80 – 120 Pacific Highway, Doyalson
Biodiversity Assessment

Doyalson Wyee RSL Club

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Template 2.8.1

Executive Summary

Eco Logical Australia Pty Ltd (ELA) was engaged by Doyalson RSL Pty Ltd to assess the biodiversity values and impacts associated with an addendum to a Planning Proposal for the rezoning of a site located on the Pacific Highway, Doyalson (the Development Site) in the Central Coast Local Government Area (LGA). The Development site is located at 80 – 120 Pacific Highway, within the following Lot/DPs:

- Lots 1-9 DP216875
- Lot 1 DP503655
- Lot 11 DP240585
- Lot 7 DP240685
- Lot 49 DP707586
- Lot 62 DP755266

The methodology and contents of this report are based on the Biodiversity Assessment Methodology under the Biodiversity Conservation Regulation 2017. This enables the assessment to present information in a format that is consistent with the Biodiversity Development Assessment Report(s) that will ultimately be submitted with Development Applications for the site.

The Development Site comprises an area of 42 hectares (ha) and is bounded by a hobby farms to the north, housing to the south, the Pacific Highway to the west, and bushland to the east. The Development Site is currently privately owned and used for an adventure course and greenhouses. The Development Site has been subject to past native vegetation clearance and ongoing disturbance, however, the site includes three Plant Community Types (PCTs) as described below:

- 1636 - Scribbly Gum - Red Bloodwood - *Angophora inopina* heathy woodland on lowlands of the Central Coast
- 1638 - Smooth-barked Apple - Red Bloodwood - Scribbly Gum grass - shrub woodland on lowlands of the Central Coast
- 1717 - Broad-leaved Paperbark - Swamp Mahogany - Swamp Oak - Saw Sedge swamp forest of the Central Coast and Lower North Coast.

The site also includes planted native and exotic trees which have been mapped separately. PCT 1717 conforms to '*Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions'* which is listed as an Endangered Ecological Community (EEC) under the NSW BC Act. This PCT has been identified based on the assemblage of species recorded and the landscape position of the Development Site.

Of the 42 ha Development Site, 9.45 ha comprises native vegetation of which 1.41 ha is EEC vegetation and 32 ha is cleared land or exotic vegetation. The Development Site has not been the subject of previous flora and fauna investigations, although there are previous records in BioNet (OEH, 2018) of the following threatened species within or nearby (within 100m) to the Development Site:

- *Haliaeetus leucogaster* (White-bellied Sea-eagle) – listed as Vulnerable under the BC Act.
- *Grevillea parviflora* subsp. *parviflora* (Small-flowered Grevillea) – listed as Vulnerable under the BC Act and Vulnerable under the EPBC Act.

Whilst there are records of White-bellied Sea-eagle nearby to the site, there are no breeding sites for this species identified. Subsequent surveys for *G. parviflora* subsp. *parviflora*, during the flowering period have determined that the historic record onsite is a likely misidentification, as no individuals of this species were confirmed onsite.

Following preliminary investigations of the study area, an additional threatened species *Calyptorhynchus lathami* (Glossy Black-cockatoo) which is listed as Vulnerable under the BC Act was identified within the study area.

This report outlines the measures taken to avoid and minimise impacts to the EEC vegetation and species habitat present within the Development Site and methodologies to minimise impacts during construction and operation of the development. Following consideration of all the above aspects, the residual unavoidable impacts of the project were calculated in accordance with the BAM by utilising the Biodiversity Assessment Method Credit Calculator (BAMC). This is based on the clearing of all vegetation within the development site. The values entered into the calculator will be adjusted appropriately once the final footprint is determined and submitted formally with the first subdivision DA. The number of credits actually required is likely to be significantly less than those numbers proposed below. The BAMC calculated based on a worst case scenario, is precautionary in nature, and that a maximum of 189 ecosystem credits are required to offset the unavoidable impacts to native vegetation present on the development site.

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Abbreviations

Abbreviation	Description
APZ	Asset Protection Zone
BAM	Biodiversity Assessment Method
BAMC	Biodiversity Assessment Method Credit Calculator
BC Act	NSW *Biodiversity Conservation Act 2016*
BDAR	Biodiversity Development Assessment Report
BSSAR	Biodiversity Stewardship Site Assessment Report
CEEC	Critically Endangered Ecological Community
DNG	Derived Native Grassland
DoEE	Commonwealth Department of Environment and Energy
DPE	NSW Department of Planning and Environment
EEC	Endangered Ecological Community
ELA	Eco Logical Australia Pty Ltd
EP&A Act	NSW *Environmental Planning and Assessment Act 1979*
EPBC Act	Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*
FM Act	NSW *Fisheries Management Act 1994*
GIS	Geographic Information System
GPS	Global Positioning System
IBRA	Interim Biogeographic Regionalisation for Australia
LGA	Local Government Area
LLS	Local Land Service
NSW	New South Wales
NOW	NSW Office of Water
OEH	NSW Office of Environment and Heritage
PCT	Plant Community Type
SAII	Serious and Irreversible Impacts
SEPP	State Environmental Planning Policy
SSD	State Significant Development
SSI	State Significant Infrastructure
TEC	Threatened Ecological Community

Abbreviation	Description
VIS	Vegetation Information System
VMP	Vegetation Management Plan
WLEP	*Wyong Local Environmental Plan 2013*
WM Act	NSW *Water Management Act 2000*

1. Stage 1: Biodiversity assessment

1.1 Introduction

This Biodiversity Assessment has been prepared by Alex Pursche, who is an Accredited Person under the NSW *Biodiversity Conservation Act 2016* (BC Act).

1.1.1 Development Site footprint and project description

This Planning Proposal has been prepared on behalf of Doyalson Wyee RSL Club (Club Ltd) to amend the Wyong Local Environmental Plan 2013 (WLEP 2013) for 80-120 Pacific Highway, Doyalson. This Planning Proposal is an Addendum to the Planning Proposal submitted for 100-120 Pacific Highway in December 2018.

The Club Ltd is seeking to diversify its offer to meet the needs of a growing local community and to enhance its unique landscape setting to create a new leisure and experience – the Australian Resort.

Therefore, this Planning Proposal seeks to facilitate the future redevelopment of the site for an integrated retail, recreation, community and residential precinct, centred around Doyalson Wyee RSL Club.

The current zoning permits a limited range of land uses, including rural and recreational uses. The Planning Proposal seeks to deliver a broader range of retail, recreation, community and residential uses. The Planning Proposal seeks to change the zoning from RU6 Transition to RE2 Private Recreation with an additional permitted use schedule that includes the following land uses contained in the concept plan.

An Indicative Concept Plan (Concept Plan) has been developed to support the Planning Proposal (Figure 1). The Concept Plan includes the following land uses:

- RSL Club;
- Wellness and fitness centre;
- Indoor and outdoor recreational facilities;
- Tourism and accommodation;
- Restaurants and cafes;
- Medical centre;
- Childcare centres;
- Seniors Living ;
- Residential; and
- Landscaping, open space and lakefront accessibility

1.1.2 General description of the Development Site

The Development Site comprises an area of 42 hectares (ha) and is bounded by a hobby farms to the north, existing housing to the south, the Pacific Highway to the west and bushland to the east. The Development Site is currently privately owned and used for sporting fields, an adventure course, and greenhouses.

The Development Site has been subject to past native vegetation clearance and ongoing disturbance, however, the site includes three Plant Community Types (PCTs) as described below:

- 1636 - Scribbly Gum - Red Bloodwood - *Angophora inopina* heathy woodland on lowlands of the Central Coast
- 1638 - Smooth-barked Apple - Red Bloodwood - Scribbly Gum grass - shrub woodland on lowlands of the Central Coast
- 1717 - Broad-leaved Paperbark - Swamp Mahogany - Swamp Oak - Saw Sedge swamp forest of the Central Coast and Lower North Coast.

The site also includes planted native and exotic trees which have been mapped separately. PCT 1717 conforms to '*Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions'* which is listed as an Endangered Ecological Community (EEC) under the NSW BC Act. This PCT has been identified based on the assemblage of species recorded and the landscape position of the Development Site.

Of the 42 ha Development Site, 9.45 ha comprises native vegetation of which 1.41 ha is EEC vegetation and 32 ha is cleared land or exotic vegetation. The Development Site has not been the subject of previous flora and fauna investigations, although there are previous records in BioNet (OEH, 2018) of the following threatened species within or nearby (within 100 m) to the Development Site:

- *Haliaeetus leucogaster* (White-bellied Sea-eagle) – listed as Vulnerable under the BC Act.
- *Grevillea parviflora* subsp. *parviflora* (Small-flowered Grevillea) – listed as Vulnerable under the BC Act and Vulnerable under the EPBC Act.
- *Calyptorhynchus lathami* (Glossy Black-cockatoo) – Listed as Vulnerable under the BC Act.

This report includes two base maps that highlight the landscape values and local spatial features of the development, the Site Map (**Figure 3**) and the Location Map (**Figure 4**).

1.1.3 Sources of information used

The following data sources were reviewed as part of this report:

- BioNet Vegetation Classification
- BioNet Atlas
- Threatened Biodiversity Data Collection
- Doyalson Wyee RSL Structure Plan – Biodiversity Constraints Assessment (GHD, 2018).

Figure 1 **Concept Masterplan**

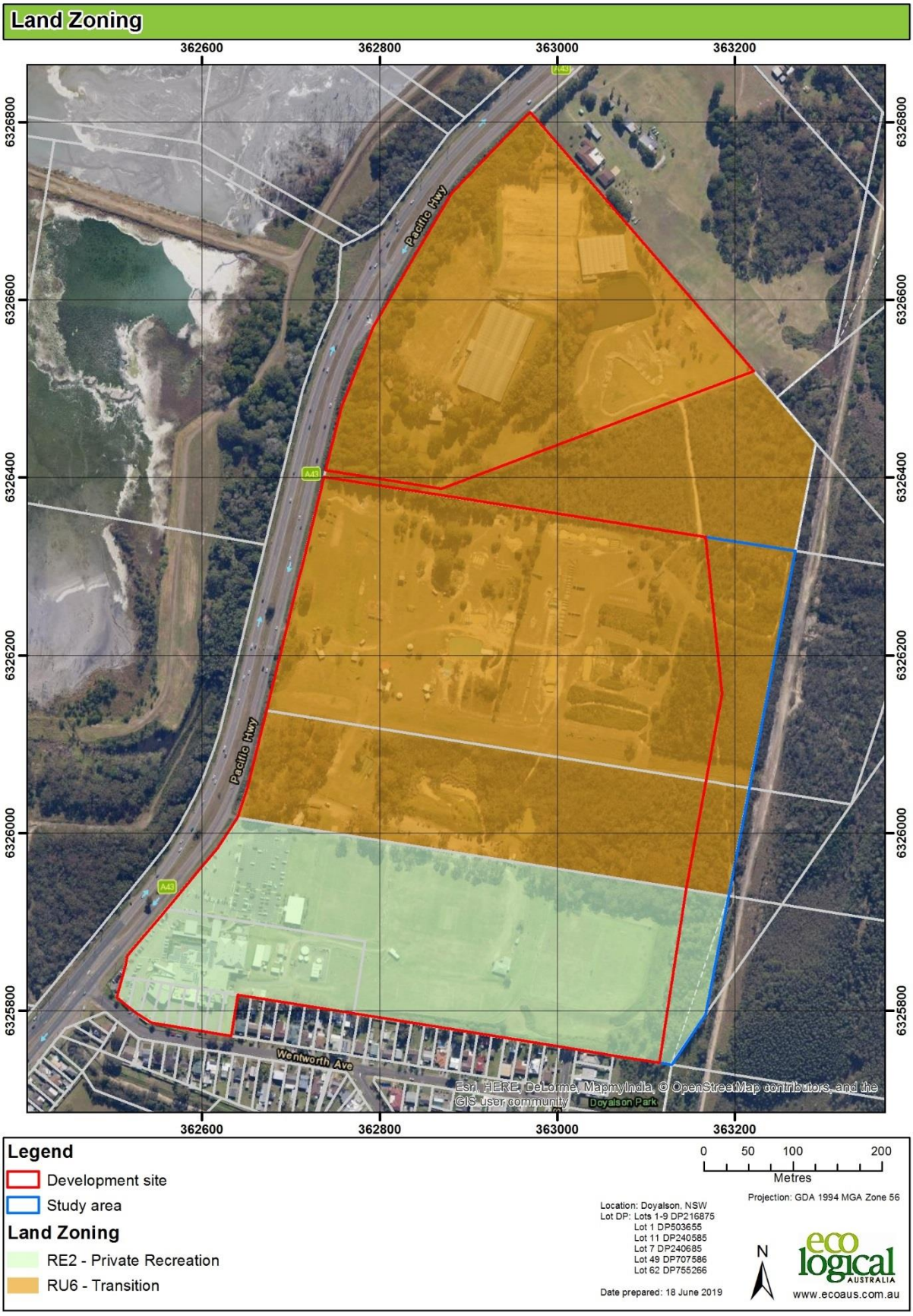

Figure 2 Current land zoning

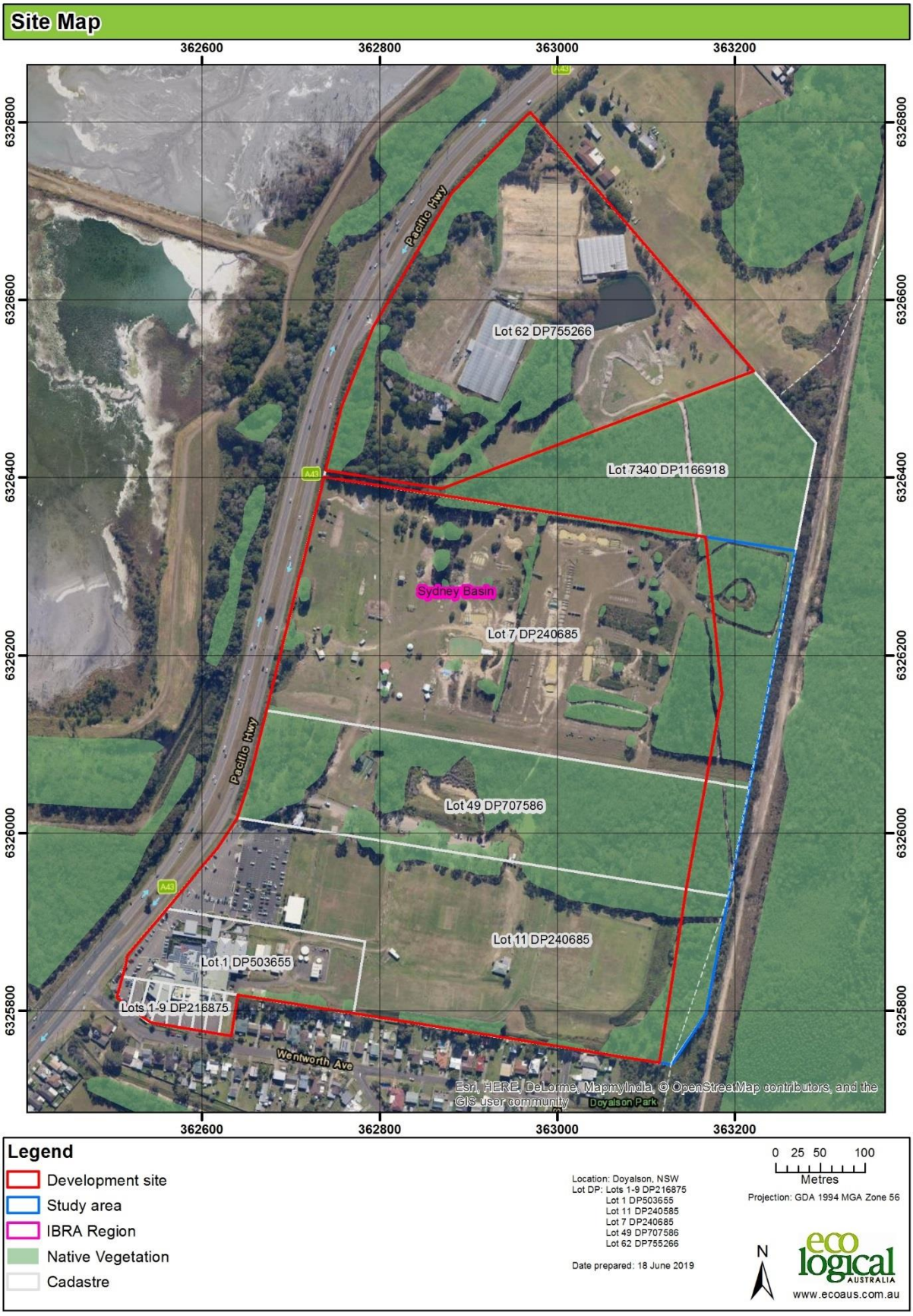

Figure 3: Site map

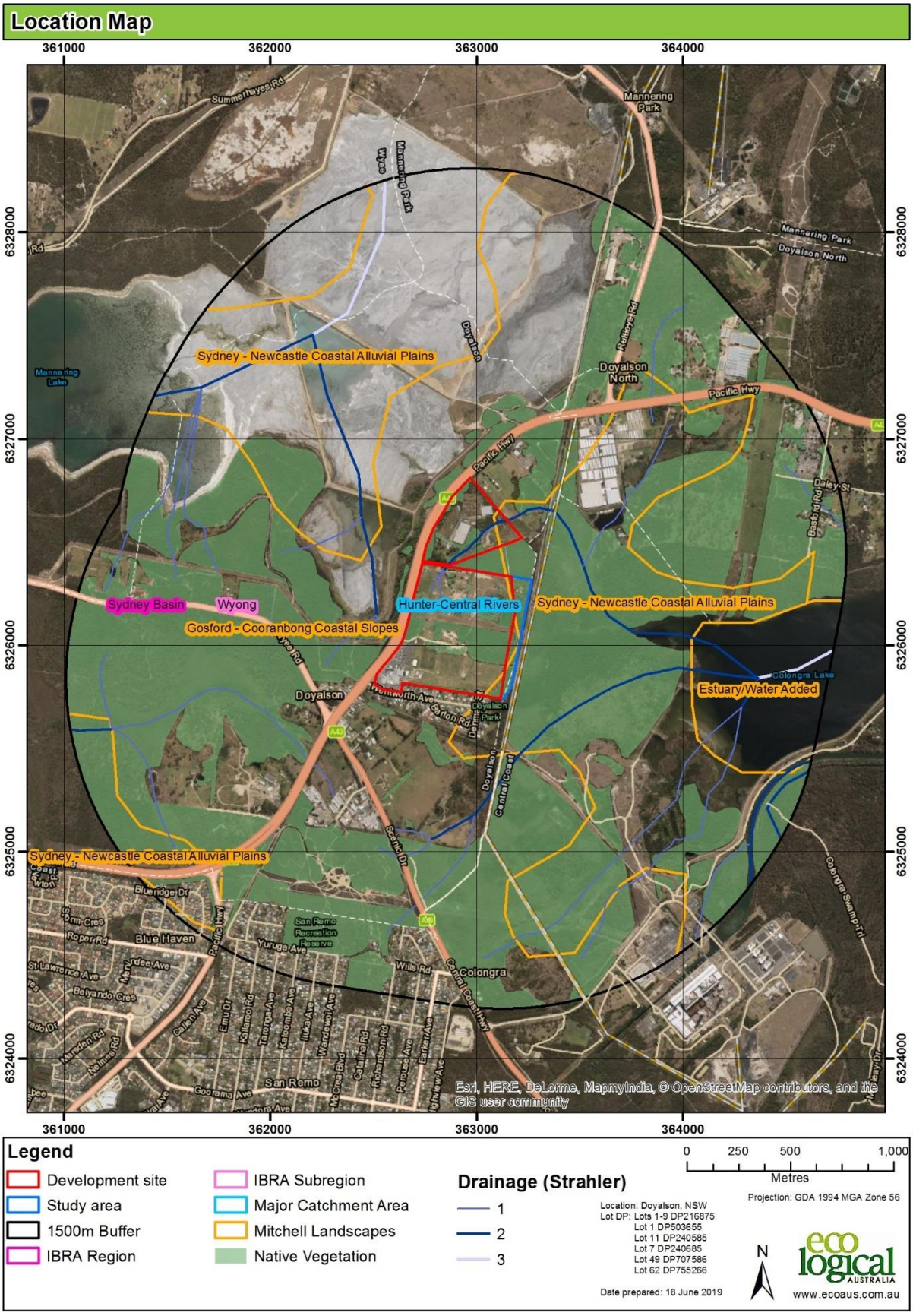

Figure 4: Location map

1.2 Legislative context

Table 1: Legislative context

Name	Relevance to the project	Report Section
Commonwealth		
Environmental Protection and Biodiversity Conservation Act 1999	Matters of National Environmental Significance have not been identified on or near the Development Site. This report assesses impacts to MNES and concludes that the development is not likely to have a significant impact on MNES.	2.5
State		
Environmental Planning and* Assessment *Act 1979	This planning proposal is to be submitted for Gateway Determination under s56 of the EP&A Act.	--
Biodiversity Conservation Act 2016	The BC Act requires submission of a Biodiversity Development Assessment Report for development under Part 4 of the EP&A Act 1979 that exceeds the Biodiversity Offset Scheme thresholds. The BC Act does not have study requirements for Planning Proposals.	--
Water Management Act 2000	The project involves works on waterfront land and therefore is likely to require a Controlled Activity Approval under s91 of the WM Act at the DA stage.	--
Planning Instruments		
Wyong Local Environment Plan 2013	The subject site is currently zoned RU6 and RE2 under the Wyong LEP. The site is not affected by any biodiversity or environmentally sensitive lands overlays.	--
Wyong Development Control Plan 2013	The Wyong Development Control Plan does not identify the site as a green corridor, habitat connectivity link, or local conservation link.	--

1.3 Landscape features

1.3.1 IBRA regions and subregions

The Development Site falls within the IBRA region and subregions as outlined in **Table 2** and **Table 3**.

Table 2: IBRA regions

IBRA region	Area within Development Site (ha)
Sydney Basin	42

Table 3: IBRA subregions

IBRA subregion	Area within Development Site (ha)
Wyong	42

1.3.2 Native vegetation extent

The extent of native vegetation within the Development Site and buffer is outlined in **Table 4**.

Table 4: Native vegetation extent

Area within the Development Site (ha)	Area within the 1,500 m buffer area (ha)
9.45	523.56

There are no differences between the mapped vegetation extent and the aerial imagery.

1.3.3 Rivers and streams

A site visit was conducted on Wednesday 20 June 2018 by two ELA staff (one terrestrial ecologist and one aquatic ecologist), accompanied by the client's representative, Brett Elliss.

Waterways mapped as per 1:25,000 topographical map were inspected. According to the client's representative on-site, the area had received approximately 100 mm of rain during the previous day and numerous overland flow paths and ponds of water were observed.

The two first order streams that appear on the 1:25,000 topographical map are not evident on-site.

No defined channel is observed until photo point 6 on **Figure 5**. Photos 2, 3, 4 and 5 (**Table 5**) show that there is no evidence of a defined channel in this area. This reach is considered not to be a river as defined under the *Water Management Act 2000* (WMA). After approximately 100 mm of rain on Tuesday 19 June 2018, an overland flow path was evident, but no defined channel.

There is a defined channel evident as shown in photo points 7-12 (**Table 5**). This reach is considered a river with a defined channel under the WMA. Based on the findings of the riparian inspection, Development Site contains an unnamed 2nd order Strahler stream as shown on **Figure 5**.

Table 5 Riparian observations and photo points

Point	Notes	Photograph
1	Looking downstream. Dam flooded during site visit. Unable to determine extent on 20/6/18 site visit. No defined channel, bed or banks. Very little emergent vegetation present, apart from a small patch of *Typha* sp., along with mainly exotic grass species. Not considered to be a river.	

Point	Notes	Photograph
2	Looking downstream. No defined channel. Not considered to be a river	
3	Overland flow path. No defined channel. Not considered to be a river	
4	Looking upstream. No bed and banks evident. Depression in grass paddock. Not considered to be a river	

Point	Notes	Photograph
5	Looking upstream. No defined channel, bed or banks. Not considered to be a river	
6	Looking upstream. Start of a channel. Considered to be a river with a defined channel	
7	Looking downstream. Pipes in channel under access road.	

Point	Notes	Photograph
8	Looking downstream. Small channel. No riparian vegetation present on right bank. Weed dominated vegetation present on left bank. Considered to be a river with a defined channel	
9	Looking downstream. Considered to be a less defined channel, with very shallow banks.	
10	Looking upstream. Right bank is mown grass. Considered to be a shallow channel.	

Point	Notes	Photograph
11	Looking downstream. Channel deepens slightly. Small amount of riparian shrub and groundcover vegetation present on right bank.	
12	Looking downstream. Considered to be a shallow channel.	
13	Looking downstream. No defined channel, bed or banks. Likely there is a pond/dam present where the reeds occur in the middle of the paddock, to the right of the tree. Considered to be a river without a defined channel.	

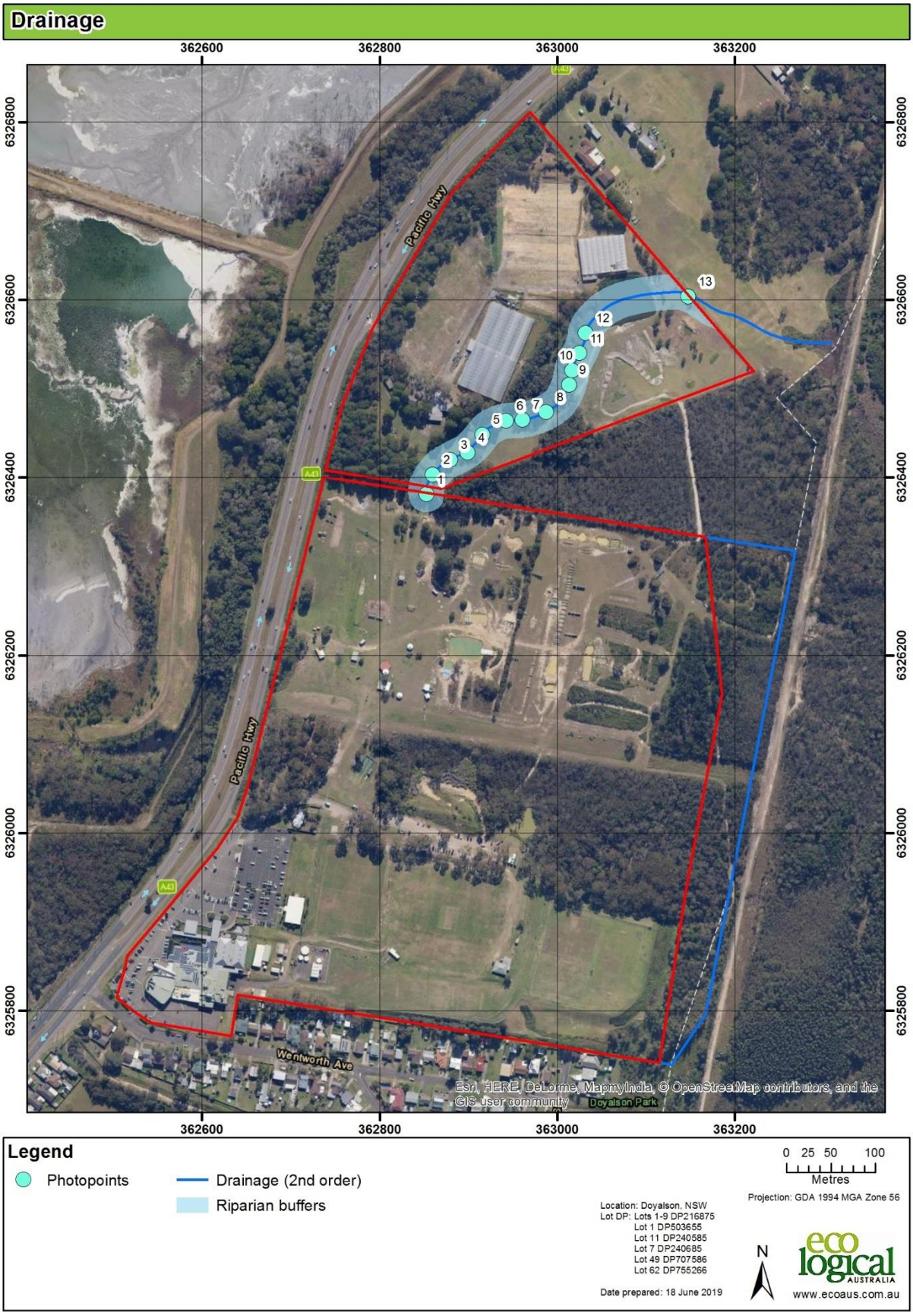

Figure 5 Drainage

1.3.4 Wetlands

The Development Site does not contain any wetlands.

1.3.5 Connectivity features

The Development Site does not contain any connectivity features.

1.3.6 Areas of geological significance and soil hazard features

The Development Site does not contain areas of geological significance and soil hazard features.

1.3.7 Site context

1.3.7.1 Method applied

The site-based method has been applied to this development.

1.3.7.2 Percent native vegetation cover in the landscape

The current percent native vegetation cover in the landscape was assessed in a Geographic Information System (GIS) using aerial imagery sourced from SIX Maps using increments of 5%. The results of this analysis are shown in Table 6.

Table 6: Percent native vegetation cover in the landscape

Area within the Development Site (ha)	Cover within the 1,500 m buffer area (%)
9.45	43.8

1.3.7.3 Patch size

Patch size was calculated using available vegetation mapping for all patches of intact native vegetation on and adjoining the Development Site (Table 7).

Table 7: Patch size

Patch	Patch size area (ha)
1	>200

1.4 Native vegetation

1.4.1 Survey effort

Vegetation survey was undertaken within the Development Site by ELA ecologists Gordon Patrick and Sarah Stevens on 19 and 20 July 2018, as well as by ELA ecologists Lily Gorrell and Alex Pursche on 2 August 2018.

A total of six full-floristic vegetation plots were surveyed to identify PCTs and TECs on the Development Site (**Table 8**). A total of six vegetation integrity plots were undertaken on the Development Site in accordance with the BAM (**Table 9**).

All field data collected at full-floristic and vegetation integrity plots is included in **Appendix B**.

Table 8: Full-floristic PCT identification plots

PCT ID	PCT Name	Number of plots surveyed
1636	Scribbly Gum - Red Bloodwood - *Angophora inopina* heathy woodland on lowlands of the Central Coast	3 plots
1638	Smooth-barked Apple - Red Bloodwood - Scribbly Gum grass - shrub woodland on lowlands of the Central Coast	2 plots
1717	Broad-leaved Paperbark - Swamp Mahogany - Swamp Oak - Saw Sedge swamp forest of the Central Coast and Lower North Coast	1 plot

Table 9: Vegetation integrity plots

Veg Zone	PCT ID	PCT Name	Condition	Area (ha)	Plots required	Plots surveyed
1	1636	Scribbly Gum - Red Bloodwood - *Angophora inopina* heathy woodland on lowlands of the Central Coast	Disturbed	7.3 (SA) 6.29 (DS)	3	3
2	1638	Smooth-barked Apple - Red Bloodwood - Scribbly Gum grass - shrub woodland on lowlands of the Central Coast	Disturbed	6.2 (SA) 1.75 (DS)	1	1
3	1717	Broad-leaved Paperbark - Swamp Mahogany - Swamp Oak - Saw Sedge swamp forest of the Central Coast and Lower North Coast	Disturbed	3.0 (SA) 1.41(DS)	1	2
Total				**16.5 (SA)** **9.45 (DS)**	**5**	**6**

* SA = Study Area, DS = Development Site

1.4.2 Plant Community Types present

A total of three PCTs were identified on the Development Site (**Table 10, Figure 6**). Of the PCTs present, one is a listed TEC under the BC Act (**Table 11, Figure 7**). The Development Site does not contain any listed TECs under the EPBC Act. Justification for the selection of PCTs occurring on the Development Site is based on a quantitative analysis of full-floristic plot data and is provided in **Table 12**.

Table 10: Plant Community Types

PCT ID	PCT Name	Vegetation Class	Vegetation Formation	Area	Percent cleared
1636	Scribbly Gum - Red Bloodwood - *Angophora inopina* heathy woodland on lowlands of the Central Coast	Dry Sclerophyll Forests (Shrubby sub-formation)	Sydney Coastal Dry Sclerophyll Forests	7.3 (SA) 6.29 (DS)	58%
1638	Smooth-barked Apple - Red Bloodwood - Scribbly Gum grass - shrub woodland on lowlands of the Central Coast	Dry Sclerophyll Forests (Shrubby sub-formation)	Sydney Coastal Dry Sclerophyll Forests	6.2 (SA) 1.75 (DS)	50%
1717	Broad-leaved Paperbark - Swamp Mahogany - Swamp Oak - Saw Sedge swamp forest of the Central Coast and Lower North Coast	Forested Wetlands	Coastal Swamp Forests	3.0 (SA) 1.41(DS)	68%

* SA = Study Area, DS = Development Site

Table 11: Threatened Ecological Communities

PCT ID	BC Act			EPBC Act		
	Listing status	Name	Area (ha)	Listing status	Name	Area (ha)
1636	Not listed	N/A	7.3 (SA) 6.29 (DS)	Not listed	n/a	n/a
1638	Not listed	N/A	6.2 (SA) 1.75 (DS)	Not listed	n/a	n/a
1717	Endangered Ecological Community	Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	3.0 (SA) 1.41(DS)	Not listed	n/a	n/a

* SA = Study Area, DS = Development Site

Table 12: PCT selection justification

PCT ID	PCT Name	Selection criteria	Species relied upon for identification of vegetation type
1636	Scribbly Gum - Red Bloodwood - *Angophora inopina* heathy woodland on lowlands of the Central Coast	IBRA region, landform, soils vegetation formation and vegetation class, species present.	*Corymbia gummifera* (Red Bloodwood), *Eucalytpus racemosa* (Narrow-leaved Scribbly Gum), *Eucalyptus sclerophylla* (Hard-leaved Scribbly Gum) present in canopy; *Acacia longifolia*, *Banksia oblongifolia* (Fern-leaved Banksia), *Leptospermum trinervium* (Flaky-barked Tea-tree) present in midstorey; *Pteridium esculentum* (Common Bracken), *Lomandra obliqua*, *Dianella caerulea* (Blue Flax-lily) present in ground layer.
1638	Smooth-barked Apple - Red Bloodwood - Scribbly Gum grass - shrub woodland on lowlands of the Central Coast	IBRA region, landform, soils vegetation formation and vegetation class, species present.	*Allocasuarina littoralis* (Black She-oak) dominates canopy; *Hakea dactyloides* (Finger Hakea) dominates mid-stratum; *Baumea rubiginosa*, *Caustis* spp., and *Parsonsia straminea* (Common Silkpod) dominate ground cover.
1717	Broad-leaved Paperbark - Swamp Mahogany - Swamp Oak - Saw Sedge swamp forest of the Central Coast and Lower North Coast	IBRA region, landform, soils vegetation formation and vegetation class, species present.	*Melaleuca quinquenervia* (Broad-leaved Melaleuca), *Kunzea ambigua* (Tick Bush), and *Allocasuarina littoralis* (Black She-Oak) dominate canopy. *Casuarina glauca* (Swamp Oak) present extensively outside floristic plots; *Leptospermum trinervium* (Flaky-barked Tea-tree) in mid layer; ground cover variable and weedy.

1.4.2.1 PCT selection justification

In determining the PCT for the Development Site, various attributes were considered in combination to assign vegetation to the best fit PCT. Attributes included dominant species in each stratum, community composition, soils and landscape position. Plot data collected in the field was analysed in a quantitative analysis tool developed by ELA, using the characteristic species present in each structural layer for all PCTs in the region sourced from the BioNet Vegetation Information System (VIS). This quantitative analysis was used to assist in determining PCTs that may be present. The tool uses positive characteristic species of PCTs and matches them to the flora species collected in plots. The tool then provides a total number of characteristic species present in the canopy, mid-storey and ground-layer and matches those communities that fit most strongly with the PCTs available. The higher the number of characteristic species the greater the fit for that community. It can be the case that a community matches strongly with flora species within varying stratum, however does not match well with the position in the landscape. Therefore, this tool assists in the decision-making process but is not the sole determining factor.

The PCT selection tool for the data collected within the study area did not result in a suitable representation of the PCTs that occur onsite. This is due to the historic disturbance of the site and weediness in areas of native vegetation. The table below **Table 13** details the outcomes of the quantitative assessment as well as a rationale for final selection of each PCT.

Table 13 Quantitative PCT selection

Plots	Quantitative PCT outcome	Considerations	Final Choice
1, 2, 4	PCT 1138 had the most characteristic species across two of the three plots ranging from 5 to 9 characteristic species. Another PCT identified through the quantitative analysis is PCT 1716.	PCT 1138 is not representative of what occurs onsite. Most of the characteristic species are ground species, for which 1138 has more listed and as such would always attract a greater correlation. The study area contains *Eucalyptus haemastoma* in the canopy, as well as *Banksia serrata*, *Banksia ericifolia* in the mid-storey which are not listed for 1138. 1138 is also primarily known from the (former) Gosford LGA south of the study area. PCT 1716 does not represent the vegetation within this zone in any way.	PCT 1636 is a far better fit, based on the canopy and mid storey species, as well as the extent. Full description provided below.
3	PCT 978 had the most characteristic species with two characteristic species present.	Based on the canopy, mid-storey, landscape position, and formation, PCT 978 does not represent the vegetation within this zone in any way. The vegetation within this community is not an upland swamp on a sandstone plateau.	PCT 1638 is a far better fit, based on the canopy and mid storey species, as well as the extent. Full description provided below
5, 6	Quantitative analysis identified 1722 and 1700 as potential PCTs with 3 and 2 characteristic species respectively	Due to the low correlation in characteristic species, the assessor has reviewd other potential PCTs that contain *Melaleuca quinquinervea*, Casuarina glauca, and *Eucalyptus robusta* as indicative species.	Based on a review of the dominant species present, the landscape position, PCT 1717 is the only PCT that fits the vegetation occurring onsite.

ELA considers three PCTs to be present within the Development Site:

- 1636 - Scribbly Gum - Red Bloodwood - *Angophora inopina* heathy woodland on lowlands of the Central Coast
- 1638 - Smooth-barked Apple - Red Bloodwood - Scribbly Gum grass - shrub woodland on lowlands of the Central Coast
- 1717 - Broad-leaved Paperbark - Swamp Mahogany - Swamp Oak - Saw Sedge swamp forest of the Central Coast and Lower North Coast.

Descriptions of these PCTs and the condition they occur in on the site are presented below.

1.4.2.2 1636 - Scribbly Gum - Red Bloodwood - Angophora inopina heathy woodland on lowlands of the Central Coast

1636 - Scribbly Gum - Red Bloodwood - *Angophora inopina* heathy woodland on lowlands of the Central Coast	
Vegetation formation:	Dry Sclerophyll Forests (Shrubby sub-formation)
Vegetation class:	Sydney Coastal Dry Sclerophyll Forests
Vegetation structure	Forest
Conservation status:	Not listed

The following provides an outline of the PCT determined from species identified during field surveys. For a full description of the PCT please consult the VIS database

This community occurs in a mosaic of condition within the site, with some small patches underscrubbed, and other areas without canopy trees. This community was characterised by a ground stratum comprising of *Allocasuarina littoralis* (Black She-oak), *Eucalyptus racemosa* (Narrow-leaved Scribbly Gum), *Eucalyptus sclerophylla* (Hard-leaved Scribbly Gum), and *Corymbia gummifera* (Red Bloodwood). This community occurs on sandy soils on elevated parts of the site.

Characteristic trees	*Allocasuarina littoralis, Corymbia gummifera, Eucalyptus racemosa, Eucalyptus sclerophylla*
Characteristic midstorey	*Pittosporum undulatum, Acacia longifolia, Dodonaea triquetra*
Characteristic groundcovers	*Entolasia stricta, Dianella caerulea, Lindsaea linearis, Pteridium esculentum*
Mean native richness	28
Weediness (all species)	9.5 %
Exotic species	*Ehrharta erecta, Cinnamomum camphora, Anagallis arvensis, Andropogon virginicus*
Condition	Disturbed. Additional notes: Moderate-Good condition, some patches have been under-scrubbed.
Variation and disturbance	Ground cover varies with disturbance regime.
Soil type	Sandy
% remaining in NSW	42 %
Threats	Weed invasion, rubbish dumping, under-scrubbing, trampling from local walking tracks
Threat category	Of Concern
No. sites sampled	3
Threatened flora species	*Grevillea parviflora* subsp. *parviflora*

1.4.2.3 1638 - Smooth-barked Apple - Red Bloodwood - Scribbly Gum grass - shrub woodland on lowlands of the Central Coast

1638: Smooth-barked Apple - Red Bloodwood - Scribbly Gum grass - shrub woodland on lowlands of the Central Coast	
Vegetation formation:	Dry Sclerophyll Forests (Shrubby sub-formation)
Vegetation class:	Sydney Coastal Dry Sclerophyll Forests
Vegetation structure	Forest
Conservation status:	Not listed

The following provides an outline of the PCT determined from species identified during field surveys. For a full description of the PCT please consult the VIS database

This PCT occurs as a likely regenerating community with a lack of large canopy trees. The majority of the PCT within the study area occurs as an *A. littoralis* thicket with occasional occurrences of *Glochidion ferdinandi* (Cheese Tree). It should be noted that this community occurs on the lower slopes where vegetation is intergrading between 1636 and 1717, where surface water influence increases.

Characteristic trees	*Allocasuarina littoralis, Glochidion ferdinandi*
Characteristic midstorey	*Banksia oblongifolia, Hakea dactyloides, Lambertia formosa, Petrophile pulchella*
Characteristic groundcovers	*Baumea rubiginosa, Caustis* spp.*, Parsonsia straminea*
Mean native richness	15
Weediness (all species)	0 %
Exotic species	N/A
Condition	Disturbed. Additional notes: Moderate - good
Variation and disturbance	Homogenous condition
Soil type	Sandy loam
% remaining in NSW	50 %
Threats	Weed invasion, rubbish dumping, trampling from local walking tracks
Threat category	N/A
No. sites sampled	1
Threatened flora species	None

1.4.2.4 1717 - Broad-leaved Paperbark - Swamp Mahogany - Swamp Oak - Saw Sedge swamp forest of the Central Coast and Lower North Coast

1717 - Broad-leaved Paperbark - Swamp Mahogany - Swamp Oak - Saw Sedge swamp forest of the Central Coast and Lower North Coast	
Vegetation formation:	Forested Wetlands
Vegetation class:	Coastal Swamp Forests
Vegetation structure	Forest
Conservation status:	Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions

The following provides an outline of the PCT determined from species identified during field surveys. For a full description of the PCT please consult the VIS database

The most representative stand of this community occurs along the unnamed drainage line as a stand of *Melaleuca quinquinervia* as well as *Casuarina glauca* immediately adjacent on slightly drier soils. The mid-storey is absent and the ground layer is dominated by weeds. Along the eastern periphery of the study area this community also occurs and intergrades with PCT 1638.

This PCT occurs in wet areas where surface water drainage slows.

Characteristic trees	*Melaleuca quinquinervia*, *Casuarina glauca*
Characteristic midstorey	N/A
Characteristic groundcovers	*Sarcocornia quinqueflora* (Beaded Samphire), *Sporobolus virginicus* (Marine Couch), *Selliera radicans* (Swamp Weed), *Suaeda australia* (Austral Seablite) and *Juncus kraussii* (Sea Rush)
Mean native richness	12
Weediness (all species)	5 %
Exotic species	*Ageratina adenophora, Cinnamomum camphora, Lantana camara, Pinus radiata*
Condition	Disturbed. Additional notes: Moderate condition, disturbance evident
Variation and disturbance	Ground cover varies with disturbance regime. Weeds focussed along wetter areas.
Soil type	Sandy loam
% remaining in NSW	32 %
Threats	Weed invasion, rubbish dumping, trampling from local walking tracks
Threat category	Of Concern
No. sites sampled	2
Threatened flora species	None

1.4.2.5 Exotic vegetation

Cleared land	
Vegetation formation:	N/A
Vegetation class:	N/A
Vegetation structure	Forest
Conservation status:	N/A

This vegetation does not align with any PCTs within the Vegetation Information Systems.

The exotic canopy consists of either *Pinus radiata* or *Cinnamomum camphora*.

This vegetation occurs in disjunct stands that have been planted.

This vegetation still provides habitat for fauna species such as Common Ringtail Possum.

Characteristic trees	*Pinus radiata, Cinnamomum camphora*
Characteristic midstorey	*Lantana camara*
Characteristic groundcovers	N/A
Mean native richness	N/A
Weediness (all species)	90 %
Exotic species	*Pinus radiata, Cinnamomum camphora, Lantana camara*
Condition	Exotic
Variation and disturbance	N/A
Soil type	Occurs on sandy loam
% remaining in NSW	N/A
Threats	N/A
Threat category	N/A
No. sites sampled	0
Threatened flora species	None

1.4.2.6 Cleared land

Cleared land	
Vegetation formation:	N/A
Vegetation class:	N/A
Vegetation structure	Cleared land
Conservation status:	N/A

Cleared land within the study area consists of areas of land without native vegetation and includes the following development types:

- Green houses
- Roads
- Parking areas
- Playing fields
- Adventure parks.

These areas are not consistent with any PCT.

Characteristic trees	N/A
Characteristic midstorey	N/A
Characteristic groundcovers	N/A
Mean native richness	N/A
Weediness (all species)	90 %
Exotic species	N/A
Condition	Exotic
Variation and disturbance	N/A
Soil type	Occurs on sandy loam
% remaining in NSW	N/A
Threats	N/A
Threat category	N/A
No. sites sampled	0
Threatened flora species	None

1.5 Vegetation integrity assessment

A vegetation integrity assessment using the Credit Calculator (BAMC) was undertaken and the results are outlined in **Table 14**.

Table 14: Vegetation integrity

Veg Zone	PCT ID	Condition	Area (ha)	Composition Condition Score	Structure Condition Score	Function Condition Score	Current vegetation integrity score
1	1636	Disturbed	7.3 (SA) 6.29 (DS)	47	51.9	61.9	53.2
2	1638	Disturbed	6.2 (SA) 1.75 (DS)	32.2	24.7	45.4	33.0
3	1717	Disturbed	3.0 (SA) 1.41(DS)	15.9	49.4	31.1	29.0

* SA = Study Area, DS = Development Site

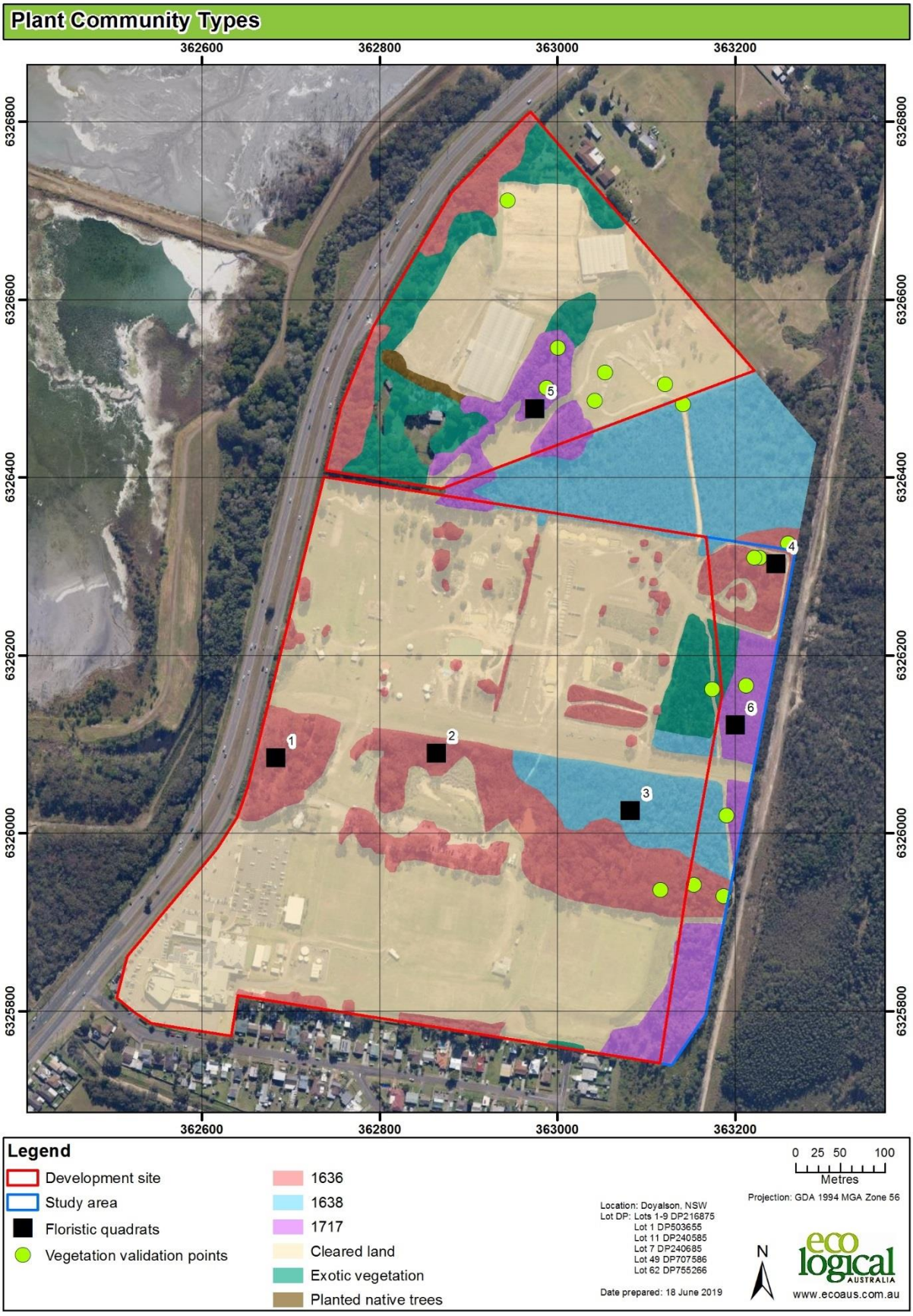

Figure 6: Plant Community Types and native vegetation extent

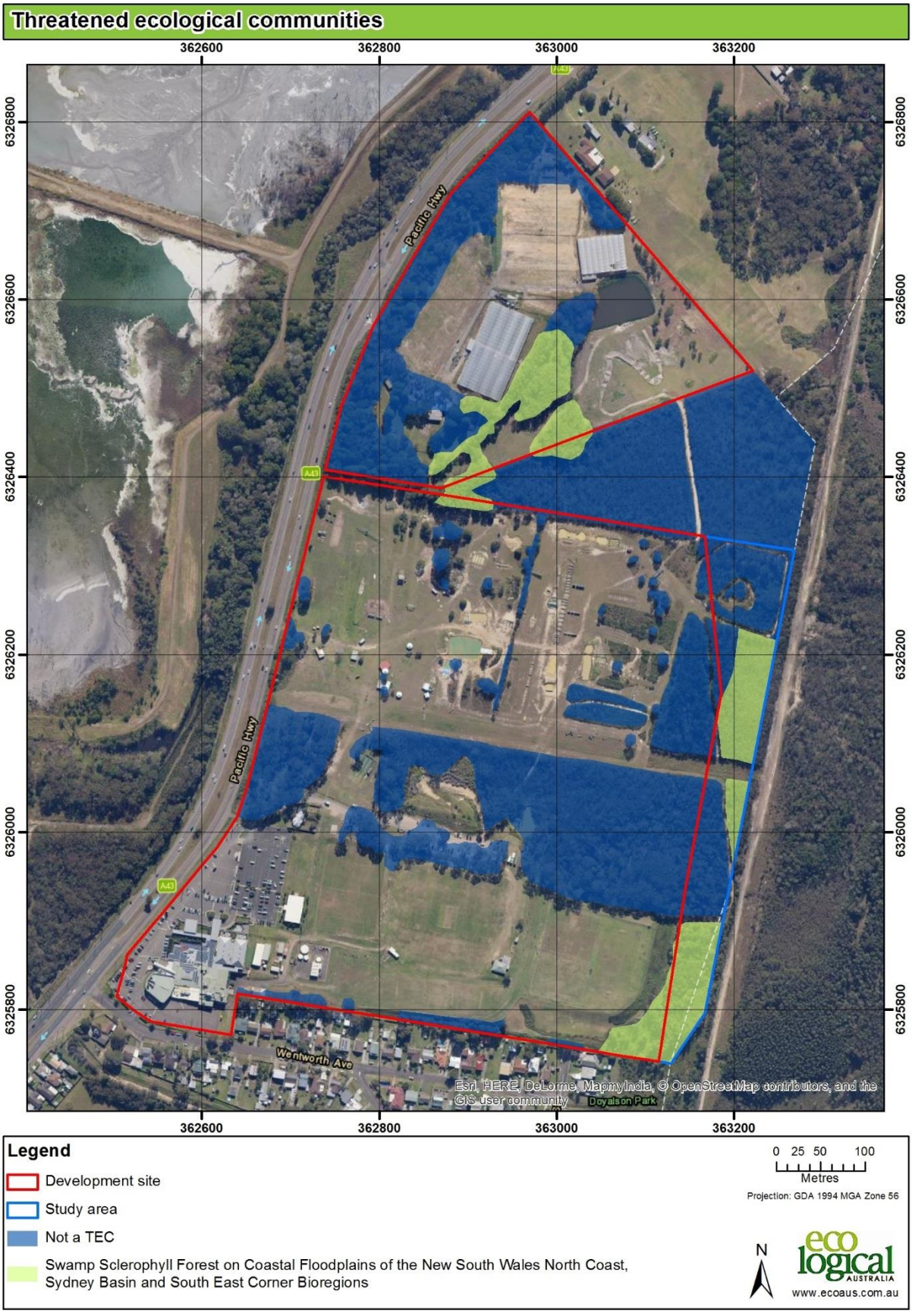

Figure 7: Threatened Ecological Communities

1.6 Threatened species

1.6.1 Ecosystem credit species

Ecosystem credit species predicted to occur at the Development Site, their associated habitat constraints, geographic limitations and sensitivity to gain class is included in **Table 15**.

Table 15: Predicted ecosystem credit species

Species	Common Name	Habitat Constraints	Geographic limitations	Sensitivity to gain class	NSW listing status	EPBC Listing status
Anthochaera phrygia	Regent Honeyeater (Foraging)	N/A	N/A	High Sensitivity to Potential Gain	Critically Endangered	Critically Endangered
Anthochaera phrygia	Regent Honeyeater (Foraging)	N/A	N/A	High Sensitivity to Potential Gain	Critically Endangered	Critically Endangered
Callocephalon fimbriatum	Gang-gang Cockatoo (Foraging)	N/A	N/A	Moderate Sensitivity to Potential Gain	Vulnerable	Not Listed
Calyptorhynchus lathami	Glossy Black-Cockatoo (Foraging)	N/A	N/A	High Sensitivity to Potential Gain	Vulnerable	Not Listed
Chthonicola sagittata	Speckled Warbler	N/A	N/A	High Sensitivity to Potential Gain	Vulnerable	Not Listed
Climacteris picumnus victoriae	Brown Treecreeper (eastern subspecies)	N/A	N/A	High Sensitivity to Potential Gain	Vulnerable	Not Listed
Daphoenositta chrysoptera	Varied Sittella	N/A	N/A	Moderate Sensitivity to Potential Gain	Vulnerable	Not Listed
Dasyurus maculatus	Spotted-tailed Quoll	n/a	n/a	High Sensitivity to Potential Gain	Vulnerable	Endangered

Species	Common Name	Habitat Constraints	Geographic limitations	Sensitivity to gain class	NSW listing status	EPBC Listing status
Ephippiorhynchus asiaticus	Black-necked Stork	Swamps; Shallow, open freshwater or saline wetlands or shallow edges of deeper wetlands within 300 m of these swamps; Shallow lakes, lake margins and estuaries within 300 m of these waterbodies	N/A	Moderate Sensitivity to Potential Gain	Endangered	Not Listed
Falsistrellus tasmaniensis	Eastern False Pipistrelle	N/A	N/A	High Sensitivity to Potential Gain	Vulnerable	Not Listed
Glossopsitta pusilla	Little Lorikeet	N/A	N/A	High Sensitivity to Potential Gain	Vulnerable	Not Listed
Grantiella picta	Painted Honeyeater	Mistletoes present at a density of greater than five mistletoes per hectare	N/A	Moderate Sensitivity to Potential Gain	Vulnerable	Vulnerable
Haliaeetus leucogaster	White-bellied Sea-Eagle (Foraging)	N/A	N/A	High Sensitivity to Potential Gain	Vulnerable	Not Listed
Hieraaetus morphnoides	Little Eagle (Foraging)	N/A	N/A	Moderate Sensitivity to Potential Gain	Vulnerable	Not Listed

Species	Common Name	Habitat Constraints	Geographic limitations	Sensitivity to gain class	NSW listing status	EPBC Listing status
Ixobrychus flavicollis	Black Bittern	Waterbodies; Land within 40 m of freshwater and estuarine wetlands, in areas of permanent water and dense vegetation	N/A	Moderate Sensitivity to Potential Gain	Vulnerable	Not Listed
Kerivoula papuensis	Golden-tipped Bat	N/A	N/A	High Sensitivity to Potential Gain	Vulnerable	Not Listed
Lathamus discolor	Swift Parrot (Foraging)	N/A	N/A	Moderate Sensitivity to Potential Gain	Endangered	Critically Endangered
Lophoictinia isura	Square-tailed Kite (Foraging)	N/A	N/A	Moderate Sensitivity to Potential Gain	Vulnerable	Not Listed
Melithreptus gularis gularis	Black-chinned Honeyeater (eastern subspecies)	N/A	N/A	Moderate Sensitivity to Potential Gain	Vulnerable	Not Listed
Miniopterus australis	Little Bentwing-bat (Foraging)	N/A	N/A	High Sensitivity to Potential Gain	Vulnerable	Not Listed
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat (Foraging)	N/A	N/A	High Sensitivity to Potential Gain	Vulnerable	Not Listed
Mormopterus norfolkensis	Eastern Freetail-bat	N/A	N/A	High Sensitivity to Potential Gain	Vulnerable	Not Listed
Neophema pulchella	Turquoise Parrot	N/A	N/A	High Sensitivity to Potential Gain	Vulnerable	Not Listed
Ninox connivens	Barking Owl (Foraging)	N/A	N/A	High Sensitivity to Potential Gain	Vulnerable	Not Listed

Species	Common Name	Habitat Constraints	Geographic limitations	Sensitivity to gain class	NSW listing status	EPBC Listing status
Ninox strenua	Powerful Owl (Foraging)	N/A	N/A	High Sensitivity to Potential Gain	Vulnerable	Not Listed
Pandion cristatus	Eastern Osprey (Foraging)	N/A	N/A	Moderate Sensitivity to Potential Gain	Vulnerable	Not Listed
Petaurus australis	Yellow-bellied Glider	Hollow bearing trees; Hollows > 25cm diameter	N/A	High Sensitivity to Potential Gain	Vulnerable	Not Listed
Petroica boodang	Scarlet Robin	N/A	N/A	Moderate Sensitivity to Potential Gain	Vulnerable	Not Listed
Phascolarctos cinereus	Koala (Foraging)	N/A	N/A	High Sensitivity to Potential Gain	Vulnerable	Vulnerable
Pomatostomus temporalis temporalis	Grey-crowned Babbler (eastern subspecies)	N/A	N/A	Moderate Sensitivity to Potential Gain	Vulnerable	Not Listed
Potorous tridactylus	Long-nosed Potoroo	Dense shrub layer or alternatively high canopy cover exceeding 70% (i.e. to capture populations inhabiting wet sclerophyll and rainforest))	N/A	High Sensitivity to Potential Gain	Vulnerable	Vulnerable
Pseudomys gracilicaudatus	Eastern Chestnut Mouse	N/A	N/A	High Sensitivity to Potential Gain	Vulnerable	Not Listed
Pteropus poliocephalus	Grey-headed Flying-fox (Foraging)	N/A	N/A	High Sensitivity to Potential Gain	Vulnerable	Vulnerable

Species	Common Name	Habitat Constraints	Geographic limitations	Sensitivity to gain class	NSW listing status	EPBC Listing status
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	N/A	N/A	High Sensitivity to Potential Gain	Vulnerable	Not Listed
Scoteanax rueppellii	Greater Broad-nosed Bat	N/A	N/A	High Sensitivity to Potential Gain	Vulnerable	Not Listed
Tyto novaehollandiae	Masked Owl (Foraging)	N/A	N/A	High Sensitivity to Potential Gain	Vulnerable	Not Listed

Ecosystem credit species which have been excluded from the assessment and relevant justification is included in **Table 16**.

Table 16: Justification for exclusion of predicted ecosystem credit species

Species	Common Name	NSW listing status	EPBC Listing status	Justification for exclusion of species
Ephippiorhynchus asiaticus	Black-necked Stork	Endangered	Not listed	Only water body present is a farm dam. No wetlands or permanent water with dense vegetation present.
Ixobrychus flavicollis	Black Bittern	Vulnerable	Not listed	Only water body present is a farm dam. No wetlands or permanent water with dense vegetation present.
Petaurus australis	Yellow-bellied Glider	Vulnerable	Not listed	Hollow-bearing trees with sufficient hollow sizes only present in PCT 1636. Species excluded from other PCTs.
Potorous tridactylus	Long-nosed Potoroo	Vulnerable	Vulnerable	Vegetation is too patchy or degraded for this species.

1.7 Species credit species

Assessment of species credits was conducted using a four-stage process:

- Initially a list of candidate species was generated using the BAMC based on the PCTs and landscape assessment for the study area.

- Secondly, the list of candidate species was augmented by considering records of threatened species nearby to the study area.
- Thirdly, the list was refined by assessing the habitat suitability within the study area to determine those species which are actually likely to occur.
- The fourth step was to conduct a targeted survey for those species whose distribution and habitat requirements were considered suitable within the study area.

Species credit species predicted to occur at the Development Site (i.e. candidate species), their associated habitat constraints, geographic limitations and sensitivity to gain class is included in **Table 17** and **Table 18**.

Table 17: Candidate species credit flora species

Species	Common Name	Habitat Constraints	Geographic limitations	Sensitivity to gain class	NSW listing status	EPBC Listing status
Acacia bynoeana	Bynoe's Wattle	N/A	N/A	High Sensitivity to Potential Gain	Endangered	Vulnerable
Angophora inopina	Charmhaven Apple	N/A	N/A	n/a	Vulnerable	Vulnerable
Astrotricha crassifolia	Thick-leaf Star-hair	N/A	N/A	Very High Sensitivity to Potential Gain	Vulnerable	Vulnerable
Callistemon linearifolius	Netted Bottle Brush	N/A	N/A	High Sensitivity to Potential Gain	Vulnerable	Not Listed
Eucalyptus camfieldii	Camfield's Stringybark	N/A	N/A	High Sensitivity to Potential Gain	Vulnerable	Vulnerable
Eucalyptus parramattensis subsp. *decadens*		N/A	Northern section of sub-region, associated with poorly drained sand deposits within 10 km radius of Kurri Kurri	High Sensitivity to Potential Gain	Vulnerable	Vulnerable
Eucalyptus parramattensis subsp. *parramattensis* - endangered population	*Eucalyptus parramattensis* C. Hall. subsp. *parramattensis* in Wyong and Lake Macquarie local	N/A	N/A	High Sensitivity to Potential Gain	Endangered Population	Not Listed

Species	Common Name	Habitat Constraints	Geographic limitations	Sensitivity to gain class	NSW listing status	EPBC Listing status
	government areas					
Grevillea parviflora subsp. parviflora	Small-flower Grevillea	N/A	N/A	High Sensitivity to Potential Gain	Vulnerable	Vulnerable
Cryptostylis hunteriana	Leafless Tongue Orchid	N/A	N/A	High Sensitivity to Potential Gain	Vulnerable	Vulnerable
Dendrobium melaleucaphilum	Spider orchid	N/A	N/A			
Diuris praecox	Rough Doubletail	N/A	N/A	Moderate Sensitivity to Potential Gain	Vulnerable	Vulnerable
Genoplesium insigne	Variable Midge Orchid	N/A	N/A	Moderate Sensitivity to Potential Gain	Critically Endangered	Critically Endangered
Maundia triglochinoides		Swamps or shallow fresh water on clay	N/A	High Sensitivity to Potential Gain	Vulnerable	Not Listed
Melaleuca biconvexa	Biconvex Paperbark	Swamp margins or creek edges	N/A	High Sensitivity to Potential Gain	Vulnerable	Vulnerable
Melaleuca groveana	Grove's Paperbark	N/A	N/A	High Sensitivity to Potential Gain	Vulnerable	Not Listed
Prostanthera askania	Tranquility Mintbush	N/A	N/A	High Sensitivity to Potential Gain	Endangered	Endangered
Rutidosis heterogama	Heath Wrinklewort	N/A	N/A	High Sensitivity to Potential Gain	Vulnerable	Vulnerable
Tetratheca glandulosa		N/A	N/A	High Sensitivity to Potential Gain	Vulnerable	Not Listed
Tetratheca juncea	Black-eyed Susan	N/A	N/A	High Sensitivity to	Vulnerable	Vulnerable

Species	Common Name	Habitat Constraints	Geographic limitations	Sensitivity to gain class	NSW listing status	EPBC Listing status
				Potential Gain		

Table 18: Candidate species credit fauna species

Species	Common Name	Habitat Constraints	Geographic limitations	Sensitivity to gain class	NSW listing status	EPBC Listing status
Anthochaera phrygia	Regent Honeyeater	N/A	N/A	High Sensitivity to Potential Gain	Critically Endangered	Critically Endangered
Burhinus grallarius	Bush Stone-curlew	Fallen/standing dead timber, including logs	N/A	High Sensitivity to Potential Gain	Endangered	Not Listed
Callocephalon fimbriatum	Gang-gang Cockatoo	N/A	N/A	High Sensitivity to Potential Gain	Vulnerable	Not Listed
Calyptorhynchus lathami	Glossy Black-Cockatoo	N/A	N/A	High Sensitivity to Potential Gain	Vulnerable	Not Listed
Cercartetus nanus	Eastern Pygmy-possum	N/A	N/A	High Sensitivity to Potential Gain	Vulnerable	Not Listed
Chalinolobus dwyeri	Large-eared Pied Bat	Cliffs, within 2 km of rocky areas containing caves, overhangs, escarpments, outcrops, or crevices, or within 2 km of old mines or tunnels	N/A	Very High Sensitivity to Potential Gain	Vulnerable	Vulnerable
Crinia tinnula	Wallum Froglet	N/A	N/A	Moderate Sensitivity to Potential Gain	Vulnerable	Not Listed
Haliaeetus leucogaster	White-bellied Sea-Eagle	N/A	N/A	High Sensitivity to Potential Gain	Vulnerable	Not Listed
Heleioporus australiacus	Giant Burrowing Frog	N/A	N/A	Moderate Sensitivity to Potential Gain	Vulnerable	Vulnerable

Species	Common Name	Habitat Constraints	Geographic limitations	Sensitivity to gain class	NSW listing status	EPBC Listing status
Hieraaetus morphnoides	Little Eagle	N/A	N/A	Moderate Sensitivity to Potential Gain	Vulnerable	Not Listed
Hoplocephalus bitorquatus	Pale-headed Snake	N/A	N/A	High Sensitivity to Potential Gain	Vulnerable	Not Listed
Lathamus discolor	Swift Parrot	N/A	N/A	Moderate Sensitivity to Potential Gain	Endangered	Critically Endangered
Litoria aurea	Green and Golden Bell Frog	Semi-permanent/ephemeral wet areas, within 1 km of wet areas, swamps, or waterbodies	N/A	High Sensitivity to Potential Gain	Endangered	Vulnerable
Litoria brevipalmata	Green-thighed Frog	N/A	N/A	Moderate Sensitivity to Potential Gain	Vulnerable	Not Listed
Lophoictinia isura	Square-tailed Kite	N/A	N/A	Moderate Sensitivity to Potential Gain	Vulnerable	Not Listed
Miniopterus australis	Little Bentwing-bat	N/A	N/A	Very High Sensitivity to Potential Gain	Vulnerable	Not Listed
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat	N/A	N/A	Very High Sensitivity to Potential Gain	Vulnerable	Not Listed
Myotis macropus	Southern Myotis	Hollow-bearing trees, within 200 m of riparian zone, bridges, caves or artificial structures within 200 m of riparian zone	N/A	High Sensitivity to Potential Gain	Vulnerable	Not Listed
Ninox connivens	Barking Owl	N/A	N/A	High Sensitivity to Potential Gain	Vulnerable	Not Listed
Ninox strenua	Powerful Owl	N/A	N/A	High Sensitivity to Potential Gain	Vulnerable	Not Listed

Species	Common Name	Habitat Constraints	Geographic limitations	Sensitivity to gain class	NSW listing status	EPBC Listing status
Pandion cristatus	Eastern Osprey	N/A	N/A	Moderate Sensitivity to Potential Gain	Vulnerable	Not Listed
Petalura gigantea	Giant Dragonfly	Swamps and within 500 m of swamps	N/A	Very High Sensitivity to Potential Gain	Endangered	Not Listed
Petaurus norfolcensis	Squirrel Glider	N/A	N/A	High Sensitivity to Potential Gain	Vulnerable	Not Listed
Petrogale penicillata	Brush-tailed Rock-wallaby	Land within 1 km of rocky escarpments, gorges, steep slopes, boulder piles, rock outcrops or clifflines	N/A	Very High Sensitivity to Potential Gain	Endangered	Vulnerable
Phascogale tapoatafa	Brush-tailed Phascogale	Hollow-bearing trees	N/A	High Sensitivity to Potential Gain	Vulnerable	Not Listed
Phascolarctos cinereus	Koala	N/A	N/A	High Sensitivity to Potential Gain	Vulnerable	Vulnerable
Planigale maculata	Common Planigale	N/A	N/A	High Sensitivity to Potential Gain	Vulnerable	Not Listed
Pteropus poliocephalus	Grey-headed Flying-fox	N/A	N/A	High Sensitivity to Potential Gain	Vulnerable	Vulnerable
Tyto novaehollandiae	Masked Owl	N/A	N/A	High Sensitivity to Potential Gain	Vulnerable	Not Listed
Uperoleia mahonyi	Mahony·s Toadlet	N/A	N/A	High Sensitivity to Potential Gain	Endangered	Not Listed

1.7.1 Fauna habitat assessment

Fauna habitat assessment was carried out across the study area with the aim of refining the candidate species list.

Broad habitat mapping and high-quality habitat mapping for individual threatened species was undertaken within the study area to delineate fauna habitat types to further understand which species/fauna assemblages may be expected to occur.

Fauna habitat included an assessment of the following features within each fauna habitat type:

- Site condition
- Vegetation structure
- Presence of stock
- Evidence of feral animals
- Evidence of human disturbance
- Evidence of erosion
- Fire history
- Nectar or fruit resources and perch sites
- Proximity to water
- Evidence of fauna occupation
- Dominant canopy species and cover
- Dominant mid-storey species and cover
- Dominant ground species and cover
- % cover of weeds, bare ground, leaf litter, rock cover
- Evidence of seedling recruitment
- Hollow resources
- Wetlands with emergent vegetation
- Cliffs or caves.

The habitat assessment data captured was then incorporated with species information from BioNet (including habitat constraints, habitat preferences, and ecology) for each threatened species known or likely to occur within the study area to generate species habitat polygons. Mapping of species habitat polygons was undertaken in accordance with the BAM and only undertaken for 'species credit' species (or species credit components of a species habitat). Threatened species habitat mapping also included consideration of other databases (such as the EPBC Species Profile and Threats Database) and relevant planning instruments (i.e. State Environment Planning Policy 44 – Koala Habitat Protection / SEPP44).

The fauna habitat features present within each of the broad fauna habitats present is described in the **Table 19**, and shown on **Figure 8**.

Table 19 Fauna habitats present

Habitat feature	Dry sclerophyll forest	Forested wetland	Exotic vegetation	Cleared land	Dam/waterbody
Site condition	Patchy site condition, with evidence of site disturbance present throughout habitat type.	Extensive disturbance with mid-storey and ground cover dominated by exotic vegetation.	Exotic vegetation such as *Pinus radiata* or *Cinnamomum camphora* dominating canopy. Exotic understorey. Limited to no shrub layer.	Cleared grass, playing fields, adventure course, RSL club	Man-made dams and ponds. No natural permanent water sources present.
Vegetation structure	Forest	Forest	Forest	Grassland/cleared land	Waterbody
Presence of stock	No	No	No	Hoof prints from feral deer observed in northern clearing	No
Evidence of feral animals	*Lepus capensis* (Brown Hare), *Vulpes vulpes* (Fox)	*Lepus capensis* (Brown Hare), *Vulpes vulpes* (Fox)	*Lepus capensis* (Brown Hare), *Vulpes vulpes* (Fox)	*Lepus capensis* (Brown Hare), *Vulpes vulpes* (Fox)	
Evidence of human disturbance	Dumped rubbish, under-scrubbing, weeds, felled logs.	Dumped rubbish, weeds	Dumped rubbish, under-scrubbing, weeds, felled logs.	Cleared for human activities	Manmade waterbodies only
Evidence of erosion	No	No	No	Yes, man-made mud pits	No
Fire history	No recent evidence of fire	No recent evidence of fire	No recent evidence of fire	No recent evidence of fire	No recent evidence of fire
Nectar or fruit resources and perch sites	No flowering species observed during surveys	No flowering species observed during surveys	No flowering species observed during surveys	No flowering species observed during surveys	No flowering species observed during surveys
Proximity to water	Manmade dam on-site. Nearest natural waterbody several kilometres east of study area	Manmade dam on-site. Nearest natural waterbody several kilometres east of study area	Manmade dam on-site. Nearest natural waterbody several kilometres east of study area	Manmade dam on-site. Nearest natural waterbody several kilometres east of study area	Manmade dam on-site. Nearest natural waterbody several kilometres east of study area
Evidence of fauna occupation	*Trichoglossus haematodus* (Rainbow Lorikeet), *Trichoglossus chlorolepidotus* (Scaly-breasted Lorikeet), *Trichosurus vulpecula*	No	*Pseudocheirus peregrinus* (Common Ringtail Possum) observed using vegetation.	No	*Chenonetta jubata* (Australian Wood Duck) observed using dam

Habitat feature	Dry sclerophyll forest	Forested wetland	Exotic vegetation	Cleared land	Dam/waterbody
	(Common Brush-tailed Possum), and *Pseudocheirus peregrinus* (Common Ringtail Possum) observed using hollows.				
Dominant canopy species and cover	*Eucalyptus racemosa, Eucalyptus sclerophylla, Corymbia gummifera*	*Melaleuca quinquenervia*	*Pinus radiata, Cinnamomum camphor*	Absent	Absent
Dominant mid-storey species and cover	*Allocasuarina littoralis*	Absent	*Lantana camara*	Absent	Absent
Evidence of seedling recruitment	Limited recruitment	Absent	N/A	N/A	N/A
Hollow resources	Extensive hollow resources in south-western portion of vegetation. Hollows also occur along sports field interface.	Absent	Absent	N/A	N/A
Wetlands with emergent vegetation	Absent	Absent	Absent	Absent	Absent
Cliffs or caves	Absent	Absent	Absent	Absent	Absent

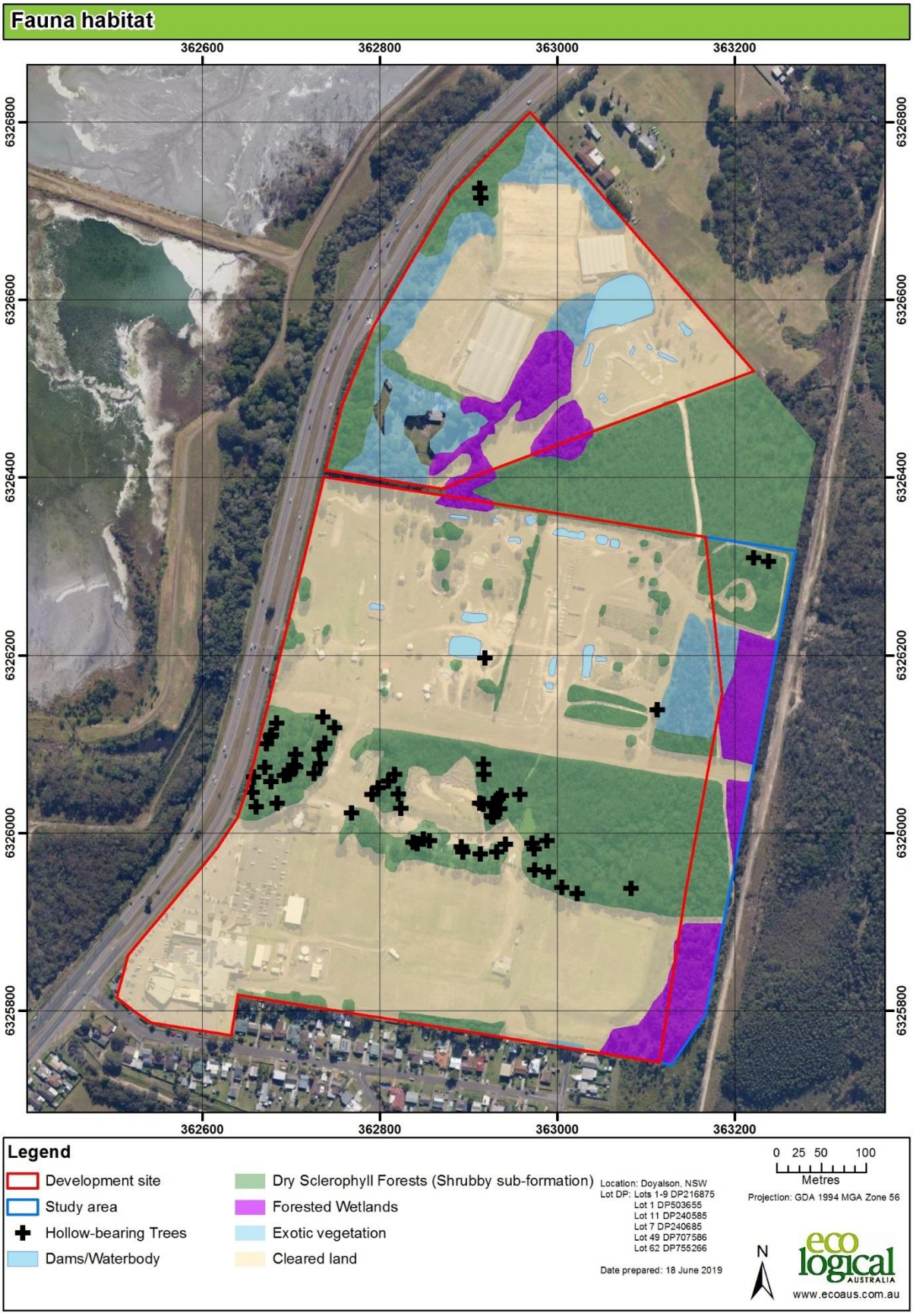

Figure 8 Fauna habitats

1.7.1.1 Exclusion of candidate species based on-site condition and habitat features present

The following species (Table 20) have been excluded from further assessment consistent with Section 6.4.1.10 of the BAM (OEH, 2017).

Table 20: Justification for exclusion of candidate species credit species

Species	Common Name	NSW listing status	EPBC Listing status	Justification for exclusion of species
Chalinolobus dwyeri	Large-eared Pied Bat	Vulnerable	Vulnerable	In accordance with BAM section 6.4.1.10, habitat constraints identified in the Threatened Biodiversity Data Collection have been used to assess habitat on the Development Site for this species. This is a dual credit species, and only a species credit species when specific habitat constraints are present for breeding. No cliffs are present and Development Site is not in a landscape position to be located within 2 km of rocky areas containing caves, overhangs, escarpments, outcrops or crevices, or within 2 km of old mines or tunnels.
Maundia triglochinoides		Vulnerable	Not listed	In accordance with BAM section 6.4.1.10, habitat constraints identified in the Threatened Biodiversity Data Collection have been used to assess habitat on the Development Site for this species. This is a dual credit species, and only a species credit species when specific habitat constraints are present. No swamps, or shallow fresh water on clay are present.
Petalura gigantea	Giant Dragonfly	Endangered	Not listed	In accordance with BAM section 6.4.1.10, habitat constraints identified in the Threatened Biodiversity Data Collection have been used to assess habitat on the Development Site for this species. This is a dual credit species, and only a species credit species when specific habitat constraints are present. No swamps or land within 500 m of swamps are present
Petrogale penicillata	Brush-tailed Rock-wallaby	Endangered	Vulnerable	In accordance with BAM section 6.4.1.10, habitat constraints identified in the Threatened Biodiversity Data Collection have been used to assess habitat on the Development Site for this species. This is a dual credit species, and only a species credit species when specific habitat constraints are present. No land within 1 km of rocky escarpments, gorges, steep slopes, boulder piles, rock outcrops or cliff-lines are present.

1.7.2 Targeted surveys

Targeted surveys for species credit species (flora Table 21 and fauna Table 22) were undertaken at the Development Site on the dates outlined in **Table 23**.

The location of targeted surveys are shown on **Figure 10**, with the results of the surveys shown as individual species polygons on **Figure 11**.

Table 21 Threatened flora survey timing requirements from BAMC

Species	Common	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Acacia bynoeana	Bynoe's Wattle	X	X	X						X	X	X	X
Angophora inopina	Charmhaven Apple	X	X	X	X	X	X	X	X	X	X	X	X
Astrotricha crassifolia	Thick-leaf Star-hair	X	X	X	X	X	X	X	X	X	X	X	X
Callistemon linearifolius	Netted Bottle Brush	X	X	X						X	X	X	X
Eucalyptus camfieldii	Camfield's Stringybark	X	X	X	X	X	X	X	X	X	X	X	X
Eucalyptus parramattensis subsp. *parramattensis* - endangered population	*Eucalyptus parramattensis* C. Hall. subsp. *parramattensis* in Wyong and Lake Macquarie local government areas	X	X	X	X	X	X	X	X	X	X	X	X
Grevillea parviflora subsp. *parviflora*	Small-flower Grevillea	X	X	X	X	X	X	X	X	X	X	X	X
Cryptostylis hunteriana	Leafless Tongue Orchid	X	X									X	X
Dendrobium melaleucaphilum	Spider orchid												
Diuris praecox	Rough Doubletail							X	X				
Genoplesium insigne	Variable Midge Orchid								*	X	X	X	
Melaleuca biconvexa	Biconvex Paperbark	X	X	X	X	X	X	X	X	X	X	X	X
Melaleuca groveana	Grove's Paperbark	X	X	X	X	X	X	X	X	X	X	X	X
Prostanthera askania	Tranquility Mintbush									X	X	X	X
Rutidosis heterogama	Heath Wrinklewort	X	X	X	X	X	X	X	X	X	X	X	X
Tetratheca glandulosa								X	X	X	X	X	
Tetratheca juncea	Black-eyed Susan							X	X	X	X	X	X

X = appropriate survey period.

Bright green = survey period selected.

* denotes reference site observed flowering

Table 22 Threatened fauna survey timing requirements from BAMC

Class	Species	Common	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Amphibia	*Crinia tinnula*	Wallum Froglet	X	X	X	X	X	X	X	X	X	X	X	X
	Heleioporus australiacus	Giant Burrowing Frog	X	X	X	X	X				X	X	X	X
	Litoria aurea	Green and Golden Bell Frog	X	X	X								X	X
	Litoria brevipalmata	Green-thighed Frog	X	X	X							X	X	X
	Uperoleia mahonyi	Mahony's Toadlet	X	X	X							X	X	X
Aves - diurnal	*Anthochaera phrygia*	Regent Honeyeater									X	X	X	X
	Callocephalon fimbriatum	Gang-gang Cockatoo	X									X	X	X
	Calyptorhynchus lathami	Glossy Black-cockatoo			X	X	X	X	X	X				
	Haliaeetus leucogaster	White-bellied Sea-eagle							X	X	X	X	X	X
	Hieraaetus morphnoides	Little Eagle								X	X	X		
	Lathamus discolor	Swift Parrot					X	X	X	X				
	Lophoictinia isura	Square-tailed Kite	X								X	X	X	X
	Pandion cristatus	Eastern Osprey				X	X	X	X	X	X	X	X	
Aves - nocturnal	*Burhinus grallarius*	Bush Stone-curlew	X	X	X	X	X	X	X	X	X	X	X	X
	Ninox connivens	Barking Owl					X	X	X	X	X	X	X	X
	Ninox strenua	Powerful Owl					X	X	X	X				
	Tyto novaehollandiae	Masked Owl					X	X	X	X				
Mammalia	*Cercartetus nanus*	Eastern Pygmy-possum	X	X	X							X	X	X
	Miniopterus australis	Little Bentwing-bat	X	X										X
	Miniopterus schreibersii oceanensis	Eastern Bentwing-bat	X	X									X	X
	Myotis macropus	Southern Myotis	X	X	X								X	X
	Petaurus norfolcensis	Squirrel Glider	X	X	X	X	X	X	X	X	X	X	X	X
	Phascogale tapoatafa	Brush-tailed Phascogale	X	X	X	X	X	X	X	X	X	X	X	X

Class	Species	Common	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mammalia	*Phascolarctos cinereus*	Koala	X	X	X	X	X	X	X	X	X	X	X	X
	Planigale maculata	Common Planigale	X	X	X	X	X	X	X	X	X	X	X	X
	Pteropus poliocephalus	Grey-headed Flying-fox										X	X	X
Reptilia	*Hoplocephalus bitorquatus*	Pale-headed Snake	X	X	X								X	X

X = appropriate survey period.

Bright green = survey period selected.

Survey effort undertaken at the development for threatened flora is outlined in **Table 23.**

Table 23: Targeted surveys for threatened flora

Date	Surveyors	Method	Target species	Effort
19 July 2018	Gordon Patrick and Sarah Stevens	Floristic plots and random meanders	*Angophora inopina*, *Astrotricha crassifolia*, *Eucalyptus camfieldii*, *Eucalyptus parramattensis* subsp. *parramattensis* - endangered population, *Grevillea parviflora* subsp. *parviflora*, *Diuris praecox*, *Dendrobium melaleucaphilum*, *Melaleuca biconvexa, Melaleuca groveana, Rutidosis heterogama*, *Tetratheca glandulosa*, *Tetratheca juncea*	Two floristic quadrats plus random meanders
20 July 2018	Gordon Patrick and Sarah Stevens	Floristic plots and random meanders		Two floristic quadrats plus random meanders
2 August 2018	Alex Pursche and Lily Gorrell	Floristic plots and random meanders		Two floristic quadrats plus random meanders
30 August 2018	Alex Pursche and Emily Mowat	Meander searches in suitable habitat		Approximately 9 km walking targeted searches in suitable habitat
8 November 2018	Lily Gorrell and Dee Ryder	Meander searches in suitable habitat	Cryptostylis hunteriana, Acacia byneoana ,*Callistemon linearifolius,* Prostanthera *askania, Genoplesium insigne*	Approximately 13 km walking targeted searches in suitable habitat

Survey effort undertaken at the development for threatened fauna is outlined in **Table 24**. All surveys have been completed for all candidate species. No additional surveys are planned.

Table 24: Survey effort for threatened fauna

Target species	Method and minimum effort	Habitat (ha)	Total effort
Squirrel Glider Brush-tailed Phascogale Masked Owl Barking Owl Powerful Owl Bush-stone Curlew	Spotlighting on foot - 2 x 1 hour and 1 km up to 200 ha of stratification unit, walking at approximately 1 km per hour on 2 separate nights	9.45 ha	Spotlighting on foot for 1 hour with two observers on 20 – 23 August 2018. Additional surveys conducted on 13 November 2018, and 25, 26, and 28 March 2019. Total effort to date 16 hours spotlighting over 8 nights. Minimum survey requirement exceeded.

Target species	Method and minimum effort	Habitat (ha)	Total effort
Squirrel Glider Masked Owl Barking Owl Powerful Owl Bush-stone Curlew	Call playback - sites should be separated by 800 m – 1 km, and each site must have the playback session repeated as follows: at least 5 visits per site, on different nights are required for the Powerful Owl, Barking Owl and the Grass Owl; at least 6 visits per site for the Sooty Owl, and 8 visits per site for the Masked Owl are required. Sites for Bush Stone-curlew surveys should be 2-4 km apart and conducted during the breeding season	9.45 ha	Call playback for 30 minutes with two observers on 20 – 23 August 2018. Additional surveys conducted on 13 November 2018, and 25, 26, and 28 March 2019. Total effort to date 8 hours call playback over 8 nights. Minimum survey requirement completed Species may use the site on occasion but unlikely to use the site as breeding habitat.
Bush-stone Curlew	Day habitat search - Search habitat for pellets, and likely hollows. Flushing of Bush Stone-curlews by walking through potential habitat.	9.45 ha	4.37 km habitat searches on 20 June 2018 and 6.39 km habitat search on 2 August 2018 10.75 km total habitat search Minimum survey requirement exceeded.
Squirrel Glider Brush-tailed Phascogale Koala	Arboreal remote cameras baited with peanut butter – no minimum guideline established	9.45 ha	Five Reconyx cameras set from 2 August to 23 August inclusive. Total effort 110 trapping nights Minimum survey requirement exceeded.
Regent Honeyeater Gang-gang Cockatoo Glossy Black-cockatoo White-bellied Sea-eagle Little Eagle Swift Parrot Square-tailed Kite Eastern Osprey	Area search for breeding habitat	9.45 ha	4.37 km habitat searches on 20 June 2018 and 6.39 km habitat search on 2 August 2018 10.75 km total habitat search Minimum survey requirement exceeded.
Squirrel Glider	Arboreal Elliot traps - 24 trap nights over 3-4 consecutive nights	9.45 ha	24 trap nights from 12 – 16 November Minimum survey requirement completed
Wallum Froglet Giant Burrowing Frog Green and Golden Bell Frog Green-thighed Frog Mahony's Toadlet	Combination of tadpole surveys, call surveys and nocturnal searches in suitable weather conditions around swamps, dams and flooded roadside ditches. Minimum of one 200 m transect per water body or inundated area, repeated on a minimum of 2 separate nights.	limited habitat onsite	It is noted that the habitat onsite is moderately degraded and is not ideal habitat for these species. Surveys conducted on 25, 26, and 28 March 2019 during suitable weather conditions. Minimum survey requirement completed

Target species	Method and minimum effort	Habitat (ha)	Total effort
Eastern Pygmy-possum Common Planigale	Small Elliott traps - 100 trap nights over 3-4 consecutive nights	4 ha	100 trap nights from 12 – 16 November Minimum survey requirement completed
	Pitfall traps with drift nets - 24 trap nights over 3-4 consecutive nights	4 ha	24 trap nights from 12 – 16 November Minimum survey requirement completed
Southern Myotis Little Bentwing-bat Eastern Bentwing-bat	Harp trapping - 4 trap nights over 4 consecutive nights	9.45 ha	16 trap nights from 12 – 16 November 2018. Minimum survey requirement completed
Grey-headed Flying-fox	Area search for breeding habitat		Opportunistic searches. No breeding habitat present. Minimum survey requirement completed
Pale-headed Snake	Spotlighting - 30-minute search on 2 separate nights targeting specific habitat		Surveys conducted on 25, 26, and 28 March 2019 during suitable weather conditions. Minimum survey requirement completed

Results from the fauna survey are shown in **Table 25**below. A complete species list of all fauna species identified onsite is provided in the appendices of this report.

Table 25 Fauna survey results

Target species	Method and minimum effort	Species detected
Squirrel Glider Brush-tailed Phascogale Masked Owl Barking Owl Powerful Owl Bush-stone Curlew	Spotlighting on foot - 2 x 1 hour and 1 km up to 200 ha of stratification unit, walking at approximately 1 km per hour on 2 separate nights	Tawny Frogmouth and Common Ringtail Possum most frequently encountered species. No threatened species identified
Squirrel Glider Masked Owl Barking Owl Powerful Owl Bush-stone Curlew	Call playback - sites should be separated by 800 m – 1 km, and each site must have the playback session repeated as follows: at least 5 visits per site, on different nights are required for the Powerful Owl, Barking Owl and the Grass Owl; at least 6 visits per site for the Sooty Owl, and 8 visits per site for the Masked Owl are required. Sites for Bush Stone-curlew surveys should be 2-4 km apart and conducted during the breeding season	No species responded to call playback.

Target species	Method and minimum effort	Species detected
Bush-stone Curlew	Day habitat search - Search habitat for pellets, and likely hollows. Flushing of Bush Stone-curlews by walking through potential habitat.	No Bush-stone Curlews identified during meanders and habitat searches.
Squirrel Glider Brush-tailed Phascogale Koala	Arboreal remote cameras – no minimum guideline established	Most commonly identified native species was Common Brushtail Possum. On ground camera, numerous Fox, Brown Hare, and Rabbit identified.
Regent Honeyeater Gang-gang Cockatoo Glossy Black-cockatoo White-bellied Sea-eagle Little Eagle Swift Parrot Square-tailed Kite Eastern Osprey	Area search for breeding habitat	Four Glossy Black-cockatoos observed feeding in *A. littoralis* during searches for breeding habitat. Two nests observed in *Cinnamomum camphor* in open space – but size and build indicates likely egret nests.
Squirrel Glider	Arboreal Elliot traps - 24 trap nights over 3-4 consecutive nights	No species captured
Eastern Pygmy-possum Common Planigale	Small Elliott traps - 100 trap nights over 3-4 consecutive nights	No threatened species captured. Common species such as *Rattus fuscipes*, *Rattus luterolus*, *Antechinus swainsonii*, & *Antechinus stuartii* captured regularly within small Elliot traps
Eastern Pygmy-possum Common Planigale	Pitfall traps with drift nets - 24 trap nights over 3-4 consecutive nights	One *Anilios nigrescens* captured
Southern Myotis Little Bentwing-bat Eastern Bentwing-bat	Harp trapping - 4 trap nights over 4 consecutive nights	*Nyctophilus geoffroyi*, and *Vespadelus vulturnus* captured in northern portion of site. No captures in harp traps along edge of dam.

Photograph 1 Common Brushtail Possum recorded on arboreal camera

Photograph 2 Swamp Wallaby recorded on ground camera

Weather conditions during the targeted surveys are outlined in **Table 26**.

Table 26: Weather conditions

Date	Minimum temperature 0C	Maximum temperature 0C	Rainfall (mm)
Thu 19/07/2018	9.0	22.0	0
Fri 20/07/2018	13.4	21.4	0
Thu 02/08/2018	9.8	19.4	1.4
Fri 03/08/2018	10.9	20.1	0
Sat 04/08/2018	11.2	20.2	0
Sun 05/08/2018	9.3	22.3	0
Mon 06/08/2018	12.3	18.6	0
Tue 07/08/2018	10.5	18.1	2
Wed 08/08/2018	7.6	20.3	0
Thu 09/08/2018	9.9	19.1	0
Fri 10/08/2018	8.9	21.2	0
Sat 11/08/2018	13.1	23.1	0.2
Sun 12/08/2018	9.7	16.4	0
Mon 13/08/2018	6.5	20.2	0
Tue 14/08/2018	8.5	22.2	0
Wed 15/08/2018	11.6	24.2	0
Thu 16/08/2018	12.9	20.7	0
Fri 17/08/2018	8.7	18.2	0
Sat 18/08/2018	7.8	22.2	0
Sun 19/08/2018	10	17.2	0
Mon 20/08/2018	8.7	13.9	0
Tue 21/08/2018	6.9	18.9	0
Wed 22/08/2018	8.6	16.5	0
Thu 23/08/2018	9.2	18.7	0
Thu 30/08/2018	6.6	17.5	0
Mon 12/11/18	16.4	23.4	0
Tues 13/11/18	18.9	26.4	0
Wed 14/11/18	18.0	22.2	0
Thu 15/11/18	18.2	22.6	0.2
Fri 16/11/18	16.5	20.1	9.6
Mon 25/3/19	20.4	25.0	7.6
Tue 26/3/19	18.2	26.0	2.8
Thu 28/3/19	17.7	28.7	0

Following completion of targeted surveys, the species credit species included in the assessment are outlined in **Table 27**. All species not identified during survey have been excluded from further assessment. All species that were correctly surveyed for in July, August, and November 2018 and not identified on-site have been excluded in the BAMC from further assessment.

Table 27: Species credit species included in the assessment

Species	Common Name	Species presence	Geographic limitations	Number of individuals / Habitat (ha)	Biodiversity Risk Weighting
Calyptorhynchus lathami	Glossy Black-cockatoo	Four individuals observed on 2 August 2018 feeding in *A. littoralis*.	Breeding habitat: Living or dead tree with hollows greater than 15 cm diameter and greater than 5m above ground. Foraging habitat: Presence of *Allocasuarina* and *Casuarina* species	Four individuals observed. PCT 1636 containing hollow-bearing trees identified as potential breeding habitat. Total potential breeding habitat on-site = 4.12 ha	2.0

1.7.3 Species polygons

Species polygons have been drafted for Glossy Black-cockatoo based on the following habitat limitations and includes patches of vegetation with:

- hollow-bearing trees
- stands of Black She-oak.

Species polygons for Glossy Black-cockatoo are shown on **Figure 11.**

1.7.4 Use of local data

No local data proposed for use.

1.7.5 Expert reports

No expert reports are proposed for use.

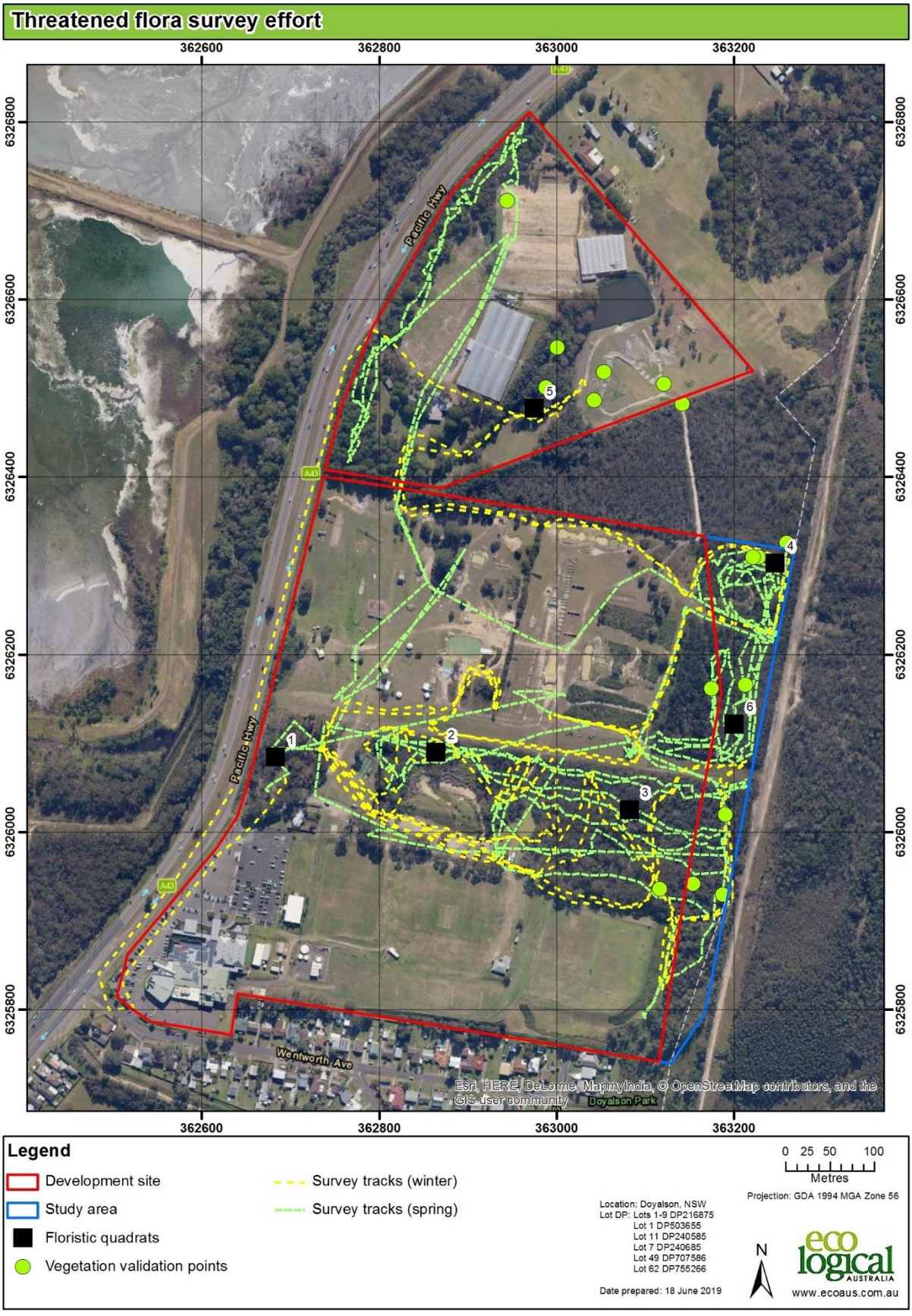

Figure 9: Targeted flora surveys

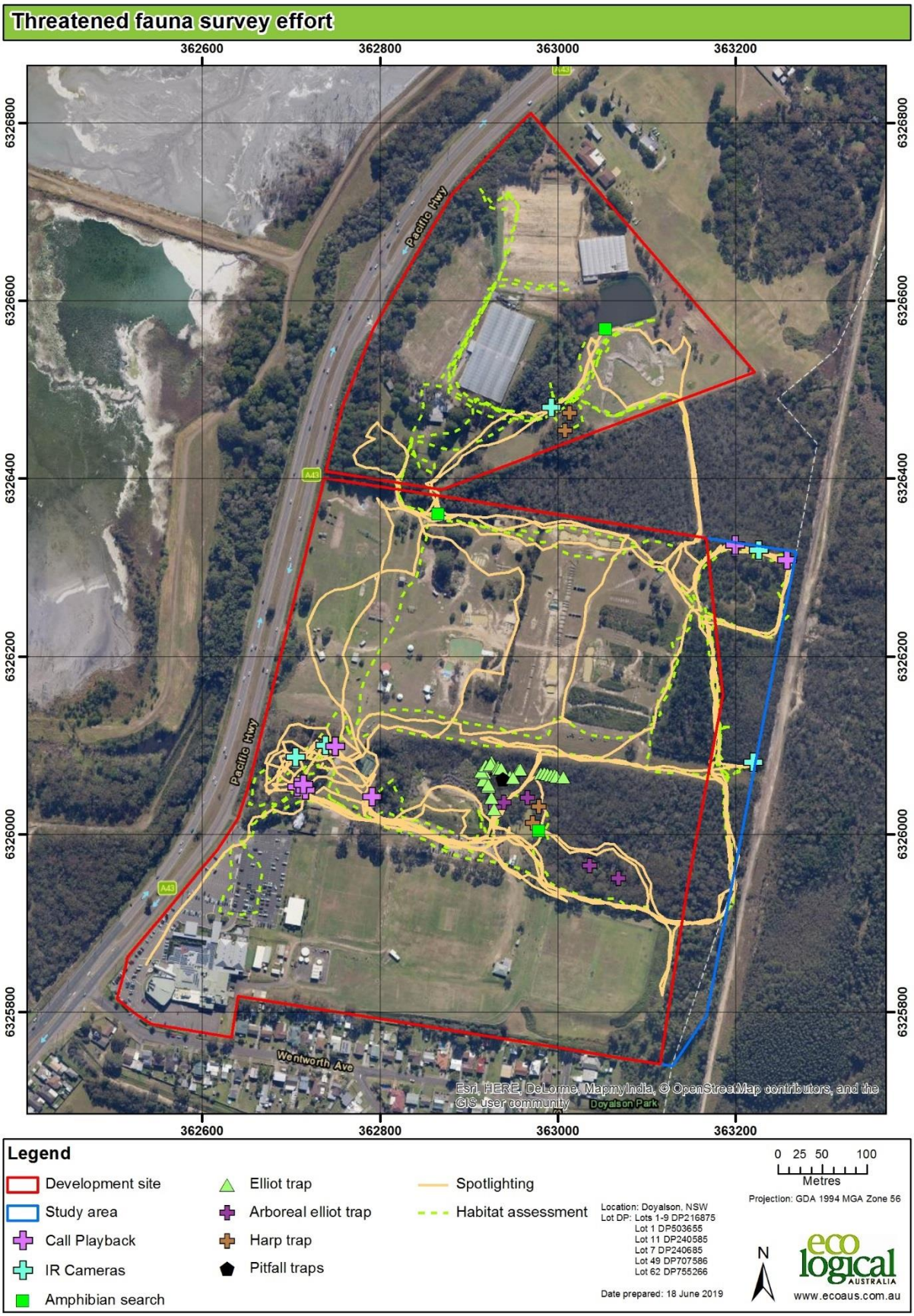

Figure 10 Targeted fauna surveys

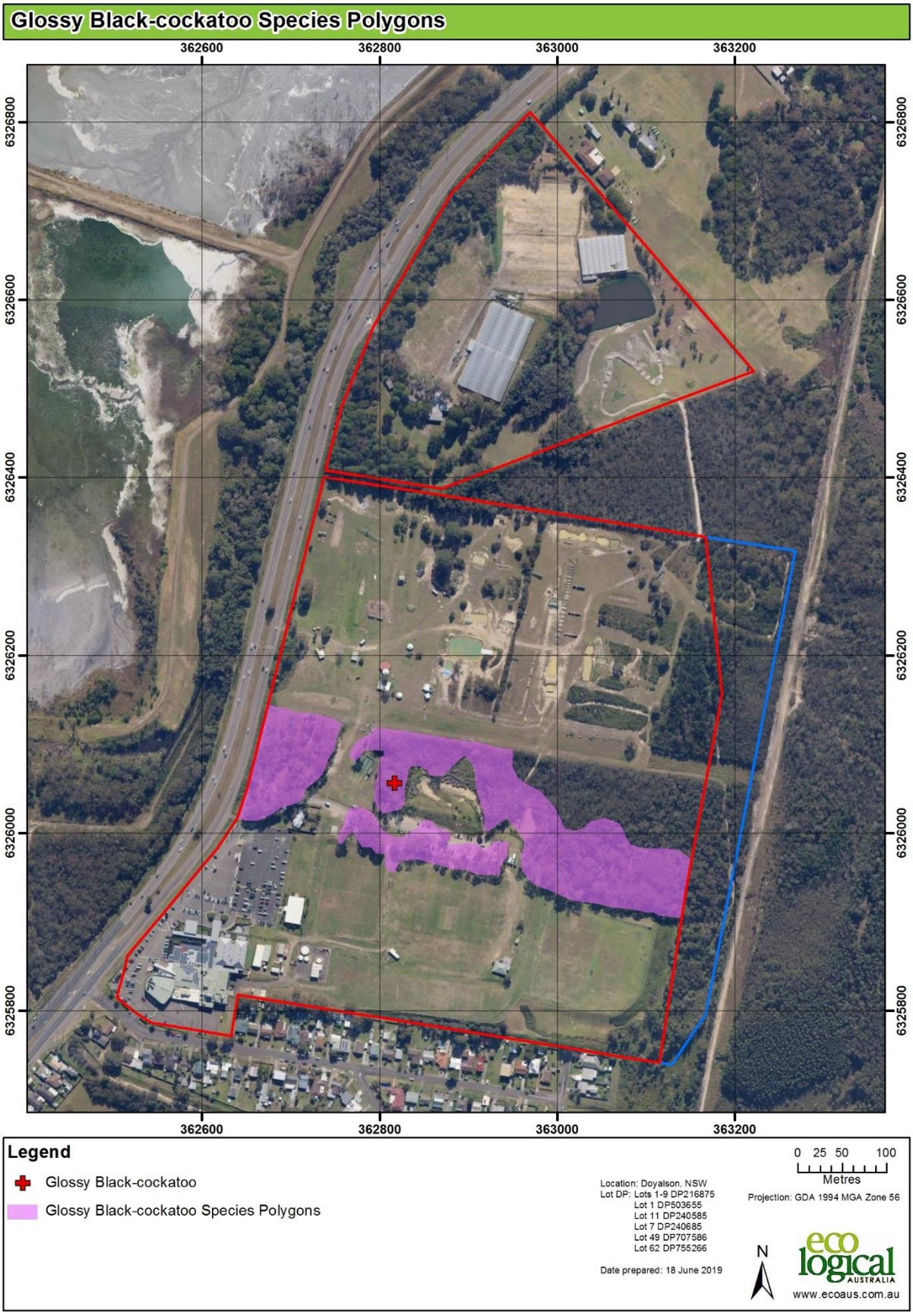

Figure 11: Glossy Black-cockatoo species polygons

2. Stage 2: Impact assessment (biodiversity values)

The impact assessment below is preliminary in nature. As this assessment is reviewing the proposed masterplan for the site prior to rezoning, there are uncertainties surrounding the final design. The author of this report has adopted the precautionary approach and included all vegetation as impacted within the Masterplan boundary (**Figure 1**). The extent of impacts however will likely change throughout the rezoning process as areas of retention are firmed up.

As such, there are several assumptions that have been included within any figures quoted below:

- Assumption 1 – all vegetation within the Development Site has been included within the impact calculations. This is likely an overestimate of the actual impacts of the proposal.
- Assumption 2 – some areas of native vegetation (such as canopy trees in open space areas) can be retained in the future.
- Assumption 3 – areas of retained vegetation will be managed under a Vegetation Management Plan (VMP) to improve biodiversity values.

2.1 Avoiding impacts

2.1.1 Locating a project to avoid and minimise impacts on vegetation and habitat

The proposed development has been located to avoid and minimise impacts as outlined in **Table 28**.

Table 28: Locating a project to avoid and minimise impacts on vegetation and habitat

Approach	How addressed	Justification
Locating the project in areas where there are no biodiversity values	All areas of cleared land containing no biodiversity values have been utilised.	The placement of the Development Site footprint has centred around the area of lowest biodiversity value within the development boundary.
Locating the project in areas where the native vegetation or threatened species habitat is in the poorest condition	All areas of vegetation on the periphery of the cleared land that suffers from edge effects and disturbance from past clearing activities and current grazing pressures have been utilised.	The placement of the Development Site footprint has centred around the area of lowest biodiversity value (cleared paddock) within the Development Site boundary whilst also encompassing moderate condition periphery vegetation.
Locating the project in areas that avoid habitat for species and vegetation in high threat categories (e.g. an EEC or CEEC), indicated by the biodiversity risk weighting for a species	The Development Site has not been able to completely avoid impacts to areas providing species habitat and EEC vegetation.	The placement of the Development Site footprint has centred around the area of lowest biodiversity value (cleared paddock) and aimed to minimise impacts to EEC and species habitat by impacting on the moderate condition periphery vegetation and avoiding higher quality remaining EEC vegetation surrounding the Development Site. Areas of EEC occurring along the drainage line will be retained.

Approach	How addressed	Justification
Locating the project such that connectivity enabling movement of species and genetic material between areas of adjacent or nearby habitat is maintained	Development footprint has been centred around the area of least biodiversity impact with the aim to conserve connectivity values surrounding the Development Site.	Connectivity will be unavoidably diminished as a result of the proposal.

Regarding measures to avoid and minimise impacts during site selection and planning phase, the suitability of the Development Site has been selected with consideration given to limiting the amount of EEC vegetation to be removed with the placement of the facilities occurring within the cleared and highly disturbed paddock containing no biodiversity values and extending out into the disturbed, fragmented portions of native vegetation with the aim being to retain the outer periphery of intact, less disturbed EEC vegetation present along the eastern sides of the Development Site .

2.1.2 Designing a project to avoid and minimise impacts on vegetation and habitat

The development has been designed to avoid and minimise impacts as outlined in **Table 29**.

Table 29: Designing a project to avoid and minimise impacts on vegetation and habitat

Approach	How addressed	Justification
Reducing the clearing footprint of the project	In designing the development, the aim was to conserve the more intact EEC vegetation along the drainage line whilst centring development in the most cleared portion of the study area.	The design has minimised vegetation clearing through strategic placement.
Locating ancillary facilities in areas where there are no biodiversity values	The design has endeavoured to locate ancillary facilities within the central cleared/disturbed portion of the Development Site and along roads designed in the final footprint.	The placement of ancillary facilities has been designed to minimise impacts to biodiversity values by locating them in areas of no biodiversity values (cleared paddock).
Locating ancillary facilities in areas where the native vegetation or threatened species habitat is in the poorest condition (i.e. areas that have a lower vegetation integrity score)	The design has endeavoured to locate ancillary facilities in areas of vegetation on the periphery of the cleared land that suffers from edge effects and disturbance from past clearing activities and current disturbance pressures.	The placement of ancillary facilities has been designed to minimise impacts to biodiversity values by locating them in areas of lower biodiversity value (cleared paddock) within the Development Site boundary whilst also encompassing moderate condition periphery vegetation.
Locating ancillary facilities in areas that avoid habitat for species and vegetation in high threat status categories (e.g. an EEC or CEEC)	It has not been possible to completely avoid impacts to areas providing species habitat and EEC vegetation. The placement of the Development Site has minimised impacts as far as practicable to the EEC vegetation whilst maximising extent necessary for development.	The placement of ancillary facilities has been designed to work in and around roads and building footprint. No clearing of species habitat or EEC will occur solely for ancillary facilities.

Approach	How addressed	Justification
Providing structures to enable species and genetic material to move across barriers or hostile gaps	The site is currently isolated to the south, north and west of the study area.	Corridor movement will be retained for species movement along the eastern, boundary.
Making provision for the demarcation, ecological restoration, rehabilitation and/or ongoing maintenance of retained native vegetation habitat on the development site.	Proponent to protect all remaining vegetation outside of the Development Site footprint.	The proponent will demarcate all areas outside the Development Site boundary to be retained and will rehabilitate all remaining EEC vegetation.
Efforts to avoid and minimise impacts through design must be documented and justified	In designing the development, the aim was to conserve the more intact periphery vegetation to the west and south whilst centring development in the most cleared portion of the study area.	The design has minimised vegetation clearing through strategic placement.

2.1.3 Prescribed biodiversity impacts

The Development Site has the prescribed biodiversity impacts outlined in **Table 30**.

Table 30: Prescribed biodiversity impacts

Prescribed biodiversity impact	Description in relation to the Development Site	Threatened species or ecological communities affected
Impacts of development on water quality, water bodies and hydrological processes that sustain threatened species and threatened ecological communities (including from subsidence or upsidence resulting from underground mining)	Development adjacent to the unnamed 2nd order Strahler stream may impact water quality	Swamp Sclerophyll Forest on Coastal Floodplains

2.1.3.1 Locating a project to avoid and minimise prescribed biodiversity impacts

The development has been located to avoid and minimise prescribed biodiversity impacts as outlined in **Table 31.**

Table 31: Locating a project to avoid and minimise prescribed biodiversity impacts

Approach	How addressed	Justification
Locating the project to avoid direct impacts on water bodies	Vegetation will be retained adjacent to the unnamed 2nd order Strahler stream	To avoid further impacts to EECs

2.1.3.2 Designing a project to avoid and minimise prescribed biodiversity impacts

The development has been designed to avoid and minimise prescribed biodiversity impacts as outlined in **Table 32.**

Table 32: Designing a project to avoid and minimise prescribed biodiversity impacts

Approach	How addressed	Justification
Design of the project to maintain hydrological processes that sustain threatened species and TECs	Vegetation will be retained adjacent to the unnamed 2nd order Strahler stream. Vegetation will also be enhanced under management under a VMP.	To avoid further impacts to EECs

2.2 Assessment of Impacts

2.2.1 Direct impacts

The direct impacts of the development on:

- native vegetation are outlined in **Table 33.**
- threatened ecological communities are outlined in **Table 34.**
- threatened species and threatened species habitat is outlined in **Table 35.**
- prescribed biodiversity impacts is outlined in **Section 2.2.4.**

Direct impacts including the final project footprint (construction and operation) are shown on **Figure 12**: Masterplan project footprint including construction and operation **.**

Table 33: Direct impacts to native vegetation

PCT ID	PCT Name	Vegetation Class	Vegetation Formation	Direct impact (ha)
1636	Scribbly Gum - Red Bloodwood - *Angophora inopina* heathy woodland on lowlands of the Central Coast	Dry Sclerophyll Forests (Shrubby sub-formation)	Sydney Coastal Dry Sclerophyll Forests	7.3 (SA) 6.29 (DS)
1638	Smooth-barked Apple - Red Bloodwood - Scribbly Gum grass - shrub woodland on lowlands of the Central Coast	Dry Sclerophyll Forests (Shrubby sub-formation)	Sydney Coastal Dry Sclerophyll Forests	6.2 (SA) 1.75 (DS)
1717	Broad-leaved Paperbark - Swamp Mahogany - Swamp Oak - Saw Sedge swamp forest of the Central Coast and Lower North Coast	Forested Wetlands	Coastal Swamp Forests	3.0 (SA) 1.41(DS)

Table 34: Direct impacts on threatened ecological communities

PCT ID	BC Act			EPBC Act		
	Listing status	Name	Direct impact (ha)	Listing status	Name	Direct impact (ha)
1717	Endangered Ecological Community	Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	1.07	Not listed	N/A	N/A

Table 35: Direct impacts on threatened species and threatened species habitat

Species	Common Name	Direct impact number of individuals / habitat (ha)	NSW listing status	EPBC Listing status
Calyptorhynchus lathami	Glossy Black-cockatoo	Four individuals observed. PCT 1636 containing hollow-bearing trees identified as potential breeding habitat. Total potential breeding habitat on-site = 4.12 ha	Vulnerable	Not listed

2.2.2 Change in vegetation integrity

The change in vegetation integrity as a result of the development is outlined in **Table 36**. Values presented below assume all native vegetation to be removed. Should the Masterplan change in the future through detailed design and vegetation can be retained, such as in a managed Asset Protection Zone (APZ) or public open space, then the future integrity score may be greater than 0 for some vegetation zones.

Table 36: Change in vegetation integrity

Veg Zone	PCT ID	Condition	Area (ha)	Current vegetation integrity score	Future vegetation integrity score	Change in vegetation integrity
1636	Scribbly Gum - Red Bloodwood - *Angophora inopina* heathy woodland on lowlands of the Central Coast	Disturbed	6.29	53.2	0	-53.2
1638	Smooth-barked Apple - Red Bloodwood - Scribbly Gum grass - shrub woodland on lowlands of the Central Coast	Disturbed	1.75	29	0	-29
1717	Broad-leaved Paperbark - Swamp Mahogany - Swamp Oak - Saw Sedge swamp forest of the Central Coast and Lower North Coast	Disturbed	1.41	33	0	-33

2.2.3 Indirect impacts

The indirect impacts of the development are outlined in **Table 37**. Indirect impact zones are shown on **Figure 13**.

Table 37: Indirect impacts

Indirect impact	Project phase	Nature	Extent	Frequency	Duration	Timing
Sedimentation and contaminated and/or nutrient rich run-off	Construction	Runoff during construction works	10 m from Development Site boundary	During heavy rainfall or storm events	During rainfall events	Short-term impacts
Noise, dust or light spill	Construction	Noise and dust created from machinery (no night works proposed therefore no light spill) Light spill from Development into adjacent retained vegetation	Noise and dust likely to carry further than 10 m from Development boundary	Daily, during construction works Nightly during operation of development	Sporadic throughout construction period Nightly during operation of development	Short-term impacts Long-term impacts from Development
Inadvertent impacts on adjacent habitat or vegetation	Construction	Damage to adjacent habitat or vegetation	10 m from Development Site boundary	Daily, during construction works	Throughout construction period	Short-term impacts
Transport of weeds and pathogens from the site to adjacent vegetation	Construction	Spread of weed seed or pathogens	Potential for spread into adjacent habitat	Daily, during construction works	Sporadic throughout construction period	Short-term impacts
Vehicle strike	Construction / operation	Potential for native fauna to be struck by working machinery and moving vehicles	Within Development Site	Daily, during both construction works and operation of the development	During working hours for construction Potential at any point during operation of the development	During working hours for construction Potential at any point during operation of the development

Indirect impact	Project phase	Nature	Extent	Frequency	Duration	Timing
Rubbish dumping	Construction / operation	Illegal dumping by local residents / construction crews	Potential for rubbish to spread via wind into adjacent vegetation	Potential to occur at any time throughout construction or operational phases	During working hours for construction Potential at any point during operation of the development	During working hours for construction Potential at any point during operation of the development
Wood collection	Construction / operation	Removal of wood in vegetation adjacent to the Development Site	Throughout adjacent vegetation	Potential to occur at any time throughout construction or operational phases	During working hours for construction Potential at any point during operation of the development	During working hours for construction Potential at any point during operation of the development
Bush rock removal and disturbance	Construction / operation	No bush rock present	N/A	N/A	N/A	N/A
Increase in predatory species populations	Construction / operation	Potential for an increase in predatory species in the locality through disturbance to vegetation	Throughout adjacent vegetation	Likely to occur gradually after disturbance to habitat and vegetation takes place	For a period after clearing works take place	At any point once clearing and disturbance to habitat take place
Increase in pest animal populations	Construction / operation	Potential for an increase in pest animal populations in the locality through disturbance to vegetation	Throughout adjacent vegetation	Likely to occur gradually after disturbance to habitat and vegetation takes place	For a period after clearing works take place	At any point once clearing and disturbance to habitat take place

Indirect impact	Project phase	Nature	Extent	Frequency	Duration	Timing
Increased risk of fire	Construction / operation	Potential for fire to spark during construction works especially any electrical or machinery works Potential for fire to occur from residences of the development	Throughout adjacent vegetation	Potential to occur at any time throughout construction or operational phases	During working hours for construction Potential at any point during operation of the development	During working hours for construction Potential at any point during operation of the development
Disturbance to specialist breeding and foraging habitat	Construction / operation	Potential for increased disturbance during construction and operation phases, especially due to light spill, noise, and dust.	Throughout retained vegetation	Potential to occur at any time throughout construction or operational phases	During working hours for construction Potential at any point during operation of the development	During working hours for construction Potential at any point during operation of the development

2.2.4 Prescribed biodiversity impacts

The Development Site has the prescribed biodiversity impacts as outlined in **Table 38**.

Table 38: Direct impacts on prescribed biodiversity impacts

Prescribed biodiversity impact	Nature	Extent	Frequency	Duration	Timing
Impacts of development on water quality, water bodies and hydrological processes that sustain threatened species and threatened ecological communities (including from subsidence or upsidence resulting from underground mining)	Changes to water quality due to development within riparian area of unnamed 2nd order Strahler stream	Throughout riparian vegetation, most likely during rainfall events.	During heavy rainfall or storm events	During rainfall events	Short-term impacts

2.2.5 Mitigating and managing impacts

Mitigation measures are to be confirmed at the Development Application and construction stage. As the project is at the Planning Proposal stage, the following mitigation measures are indicative of the types of measures that are to be considered. Measures proposed to mitigate and manage impacts at the Development Site before, during and after construction are outlined in Table 39.

Table 39: Measures proposed to mitigate and manage impacts

Measure	Risk before mitigation	Risk after mitigation	Action	Outcome	Timing	Responsibility
Displacement of resident fauna	Moderate	Minor	Pre-clearance survey of trees to be removed and identification of habitat trees Supervision of qualified ecologist during tree removal in accordance with best practise methods	Relocation of fauna in a sensitive manner	Moderate	Minor
Timing works to avoid critical life cycle events such as breeding or nursing	Moderate	Minor	Avoid clearing works in August to October during breeding/nesting period	Impacts to fauna during nesting/nursing avoided	Moderate	Minor
Instigating clearing protocols including pre-clearing surveys, daily surveys and staged clearing, the presence of a trained ecological or licensed wildlife handler during clearing events	Major	Minor	Pre-clearance survey of trees to be removed and identification of habitat trees Supervision of qualified ecologist/licensed wildlife handler during tree removal in accordance with best practise methods	Any fauna utilising habitat within the Development Site will be identified and managed to ensure clearing works minimise the likelihood of injuring resident fauna	Major	Minor
Installing artificial habitats for fauna in adjacent retained vegetation and habitat or human made structures to replace the habitat resources lost and encourage animals to move from the impacted site, e.g. nest boxes	Moderate	Minor	Any trees removed that have small hollows/hollow trunks/fissures should be retained as ground fauna habitat and/or used as replacement hollows and attached to trees within the Development Site/Lot	Replacement of habitat features removed	Moderate	Minor
Clearing protocols that identify vegetation to be retained, prevent inadvertent damage and reduce soil disturbance; for example, removal of native vegetation by chain-saw, rather than heavy machinery, is preferable in situations where partial clearing is proposed	Moderate	Minor	During the construction period, fencing and signage will be placed around those areas of vegetation to be maintained to prevent any accidental construction damage and provide a permanent barrier between the Development Site and retained areas. The type of fencing during construction may be of a temporary nature and scale that is robust enough to withstand damage during this phase of work	Vegetation to be retained outside of the Development Site boundary will not be disturbed	Moderate	Minor

Measure	Risk before mitigation	Risk after mitigation	Action	Outcome	Timing	Responsibility
Sediment barriers or sedimentation ponds to control the quality of water released from the site into the receiving environment	Minor	Negligible	Appropriate controls will be utilised to manage exposed soil surfaces and stockpiles to prevent sediment discharge into waterways Ensure all works within proximity to the drainage lines have adequate sediment and erosion controls Commence revegetation as soon as practicable to minimise the risks of erosion	Erosion and sedimentation will be controlled	Minor	Negligible
Noise barriers or daily/seasonal timing of construction and operational activities to reduce impacts of noise	Minor	Negligible	Timing of construction works should be planned to occur outside of the August - October breeding season. Daily timing of construction activities is recommended in accordance with Table 1 of Interim Noise Guidelines (2009) Monday to Friday 7.00am to 6.00pm Saturday 8.00am to 1.00pm No work on Sunday or public holidays	Noise impacts associated with the development will be managed in accordance with guidelines	Minor	Negligible
Light shields or daily/seasonal timing of construction and operational activities to reduce impacts of light spill	Minor	Negligible	Construction works will occur only during daylight hours and night lights will not be used Lights associated with operation of the development should be directional to avoid shining into adjacent retained vegetation	Light impacts will be avoided as all works will occur during daylight hours Light spill into adjacent vegetation is reduced	Minor	Negligible
Adaptive dust monitoring programs to control air quality	Minor	Negligible	Dust suppression measures will be implemented during construction works to limit dust on-site Commence revegetation as soon as practicable to minimise areas likely to create dust	Mitigate dust created during construction activities	Minor	Negligible

Measure	Risk before mitigation	Risk after mitigation	Action	Outcome	Timing	Responsibility
Programming construction activities to avoid impacts; for example, timing construction activities for when migratory species are absent from the site, or when particular species known to or likely to use the habitat on the site are not breeding or nesting	Moderate	Minor	Timing of construction works should be planned to occur outside of the winter/spring breeding season.	Impacts to fauna during nesting/nursing avoided	Moderate	Minor
Temporary fencing to protect significant environmental features such as riparian zones	Moderate	Minor	All machinery to be cleaned prior to entering and exiting the Development Site to minimise transport of weed seeds to retained areas Weeds present within the Development Site listed under the NSW *Biosecurity Act 2015* should be managed. Weeds present include - *Senecio madagascariensis* (Fireweed) - *Lantana camara* (Lantana) - *Rubus* sp. (Blackberry)	Prevent spread of weeds or pathogens	Moderate	Minor

Measure	Risk before mitigation	Risk after mitigation	Action	Outcome	Timing	Responsibility
Hygiene protocols to prevent the spread of weeds or pathogens between infected areas and uninfected areas	Minor	Negligible	All staff working on the development will undertake an environmental induction as part of their site familiarisation. This induction will include items such as: ○ Site environmental procedures (vegetation management, sediment and erosion control, exclusion fencing and noxious weeds) ○ What to do in case of environmental emergency (chemical spills, fire, injured fauna) ○ Key contacts in case of environmental emergency	All staff entering the Development Site are fully aware of all environmental aspects relating to the development and know what to do in case of any environmental emergencies	Minor	Negligible
Staff training and site briefing to communicate environmental features to be protected and measures to be implemented	Minor	Negligible	Strategy to be developed and implemented as part of the development may include: ○ restrictions on pet ownership ○ rubbish disposal guidance ○ prohibition of wood collection ○ prohibition on lighting of fires ○ any disturbance to vegetation outside Development Site footprint	Strategy to protect vegetation and habitat adjacent to development	Minor	Negligible
Development control measures to regulate activity in vegetation and habitat adjacent to residential development including controls on pet ownership, rubbish disposal, wood collection, fire management and disturbance to nests and other niche habitats	Minor	Negligible	Landscaping in the Development Site is to use locality derived native species and those found within the PCT present Remaining areas of the PCT present surrounding the Development Site will be rehabilitated using appropriate species identified from that PCT	Areas within the Development Site will be re-planted using appropriate species and vegetation present outside Development Site will be rehabilitated and enhanced through additional plantings	Minor	Negligible

Measure	Risk before mitigation	Risk after mitigation	Action	Outcome	Timing	Responsibility
Making provision for the ecological restoration, rehabilitation and/or ongoing maintenance of retained native vegetation habitat on or adjacent to the Development Site	Moderate	Minor	Pre-clearance survey of trees to be removed and identification of habitat trees Supervision of qualified ecologist during tree removal in accordance with best practise methods	Relocation of fauna in a sensitive manner	Moderate	Minor

2.2.6 Serious and Irreversible Impacts (SAII)

The development does not have any potential Serious and Irreversible Impacts (SAIIs) entities present on site.

The following entities have potential Serious and Irreversible Impacts (SAIIs) (**Table 40**). Surveys did not detect any of these entities and the development will not have any potential SAIIs.

Table 40: Entities with potential SAIIs and the principles applicable identified in the Biodiversity Conservation Regulation 2017

Scientific name	Common name	SAII principle	Survey method	Survey results
Astrotricha crassifolia	Thick-leaf Star-hair	2, 3, and 4	Targeted surveys – meander searches and floristic plots in suitable habitat during July and August.	Yes – not present. No potential SAII.
Genoplesium insigne	Variable Midge Orchid	2 and 3	Targeted surveys – meander surveys and floristic plots in suitable habitat during August	Yes – not present. No potential SAII.
Anthochaera phrygia	Regent Honeyeater	1	Area search for breeding habitat	Yes – not present. No potential SAII.
Lathamus discolor	Swift Parrot	1	Area search for breeding habitat	Yes – not present. No potential SAII.
Petalura gigantea	Giant Dragonfly	4	Excluded - No swamps or land within 500 m of swamps are present	No – excluded based on habitat constraints. No potential SAII.
Chalinolobus dwyeri	Large-eared Pied Bat	4	No cliffs are present and Development Site is not in a landscape position to be located within 2 km of rocky areas containing caves, overhangs, escarpments, outcrops or crevices, or within 2 km of old mines or tunnels.	No – excluded based on habitat constraints. No potential SAII.
Miniopterus australis	Little Bentwing-bat	4	Harp trapping - 4 trap nights over 4 consecutive nights	Yes – not present. No potential SAII.
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat	4	Harp trapping - 4 trap nights over 4 consecutive nights	Yes – not present. No potential SAII.

2.3 Risk assessment

A risk assessment has been undertaken for any residual impacts likely to remain after the mitigation measures (**Section 2.2.5**) have been applied. Likelihood criteria, consequence criteria and the risk matrix are provided in **Table 41**, **Table 42** and **Table 43** respectively.

Table 41: Likelihood criteria

Likelihood criteria	Description
Almost certain (Common)	Will occur, or is of a continuous nature, or the likelihood is unknown. There is likely to be an event at least once a year or greater (up to ten times per year). It often occurs in similar environments. The event is expected to occur in most circumstances.
Likely (Has occurred in recent history)	There is likely to be an event (on average) every 1 - 5 years. Likely to have been a similar incident occurring in similar environments. The event will probably occur in most circumstances.
Possible (Could happen, has occurred in the past, but not common)	The event could occur. There is likely to be an event on average every five to twenty years.
Unlikely (Not likely or uncommon)	The event could occur but is not expected. A rare occurrence (once per one hundred years).
Remote (Rare or practically impossible)	The event may occur only in exceptional circumstances. Very rare occurrence (once per one thousand years). Unlikely that it has occurred elsewhere; and, if it has occurred, it is regarded as unique.

Table 42: Consequence criteria

Consequence category	Description
Critical (Severe, widespread long-term effect)	Destruction of sensitive environmental features. Severe impact on ecosystem. Impacts are irreversible and/or widespread. Regulatory and high-level government intervention/action. Community outrage expected. Prosecution likely.
Major (Wider spread, moderate to long term effect)	Long-term impact of regional significance on sensitive environmental features (e.g. wetlands). Likely to result in regulatory intervention/action. Environmental harm either temporary or permanent, requiring immediate attention. Community outrage possible. Prosecution possible.
Moderate (Localised, short-term to moderate effect)	Short term impact on sensitive environmental features. Triggers regulatory investigation. Significant changes that may be rehabilitated with difficulty. Repeated public concern.
Minor (Localised short-term effect)	Impact on fauna, flora and/or habitat but no negative effects on ecosystem. Easily rehabilitated. Requires immediate regulator notification.
Negligible (Minimal impact or no lasting effect)	Negligible impact on fauna/flora, habitat, aquatic ecosystem or water resources. Impacts are local, temporary and reversible. Incident reporting according to routine protocols.

Table 43: Risk matrix

Consequence	Likelihood				
	Almost certain	Likely	Possible	Unlikely	Remote
Critical	Very High	Very High	High	High	Medium
Major	Very High	High	High	Medium	Medium

Consequence	Likelihood				
Moderate	High	Medium	Medium	Medium	Low
Minor	Medium	Medium	Low	Low	Very Low
Negligible	Medium	Low	Low	Very Low	Very Low

Table 44: Risk assessment

Potential impact	Project phase	Risk (pre-mitigation)	Risk (post mitigation)
Vegetation clearing	Construction / operation	Medium	Low
Sedimentation and contaminated and/or nutrient rich run-off	Construction	Medium	Very Low
Noise, dust or light spill	Construction	Low	Very Low
Inadvertent impacts on adjacent habitat or vegetation	Construction	Medium	Low
Transport of weeds and pathogens from the site to adjacent vegetation	Construction	Medium	Very Low
Vehicle strike	Construction / operation	Low	Very Low
Trampling of threatened flora species	Construction / operation	Medium	Very Low
Rubbish dumping	Construction / operation	Low	Very Low
Wood collection	Construction / operation	Low	Very Low
Bush rock removal and disturbance	Construction / operation	Low	Very Low
Increase in predatory species populations	Construction / operation	Medium	Low
Increase in pest animal populations	Construction / operation	Medium	Low
Increased risk of fire	Construction / operation	Low	Very Low
Disturbance to specialist breeding and foraging habitat	Construction / operation	Medium	Medium
Sedimentation and contaminated and/or nutrient rich run-off	Construction	Medium	Low

2.4 Adaptive management strategy

This section is required for those impacts that are infrequent, cumulative or difficult to predict. Impacts associated with the proposed development have been considered and addressed **Section 2.2** and no further impacts are considered to be addressed.

2.5 Assessment of Matters of National Environmental Significance listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*

An assessment of impacts to Matters of National Environmental Significance (MNES) listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) has been undertaken for all MNES known to occur within the study area.

No MNES have been identified within the study area, and as such a referral to the Commonwealth is not required.

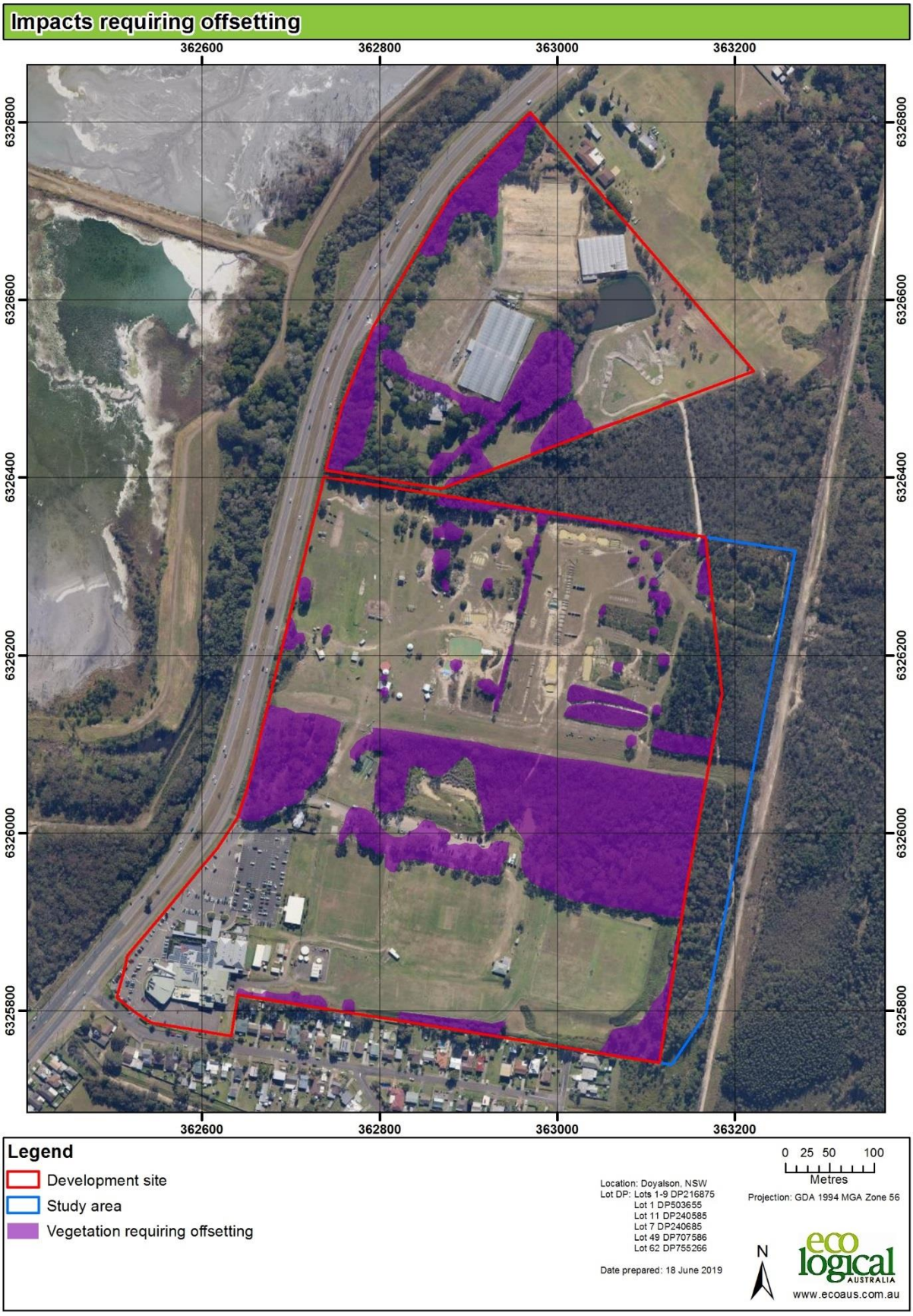

Figure 12: Masterplan project footprint including construction and operation

2.6 Impact summary

Following implementation of the BAM and the BAMC, the following impacts have been determined.

2.6.1 Serious and Irreversible Impacts (SAII)

The development does not have any Serious and Irreversible Impacts (SAII).

2.6.2 Impacts requiring offsets

At the time of the first subdivision DA, the application must be accompanied by a BDAR that identifies the areas of biodiversity that require offsetting. The maximum upper limit of biodiversity offsets have been calculated below to pre-empt the quantity of BAM credits that may be required. This is based on the clearing of all vegetation within the development site. These values below will be adjusted once the final footprint is determined and submitted formally with the first subdivision DA. The number of credits actually required is likely to be significantly less than those numbers proposed below.

The likely impacts of the masterplan development requiring offset for native vegetation are outlined in **Table 45** and shown on **Figure 13**: . The impacts of the development requiring offset for threatened species and threatened species habitat are outlined in **Table 46** and on Figure 13: **.**

Table 45: Impacts to native vegetation that require offsets

PCT ID	PCT Name	Vegetation Class	Vegetation Formation	Direct impact (ha)
1636	Scribbly Gum - Red Bloodwood - *Angophora inopina* heathy woodland on lowlands of the Central Coast	Dry Sclerophyll Forests (Shrubby sub-formation)	Sydney Coastal Dry Sclerophyll Forests	Up to 6.29
1638	Smooth-barked Apple - Red Bloodwood - Scribbly Gum grass - shrub woodland on lowlands of the Central Coast	Dry Sclerophyll Forests (Shrubby sub-formation)	Sydney Coastal Dry Sclerophyll Forests	Up to 1.75
1717	Broad-leaved Paperbark - Swamp Mahogany - Swamp Oak - Saw Sedge swamp forest of the Central Coast and Lower North Coast	Forested Wetlands	Coastal Swamp Forests	Up to 1.44

Table 46: Impacts on threatened species and threatened species habitat that require offsets

Species	Common Name	Direct impact number of individuals / habitat (ha)	NSW listing status	EPBC Listing status
Calyptorhynchus lathami	Glossy Black-cockatoo	Four individuals observed. PCT 1636 containing hollow-bearing trees identified as potential breeding habitat. Total potential breeding habitat on-site = 4.12 ha	Vulnerable	Not listed

2.6.3 Impacts not requiring offsets

All areas of native vegetation will require offsets. Only areas of cleared land, which do not contain native vegetation, do not require offsets.

2.6.4 Areas not requiring assessment

There are no areas that do not require assessment.

2.6.5 Credit summary

The number of ecosystem credits required for the development are outlined in **Table 47**. The number of species credits required for the development are outlined in **Table 48**. A biodiversity credit report is included in **Appendix C:**

Table 47: Ecosystem credits required

PCT ID	PCT Name	Vegetation Formation	Direct impact (ha)	Credits required
1636	Scribbly Gum - Red Bloodwood - *Angophora inopina* heathy woodland on lowlands of the Central Coast	Sydney Coastal Dry Sclerophyll Forests	Up to 6.29	Up to 147credits required
1638	Smooth-barked Apple - Red Bloodwood - Scribbly Gum grass - shrub woodland on lowlands of the Central Coast	Sydney Coastal Dry Sclerophyll Forests	Up to 1.75	Up to 22 credits required
1717	Broad-leaved Paperbark - Swamp Mahogany - Swamp Oak - Saw Sedge swamp forest of the Central Coast and Lower North Coast	Coastal Swamp Forests	Up to 1.44	Up to 20 credits required

PCT ID	PCT Name	Vegetation Formation	Direct impact (ha)	Credits required
Total				**Up to 189 credits required**

Table 48: Species credit summary

Species	Common Name	Direct impact number of individuals / habitat (ha)	Credits required
Calyptorhynchus lathami	Glossy Black-cockatoo	Four individuals observed. PCT 1636 containing hollow-bearing trees identified as potential breeding habitat. Total potential breeding habitat on-site = 6.29 ha	Up to 167 credits required

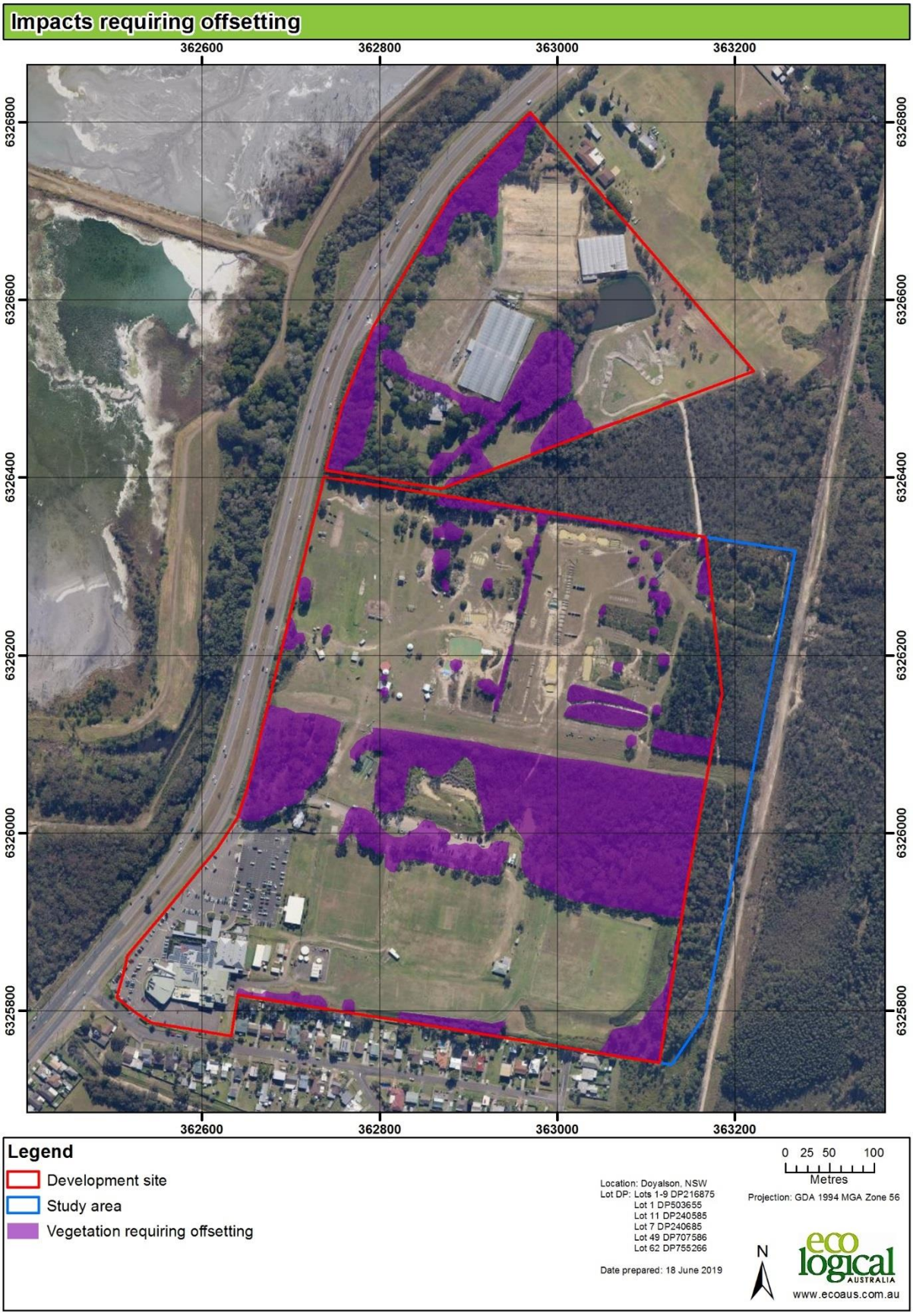

Figure 13: Impacts requiring offset

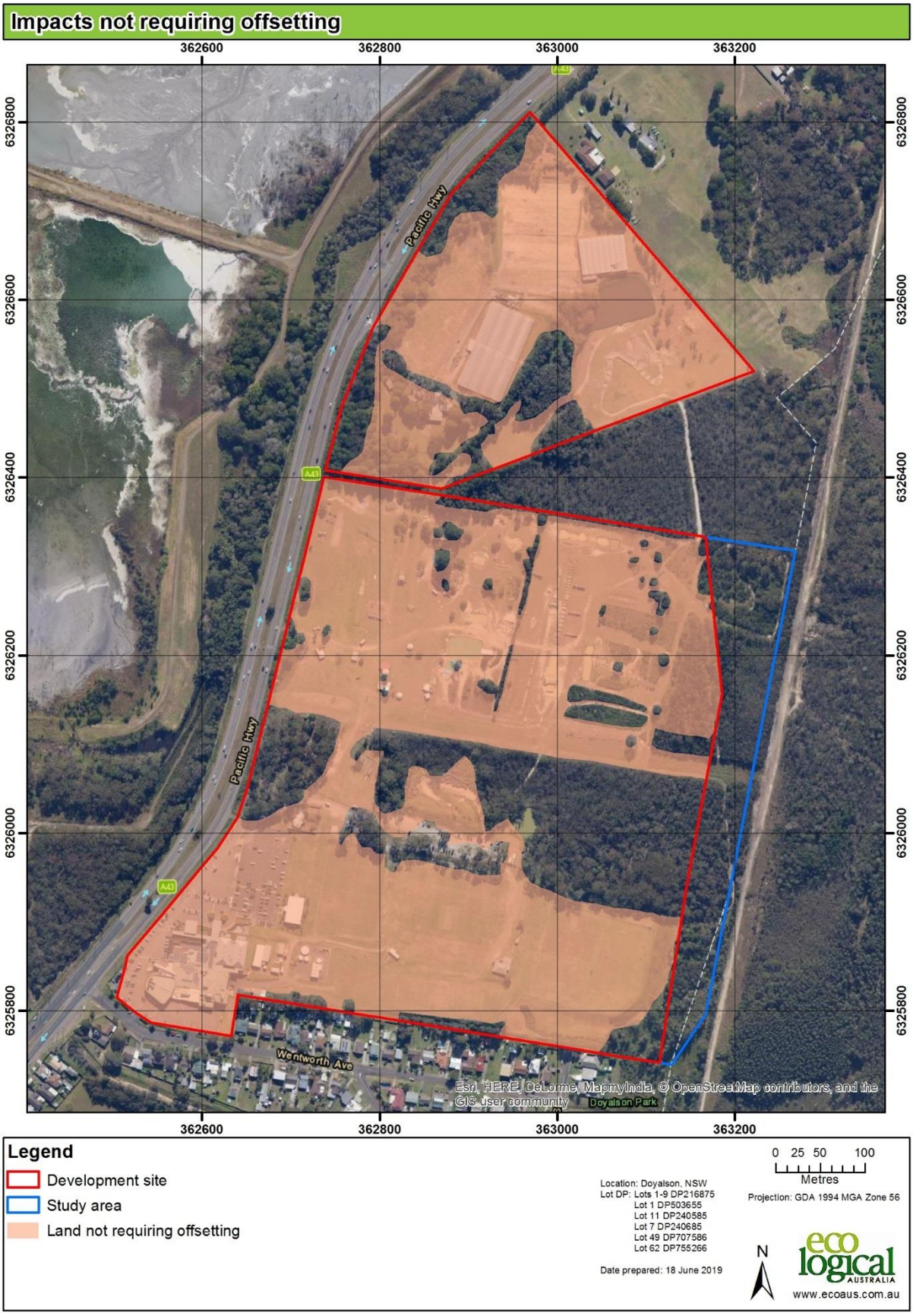

Figure 14: Impacts not requiring offset

3. Conclusion

This Biodiversity Assessment has been prepared to support a Planning Proposal on behalf of Doyalson Wyee RSL Club (Club Ltd) to amend the *Wyong Local Environmental Plan 2013* (WLEP 2013) for 80-120 Pacific Highway, Doyalson.

This report included investigations into the biodiversity values present within the study area, which included consideration of:

- Native vegetation extent
- Plant community types present, including those which may be threatened ecological communities under the BC Act and/or EPBC Act that may occur
- Threatened flora that may occur
- Threatened fauna and their habitats that may occur
- Drainage and waterways present.

The field investigations included site inspections and targeted studies in July, August, and November 2018, and were drafted to comply with the required survey effort for any future BDAR that would be required for submission with a subdivision or masterplan DA.

Based on the field investigations, the following biodiversity values were identified within the site:

- Three plant community types, including one which is an EEC under the BC Act
- One threatened bird – Glossy Black-cockatoo

Despite previous records occurring onsite, no *Grevillea parviflora* subsp. *parviflora* was identified within the site.

Following the rezoning process, the next step in the biodiversity assessment would be to refine this document for submission with the first subdivision or masterplan DA. This would require refining clearing areas, as well as investigations into which trees can be retained under a detailed development plan. Refinement of the development may allow for a reduction in the biodiversity credits proposed in this report.

The residual biodiversity credits required would be offset through one of the following options:

- establishing a Stewardship Site that contains like-for-like credits
- purchasing like for like credits from the market
- paying to the Biodiversity Conservation Trust – commensurate to the value of the required credits
- funding a biodiversity action (as defined by the BCT)

4. References

Department of Environment and Climate Change (2009) Interim Construction Noise Guideline

Department of Environment and Conservation (2004) Threatened Species Survey and Assessment: Guidelines for developments and activities (working draft), New South Wales Department of Environment and Conservation, Hurstville, NSW.

Department of Environment and Climate Change. (2002) 'Descriptions for NSW (Mitchell) Landscapes Version 2'. Sourced 27 October (2017) from: http://www.environment.nsw.gov.au/resources/conservation/landscapesdescriptions.pdf

Department of the Environment (DotE) (2018). *EPBC Protected Matters Search Tool*. Available at: https://www.environment.gov.au/epbc/protected-matters-search-tool

Department of Planning (DP&E) (2018). *NSW Planning Portal*. Available at: https://www.planningportal.nsw.gov.au/

GHD (2018) Doyalson Wyee RSL Structure Plan Biodiversity Constraints Assessment

Land and Property Information. (2015), 'SIX maps aerial imagery'.

Office of Environment and Heritage (OEH) (2011). Swamp sclerophyll forest on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions – endangered ecological listing. Available online: http://www.environment.nsw.gov.au/determinations/SwampSchlerophyllEndSpListing.htm

Office of Environment and Heritage (OEH) (2017). Biodiversity Assessment Methodology

Office of Environment and Heritage (OEH) (2016) NSW Guide to Surveying Threatened Plants

Office of Environment and Heritage (OEH) (2017). *BioNet Atlas of NSW Wildlife*. Available at: http://www.bionet.nsw.gov.au/

Office of Environment and Heritage (OEH) (2017). *Vegetation Information System (VIS) Classification 2.1*. Available at: http://www.environment.nsw.gov.au

Stahler (1952), *Hypsometric (area-altitude) analysis of erosional topology*, Geological Society of America Bulletin **63** (11): 1117–1142

Appendix A: Definitions

Terminology	Definition
Biodiversity credit report	The report produced by the Credit Calculator that sets out the number and class of biodiversity credits required to offset the remaining adverse impacts on biodiversity values at a Development Site or on land to be biodiversity certified, or that sets out the number and class of biodiversity credits that are created at a biodiversity stewardship site.
BioNet Atlas	The BioNet Atlas (formerly known as the NSW Wildlife Atlas) is the OEH database of flora and fauna records. The Atlas contains records of plants, mammals, birds, reptiles, amphibians, some fungi, some invertebrates (such as insects and snails) and some fish
Broad condition state:	Areas of the same PCT that are in relatively homogenous condition. Broad condition is used for stratifying areas of the same PCT into a vegetation zone for the purpose of determining the vegetation integrity score.
Connectivity	The measure of the degree to which an area(s) of native vegetation is linked with other areas of vegetation.
Credit Calculator	The computer program that provides decision support to assessors and proponents by applying the BAM, and which calculates the number and class of biodiversity credits required to offset the impacts of a development or created at a biodiversity stewardship site.
Development	Has the same meaning as development at section 4 of the EP&A Act, or an activity in Part 5 of the EP&A Act. It also includes development as defined in section 115T of the EP&A Act.
Development footprint	The area of land that is directly impacted on by a proposed development, including access roads, and areas used to store construction materials.
Development site	An area of land that is subject to a proposed development that is under the EP&A Act.
Ecosystem credits	A measurement of the value of EECs, CEECs and threatened species habitat for species that can be reliably predicted to occur with a PCT. Ecosystem credits measure the loss in biodiversity values at a Development Site and the gain in biodiversity values at a biodiversity stewardship site.
High threat exotic plant cover	Plant cover composed of vascular plants not native to Australia that if not controlled will invade and outcompete native plant species.
Hollow bearing tree	A living or dead tree that has at least one hollow. A tree is considered to contain a hollow if: (a) the entrance can be seen; (b) the minimum entrance width is at least 5 cm; (c) the hollow appears to have depth (i.e. you cannot see solid wood beyond the entrance); (d) the hollow is at least 1 m above the ground. Trees must be examined from all angles.
Important wetland	A wetland that is listed in the Directory of Important Wetlands of Australia (DIWA) and SEPP 14 Coastal Wetlands
Linear shaped development	Development that is generally narrow in width and extends across the landscape for a distance greater than 3.5 kilometres in length
Local population	The population that occurs in the study area. In cases where multiple populations occur in the study area or a population occupies part of the study area, impacts on each subpopulation must be assessed separately.
Local wetland	Any wetland that is not identified as an important wetland (refer to definition of Important wetland).
Mitchell landscape	Landscapes with relatively homogeneous geomorphology, soils and broad vegetation types, mapped at a scale of 1:250,000.

Terminology	Definition
Multiple fragmentation impact development	Developments such as wind farms and coal seam gas extraction that require multiple extraction points (wells) or turbines and a network of associated development including roads, tracks, gathering systems/flow lines, transmission lines
Operational Manual	The Operational Manual published from time to time by OEH, which is a guide to assist assessors when using the BAM
Patch size	An area of intact native 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 native vegetation (or ≤30 m for non-woody ecosystems). Patch size may extend onto adjoining land that is not part of the Development Site or Stewardship Site.
Proponent	A person who intends to apply for consent to carry out development or for approval for an activity.
Reference sites	The relatively unmodified sites that are assessed to obtain local benchmark information when benchmarks in the Vegetation Benchmarks Database are too broad or otherwise incorrect for the PCT and/or local situation. Benchmarks can also be obtained from published sources.
Regeneration	The proportion of over-storey species characteristic of the PCT that are naturally regenerating and have a diameter at breast height <5 cm within a vegetation zone.
Remaining impact	An impact on biodiversity values after all reasonable measures have been taken to avoid and minimise the impacts of development. Under the BAM, an offset requirement is calculated for the remaining impacts on biodiversity values.
Retirement of credits	The purchase and retirement of biodiversity credits from an already-established biobank site or a biodiversity stewardship site secured by a biodiversity stewardship agreement.
Riparian buffer	Riparian buffers applied to water bodies in accordance with the BAM
Sensitive biodiversity values land map	Development within an area identified on the map requires assessment using the BAM.
Site attributes	The matters assessed to determine vegetation integrity. They include: native plant species richness, native over-storey cover, native mid-storey cover, native ground cover (grasses), native ground cover (shrubs), native ground cover (other), exotic plant cover (as a percentage of total ground and mid-storey cover), number of trees with hollows, proportion of over-storey species occurring as regeneration, and total length of fallen logs.
Site-based development	a development other than a linear shaped development, or a multiple fragmentation impact development
Species credits	The class of biodiversity credits created or required for the impact on threatened species that cannot be reliably predicted to use an area of land based on habitat surrogates. Species that require species credits are listed in the Threatened Biodiversity Data Collection.
Subject land	Is land to which the BAM is applied in Stage 1 to assess the biodiversity values of the land. It includes land that may be a Development Site, clearing site, proposed for biodiversity certification or land that is proposed for a biodiversity stewardship agreement.
Threatened Biodiversity Data Collection	Part of the BioNet database, published by OEH and accessible from the BioNet website.
Threatened species	Critically Endangered, Endangered or Vulnerable threatened species as defined by Schedule 1 of the BC Act, or any additional threatened species listed under Part 13 of the EPBC Act as Critically Endangered, Endangered or Vulnerable.

Terminology	Definition
Vegetation Benchmarks Database	A database of benchmarks for vegetation classes and some PCTs. The Vegetation Benchmarks Database is published by OEH and is part of the BioNet Vegetation Classification.
Vegetation zone	A relatively homogenous area of native vegetation on a Development Site, land to be biodiversity certified or a biodiversity stewardship site that is the same PCT and broad condition state.
Wetland	An area of land that is wet by surface water or ground water, or both, for long enough periods that the plants and animals in it are adapted to, and depend on, moist conditions for at least part of their life cycle. Wetlands may exhibit wet and dry phases and may be wet permanently, cyclically or intermittently with fresh, brackish or saline water
Woody native vegetation	Native vegetation that contains an over-storey and/or mid-storey that predominantly consists of trees and/or shrubs

Appendix B: Vegetation plot data

Table 49: Plot location data

Plot Number	Easting	Northing	Zone
Plot 1	362683	6326085	56
Plot 2	362864	6326090	56
Plot 3	363082	6326026	56
Plot 4	363246	6326303	56
Plot 5	362975	6326478	56
Plot 6	363200	6326122	56

Table 50: Composition Condition Scores (number of species in each growth form group)

Plot	Tree	Shrub	Grass	Forbs	Ferns	Other
Plot 1	4.0	10.0	5.0	13.0	2.0	4.0
Plot 2	2.0	14.0	5.0	7.0	0.0	3.0
Plot 3	2.0	5.0	2.0	4.0	0.0	1.0
Plot 4	3.0	4.0	3.0	5.0	0.0	1.0
Plot 5	1.0	1.0	2.0	1.0	1.0	2.0
Plot 6	2.0	5.0	8.0	1.0	0.0	1.0

Table 51: Structure Condition Scores (summed cover for each growth form group)

Plot	Tree	Shrub	Grass	Forbs	Ferns	Other
Plot 1	45.1	1.0	1.3	1.4	5.1	0.5
Plot 2	40.0	11.2	71.0	0.8	0.0	30.2
Plot 3	30.2	4.6	75.0	0.4	0.0	10.0
Plot 4	33.1	3.7	5.2	1.4	0.0	0.2
Plot 5	25.0	0.1	0.2	0.1	20.0	0.3
Plot 6	16.0	6.3	1.3	0.1	0.0	0.1

Table 52: Function Condition Scores

Plot	Size Class (DBH)	Large Trees	Hollow trees	Litter Cover	Coarse woody debris	High threat weed cover
Plot 1	5 – 9 cm = absent 10 – 19 cm = absent 20 – 29 cm = absent 30 – 49 cm = present 50 – 79 cm = present 80 cm + = present	0	2.0	53.0	0.0	7.0
Plot 2	5 – 9 cm = present 10 – 19 cm = present 20 – 29 cm = present 30 – 49 cm = present 50 – 79 cm = absent 80 cm + = absent	0	0.0	19.0	9.0	0.0
Plot 3	5 – 9 cm = present 10 – 19 cm = present 20 – 29 cm = absent 30 – 49 cm = absent 50 – 79 cm = absent 80 cm + = absent	0	0.0	26.0	6.5	0.0
Plot 4	5 – 9 cm = present 10 – 19 cm = present 20 – 29 cm = present 30 – 49 cm = present 50 – 79 cm = present 80 cm + = absent	0	2.0	64.0	24.5	4.0
Plot 5	5 – 9 cm = absent 10 – 19 cm = present 20 – 29 cm = present 30 – 49 cm = present 50 – 79 cm = present 80 cm + = present	4	0.0	28.0	1.0	6.0
Plot 6	5 – 9 cm = present 10 – 19 cm = present 20 – 29 cm = present 30 – 49 cm = absent 50 – 79 cm = absent 80 cm + = absent	0	0.0	60.0	2.0	0.0

Table 53 Floristic quadrat data

Species	Exotic	High Threat Weeds	Plot 1 - 1636		Plot 2 - 1636		Plot 3 - 1638		Plot 4 - 1636		Plot 5 - 1717		Plot 6 - 1717	
			C	A	C	A	C	A	C	A	C	A	C	A
Acacia brownii		0			0.1	2								
Acacia longifolia		0	0.1	25	1	10			3	20				
Acacia myrtifolia		0	0.1	5										
Actinotus minor		0					0.1	5						
Ageratina adenophora	*	1									2	500		
Allocasuarina littoralis		0	0.1	20	30	150	30	50	3	15			8	25
Anagallis arvensis	*	0	0.1	25										
Andropogon virginicus	*	1							20	1000				
Asparagus aethiopicus	*	1	0.1	5										
Axonopus fissifolius	*	1							0.2	50				
Banksia oblongifolia		0			2	20	0.2	5						
Baumea sp.		0			5	500								
Baumea rubiginosa		0			2	500	60	1000						
Bidens pilosa	*	1	0.1	20							0.1	2		
Billardiera scandens		0	0.1	5										
Bossiaea stephensonii		0	0.1	10										
Breynia oblongifolia		0	0.1	2										
Brunoniella australis		0	0.1	5	0.1	2								
Burchardia umbellata		0			0.1	3								
Callistemon sp.		0			0.2	3							0.1	5

Species	Exotic	High Threat Weeds	Plot 1 - 1636		Plot 2 - 1636		Plot 3 - 1638		Plot 4 - 1636		Plot 5 - 1717		Plot 6 - 1717	
			C	A	C	A	C	A	C	A	C	A	C	A
Callistemon rigidus		0			0.1	1								
Calochilus sp.		0							0.1	1				
Calochlaena dubia		0									20	1000		
Cassytha glabella		0			0.1	5								
Caustis sp.		0			45	1000	15	1000						
Centella asiatica		0	0.1	5										
Chlorophytum comosum	*	1	0.1	2										
Chrysanthemoides monilifera	*	0	0.1	15					0.1	5				
Cinnamomum camphora	*	1	0.1	25					1	20	5	25		
Cirsium vulgare	*	0	0.1	2										
Commelina cyanea		0	0.1	20							0.1	10		
Conyza canadensis	*	0	0.1	20							0.1	5		
Corymbia gummifera		0	15	7										
Cotula australis		0	0.1	20										
Crassocephalum crepidioides	*	0	0.1	20										
Cryptostylis erecta		0												
Cryptostylis subulata		0	0.1	25	0.1	50	0.1	20	0.1	25				
Dampiera stricta		0			0.1	5								
Daviesia ulicifolia		0	0.1	2										
Dianella caerulea		0	0.2	100	0.1	2	0.1	10	1	35			0.1	5
Dodonaea triquetra		0	0.1	25										

Species	Exotic	High Threat Weeds	Plot 1 - 1636		Plot 2 - 1636		Plot 3 - 1638		Plot 4 - 1636		Plot 5 - 1717		Plot 6 - 1717	
			C	A	C	A	C	A	C	A	C	A	C	A
Echinopogon caespitosus		0							0.1	20				
Ehrharta erecta	*	1	0.2	250										
Ehrharta erecta	*	1	0.5	250					5	500	0.1	20		
Emilia sp.	*	0	0.1	10										
Entolasia stricta		0	0.3	5000	15	1000			0.1	25			0.1	20
Epacris microphylla		0											0.1	10
Eucalyptus racemosa		0	20	10										
Eucalyptus sclerophylla		0			10	5			30	15				
Euchiton involucratus		0	0.1	25										
Euphorbia peplus	*	0	0.1	1										
Ficus macrophylla		0									1	2		
Unknown sedge (flat, long)													1	20
Gahnia clarkei		0											0.1	2
Geranium sp.	*	0									0.1	20		
Glochidion ferdinandi		0	10	500			0.2	1	0.1	2				
Glycine microphylla		0	0.1	5										
Gonocarpus teucrioides		0	0.1	25										
Grass and grass-like (GG)		0											0.1	10
Haemodorum sp.		0	0.1	2										
Hakea dactyloides		0			1	10	2	15						
Hardenbergia sp.		0	0.1	25										

Species	Exotic	High Threat Weeds	Plot 1 - 1636		Plot 2 - 1636		Plot 3 - 1638		Plot 4 - 1636		Plot 5 - 1717		Plot 6 - 1717	
			C	A	C	A	C	A	C	A	C	A	C	A
Imperata cylindrica		0	0.2	100										
Isopogon anemonifolius		0					0.2	5						
Kunzea ambigua		0							0.2	5			5	20
Lambertia formosa		0			3	20	2	15					1	50
Lantana camara	*	1									1	5		
Lepidosperma laterale		0											0.1	5
Leptospermum trinervium		0			2	10								
Lepyrodia scariosa		0											0.5	100
Ligustrum sinense	*	1	0.1	1										
Ligustrum sinense	*	1									0.1	5		
Lindsaea linearis		0	0.1	500										
Livistona australis		0									0.2	1		
Lomandra confertifolia		0	0.2	250										
Lomandra multiflora		0	0.1	150										
Lomandra obliqua		0			4	1000								
Marsdenia rostrata		0									0.1	1		
Medicago truncatula	*	0	0.1	2										
Melaleuca quinquenervia		0									25	17	8	15
Melaleuca thymifolia		0			0.1	2								
Microlaena stipoides		0											0.1	20
Unknown Mistletoe (on *A. littoralis*)					0.1	10								

Species	Exotic	High Threat Weeds	Plot 1 - 1636		Plot 2 - 1636		Plot 3 - 1638		Plot 4 - 1636		Plot 5 - 1717		Plot 6 - 1717	
			C	A	C	A	C	A	C	A	C	A	C	A
Unknown Mistletoe (on Scribbly Gum)					0.1	2								
Modiola caroliniana	*	0	0.1	10										
Opercularia aspera		0			0.1	10								
Opercularia diphylla		0	0.1	5										
Oplismenus spp.		0									0.1	50		
Oxalis perennans		0	0.1	10										
Panicum simile		0	0.1	20									0.2	50
Parsonsia straminea		0			0.1	3	10	25			0.1	1	0.1	1
Patersonia sericea		0	0.1	2	0.2	20	0.1	10						
Persoonia lanceolata		0							0.4	3				
Persoonia levis		0			0.1	1								
Petrophile pulchella		0			1	10	0.2	5					0.1	10
Phytolacca octandra	*	0	0.2	50										
Pimelea latifolia		0	0.1	25	0.1	5								
Pinus radiata	*	1							0.2	5	2	1		
Pittosporum undulatum		0	0.1	15					0.1	2	0.1	5		
Pratia purpurascens		0	0.1	15					0.1	50				
Pteridium esculentum		0	5	500										
Pultenaea sp.		0	0.1	2	0.1	1								
Pultenaea paleacea		0	0.1	5										
Pultenaea tuberculata		0			0.4	5								

Species	Exotic	High Threat Weeds	Plot 1 - 1636		Plot 2 - 1636		Plot 3 - 1638		Plot 4 - 1636		Plot 5 - 1717		Plot 6 - 1717	
			C	A	C	A	C	A	C	A	C	A	C	A
Ranunculus sp.		0							0.1	30				
Rubus anglocandicans	*	0	0.1	5										
Schoenus sp.		0											0.1	20
Senecio madagascariensis	*	1	0.1	5										
Sida rhombifolia	*	0	0.1	25										
Solanum sp											0.1	50		
Soliva spp.	*	0	0.1	20										
Sonchus oleraceus	*	0							0.1	2				
Stellaria media	*	0	0.1	10										
Unknown POACEAE (Tall)							0.2	25						
Watsonia sp.	*	0	0.1	200										
Xanthorrhoea fulva		0	0.2	2	30	50			0.2	1				

Appendix C: Fauna species observed

Class	Species	Common	BC Act	EPBC Act	Exotic
Amphibia	*Crinia signifera*	Common Eastern Froglet			
	Limnodynastes tasmaniensis	Spotted Grass Frog			
Aves	*Podargus strigoides*	Tawny Frogmouth			
	Chenonetta jubata	Australian Wood Duck			
	Trichoglossus haematodus	Rainbow Lorikeet			
	Rhipidura leucophrys	Willie Wagtail			
	Calyptorhynchus funereus	Yellow-tailed Black-Cockatoo			
	Nesoptilotis leucotis	White-eared Honeyeater			
	Caligavis chrysops	Yellow-faced Honeyeater			
	Platycercus eximius	Eastern Rosella			
	Manorina melanocephala	Noisy Miner			
	Cracticus tibicen	Australian Magpie			
	Malurus lamberti	Variegated Fairy-wren			
	Egretta novaehollandiae	White-faced Heron			
	Pardalotus striatus	Striated Pardalote			
	Oriolus sagittatus	Olive-backed Oriole			
	Anthochaera chrysoptera	Little Wattlebird			
	Trichoglossus chlorolepidotus	Scaly-breasted Lorikeet			
	Vanellus miles	Masked Lapwing			
	Calyptorhynchus lathami	Glossy Black-Cockatoo	V		
Mammalia	*Pseudocheirus peregrinus*	Common Ringtail Possum			
	Wallabia bicolor	Swamp Wallaby			
	Vulpes vulpes	Fox			*
	Lepus capensis	Brown Hare			*
	Oryctolagus cuniculus	Rabbit			*
	Trichosurus vulpecula	Common Brushtail Possum			
	Rattus lutreolus	Swamp Rat			
	Rattus rattus	Black Rat			*
	Antechinus stuartii	Brown Antechinus			
	Antechinus swainsonii	Dusky Antechinus			
	Nyctophilus geoffroyi	Lesser Long-eared bat			
	Vespadelus vulturnus	Little Forest bat			
Reptilia	*Anilios nigrescens*	Blackish Blind Snake			
	Cyclodomorphus michaeli	Mainland She-oak Skink			

Appendix D: Preliminary Biodiversity credit report

BAM Biodiversity Credit Report (Like for like)

Proposal Details

Assessment Id
00011612/BAAS17021/19/00011613

Proposal Name
10504_Doyalson

BAM data last updated *
12/06/2019

Assessor Name
Alexander Pursche

Assessor Number
BAAS17021

BAM Data version *
11

Proponent Names

Report Created
19/06/2019

* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

Revision No
0

Potential Serious and Irreversible Impacts

Nil

Nil

Additional Information for Approval

PCTs With Customized Benchmarks
No Changes

Predicted Threatened Species Not On Site
No Changes

Ecosystem Credit Summary

PCT	TEC	Area	Credits
1636-Scribbly Gum - Red Bloodwood - Angophora inopina heathy woodland on lowlands of the Central Coast	Not a TEC	6.3	147.00
1638-Smooth-barked Apple - Red Bloodwood - Scribbly Gum grass - shrub woodland on lowlands of the Central Coast	Not a TEC	1.8	22.00
1717-Broad-leaved Paperbark - Swamp Mahogany - Swamp Oak - Saw Sedge swamp forest of the Central Coast and Lower North Coast	Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	1.4	20.00

Credit classes for 1636	Like-for-like options			
	Class	Trading group	HBT	IBRA region
	Sydney Coastal Dry Sclerophyll Forests (including PCT's 1138, 1253, 1625, 1636, 1638, 1776, 1778, 1782, 1786)	Sydney Coastal Dry Sclerophyll Forests - ≥ 50% - < 70% cleared group (including Tier 6 or higher).	Yes	Wyong, Hunter, Pittwater and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

Credit classes for 1636

Credit classes for 1638

Like-for-like options

Class	Trading group	HBT	IBRA region
Sydney Coastal Dry Sclerophyll Forests (including PCT's 1138, 1253, 1625, 1636, 1638, 1776, 1778, 1782, 1786)	Sydney Coastal Dry Sclerophyll Forests - ≥ 50% - < 70% cleared group (including Tier 6 or higher).	No	Wyong, Hunter, Pittwater and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

Credit classes for 1717

Like-for-like options

TEC	HBT	IBRA region
Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions (including PCT's 837, 839, 971, 1064, 1092, 1227, 1230, 1231, 1232, 1235, 1649, 1715, 1716, 1717, 1718, 1719, 1721, 1722, 1723, 1724, 1725, 1730, 1795, 1798)	Yes	Wyong, Hunter, Pittwater and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

Credit classes for 1717

Species Credit Summary

Species	Area	Credits
Calyptorhynchus lathami / Glossy Black-Cockatoo	6.3	167.00

Calyptorhynchus lathami/ Glossy Black-Cockatoo

1636_Disturbed

Like-for-like options

Spp	IBRA region
Calyptorhynchus lathami/Glossy Black-Cockatoo	Any in NSW

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