure that the biodiversity values of the site will be enhanced, maintained and protected for the long-term.

The additional compensatory measures at the development site aim to actively restore degraded farmland to be representative of the surrounding native vegetation which is being impacted by the development. In the long-term this is intended to provide additional habitat for the Grey-crowned Babbler in the immediate area where habitat is being lost and where the species is known to occur and breed. A monitoring regime has been proposed to determine whether these objectives are being met. Combined with the Offset Site, these additional measures form a Biodiversity Offset Package which is considered adequate to offset the residual impacts of the Nyngan Solar Plant development.

8 REFERENCES

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APPENDIX A BIODIVERSITY OFFSET MANAGEMENT PLAN - CONDITION OF APPROVAL C5

C5. Following final design and prior to the commencement of construction, or as otherwise agreed to by the Director-General, the Proponent shall develop and submit a Biodiversity Offset Management Package for the approval of the Director-General. The package shall detail how the ecological values lost as a result of the Project will be offset. The Biodiversity Offset Management Package shall be developed in consultation with the OEH and shall (unless otherwise agreed by the Director-General) include, but not necessarily be limited to:

(a) an assessment of all native vegetation communities and threatened species habitat supported by a suitable metric method (such as the Biobanking Assessment Methodology) that will either be directly or indirectly impacted by the proposal;

(b) the objectives and biodiversity outcomes to be achieved (including 'improve or maintain' biodiversity values), and the adequacy of the proposed offset considered;

(c) the final suite of the biodiversity offset measures selected and secured including but not necessarily limited to;

> *i) an offset proposal which is supported by a suitable metric method (such as the Biobanking Assessment Methodology);*
>
> *ii) details of the relative condition and values of communities on the offset site in comparison to those to be impacted, including all areas of native shrubland in moderate to good condition;*
>
> *iii) proposed management actions and expected gains;*

(d) the monitoring requirements for compensatory habitat works and other biodiversity offset measures proposed to ensure the outcomes of the package are achieved, including:

> *i) the monitoring of the condition of species and ecological communities at offset locations;*
>
> *ii) the methodology for the monitoring program(s), including the number and location of offset monitoring sites, and the sampling frequency at these sites;*
>
> *iii) provisions for the annual reporting of the monitoring results for a set period of time as determined in consultation with the OEH;*

(e) timing and responsibilities for the implementation of the provisions of the Package.

Land offsets shall be consistent with the Principles for the use of Biodiversity Offsets in NSW (NSW Office of Environment and Heritage, June 2011). Any land offset shall be enduring and be secured by a conservation mechanism which protects and manages the land in perpetuity. Where land offsets cannot solely achieve compensation for the loss of habitat, additional measures shall be provided to collectively deliver an improved or maintained biodiversity outcome for the region.

Where monitoring referred to in condition (d) indicates that biodiversity outcomes are not being achieved, remedial actions shall be undertaken to ensure that the objectives of the Biodiversity Offset Package are achieved.

APPENDIX B SPECIES RECORDED DURING SURVEYS

B.1 FLORA SPECIES LIST

Relative abundance is given by a cover abundance scale (modified Braun-Blanquet):

1 1 to a few individuals present, less than 5% cover

2 many individuals present, but still less than 5% cover

3 5 - < 20% cover

4 20 - < 50% cover

5 50 - < 75% cover

6 75 - 100% cover

Cover/abundance scores relate to representative quadrats within monitoring plots. For the broader site, cover/abundance is not given as the entire site was not surveyed in detail. Presence of species additional to those recorded within the quadrats is indicated by an 'X'.

*Introduced species are preceded by an asterisk. Where it was not possible to identify a species to specific level, the genus is listed followed by 'sp.' (species). Where uncertainty exists, the taxon is preceded by a question mark '?'.

Scientific name	Common name	Family	Abundance				
			M01	M02	M03	M04	Broader site
TREES							
Callitris glaucophylla	White Cypress Pine	Cupressaceae	1		3	4	
Eremophila mitchellii	Budda	Myoporaceae					X
Eucalyptus intertexta	Inland Red Box	Myrtaceae					X
Eucalyptus populnea ssp *bimbil*	Bimble Box	Myrtaceae	1		1	1	
Geijera parviflora	Wilga	Rutaceae					X
Hakea tephrosperma	Hooked Needlewood	Proteaceae					X
SHRUBS, SUB-SHRUBS							
Dodonaea viscosa ssp *mucronata*	Broad-leaf Hopbush	Sapindaceae				1	
Einadia nutans subsp. *nutans*	Climbing Saltbush		1		2	2	
Enchylaena tomentosa	Ruby Saltbush	Chenopodiaceae			2		
Eremophila longifolia	Emubush	Myoporaceae			1		
Maireana microphylla	Eastern Cottonbush	Chenopodiaceae			1		
?Melhania oblongifolia		Malvaceae		1			

Scientific name	Common name	Family	Abundance				
			M01	M02	M03	M04	Broader site
Sclerolaena birchii	Galvanised Burr	Chenopodiaceae		1		2	
Sclerolaena convexula		Chenopodiaceae					X
Sclerolaena diacantha	Grey Copperburr	Chenopodiaceae		1	2	1	
FERNS							
Cheilanthes sieberi ssp *sieberi*	Rock or Mulga Fern	Sinopteridaceae	1				
VINES AND TWINERS							
Convolvulus recurvatus ssp. *recurvatus*	Bindweed	Convolvulaceae	1	1	1		
Parsonsia eucalyptophylla	Gargaloo	Apocynaceae				1	
Rhyncharrhena linearis	Purple pentatrope	Apocynaceae					X
FORBS							
Abutilon halophilum	Plains Lantern-bush	Malvaceae		1			
Actinobole uliginosum	Flannel Cudweed	Asteraceae	2	2			
**Asphodelus fistulosus*	Wild Onion	Asphodelaceae					X
Brunoniella australis	Blue Trumpet	Acanthaceae				2	
Calotis cuneifolia	Purple Burr-daisy	Asteraceae	2	2			
Calotis lappulacea	Yellow Burr-daisy	Asteraceae	2	2			
**Carthamus lanatus*	Saffron Thistle	Asteraceae	1	1			
Chamaesyce drummondii	Caustic Weed	Euphorbiaceae	1				
Chrysocephalum apiculatum	Yellow Buttons	Asteraceae	3	2			
Daucus glochidiatus	Native Carrot	Apiaceae	3	3	1		
Dianella longifolia var. *longifolia*		Phormiaceae			1		
Erodium crinitum	Blue Storksbill	Geraniaceae	1	2		1	
Euchiton sphaericus	Cudweed	Asteraceae	1				
Goodenia cycloptera	Serrated Goodenia	Goodeniaceae	2	2	1		
Harmsiodoxa blennodioides		Brassicaceae	2	2		2	
*?*Hypochaeris microcephalum* ssp. *albiflora*		Asteraceae				1	
**Medicago laciniata*	Cut-leaf Medic	Fabaceae	2	3	2	2	
Plantago cunninghamii		Plantaginaceae		1			
Portulaca oleracea	Purslane, Pigweed	Portulacaceae					X
Ptilotus sessilifolius	Crimson Foxtail	Amaranthaceae			2	1	

Scientific name	Common name	Family	Abundance				
			M01	M02	M03	M04	Broader site
Ptilotus obovatus		Amaranthaceae					X
Ptilotus polystachyos	Long-tails	Amaranthaceae		1			
Rhodanthe corymbiflora	Small White Sunray	Asteraceae	2	2			
Rostellularia adscendens var. *pogonanthera*	Pink Tongues	Acanthaceae			2	2	
Sida corrugata	Corrugated Sida	Malvaceae		2		2	
**Sisymbrium irio*	London Rocket	Brassicaceae			2	3	
Solanum esuriale	Quena	Solanaceae		1	2		
**Sonchus oleraceus*	Milk Thistle	Asteraceae	1			1	
Stuartina muelleri	Spoon Cudweed	Asteraceae			2		
Vittadinia gracilis		Asteraceae	1	2			
Vittadinia ?pustulatum	Fuzzweed	Asteraceae		1			
Wahlenbergia communis	Tufted Bluebell	Campanulaceae	2				
Wahlenbergia graniticola		Campanulaceae	1	1			
Wahlenbergia sp.		Campanulaceae		2			
Xerochrysum bracteatum	Paper Daisy	Asteraceae	2	2	1	1	
GRASSES							
Aristida behriana	Brush Wiregrass	Poaceae				1	
Aristida jerichoensis var. *subspinulifera*	Number 9 Wiregrass	Poaceae	3	3	2	2	
Austrodanthonia setacea	Small-flowered Wallaby Grass	Poaceae					X
Austrostipa scabra ssp *falcata*	Corkscrew Grass	Poaceae	3	3	2	2	
Austrostipa verticillata	Slender Bamboo Grass	Poaceae					X
Chloris truncata	Windmill Grass	Poaceae					X
Cymbopogon refractus	Barbed Wire Grass	Poaceae					X
Digitaria brownii	Cotton Panic Grass	Poaceae					X
Elymus scaber	Wheat Grass	Poaceae	2	2			
Enteropogon acicularis	Curly Windmill Grass	Poaceae			2	2	
?Microlaena stipoides	Weeping Grass				1		
Panicum decompositum	Pepper Grass	Poaceae					X
Themeda australis	Kangaroo Grass	Poaceae	1				
Thyridolepis mitchelliana	Mulga Mitchell Grass	Poaceae	2	2	2	2	

Scientific name	Common name	Family	Abundance				
			M01	M02	M03	M04	Broader site
GRAMINOIDS							
Lomandra effusa	Scented Mat-rush	Lomandraceae		1			

B.2 FAUNA SPECIES LIST

Common Name	Scientific Name	Sighting
Birds		
Apostlebird	*Struthidea cinerea*	Observed
Australian Magpie	*Cracticus tibicen*	Observed
Australian Raven	*Corvus coronoides*	Observed
Blue Bonnet	*Northiella haematogaster*	Observed
Crested Pigeon	*Ocyphaps lophotes*	Observed
Galah	*Eolophus roseicapillus*	Observed
Grey-crowned Babbler	*Pomatostomus temporalis temporalis*	Observed
Little Corella	*Cacatua sanguinea*	Observed
Nankeen Kestrel	*Falco cenchroides*	Observed
Noisy Miner	*Manorina melanocephala*	Observed
White-winged Chough	*Corcorax melanorhamphos*	Observed
Willie Wagtail	*Rhipidura leucophrys*	Observed
Mammals		
Eastern Grey Kangaroo	*Macropus giganteus*	Observed
*European Rabbit	*Oryctolagus cuniculus*	Observed
*Feral Pig	*Sus scrofa*	Observed
Reptiles		
Sand Goanna	*Varanus gouldii*	Observed

APPENDIX C HOLLOW-BEARING TREE REGISTER

Easting	Northing	Species	Features	Class	DBH (mm)
6498139	501602.3	Eucalyptus intertexta	Several small spouts	1	1000
6498109	501594.8	Eucalyptus populnea	1 medium spout near trunk	2	1600
6498137	501513.9	Eucalyptus populnea	1 large spout several small	3	900
6498106	501479.3	Eucalyptus populnea	3 medium spouts	3	900
6498127	501477.6	Eucalyptus populnea	1 large fissure	2	1000
6498160	501473.6	Eucalyptus populnea	Potential large spout	Potential	1000
6498149	501462.3	Eucalyptus populnea	1 large in base of trunk	3	1000
6498130	501460.2	Eucalyptus populnea	2 large spouts potentially others	3	1200
6498152	501384.7	Eucalyptus populnea	2 small spouts and 1 medium in trunk with feathers around entrance	2	800
6498153	501338.3	Eucalyptus populnea	1 medium in main limb potentially others	2	1100
6498174	501292.1	Eucalyptus populnea	1 large in main trunk	3	1000
6498153	501269	Eucalyptus populnea	2 medium spouts and large fissure in trunk	2	1000
6498128	501257.9	Eucalyptus intertexta	Potential medium spout	Potential	1000
6498135	501209.2	Eucalyptus populnea	2 medium spouts	2	700
6498156	501172.6	Eucalyptus intertexta	1 very large hollow in trunk	3	1000
6498184	501155.9	Eucalyptus populnea	Large fissure in trunk only	1	1200
6498192	501131.2	Eucalyptus intertexta	1 medium at end of main limb	2	1000
6498198	501092.6	Eucalyptus populnea	1 small spout and 1 large in main trunk	3	900
6498193	501034.4	Eucalyptus intertexta	1 medium spout	2	900
6498160	500989.1	Eucalyptus intertexta	1 large spout	3	1000
6498170	500969.8	Eucalyptus populnea	1 small spout	1	600
6498188	500971.6	Eucalyptus populnea	1 medium spout and potentially others	2	900
6498185	500898.8	Eucalyptus populnea	1 medium spout though seems to narrow quickly	1	800
6498205	500864.2	Eucalyptus populnea	1 small in trunk and one medium spout	2	1100
6498158	500828.6	Eucalyptus populnea	1 small and 1 medium spout	2	1000

Easting	Northing	Species	Features	Class	DBH (mm)
6498202	500819.6	Eucalyptus populnea	1 small spout and 1 large in main trunk	3	800
6498270	500833	Eucalyptus populnea	1 medium spout	2	800
6498307	500836.1	Eucalyptus populnea	1 large in main trunk and potentially others	3	1100
6498329	500812.8	Eucalyptus populnea	1 large spout	3	1200
6498380	500836.9	Eucalyptus populnea	1 large spout and potentially others	3	1200
6498419	500832.8	Eucalyptus populnea	2 large spouts	3	900
6498551	500870.8	Eucalyptus populnea	2 small in trunk and 1 medium spout	2	800
6498681	500855	Eucalyptus populnea	Potentially 2 medium spouts in dead limbs	Potential	800
6498764	500877	Eucalyptus populnea	1 medium in main trunk	2	700

APPENDIX D PRINCIPLES FOR BIODIVERSITY OFFSETS IN NSW - CHECKLIST

The following principles, developed by OEH, provide a useful framework for developing offset proposals. They have been considered in developing this Offset Plan, as detailed below.

Impacts must be avoided first by using prevention and mitigation measures.

Offsets are then used to address remaining impacts. This may include modifying the proposal to avoid an area of biodiversity value or putting in place measures to prevent offsite impacts.

The proposal has avoided impacts to the extent that the impacts are the minimum required to meet the objectives of the proposal. Mitigation measures to minimise impacts form part of the conditions of consent for the project. Residual impacts resulting from the clearing of common vegetation types are being offset only.

All regulatory requirements must be met.

Offsets cannot be used to satisfy approvals or assessments under other legislation, e.g. assessment requirements for Aboriginal heritage sites, pollution or other environmental impacts (unless specifically provided for by legislation or additional approvals).

The Offset Plan is required as part of the approval conditions for the project. The proposed offsets will not be used to satisfy approvals or assessments under other legislation.

Offsets must never reward ongoing poor performance.

Offset schemes should not encourage landholders to deliberately degrade or mismanage offset areas in order to increase the value from the offset.

The Offset Site will be set up in perpetuity – this removes the incentive to degrade the Offset Site to facilitate development at a later date.

The management measures have clear targets and are set out to push most management to the beginning of the agreement, where successful accomplishment of targets would be rewarded by less intensive management in ongoing years. This suits measures such as weed and feral animal control which are more easily achieved with intensive efforts to eradicate infestations rather than small ongoing efforts that may allow re-colonisation or dispersal.

Offsets will complement other government programs.

A range of tools is required to achieve the NSW Government's conservation objectives, including the establishment and management of new national parks, nature reserves, state conservation areas and regional parks and incentives for private landholders.

A CPVP for the Offset Site will be attached to the title of the land containing measures that will ensure long-term management for conservation. Privately managed conservation lands complement public reserves and contribute to the protected area system in NSW.

Offsets must be underpinned by sound ecological principles.

They must:

- *include the consideration of structure, function and compositional elements of biodiversity, including threatened species*

- *enhance biodiversity at a range of scales*
- *consider the conservation status of ecological communities*
- *ensure the long-term viability and functionality of biodiversity.*

Biodiversity management actions, such as enhancement of existing habitat and securing and managing land of conservation value for biodiversity, can be suitable offsets. Reconstruction of ecological communities involves high risks and uncertainties for biodiversity outcomes and is generally less preferable than other management strategies, such as enhancing existing habitat.

The biodiversity values contained within the Offset Site have been described in this report and include consideration for threatened species. The condition of vegetation at the site has been assessed using the Biometrics methodology. The site contains the same community and habitat types that are to be impacted by the development.

The management measures to be implemented at the Offset Site focus on the removal of threatening processes which should be effective in enhancing threatened species habitats. Additionally, the progress and outcomes of management measures can be monitored and adapted over time to ensure continuing beneficial outcomes.

Offsets should aim to result in a net improvement in biodiversity over time.

Enhancement of biodiversity in offset areas should be equal to or greater than the loss in biodiversity from the impact site.

Setting aside areas for biodiversity conservation without additional management or increased security is generally not sufficient to offset against the loss of biodiversity. Factors to consider include protection of existing biodiversity (removal of threats), time-lag effects, and the uncertainties and risks associated with actions such as revegetation.

Offsets may include enhancing habitat, reconstructing habitat in strategic areas to link areas of conservation value, or increasing buffer zones around areas of conservation value and removal of threats by conservation agreements or reservation.

This biodiversity offset management plan:

- Identifies threats to the Offset Site's values.
- Sets out suitable management measures that can be undertaken for the long-term.
- Provides security by registering the site as a conservation area on title.

Offsets must be enduring - they must offset the impact of the development for the period that the impact occurs.

As impacts on biodiversity are likely to be permanent, the offset should also be permanent and secured by a conservation agreement or reservation and management for biodiversity. Where land is donated to a public authority or a private conservation organisation and managed as a biodiversity offset, it should be accompanied by resources for its management. Offsetting should only proceed if an appropriate legal mechanism or instrument is used to secure the required actions.

The offset plan for this development is required in perpetuity. A CPVP will be prepared for the Offset Site and attached to the land title making it binding on all successors. The CPVP will contain management measures to ensure a maintain or improve outcome.

Offsets should be agreed prior to the impact occurring.

Offsets should minimise ecological risks from time-lags. The feasibility and in-principle agreements to the necessary offset actions should be demonstrated prior to the approval of the impact. Legal commitments to the offset actions should be entered into prior to the commencement of works under approval.

It is proposed that all offset arrangements are approved and in order prior to construction. An audit of the actual area impacted by the development will be conducted post construction and the offset area adjusted if required.

Offsets must be quantifiable - the impacts and benefits must be reliably estimated.

Offsets should be based on quantitative assessment of the loss in biodiversity from the clearing or other development and the gain in biodiversity from the offset. The methodology must be based on the best available science, be reliable and used for calculating both the loss from the development and the gain from the offset. The methodology should include:

- *the area of impact*
- *the types of ecological communities and habitat/species affected*
- *connectivity with other areas of habitat/corridors*
- *the condition of habitat*
- *the conservation status and/or scarcity/rarity of ecological communities*
- *management actions*
- *level of security afforded to the offset site.*

These points are addressed and described in this Offset Plan. The methodologies used to assess the Offset Site are the same as those used to determine the impacts. Vegetation condition has been assessed using the Biometrics methodology. Management actions have been described and a methodology for monitoring the success of these actions has been implemented. The offset will be secured in perpetuity as discussed above.

The best available information/data should be used when assessing impacts of biodiversity loss and gains from offsets. Offsets will be of greater value where:

- *they protect land with high conservation significance*
- *management actions have greater benefits for biodiversity*
- *the offset areas are not isolated or fragmented*
- *the management for biodiversity is in perpetuity (e.g. secured through a conservation agreement).*

These points have been considered in the selection of Offset Site. The Offset Site and proposed security and management meet the above objectives.

Management actions must be deliverable and enforceable.

Management actions and their objectives, proposed methods of delivery and monitoring requirements are outlined in Section 5 of this plan. Provisions have been included for the annual reporting of monitoring results to DP&I and OEH.

Offsets must be targeted.

They must offset impacts on the basis of like-for-like or better conservation outcome. Offsets should be targeted according to biodiversity priorities in the area, based on the conservation status of the ecological community, the presence of threatened species or their habitat, connectivity and the potential to enhance condition by management actions and the removal of threats. Only ecological communities that are equal or greater in conservation status to the type of ecological community lost can be used for offsets. One type of environmental benefit cannot be traded for another: for example, biodiversity offsets may also result in improvements in water quality or salinity but these benefits do not reduce the biodiversity offset requirements.

Offsets have been proposed based on biodiversity values that will be impacted and to achieve a 'like for like' outcome with regard to the vegetation types and habitats being impacted.

Offsets must be located appropriately.

Wherever possible, offsets should be located in areas that have the same or similar ecological characteristics as the area affected by the development.

Locating the Offset Site in close proximity (approximately 10 km south-west) of the impacts within the same vegetation types achieves this aim.

Offsets must be supplementary.

They must be beyond existing requirements and not already funded under another scheme. Areas that have received incentive funds cannot be used for offsets. Existing protected areas on private land cannot be used for offsets unless additional security or management actions are implemented. Areas already managed by the government, such as national parks, flora reserves and public open space cannot be used as offsets.

The proposed offset is not covered by any existing covenants or agreements. The land is owned by a private land owner and it is not being managed for conservation. The offset is therefore considered supplementary.

Offsets and their actions must be enforceable through development consent conditions, licence conditions, conservation agreements or a contract.

Offsets must be audited to ensure that the actions have been carried out, and monitored to determine that the actions are leading to positive biodiversity outcomes.

Monitoring requirements are outlined in Section 5 of this plan and have been designed to ensure that the actions lead to positive biodiversity outcomes.