



Hunter Sports High School, Gateshead: Biodiversity Assessment Report

FINAL REPORT

Prepared for de Witt Consulting Pty Ltd on behalf of NSW Public Works

24 May 2016

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Document information

Report to: de Witt Consulting Pty Ltd
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Biosis project no.: 22022

File name:
22022.HunterSportsHigh.Development.Site.BAR.FIN.20160524.docx

Citation: Biosis 2016. Biodiversity Assessment Report, Hunter Sports High School Redevelopment, Gateshead. Prepared for de Witt Consulting Pty Ltd. on behalf of NSW Public Works. Authors: S Rose, B Wilson and N Garvey, Biosis Pty Ltd, Newcastle. Project no. 22022

Document control

Version	Internal reviewer	Date issued
Draft version 01	Jane Raithby-Veall	05/05/2016
Final version 01	-	24/05/2016

Acknowledgements

Biosis acknowledges the contribution of the following people and organisations in undertaking this study:

- de Witt Consulting Pty Ltd: Mark Maund
- NSW Public Works: Jennifer Bates
- EJE Architecture: Jason Condon
- Department of the Environment for access to the Protected Matters Search Tool of the Australian Government
- NSW Office of Environment and Heritage for access to the BioNet Atlas of NSW Wildlife.

Biosis staff involved in this project were:

- Alejandro Barreto for assistance in the field, Luke Stone for background research and Lauren Harley for mapping.

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Glossary

AZ rating	A rating of tree retention value applied by arborists
BAR	Biodiversity Assessment Report
CBD	Central Business District
DCDB	Digital Cadastral Database
DIWA	Directory of Important Wetlands of Australia
DoE	Department of the Environment (Commonwealth)
DP&E	NSW Department of Planning and Environment
DTDB	Digital Topographic Database
EP&A Act	<i>Environmental Planning and Assessment Act 1979</i> (NSW)
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i> (Cmwltth)
FBA	NSW Framework for Biodiversity Assessment (OEH 2014)
FM Act	<i>Fisheries Management Act 1994</i> (NSW)
GIS	Geographic Information System
IBRA	Interim Biogeographical Rationalisation of Australia
LEP	Local Environment Plan
LGA	Local Government Area
NES	National Environmental Significance
NSW	New South Wales
NV Act	<i>Native Vegetation Act 2003</i> (NSW)
NW Act	<i>Noxious Weed Act 1993</i> (NSW)
OEH	Office of Environment and Heritage (NSW)
PCT	Plant Community Types (as defined by the NSW OEH's Vegetation Information System Classification Database)
PFC	Percentage Foliage Cover

PMST	Protected Matters Search Tool (EPBC Act)
SEARs	Secretary's Environmental Assessment Requirements (DP&E)
SEPP	State Environmental Planning Policy
Study area	The subject site (see below) plus immediately adjoining land investigated during the field surveys, as shown on Figure 3.
Subject site	The maximum area to be impacted by the proposal, as shown on Figure 3.
TSC Act	<i>Threatened Species Conservation Act 1995</i> (NSW)
VIS	Vegetation Information System
WM Act	<i>Water Management Act 2000</i> (NSW)

Summary

Biosis was commissioned by de Witt Consulting Pty Ltd on behalf of NSW Public Works to prepare a Biodiversity Assessment Report in support of a proposal to demolish and redevelop the existing Hunter Sports High School at Gateshead (the project). The project is to be assessed under section 89C of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) as State Significant Development (SSD 7532). Since small patches of remnant native vegetation occur in the development area, the Secretary's Environmental Assessment Requirements (SEARs) (21.03.2016) require that this assessment be prepared in accordance with the *NSW Framework for Biodiversity Assessment* (FBA) (OEH 2014).

The proposed development will involve the progressive demolition of the existing school buildings and the reconstruction of new buildings on a slightly different footprint, but contained within the same general area as the existing buildings.

The study area (defined in section 1.2 and shown in Figure 3) is located in the suburb of Gateshead, approximately 2.5 kilometres south of Charlestown and approximately 10 kilometres south west of the Newcastle CBD (Figure 1). The entire school site has a total area of around 9.1 hectares. Site area will not change as a result of the redevelopment, which will be confined to the north-eastern corner.

Ecological values

Key ecological values identified within the subject site (defined in section 1.2 and shown in Figure 3) include:

- 0.13 hectares of highly modified native vegetation of one plant community type (PCT), being:
 - 0.13 hectares of PCT 1619 (HU833) – *Smooth-barked Apple – Red Bloodwood – Brown Stringybark – Hairpin Banksia heathy open forest of coastal lowlands*.
- Minor habitat for some native fauna species, but no breeding habitat is considered likely to occur for any threatened fauna species.
- The study area forms part of a small, local patch of connecting native vegetation 21.5 hectares in size that extends off-site.

Impact avoidance, minimisation and mitigation

The design of the development has sought to avoid and minimise impacts to ecological features identified by Terras (2016) and de Witt Consulting (2016), wherever possible by protecting key areas of remnant native vegetation within the proposed development footprint of the school grounds. An incremental area of highly modified and disturbed native vegetation within the developed part of the school grounds will be removed, but larger areas of higher quality and more intact native vegetation of the same PCT will be retained around the school ovals and will not be affected by the current development proposal.

Additional measures undertaken to avoid and minimise impacts have been provided to further reduce and mitigate impacts arising from the development. A full list of impact avoidance, minimisation and mitigation measures is outlined in Section 6.1.

Residual impacts arising from the proposed development include:

- The permanent removal of approximately 0.13 hectares of HU833: *Smooth-barked Apple – Red Bloodwood – Brown Stringybark – Hairpin Banksia heathy open forest of coastal lowlands*.

The current level of connectivity of extant native vegetation within the school grounds with off-site native vegetation will be retained following the development.

Biodiversity credits

Credit requirements arising from the impact to native vegetation as a result of the proposed development are outlined below.

PCT code	Plant community type name	Red flag	Ecosystem credits required
HU833	Smooth-barked Apple – Red Bloodwood – Brown Stringybark – Hairpin Banksia heathy open forest of coastal lowlands	No	2

No species credits were generated by the assessment. A full credit report is provided in the Appendices.

A Biodiversity Offset Strategy is required for submission with the Environmental Impact Statement EIS to address the two ecosystem credits required due to native vegetation removal. These credits can be retired either from a suitable offset site or by purchasing the credits required on the market.

Government legislation and policy

An assessment of the project against key biodiversity legislation and policy is provided in Section 8. The outcomes of this assessment are summarised below:

- No impacts on Matters of National Environmental Significance (NES) were considered likely pursuant to the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Therefore referral of the proposed action to the Australian Government Minister for the Environment is not recommended.
- Noxious weeds identified on site must be managed in accordance with the requirements of the *Noxious Weeds Act 1993* (NW Act).
- Indirect impacts on a SEPP14 wetland (Jewells Swamp) that is within the same catchment as the study area and occurs downstream from Johnsons Creek to the west are considered unlikely if standard sedimentation and siltation mitigation measures are implemented and maintained correctly.

Stage 1 – Biodiversity Assessment

1. Introduction

1.1 Project background

Biosis was commissioned by de Witt Consulting on behalf of NSW Public Works to prepare a Biodiversity Assessment Report (BAR) for the proposed demolition of the majority of the existing school buildings and the construction of new school buildings and facilities at the Hunter Sports High School at Gateshead (Figure 1).

The project will be assessed under section 89C of the NSW EP&A Act as State Significant Development (SSD 7532) and SEARs have been issued by the NSW Department of Planning and Environment (DPE) including Agency Comments from the NSW Office of Environment and Heritage (OEH) that are relevant to this assessment. The SEARs require that Biodiversity impacts related to the proposed development are to be assessed and documented in accordance with the NSW *Framework for Biodiversity Assessment* (FBA) (OEH 2014) unless otherwise agreed by OEH, by an appropriately accredited person. This report has therefore been prepared by Accredited BioBanking Assessors in support of a proposal to demolish and redevelop the existing high school in accordance with the FBA.

1.2 Development proposal

The project will involve the demolition of existing school buildings and construction of new school facilities (Figure 2). Two of the existing school buildings at the southern end are to be retained, with the remainder demolished and replaced with new buildings. The project will result in the removal of 80 trees (both remnant native trees and planted native or exotic trees) within the development area according to the arborist report for the proposal (Terras 2016). The main remnant tree species consist of Smooth-barked Apple *Angophora costata*, Red Bloodwood *Corymbia gummifera* and Brown Stringybark *Eucalyptus capitellata* (Terras 2016).

No additional Asset Protection Zones (APZs) are required for the redeveloped school, since the existing APZs exceed the requirements for bushfire protection (Eco Logical Australia 2015). Therefore, no vegetation removal is required for APZs.

The existing ovals and sports fields to the south and west of the existing school buildings will remain as they are currently and will not require any additional vegetation clearing or disturbance.

The subject site is defined as the maximum area to be impacted by the proposal. The study area is defined as the subject site plus the immediately surrounding land investigated during the field surveys. Both the subject site and study area are shown on Figure 3.

Impacts to biodiversity arising from this development are the subject of this assessment.

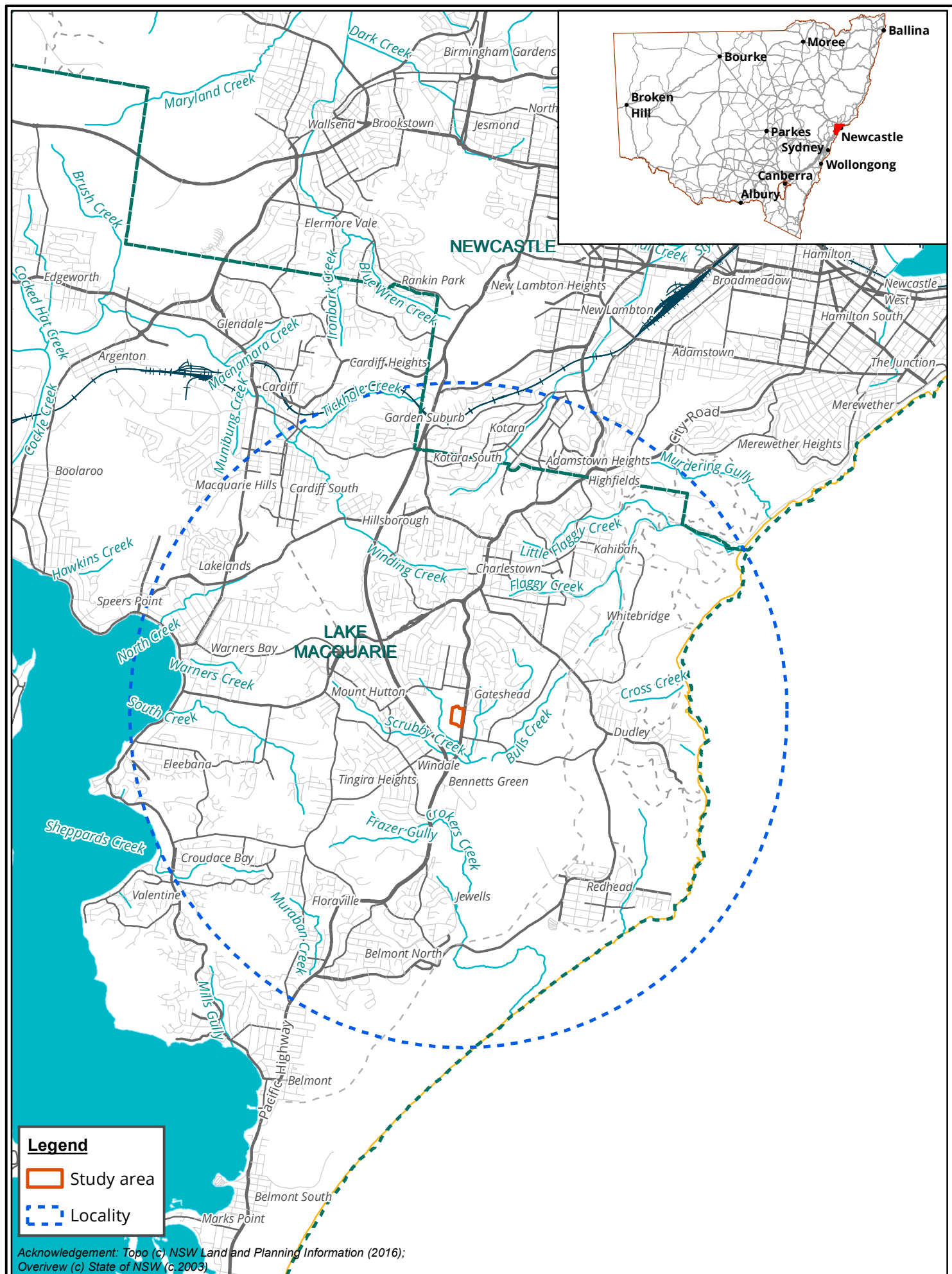


Figure 1: Location of the study area



Legend

- Study area
- New development
- To be demolished

biosis
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Ballarat, Brisbane, Canberra, Melbourne,
Newcastle, Sydney, Wangaratta & Wollongong

Figure 2: Hunter Sports High Site Plan

Acknowledgements: Topo (c) NSW Land and Planning Information (2012)

Matter: 22022
Date: 03 May 2016,
Checked by: SR, Drawn by: LH, Last edited by: lharley
Location: P:\22000s\22022\Mapping\
22022_F2_HunterHighSitePlan

0 10 20 30 40 50
Metres
Scale 1:1,000 @ A3
Coordinate System: GDA 1994 MGA Zone 56





Legend

- Study area
- Subject site

Figure 3: Hunter Sports High study area



Ballarat, Brisbane, Canberra, Melbourne, Newcastle, Sydney, Wangaratta & Wollongong

Acknowledgements: Imagery (c) Nearmap 2015; Topo (c) NSW Land and Planning Information (2012)

Matter: 22022
Date: 03 May 2016,
Checked by: SR, Drawn by: LH, Last edited by: lharley
Location: P:\22000s\22022\Mapping\22022_F3_StudyArea

0 10 20 30 40 50
Metres

Scale 1:1,000 @ A3
Coordinate System: GDA 1994 MGA Zone 56



1.3 Site description

The study area is located in the suburb of Gateshead, approximately 2.5 kilometres south of Charlestown and approximately 10 kilometres south west of the Newcastle CBD (Figure 1).

The study area is within the:

- Sydney Basin Interim Biogeographic Regionalisation of Australia (IBRA) Region.
- Wyong IBRA Subregion.
- Gosford-Cooranbong Coastal Slopes Mitchell Landscape.
- Lake Macquarie Local Government Area (LGA).

The study area is located immediately adjacent to a primary school, areas of residential development to the north, native bushland beyond the school ovals to the west, major arterial roads beyond the ovals and some remnant native vegetation to the south as well as light industrial development east of the Pacific Highway.

Johnsons Creek forms a second order stream that flows through the patch of native vegetation adjoining the ovals to the west flowing north to south and thence south-east into Jewells Wetland. No watercourses or identifiable natural drainage lines occur within the study area.

The study area is located on a flatter area within an area of generally dissected and undulating topography characterised by deep gullies, steep slopes and ridges. Soil landscapes within the study area are from the Late Permian Adamstown Subgroup of Newcastle Coal Measures consisting of conglomerate, sandstone, siltstone, coal and tuff (Hawley et al. 1994).

The study area is highly disturbed and modified. It is mostly cleared of native vegetation and replaced by existing school buildings. Small patches of highly modified native vegetation occur mainly in the south-eastern corner of the study area, with much smaller remnants elsewhere. The remnant native vegetation generally lacks any native shrub or ground layer. Remnant native elements are restricted to individual, robust shrub and herb species that occur sparsely. The remnant native vegetation in the south-eastern corner connects with a band of remnant native vegetation alongside the oval to the south of the study area that runs alongside the Pacific Highway.

Elsewhere within the study area, vegetation is artificially planted in landscaped areas and consists of either a mixture of exotic and native (mostly not locally native) species, or planting arrangements of locally native species such as rows of Spotted Gum *Corymbia maculata* Ironbark *Eucalyptus paniculata* and Swamp Mahogany *Eucalyptus robusta* that are not part of the naturally-occurring vegetation type within the study area.

1.4 Information sources

1.4.1 Publications and databases

In order to provide a context for the study area, information about flora and fauna was also obtained from within five kilometres (the 'locality') from relevant public databases. Records from the following databases were collated and reviewed:

- Department of the Environment (DoE) Protected Matters Search Tool for matters protected by the EPBC Act.

- NSW BioNet - the database for the Atlas of NSW Wildlife, OEH.
- BirdLife Australia, the New Atlas of Australian Birds 1998-2015 (BA).
- PlantNET (The Royal Botanic Gardens and Domain Trust, 2013) for Rare or Threatened Australian Plants (RoTAP).
- NSW WeedWise - noxious and environmental weed database, NSW Department of Primary Industries.

Other sources of biodiversity information:

- Relevant vegetation mapping, including:
 - OEH Vegetation Information System (VIS) Mapping through the Spatial Information eXchange (SIX) Vegetation Map Viewer.
 - *Lake Macquarie LGA Vegetation Mapping* (Bell & Driscoll 2016).
 - *Lower Hunter and Central Coast Regional Vegetation Mapping* (LHCCREMS 2003).
- NSW Vegetation Information System (VIS): Classification Version 2.1 (OEH 2015).

The following reports were also reviewed:

- *Arborist Report for Hunter Sports High* (Terras 2016).
- *Bushfire Protection Assessment Report for Proposed Building Redevelopment of Hunter Sports High School, Gateshead* (Eco Logical Australia 2015).

1.4.2 Spatial data

A site plan (11029_A011-A014_Detail Site Plan.dwg) detailing the school reconstruction layout was supplied by EJE Architecture. Data was digitised, converted into shapefile format and imported into ArcGIS.

Basemap data was obtained from NSW Land and Property Information (2012) (LPI) 1:25000 digital topographic database (DTDB), with cadastral data obtained from LPI digital cadastral database (DCDB). Determination of stream order for the nearby Johnsons Creek was undertaken with ESRI ArcGIS Spatial Analyst, using the Hydroline layer within the DTDB.

The following spatial datasets were utilised during the development of this report:

- Mitchell Landscapes Version 3.0.
- Interim Biogeographic Regionalisation of Australia (IBRA) Version 7.
- Directory of Important Wetlands (DIWA).
- State Environmental Planning Policy (SEPP) 14 Wetlands.
- Aerial photography was obtained from NearMap (2015) used to assess vegetation within the study area and LPI (2014) Imagery for identification of native vegetation within the assessment circles.

Delineation of vegetation communities was undertaken by direct observation from the random meander throughout the study area, with vegetation mapping based on reference to the high resolution aerial imagery.

Mapping herein has been produced using a Geographic Information System (GIS). Electronic GIS files containing the relevant ecological spatial data are available on request.

2. Legislative context

This section provides an overview of key biodiversity legislation and government policy considered in this assessment. Where available, links to further information are provided. This section does not describe the legislation and policy in detail and guidance provided here does not constitute legal advice.

2.1 Commonwealth

2.1.1 Environment Protection and Biodiversity Conservation Act 1999

The EPBC Act is the Australian Government's key piece of environmental legislation. The EPBC Act applies to developments and associated activities that have the potential to significantly impact on Matters of National Environmental Significance (NES) protected under the Act.

Nine Matters of NES are identified under the EPBC Act:

- world heritage properties
- national heritage places
- wetlands of international importance (also known as 'Ramsar' wetlands)
- nationally threatened species and ecological communities
- migratory species
- Commonwealth marine areas
- the Great Barrier Reef Marine Park
- nuclear actions (including uranium mining)
- a water resource, in relation to coal seam gas development and large coal mining development.

Under the EPBC Act, activities that have potential to result in significant impacts on Matters of NES must be referred to the Commonwealth Minister for the Environment for assessment.

Matters of NES relevant to the current project include nationally threatened species and ecological communities, migratory species and Ramsar wetlands. Threatened species and ecological communities protected by the EPBC Act are outlined in Section 5.5.1. An assessment of potential impacts to all Matters of NES under the provisions of the EPBC Act is provided in Section 8.1.

2.2 State

2.2.1 Environmental Planning and Assessment Act 1979

The EP&A Act was enacted to encourage the proper consideration and management of impacts of proposed development or land-use changes on the environment (both natural and built) and the community. The EP&A Act is administered by the NSW Department of Planning and Environment (DPE).

For a Major Project application under the EP&A Act, an Environmental Impact Statement (EIS) must be prepared which must address all the requirements set out in the SEARs. A BAR must be prepared to document the biodiversity values present on the development site and assess the impacts of the Major Project on these values.

Sections of the EP&A Act of primary relevance to the natural environment are outlined further below.

State Environmental Planning Policies (Part 3, Division 2)

State Environmental Planning Policies (SEPPs) are environmental planning instruments under the EP&A Act that outline policy objectives relevant to State or regional environmental planning issues. There are over 65 SEPPs; however, only those relevant to the proposed development have been considered and are detailed below.

SEPP No. 14 – Coastal Wetlands

The aim of this policy is to ensure that coastal wetlands are preserved and protected in the environmental and economic interests of the State. The boundaries of designated wetlands covered by SEPP No. 14 are mapped under the policy.

The study area is located within the catchment of a mapped SEPP No. 14 wetland, Jewells Swamp, therefore SEPP No. 14 is potentially relevant to the current assessment and is discussed further in Sections 3.2 and 6.1.2.

SEPP No. 44 – Koala Habitat Protection

SEPP No. 44 aims to encourage the conservation and management of natural vegetation areas that provide habitat for koalas to ensure permanent free-living populations will be maintained over their present range and to reverse the current trend of koala-population decline. It applies to areas of native vegetation greater than one hectare and for Councils listed in Schedule 1 to the SEPP.

The study area is located within the Lake Macquarie LGA, a Schedule 1 listed Council, however the area of native vegetation involved is less than one hectare therefore SEPP No. 44 is not relevant to the current assessment and is not discussed further.

Local Environment Plans (Part 3, Division 4)

Local Environment Plans (LEP) are created by councils in consultation with their community and guide planning decisions for LGAs. They apply either to the whole, or part of, a LGA and make provision for the protection or utilisation of the environment through zoning of land and development controls.

The study area is subject to the Lake Macquarie LEP 2014 and is zoned R2 Low Density Residential. The objectives of the R2 zone are to:

- Provide for the housing needs of the community within a low density residential environment.
- Enable other land uses that provide facilities or services to meet the day to day needs of residents.
- Encourage development that is sympathetic to the scenic, aesthetic and cultural heritage qualities of the built and natural environment.

The proposed development is permissible with consent under State Environmental Planning Policy (Infrastructure) 2007 (de Witt Consulting 2016).

2.2.2 Threatened Species Conservation Act 1995

The TSC Act is the key piece of legislation providing for the protection and conservation of biodiversity in NSW through the listing of threatened species, populations and ecological communities and the declaration and mapping of their critical habitats, as well as the identification of key threatening processes. The TSC Act also establishes a system for biodiversity certification and establishes the Biodiversity Banking and Offsets Scheme.

Impact assessment

Any impact assessment needs to consider whether there is likely to be a significant effect on any threatened species, populations or ecological communities, or their habitats.

Habitat critical to the survival of an endangered or critically endangered species, population or ecological community can be identified under the TSC Act and listed on the Register of Critical Habitat kept by the OEH. Consideration of the potential impacts of the development on critical habitat occurs as a part of the assessment.

2.2.3 Fisheries Management Act 1994

The FM Act provides for the protection and conservation of aquatic species and their habitat throughout NSW. Impacts to threatened species, populations and communities, and critical habitats listed under the FM Act must be assessed through the AoS process under Section 220ZZ of the FM Act and Section 5A of the EP&A Act (see Section 2.2.1).

The study area does not contain key fish habitat or provide habitat for threatened species listed under the FM Act. The FM Act is not relevant to the current assessment.

2.2.4 Water Management Act 2000

The WM Act provides for the sustainable and integrated management of the State's water for the benefit of both present and future generations based on the concept of ecologically sustainable development. The Act controls how water can be used and it controls and requires approvals for the extraction of water, the construction of works such as pumps, dams, drains, pipes and weirs, and the carrying out of activities on or near water sources in NSW.

Under the WM Act an approval is required to undertake controlled activities on waterfront land, unless that activity is otherwise exempt. No work will be undertaken within waterfront land. The WM Act is not relevant to the current assessment.

2.2.5 Native Vegetation Act 2003

The NV Act provides for, encourages and promotes the management of native vegetation on a regional basis and regulates the clearing of native vegetation on land in NSW. Under the NV Act no clearing of native vegetation is allowed except in accordance with prior development consent from the relevant Council or under a Property Vegetation Plan (PVP) approved by the relevant Catchment Management Authority.

Lake Macquarie City Council is one of the LGAs to which the NV Act applies. The study area is zoned R2 Low Density Residential. This zone is excluded from requirement for NV Act assessment. Therefore the NV Act is not relevant to the current assessment.

2.2.6 Noxious Weeds Act 1993

The NW Act was enacted to provide for the identification, classification and control of noxious weeds. Plants declared as noxious weeds are currently listed under Weed Control Order No. 28 *Declaring Certain Plants to be Noxious Weeds* published in the New South Wales Government Gazette No. 97 (Department of Premier and Cabinet 2011).

The Act was enacted to provide for the identification, classification and control of noxious weeds. The NW Act aims to reduce the negative impact of weeds on the economy, community and environment of NSW by:

- Establishing control mechanisms to prevent the establishment of significant new weeds in NSW.
- Preventing, eliminating or restricting the spread of particular significant weeds in NSW.
- Effectively managing widespread significant weeds in NSW.

Plants declared as noxious weeds are currently listed under *Noxious Weeds (Weed Control) Order 2014* published in the NSW Government Gazette No. 23. The NW Act is supported by a number of regulations and is administered by the DPI.

Noxious weeds are discussed further in Section 8.2.

3. Landscape

3.1 Bioregions and landscapes regions

The study area occurs within the Sydney Basin IBRA bioregion and the Wyong IBRA subregion. The Wyong IBRA subregion covers the entire development site and is the subregion used in this assessment. Both the inner and outer assessment circles (Figure 4) are also located entirely within this subregion.

The study area occurs entirely within the Gosford-Cooranbong Coastal Slopes Mitchell Landscape, which is the Mitchell Landscape used in this assessment. The Sydney-Newcastle Barriers and Beaches Mitchell Landscape occurs within the far south-eastern quadrant of the outer assessment circle only.

3.2 Waterways and wetlands

The study area is located within the Jewells Swamp catchment, a small catchment on the eastern side of Lake Macquarie within the Lake Macquarie LGA. The study area is drained by Johnson's Creek to the west, a second order stream that flows south-easterly into Jewells Swamp via Scrubby Creek. The wetland is drained by Crokers Creek that enters the Pacific Ocean at Nine Mile Beach, Redhead. No identified streams or watercourses flow through the study area itself.

Jewells Swamp is a wetland listed by State Environmental Planning Policy No. 14 (SEPP 14); therefore the study area is within the catchment of a SEPP 14 wetland.

3.3 Native vegetation extent

The smallest inner and outer assessment circles (100 hectare and 1000 hectare) were used, as the 1000 hectare assessment circle was sufficient to fit the study area. The assessment circles were both centered on the centre of the subject site.

Mapping of vegetation within the outer assessment circle was undertaken using Bell and Driscoll (2012) vegetation mapping data, which is considered the most reliable and comprehensive local vegetation mapping study. Vegetation in the outer assessment circle is shown in Figure 4.

Bell and Driscoll (2012) map nine native vegetation communities within the outer assessment circle, including:

- MU 5g – Glenrock Sheltered Bluegum Forest
- MU11 – Coastal Sheltered Apple-Peppermint Forest.
- MU15 – Coastal Foothills Spotted Gum - Ironbark Forest.
- MU30 – Coastal Plains Smooth-barked Apple Woodland.
- MU31 – Coastal Plains Scribbly Gum Woodland.
- MU37 – Swamp Mahogany - Paperbark Forest.
- MU37e – Coastal Sand Swamp Forest.
- MU44I – Munmorah Impeded Sand Sedgeland.
- MU119 – Kahibah Snappy Gum Forest.

A tenth map unit is unclassified vegetation:

- LM07 – Unclassified Vegetation.

Minor areas are mapped as Unclassified Vegetation, which on examination of high resolution aerial imagery, appear to consist of mostly non-native vegetation or predominantly weedy areas.

3.4 Assessment of landscape value

Landscape value has been calculated using the method for site-based developments, outlined in Appendix 4 of the FBA 2014 (OEH 2014).

3.4.1 Assessment of the current extent of native vegetation cover

The extent of native vegetation cover before development for both outer and inner assessment circles was determined as the sum of areas of each of the native vegetation map units listed above, excluding Unclassified Vegetation.

To determine the extent of native vegetation cover after development, the extent of vegetation required for removal (0.13 hectares) was subtracted from the extent of native vegetation cover before development. Table 1 provides a summary of the extent of native vegetation cover within the inner and outer assessments circles, before and after development. The incremental removal of native vegetation due to the development has not altered the range into which the areas for either the outer or inner assessment circles fall before or after development.

Table 1: Extent of native vegetation cover before and after development

Assessment Circle	Before Development		After Development	
	Area (ha)	Per cent	Area (ha)	Per cent
Outer assessment circle	325	32.5	325	32.5
Inner assessment circle	21.5	21.5	21.3	21.3

3.4.2 Assessment of connectivity value

The study area does not support any of the following:

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

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

The study area was assessed as being part of one connective link, with native vegetation to the south of the study area providing connectivity with native vegetation that extends to the west of the study area via narrow links to the south (Figure 4). The connecting native vegetation is clearly bound by the Newcastle Inner City Bypass to the west, and is deemed to be not connected further by a gap of greater than 100 metres in native vegetation south of the Willow Way overpass.

The study area does not connect to native vegetation the east due to development nor to the north by development, apart from a small patch of remnant native vegetation within the adjoining primary school grounds. The southern section of the single connective link was deemed to be the most limited, with a minimum linkage width of about 20 metres prior to development. This linkage width will be unaffected by the proposed development, and no change in linkage width classes will occur. Therefore, the connectivity width category both before and after development will be the same at >5 metres - 30 metres.

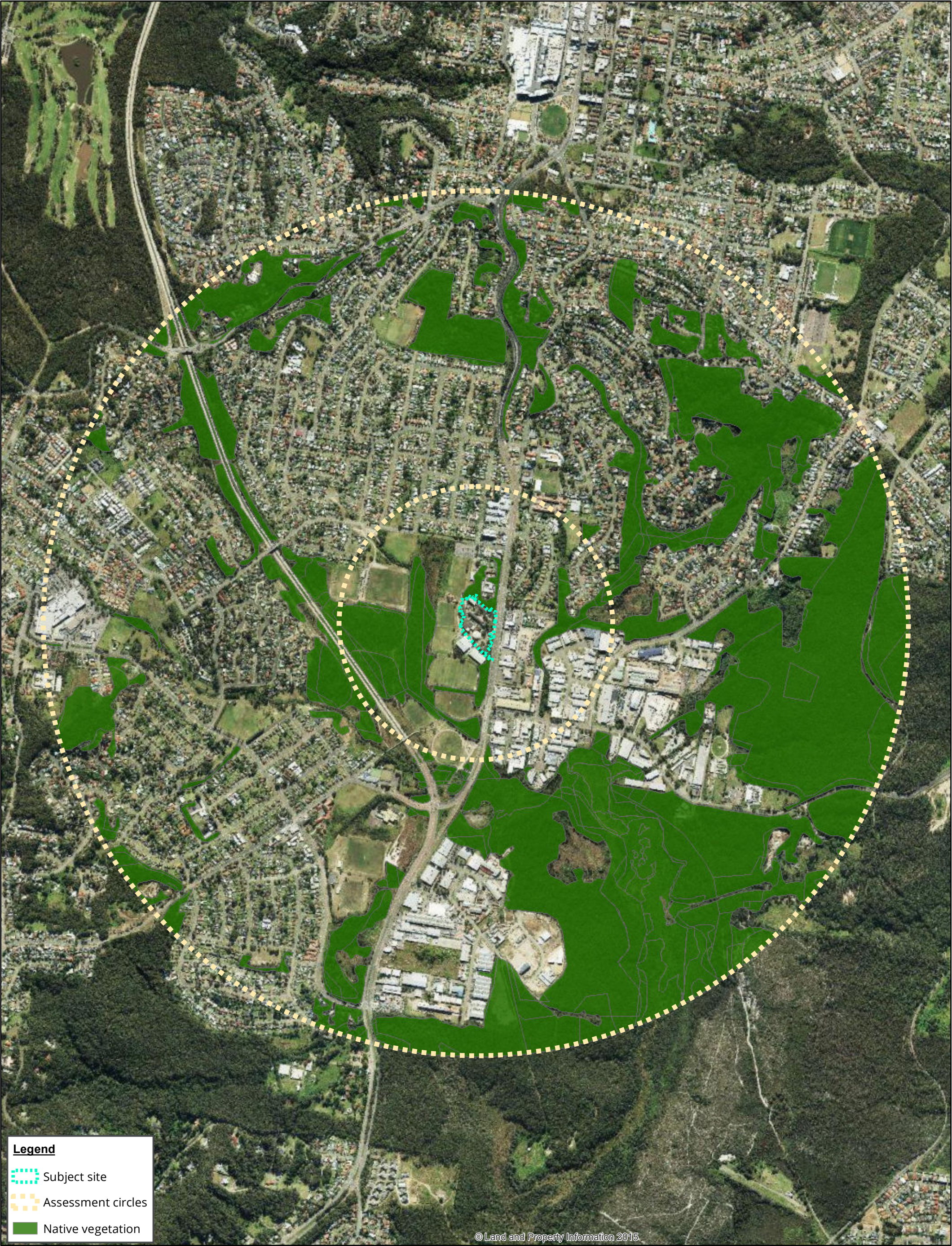
Overstorey condition for the inner and outer assessments circles was assessed based on aerial photo interpretation. Overstorey vegetation within the assessed connective link is largely intact, except for one short section of less than 60 metres to the far south of the patch which lacks an overstorey. Percentage Foliage Cover (PFC) was assessed as being at benchmark condition on average. No change in overstorey condition will result from the proposed development. Midstorey/groundcover condition was assessed based on a rapid assessment of vegetation within the locality, with vegetation reviewed from roadsides. Midstorey/groundcover vegetation adjacent to the study area is also largely intact, with a moderate to high diversity in most areas. No change to Midstorey/groundcover condition of the link will result from the proposed development.

The proposed development will not result in any change in linkage condition classes.

3.4.3 Assessment of patch size

Patch size was assessed by calculation of total areas of connecting patches using the SIX Viewer mapping tools. All vegetation not defined as low condition and separated by a distance of less than 100 metres was mapped sequentially. Using this method, vegetation within the study area forms part of a relatively small patch of connecting vegetation, extending south to Johnsons Creek and along the eastern side of the Newcastle Inner City Bypass for some distance. While native vegetation also occurs on the western side of the bypass, this road poses a 'hostile barrier' being a four-lane freeway, and is not considered to be connected to the patch. The connection is deemed to end at the Willow Road crossing over the bypass, where greater than a 100 metre gap occurs in native vegetation. The study area was assessed as having a patch size of 21.5 hectares.

Regardless of the estimated level of clearing within the Gosford-Cooranbong Coastal Slopes Mitchell Landscape, at this patch size the study area fits into the 'Small' patch size class.



Legend

 Subject site

 Assessment circles

 Native vegetation

Figure 4: Native vegetation within the assessment circles

Acknowledgements: Imagery (c) LPI 2014; Topo (c) NSW Land and Planning Information (2012)

Matter: 22022
Date: 03 May 2016,
Checked by: SR, Drawn by: LH, Last edited by: lharley
Location:P:\22000s\22022\Mapping\
22022_F4_NativeVeg_AssessCircles


Biosis Pty Ltd
Ballarat, Brisbane, Canberra, Melbourne,
Newcastle, Sydney, Wangaratta & Wollongong

0 140 280 420 560 700

Metres
Scale 1:14,000 @ A3
Coordinate System: GDA 1994 MGA Zone 56



4. Native vegetation

The extent of native vegetation within the study area was determined using Section 5 of the FBA (OEH 2014).

4.1 Background review

A review of local vegetation mapping by Bell and Driscoll (2016) and regional vegetation mapping by LHCCREMS (2003) was undertaken to inform the site investigation.

Remnants of native vegetation within the study area, mainly at its eastern and northern end have been mapped by Bell and Driscoll (2016) as Map Unit 30 – *Coastal Plains Smooth barked Apple Woodland*. This map unit equates to Plant Community Type PCT 1619 (Biometric Vegetation Type HU833) – *Smooth-barked Apple – Red Bloodwood – Brown Stringybark – Hairpin Banksia heathy open forest of coastal lowlands* that is associated with the FBA, according to the conversion chart provided by Lake Macquarie City Council (Bell 2016).

Detailed mapping of vegetation within the study area was undertaken for this assessment. Methodology is outlined in Section 4.2 and results presented in Section 4.3.

4.2 Methods

4.2.1 Site investigation

An initial field investigation of the study area was undertaken on 13 April 2016 by a senior flora ecologist (accredited BioBanking Assessor) and a fauna ecologist. The site survey identified areas of remnant vegetation within the subject site that qualified as native vegetation according to the definition given in the FBA (OEH 2014). Areas of native vegetation for which a PCT could validly be assigned were identified and delineated in the field, and their condition determined. The arborist report (Terras 2016) was consulted to identify areas of native vegetation and individual trees that are proposed to be retained, and those that are likely to be removed by the project. Trees identified in the arborist report were inspected for the presence of hollows, and any other habitat features suitable for threatened fauna within the subject site were identified.

On the basis of the initial field investigation, the subject site was found to contain a single vegetation zone of substantially less than 2 hectares in area. Therefore, only a single BioBanking field transect and plot was required. Only one patch of remnant native vegetation was found to be large enough to physically accommodate the transect and plot which was within an area representative of the vegetation zone in the south-eastern corner of the subject site.

Attribute data was recorded by the accredited BioBanking Assessor and a flora ecologist on 14 April 2016, using transect and plot survey data, as per the methodology outlined in Section 5 of the NSW FBA (OEH 2014). The site assessment for BioBanking assessment purposes consisted of:

- A 20 metre x 50 metre quadrat and 50 m transect for assessment of site attributes.
- A 40 metre x 10 metre quadrat, nested within the quadrat outlined above, for full floristic survey to determine native plant species richness.

The 40 metre by 10 metre shape rather than the standard 20 x 20 metre configuration was used for the 400 square metre flora species quadrat because of the narrow and very restricted area of the vegetation zone.

The location of the transect and plot was recorded using a hand-held (uncorrected) GPS units (GDA94). The accuracy of the points is therefore subject to the accuracy of the GPS unit (generally ± 5 metres), but in this

case the exact location of the transect and plot was readily identifiable from the high-resolution aerial imagery by reference to the site features (fences, car parking spaces and individual trees) clearly visible on the imagery (Figure 5).

Mapping of the distribution of the native vegetation zone was undertaken using direct field observation from the site random meander and aerial photo interpretation. Electronic GIS files containing the relevant flora and fauna spatial data are available to incorporate into design concept plans. However this mapping may not be sufficiently precise for detailed design purposes.

General classification of native vegetation in NSW used in this report is based on the classification system in Keith (2004) which uses three groupings of vegetation: vegetation formation, vegetation class and vegetation type, with vegetation type the finest grouping. The grouping referred to in this report is vegetation type. The single PCT was identified using the NSW Vegetation Information System (VIS): Classification Version 2.1.

The minimum number of plots/transects for the Vegetation Zone was determined using Table 3 of the FBA methodology (OEH 2014). A total of one plot/transect was completed within the study area (Figure 5).

A list of flora species was compiled for the subject site as a whole. Records of all flora species will be submitted to OEH for incorporation into the NSW BioNet Atlas of NSW Wildlife.

Fauna habitat assessment comprises inspections of all trees proposed to be removed and identification of any important habitat features for threatened species, including:

- wet areas
- Mistletoe
- rocky areas
- large trees
- hollow-bearing trees
- fallen timber
- standing dead trees
- large She-oaks
- Koala feed tree species
- areas of dense canopy growth
- areas of dense understorey vegetation
- winter flowering eucalypts
- signs of fauna presence such as diggings, scratch marks, droppings or nests.

All fauna observed opportunistically was recorded.

4.3 Results

4.3.1 Vegetation description

The study area supports 0.13 hectares of identifiable native vegetation that could be aligned with a PCT. This formed a single vegetation zone with a very high level of disturbance evident across the subject site (Figure 5). The vegetation zone occurs in several small patches throughout the subject site, with the largest two patches

occurring in the south-eastern corner of the subject site. Much smaller patches occur in the central, northern and western parts of the subject site.

4.3.2 Plant community types

Only one vegetation type was found to conform to an identifiable native vegetation type that could be aligned with one of the PCTs associated with NSW VIS: Classification Version 2.1 (Table 2).

Other vegetation types were artificial, and of two types:

- Planted predominantly exotic trees and shrubs, or native trees that are not locally-occurring, many native to other states or regions. This vegetation type occupies several patches and accounts for a moderate portion of the vegetation within the subject site.
- Planted trees, generally consisting of one or two predominantly locally occurring species that are not a part of any naturally-occurring PCT in the site. This vegetation type occupies a minor area within the subject site.

Site investigations, including determination of vegetation communities using the methodology outlined in Section 4.2.1, confirmed the presence of one vegetation community mapped by Bell and Driscoll (2016) within the study area. The distribution of this vegetation community within the study area differed slightly to that as mapped by Bell and Driscoll (2016).

Areas of planted native trees could not be aligned within any PCT in accordance with the FBA requirement and were not considered to constitute native vegetation. They therefore require no further assessment in the FBA (section 5.1.1.3), unless they are assessed as habitat for threatened species, discussed further in Section 5. An example of planted native/exotic vegetation that does not align with any PCT is shown in Plate 1.



Plate 1: Planted native / exotic vegetation

All areas of native vegetation were assessed as being in moderate/good-poor condition using the FBA (OEH 2014), resulting in one Vegetation Zone within the subject site. The native vegetation zone identified within the study area, including the PCT, the vegetation formation and vegetation class (Keith 2004), its alignment

with vegetation communities described by Bell and Driscoll (2016) and the area of the Vegetation Zone is described in Table 2.

Table 2: Vegetation zone mapped within the study area

Vegetation zone	Plant community type	Vegetation formation	Vegetation class	Vegetation community (Bell and Driscoll 2016)	Area (ha)
01	PCT 1691: Smooth-barked Apple – Red Bloodwood – Brown Stringybark – Hairpin Banksia heathy open forest of coastal lowlands.	Dry Sclerophyll Forests (Shrubby subformation)	Sydney Coastal Dry Sclerophyll Forests	Coastal Plains Smooth-barked Apple Woodland (MU30)	0.13

A detailed description of this Vegetation Zone is provided in Table 3.

Table 3: Native vegetation zone description

Vegetation zone 1 – Smooth-barked Apple – Red Bloodwood – Brown Stringybark – Hairpin Banksia heathy open forest of coastal lowlands	
PCT ID	1691
Biometric vegetation type ID	HU833
Common name	<i>Smooth-barked Apple – Red Bloodwood – Brown Stringybark – Hairpin Banksia heathy open forest of coastal lowlands.</i>
Condition	Moderate/good (poor)
Extent within study area	0.13 ha of this PCT was recorded and mapped in six patches of varying size, the largest patch within the south-eastern section of the subject site (Figure 8).
Description	This PCT occurs in sandy soil with a clay component. The canopy, where intact, consists of Smooth-barked Apple, Red Bloodwood and Brown Stringybark. Some Scribbly Gum <i>Eucalyptus haemastoma</i> also occurs as a co-dominant species in limited areas. The midstorey and ground layer species include Black She-oak <i>Allocasuarina littoralis</i> , Hairpin Banksia <i>Banksia spinulosa</i> subsp. <i>collina</i> , Blue Flax-lily <i>Dianella caerulea</i> , Red-stemmed Wattle <i>Acacia myrtifolia</i> , Kangaroo Grass <i>Themeda australis</i> and Two-colour Panic <i>Panicum simile</i> .
Survey effort	One plot/transect was used in this PCT (Figure 5).
Condition	This Vegetation Zone shows very high levels of modification and disturbance in the subject site, with minimal levels of shrub and ground cover, including both native and exotic species. The condition of the PCT is generally much lower in the subject site than in the study area more broadly. Disturbance is primarily the result of past clearing. In the largest patch, the ground in this area has been covered with a layer of gravel to provide space for an informal car parking area. Weeds where they occur generally consist of exotic herbs and

Vegetation zone 1 – Smooth-barked Apple – Red Bloodwood – Brown Stringybark – Hairpin Banksia heathy open forest of coastal lowlands

	grasses. Regeneration is severely inhibited by the gravel layer on the ground and the compaction caused by vehicle parking under the native overstorey trees. The PCT is generally much more intact in adjoining parts of the study area outside the subject site, with lower ongoing levels of disturbance and higher native species richness. Declared noxious weeds identified in the study area include: • Bitou Bush <i>Chrysanthemoides monilifera</i> subsp. <i>rotundata</i> • Fireweed <i>Senecio madagascariensis</i> Both species are also Weeds of National Significance (WoNS). The legal control requirements by landowners for these weeds on their land under the NW Act are given in section 8.2
Characteristic species used for identification of PCT	Since the vegetation community is so modified and reduced in terms of species diversity within the subject site, adjoining patches of the community with similar overstorey composition in the study area were used as the source of species considered for identification of the PCT in the subject site. The overstorey species recorded within the study area that align with the dominant species listed as characterising this PCT (Somerville 2009) are Smooth-barked Apple, Red Bloodwood and Brown Stringybark. Aligning mid-storey and ground layer species species recorded include Black She-oak <i>Allocasuarina littoralis</i>, Hairpin Banksia <i>Banksia spinulosa</i> subsp. <i>collina</i>, Blue Flax-lily <i>Dianella caerulea</i>, Red-stemmed Wattle <i>Acacia myrtifolia</i>, Kangaroo Grass <i>Themeda australis</i> and Two-colour Panic <i>Panicum simile</i>.
Justification of evidence used to identify the PCT	Apart from species composition, the stated landscape position of 'coastal hillslopes, upper slopes, coastal lowlands and low ranges of the lower North Coast and Central Coast; mainly on sandy substrates' (Somerville 2009) is consistent with that of the study area. Other diagnostic features are stated as 'Open forests with a canopy dominated by <i>Angophora costata</i> and <i>Corymbia gummifera</i>. The mid-storey is typically shrubby and commonly includes grass trees and scrambling climbers. The ground layer is typically dominated by grasses along with graminoids and scattered forbs' (Somerville 2009). These features are highly consistent with the structure and growth forms of dominant species particularly within the less disturbed and modified parts of the community in the study area.
Status	The PCT does not align with any threatened ecological communities listed by either the Commonwealth EPBC Act or NSW TSC Act.
Estimate of percent cleared value of PCT in the major catchment area	45%

Vegetation zone 1 – Smooth-barked Apple – Red Bloodwood – Brown Stringybark – Hairpin Banksia heathy open forest of coastal lowlands

Plate 2: Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands



4.3.3 Fauna Habitat present

The subject site, at the time of field investigation is an operating high school with school buildings, playgrounds, driveways and parking areas providing very limited refuge or habitat for fauna.

Trees of a range of sizes were present and comprised remnant native species and planted trees, both native and exotic.

No wet areas, mistletoe, rocky areas, large sheoaks, fallen timber, dense canopy foliage or dense understorey vegetation were present.

Only trees 4 and 32 within the subject site (numbering from Terras 2016) were found to contain small to medium hollows. A few trees contained dead sections of the trunk.

Some winter flowering tree species were present, comprising mostly planted Spotted Gums and a few planted Swamp Mahogany trees. Some exotic species such as palms provide additional foraging resources on the site for nectivores.

Koala feed tree species present include a few planted Tallowwood *Eucalyptus microcorys* and Swamp Mahogany *Eucalyptus robusta* trees, although these were mostly small trees, and a few Scribbly Gums *Eucalyptus haemastoma*.

A patch of remnant vegetation in the south-east corner of the study area (outside the subject site) was found to contain standing dead trees and hollow-bearing trees. An old Common Ringtail Possum drey was observed in this area.

A range of common bird species were observed within the subject site comprising Grey Butcherbird, Noisy Miner, Australian Magpie, Masked Lapwing, Laughing Kookaburra, Australian Raven, Sulphur-crested Cockatoo, Australian Kestrel, Rainbow Lorikeet, Welcome Swallow and Crested Pigeon.

A Water Skink was observed to emerge from a concrete drainage sump within the subject site.

Anecdotal evidence (Hunter Sports High School General Assistant) indicates that rats and possums are common on the site.

4.3.4 Site value score

Plots and transect survey data was entered into the BioBanking credit calculator to determine site value scores. Plot and transect survey data is presented in Appendix 1. Current site value for the single Vegetation Zone is outlined in Table 4.

Table 4: Site value score for the Vegetation Zone

Vegetation zone	PCT	Site value score	Area (ha)
01	PCT 1619 – Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands	21.88	0.13



Figure 5: Native vegetation within the subject site and BioBanking plot



Ballarat, Brisbane, Canberra, Melbourne, Newcastle, Sydney, Wangaratta & Wollongong

Matter: 22022
Date: 03 May 2016,
Checked by: SR, Drawn by: LH, Last edited by: lharley
Location: P:\22000s\22022\Mapping\22022_F5_NativeVegetationSubjectSite

Acknowledgements: Imagery (c) Nearmap 2015; Topo (c) NSW Land and Planning Information (2012)

0 10 20 30 40 50
Metres

Scale 1:1,000 @ A3
Coordinate System: GDA 1994 MGA Zone 56



5. Threatened species

5.1 Methods

Flora and fauna assessments of the study area have been undertaken on 13 and 14 of April 2016. The daytime assessments were undertaken during a period of light showers, clearing to sunny breaks on both days. The weather was calm and warm.

5.1.1 Targeted threatened flora survey

Flora surveys have included two survey techniques, including one BioBanking plot/transect and random meanders.

Targeted flora surveys were conducted on the 13 and 14 of April 2016. During these surveys, the site was traversed on foot using the random meander method (Cropper 1993). One BioBanking plot/transect survey was undertaken within the area of most natural area vegetation in the subject site on 14 April 2016. Because of space constraints, part of the transect and plot extended into the study area immediately adjoining the subject site to the east.

These surveys provide a comprehensive assessment of the potential for the study area to support threatened species. One threatened flora species was recorded within the subject site, Narrow-leaved Black Peppermint *Eucalyptus nicholii*. This species is listed Vulnerable by both the NSW TSC Act and Commonwealth EPBC Act. A single tree of the species occurs to the west of the central car park, and is identified as Tree No. 56 in the Arborist Report (Terras 2016). This species is native to the New England area of NSW, and is not a naturally-occurring species in the Lake Macquarie area. It has been artificially planted many years previously as part of the landscaping for the school grounds. The specimen has been recommended for removal by the Arborist Report, because of a large amount of dead wood and dieback, and hanging branches (Terras 2016). The tree is therefore likely to be towards the end of its lifespan and in the normal course of events would probably die naturally within the next few years. No additional trees of the species were found to occur within the study area. Being isolated, it is unlikely that the tree forms a part of any locally interbreeding population.

It is therefore concluded in this assessment that it is not appropriate to assess the tree for species credits, and no offsets or replacement planting for the species are considered to be required. The species is not considered further in this assessment.

5.1.2 Targeted threatened fauna survey

The habitat assessment carried out within the subject site identified highly modified habitats for fauna within the subject site providing very limited habitat features for threatened fauna species. From the habitat assessment the likelihood of occurrence of threatened fauna species within the subject site was determined (Table 18). With very limited roosting, nesting or foraging opportunities for threatened fauna being found present it was determined that there was a low likelihood of occurrence for most threatened fauna species. Targeted threatened fauna surveys were not carried out for this reason.

5.2 Geographic /habitat features

An assessment of the occurrence of geographic habitat features, in accordance with Section 6.3 of the NSW FBA (OEH 2014) was undertaken, along with a determination of whether impacts to these habitat features will result from the proposed development. The species generated by the calculator associated with the NSW FBA (OEH 2014), along with the results of this assessment are outlined in Table 5.

Table 5: Assessment of geographic habitat features within the study area

Common name	Scientific name	Feature	Impact?	Justification
Brush-tailed Rock-wallaby	<i>Petrogale penicillata</i>	land within 1 km of rock outcrops or clifflines	No	No suitable habitat for this species within study area.
Charmhaven Apple	<i>Angophora inopina</i>	land within 5 km of Wallaroo Nature Reserve in Upper Hunter CMA subregion	No	Beyond known range for this species. Known range within Wallaroo Nature Reserve in Upper Hunter CMA subregion.
Common Planigale	<i>Planigale maculata</i>	rainforest, eucalypt forest, heathland, marshland, grassland or rocky areas	No	Vegetation association and structure not present. The study area vegetation is too small and too isolated from other bushland and too disturbed to be used by this species.
Eastern Osprey	<i>Pandion cristatus</i>	land within 40 m of fresh/brackish/saline waters of larger rivers or creeks; estuaries, coastal lagoons, lakes and/or inshore marine waters	No	The study area is not within 40 m of fresh/brackish/saline waters of larger rivers or creeks; estuaries, coastal lagoons, lakes and/or inshore marine waters.
<i>Eucalyptus oblonga</i> (Narrow-leaved Stringybark) population at Bateau Bay	<i>Eucalyptus oblonga</i> - endangered population	land within Bateau Bay in Wyong CMA subregion	No	The study area is not within or near the Bateau Bay area.

Common name	Scientific name	Feature	Impact?	Justification
Green and Golden Bell Frog	<i>Litoria aurea</i>	land within 100 m of emergent aquatic or riparian vegetation	No	The study area is not located within 100 m of emergent aquatic or riparian vegetation
Green-thighed Frog	<i>Litoria brevipalmata</i>	land within 100 m of semi-permanent or ephemeral ponds or depressions containing leaf litter	No	The study area is not located within 100 m of semi-permanent or ephemeral ponds or depressions containing leaf litter.
Heath Wrinklewort	<i>Rutidosia heterogama</i>	heath on sandy soils, or moist areas in open forest	No	The ground layer within the subject site is considered too degraded for the species to occur. Not recorded during the field surveys.
Large-eared Pied Bat	<i>Chalinolobus dwyeri</i>	land containing escarpments, cliffs, caves, deep crevices, old mine shafts or tunnels.	No	No suitable habitat features are present.
Magenta Orchid	<i>Caladenia porphyrea</i> (= <i>Caladenia quadrifaria</i>)	Grows in coastal sclerophyll forest on sandy soils.	No	Suitable habitat for this species is either not present or so degraded as to warrant the species unlikely to occur.
Pale-headed Snake	<i>Hoplocephalus bitorquatus</i>	land within 40 m of watercourses, containing hollow-bearing trees, loose bark and/or fallen timber	No	The study area is not located within 40 m of any watercourses.
Wallum Froglet	<i>Crinia tinnula</i>	land within 40 m of swamps, wet or dry heaths or sedge grasslands	No	The study area is not located within 40 m of any watercourses, heaths or sedge grasslands.

5.3 Ecosystem credit species

A list of ecosystem credit species predicted to occur within the study area, based on the PCTs present and generated by the calculator associated with the NSW FBA (OEH 2014), along with an assessment of whether they occur within the study area and the Vegetation Zone they are predicted to occur in is provided in Table 6. The potential for a species to occur within the study area was assessed in accordance with Section 6.3 of the NSW FBA (OEH 2014).

5.3.1 Fauna species

None of the ecosystem credit fauna species are associated with the PCT identified as present within the development site. Targeted threatened fauna species surveys were not undertaken for this reason.

However, the potential presence of some species could not be dismissed and it was assumed that those species occur within the impact area. The Tg values were reduced for some species assumed present.

Tg values represent how well a species will respond to management at a Biobank site, and, therefore, how the removal of habitat features will impact on the species in a local area. If a species is reliant on habitat features that take a long time to develop (e.g. hollows), or management actions are ineffective at addressing a species decline, or the species has poor fecundity or dispersal capability this will generate a higher Tg value.

Tg values were reduced for the following species:

- Bush Stone-curlew
- Barking Owl
- Speckled Warbler

Tg value for the Bush Stone-curlew was reduced due to the lack of fallen timber and logs, identified as an important structural elements of Bush Stone-curlew habitat (DEC 2006b).

Tg value for Barking Owl was reduced due to lack of suitable nesting hollows, and limited roosting habitat.

Tg value for Speckled Warbler was reduced due to limited amount of fallen timber, tussock grasses and shrubs within the impact area.

A number of threatened microbat species have a Tg value of 0.45 and a resultant threatened species offset multiplier of 2.2. These species include:

- Eastern False Pipistrelle
- Eastern Freetail-bat
- Greater Broad-nosed Bat
- Yellow-bellied Sheath-tail-bat

As the PCT within Vegetation Zone 1 (PCT 1619) – *Smooth-barked Apple – Red Bloodwood – Brown Stringybark – Hairpin Banksia heathy open forest of coastal lowlands* does not align with any NSW or Commonwealth listed threatened ecological community, these multipliers will be used to determine the number of ecosystem credits required for impacts on this Vegetation Zone.

Table 6: Assessment of ecosystem credit fauna species within the study area

Scientific name	Common name	TS offset multiplier	Habitat on site	Vegetation zone	Justification
<i>Burhinus grallarius</i>	Bush Stone-curlew	2.0	No	Not associated with Vegetation Zone 1 (HU833)	Tg value reduced due to lack of fallen timber within the impact area.
<i>Callocephalon fimbriatum</i>	Gang-gang Cockatoo	2.0	Yes	Not associated with Vegetation Zone 1 (HU833)	N/A
<i>Calyptrorhynchus lathamii</i>	Glossy Black-Cockatoo	1.8	No	Not associated with Vegetation Zone 1 (HU833)	N/A
<i>Chthonicola sagittata</i>	Speckled Warbler	2.0	No	Not associated with Vegetation Zone 1 (HU833)	Tg value reduced due to limited amount of fallen timber, tussock grasses and shrubs within the impact area.
<i>Climacteris picumnus subsp. victoriae</i>	Brown Treecreeper (eastern subspecies)	2.0	No	Not associated with Vegetation Zone 1 (HU833)	N/A
<i>Daphoenositta chrysoptera</i>	Varied Sittella	1.3	Yes	Not associated with Vegetation Zone 1 (HU833)	N/A
<i>Falsistrellus tasmaniensis</i>	Eastern False Pipistrelle	2.2	Yes	Not associated with Vegetation Zone 1 (HU833)	N/A
<i>Glossopsitta pusilla</i>	Little Lorikeet	1.8	Yes	Not associated with Vegetation Zone 1 (HU833)	N/A
<i>Grantiella picta</i>	Painted Honeyeater	1.3	No	Not associated with Vegetation Zone 1 (HU833)	N/A
<i>Hieraaetus morphnoides</i>	Little Eagle	1.4	Yes	Not associated with Vegetation	N/A

Scientific name	Common name	TS offset multiplier	Habitat on site	Vegetation zone	Justification
				Zone 1 (HU833)	
<i>Lathamus discolor</i>	Swift Parrot	1.3	Yes	Not associated with Vegetation Zone 1 (HU833)	N/A
<i>Lophoictinia isura</i>	Square-tailed Kite	1.4	Yes	Not associated with Vegetation Zone 1 (HU833)	N/A
<i>Melithreptus gularis subsp. gularis</i>	Black-chinned Honeyeater (eastern subspecies)	1.3	Yes	Not associated with Vegetation Zone 1 (HU833)	N/A
<i>Mormopterus norfolkensis</i>	Eastern Freetail-bat	2.2	Yes	Not associated with Vegetation Zone 1 (HU833)	N/A
<i>Neophema pulchella</i>	Turquoise Parrot	1.8	Yes	Not associated with Vegetation Zone 1 (HU833)	N/A
<i>Ninox connivens</i>	Barking Owl	2.0	Yes	Not associated with Vegetation Zone 1 (HU833)	Tg value reduced due to lack of suitable nesting hollows, and limited roosting habitat within impact area.
<i>Pomatostromus temporalis subsp. temporalis</i>	Grey-crowned Babbler	1.3	No	Not associated with Vegetation Zone 1 (HU833)	N/A
<i>Petaurus norfolcensis</i>	Squirrel Glider	2.2	Yes	Not associated with Vegetation Zone 1 (HU833)	N/A
<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheath-tail-bat	2.2	Yes	Not associated with Vegetation Zone 1 (HU833)	N/A

Scientific name	Common name	TS offset multiplier	Habitat on site	Vegetation zone	Justification
<i>Scoteanax rueppellii</i>	Greater Broad-nosed Bat	2.2	Yes	Not associated with Vegetation Zone 1 (HU833)	N/A

5.4 Species credit species

5.4.1 Flora species

A list of species credit species (flora) predicted to occur within the study area, based on the PCT present, along with an assessment of whether the study area provides suitable habitat and whether the species will be impacted by the development is provided in Table 7. The potential for a species to occur within the study area was assessed in accordance with Section 6.5 of the NSW FBA (OEH 2014).

The assessed likelihood of occurrence of threatened flora species was strongly influenced by the current condition of the habitat available within the proposed impact area (subject site). The remnant native vegetation within the subject site has been subject to a long history of disturbance, including maintenance regimes, high levels of human foot traffic and clearing of the ground and shrub layers and spreading of gravel over most parts of the impact area to provide an informal car park. Most of the ground layer is therefore subject to compaction from regular vehicle use.

Table 7: Species credit species (flora) and status within the study area

Scientific name	Common name	Habitat present in the study area	Justification	Recorded during targeted surveys	Impacted by development
<i>Acacia bynoeana</i>	Bynoe's Wattle	No	The species prefers heath or Dry Sclerophyll forest on sandy soils, where it prefers open, sometimes slightly disturbed sites (Threatened Species Profile Database). The ground layer of the remnant native vegetation is too highly disturbed and degraded to support the species.	N/A	No
<i>Astrotricha crassifolia</i>	Thick-leaf Star-hair	No	Occurs in dry sclerophyll woodland on sandstone. There are no records for the locality and the habitat is too highly disturbed and degraded to support the species.	N/A	No
<i>Caladenia porphyrea</i>	-	No	Grows in coastal sclerophyll forest on sandy soils. There are no records for the locality and the soil is not sandy.	N/A	No
<i>Callistemon linearifolius</i>	Netted Bottle Brush	No	Grows on the coast and adjacent ranges in riparian or damp areas in a variety of communities. Suitable habitat is absent.	N/A	No
<i>Cryptostylis hunteriana</i>	Leafless Tongue Orchid	No	Grows in sandy soils in a variety of communities including Sydney Coastal Dry Sclerophyll Forests, Coastal Heath Swamps, New England Dry Sclerophyll Forests and Sydney Coastal Heaths. There are no records for the locality and the soil is not sandy.	N/A	No
<i>Diuris praecox</i>	Rough Double Tail	No	Grows on hills and slopes of near-coastal districts in a variety of communities. The ground layer is too highly cleared and modified for there to be a real possibility that this species could occur within the subject site.	N/A	No
<i>Genoplesium insigne</i>	Variable Midge	No	Grows in patches of Kangaroo Grass <i>Themeda australis</i> amongst shrubs and sedges in heathland and forest.	N/A	No

Scientific name	Common name	Habitat present in the study area	Justification	Recorded during targeted surveys	Impacted by development
	Orchid		Associated vegetation at Chain Valley Bay is described as dry sclerophyll woodland dominated by Scribbly Gum <i>Eucalyptus haemastoma</i> , Red Bloodwood <i>Corymbia gummifera</i> , Smooth-barked Apple <i>Angophora costata</i> and Black She-oak <i>Allocasuarina littoralis</i> . While some of these species occur naturally within the subject site, the ground layer is too highly cleared and modified for there to be a real possibility that this species could occur within the subject site and there are no records for the locality.		
<i>Grevillea parviflora</i> subsp. <i>parviflora</i>	Small-flower Grevillea	Yes	Sporadically distributed throughout the Sydney Basin where it grows in sandy or light clay soils usually over thin shales, often with lateritic ironstone gravels and nodules. Although many of these features are absent from the subject site, the species is known to occur on a nearby site to the south. Therefore, a precautionary approach was taken with this species, based on the presence of clay soils with a sandy component.	No	No
<i>Melaleuca groveana</i>	Groves Paperbark	No	Usually on rocky outcrops and cliffs, also in dry shrubby open forest and woodlands. Habitat is unavailable.	N/A	No
<i>Prostanthera askania</i>	Tranquillity Mint Bush		Occurs adjacent to, but not immediately in, drainage lines on flat to moderately steep slopes formed on Narrabeen sandstone and alluvial soils derived from it. Occurs in moist sclerophyll forest and warm temperate rainforest communities, and the ecotone between them. This habitat is absent from the subject site.	N/A	No

Scientific name	Common name	Habitat present in the study area	Justification	Recorded during targeted surveys	Impacted by development
<i>Rutidosia heterogama</i>	Heath Wrinklewort	Yes	Grows mostly in heath and along roadsides in coastal districts in a variety of communities. Marginal habitat could be present. Although not in the species' flowering season, the species is possible to detect in open areas with appropriate experience but was not recorded during the targeted field survey.	No	No
<i>Tetratheca glandulosa</i>	<i>Tetratheca glandulosa</i>	No	Outside of known range – no records of the species on the Atlas of NSW Wildlife in relation to the study area. This species is restricted to the Local Government Areas of Baulkham Hills, Gosford, Hawkesbury, Hornsby, Ku-ring-gai, Pittwater, Ryde, Warringah and Wyong (Threatened Species Profile Database).	N/A	No
<i>Tetratheca juncea</i>	Black-eyed Susan	No	Usually found growing at well-drained site in soils from the Awaba soil landscape comprising low nutrient sandy, skeletal soils, sandy loam soils and clay soils on sandstone or conglomerate substrates. The ground layer is highly cleared and modified in the impact areas and unlikely to support the species.	N/A	No

The justifications in the table refer to information provided in the Threatened Species Profile Database

Two flora species, *Grevillea parviflora* subsp. *parviflora* and *Rutidosia heterogama*, were identified as candidate species for further assessment, in accordance with Section 6.5 of the FBA. Targeted surveys for these species failed to record any threatened flora species within the study area.

5.4.2 Fauna species

A list of species credit species (fauna) predicted to occur within the study area, based on the PCT present, along with an assessment of whether the study area provides suitable habitat and whether the species will be impacted by the development is provided in Table 8. The potential for a species to occur within the study area was assessed in accordance with Section 6.5 of the FBA (OEH 2014).

Table 8: Species credit species (fauna) and status within the study area

Scientific name	Common name	Habitat present in the study area	Justification for dismissing the species as a candidate species	Recorded during targeted surveys	Impacted by development
<i>Chalinolobus dwyeri</i>	Large-eared Pied Bat	No	No records of the species on the Atlas of NSW Wildlife in relation to the study area. No roosting habitat within or near study area. At best site could provide some limited foraging habitat.	N/A	No
<i>Kerivoula papuensis</i>	Golden-tipped Bat	No	No records of the species on the Atlas of NSW Wildlife in relation to the study area. Habitat unsuitable. Study area likely to be too small and disturbed for this species.	N/A	No
<i>Cercartetus nanus</i>	Eastern Pygmy-possum	No	No records of the species on the Atlas of NSW Wildlife in relation to the study area. Habitat unsuitable. Study area likely to be too small and disturbed for this species.	N/A	No
<i>Pseudomys gracilicaudatus</i>	Eastern Chestnut Mouse	No	No swamps within the site and no No records of the species on the Atlas of NSW Wildlife in relation to the study area. No records of the species on the Atlas of NSW Wildlife in relation to the study area. No records of the species on the Atlas of NSW Wildlife in relation to the study area. Habitat unsuitable.	N/A	No
<i>Phascogale tapoatafa</i>	Brush-tailed Phascogale	No	No records of the species on the Atlas of NSW Wildlife in relation to the study area. Habitat unsuitable. Study area likely to be too small and disturbed for this	N/A	No

Scientific name	Common name	Habitat present in the study area	Justification for dismissing the species as a candidate species	Recorded during targeted surveys	Impacted by development
			species.		
<i>Planigale maculata</i>	Common Planigale	No	No records of the species on the Atlas of NSW Wildlife in relation to the study area. Habitat unsuitable. Study area likely to be too small and disturbed for this species.	N/A	No
<i>Litoria brevipalmata</i>	Green-thighed Frog	No	No records of the species on the Atlas of NSW Wildlife in relation to the study area. No swamps, creeks or wetlands within or adjacent to the study area. Habitat unsuitable.	N/A	No
<i>Crinia tinnula</i>	Wallum Froglet	No	No swamps or wetlands within or adjacent to the site. Habitat unsuitable.	N/A	No
<i>Litoria aurea</i>	Green and Golden Bell Frog	No	No records of the species on the Atlas of NSW Wildlife in relation to the study area. No swamps or wetlands within or adjacent to the site.	N/A	No
<i>Phascolarctos cinereus</i>	Koala	No	The study area does contain a few planted individuals of Primary Food Tree species listed in the NSW Koala Recovery Plan for the Central Coast of NSW. They are Swamp Mahogany and Tallowwood.	N/A	No
<i>Hoplocephalus bitorquatus</i>	Pale-headed Snake	No	No records of the species on the Atlas of NSW Wildlife in relation to the study area. Habitat unsuitable. Study area likely to be too small and disturbed for this species.	N/A	No

No fauna species were identified as candidate species for further assessment, in accordance with Section 6.5 of the NSW Biobanking Assessment Methodology (OEH 2014). Targeted surveys were not therefore required.

5.5 Other threatened species

5.5.1 Species listed under the EPBC Act

In order to provide a context for the study area, information about flora and fauna from within five kilometres (the 'locality') was obtained from relevant public databases. Records from the following databases were collated and reviewed:

- DoE Protected Matters Search Tool (PMST) for matters protected by the EPBC Act.
- NSW BioNet - *the database for the Atlas of NSW Wildlife*, OEH (TSC Act).
- BirdLife Australia, the New Atlas of Australian Birds 1998-2013 (BA).

Lists of threatened species listed under the EPBC Act recorded or predicted to occur within five kilometres of the study area (from database records or predicted to occur by the BioBanking credit calculator or EPBC Act PMST) are provided in Appendix 3. An assessment of the likelihood of these species occurring in the study area is shown in Table 17 (flora) and Table 18 (fauna). Previous records of threatened species within the locality are shown in Figure 6 (flora) and Figure 7 (fauna). Known habitats for migratory species have been considered and are addressed in Table 19.

Vegetation mapping of the study area has been used to determine the presence of threatened ecological communities.

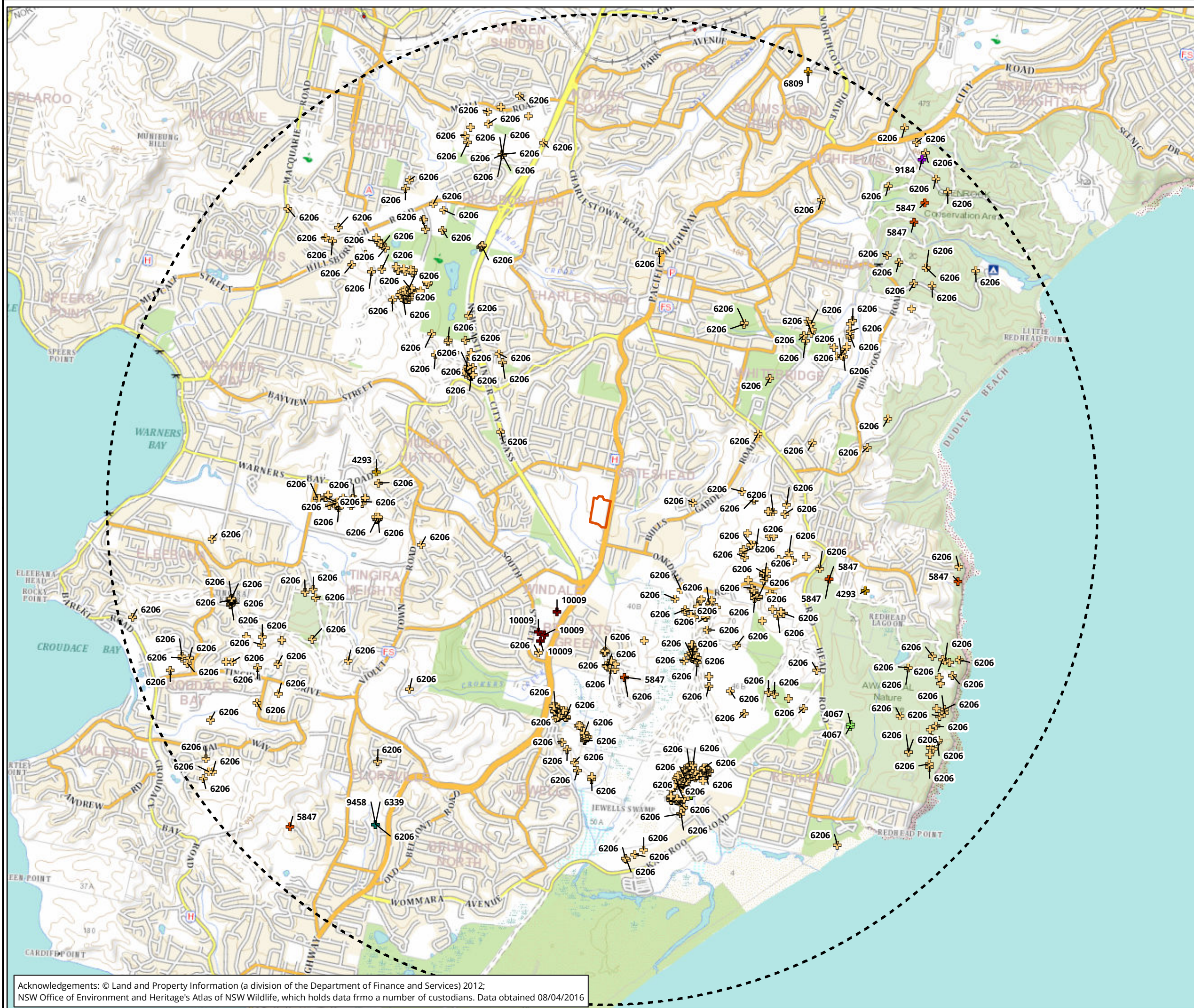
Matters of NES relevant to the project are summarised in Table 9.

Table 9: Assessment of the project against the EPBC Act

Matter of NES	Background review	Relevance to the study area and potential for significant impact
Threatened species (flora and fauna)	Thirteen threatened flora species and 13 threatened fauna species have been recorded or are predicted to occur in the locality. An assessment of the likelihood of these species occurring in the study area is provided in Table 17 (flora) and Table 18 (fauna).	Only one of these species (Grey-headed Flying-fox) is considered likely to utilise foraging resources within the study area however, development is unlikely to constitute a significant impact on this species.
Threatened ecological communities	The EPBC Act listed Threatened Ecological Community (TEC) Central Hunter Valley eucalypt forest and woodland is predicted to occur within the study area.	The TEC does not occur in the study area.
Migratory species	Fourteen migratory species have been recorded or are predicted to occur in the locality (Table 19).	While some of these species would be expected to use the study area on occasions, some may do so regularly and others may be resident, the study area does not provide important habitat for an ecologically significant proportion of any of these species.

Matter of NES	Background review	Relevance to the study area and potential for significant impact
Wetlands of international importance (Ramsar sites)	There are 12 Ramsar sites in NSW, the closest one being the Hunter Estuary Wetlands.	The study area does not flow directly into any Ramsar site and the development is not likely to result in a significant impact.

The study area does not support important or critical habitat for any threatened species listed under the EPBC Act. The study area does not support the CEEC Central Hunter Valley eucalypt forest and woodland.



Legend

Study area

Search area

Threatened Flora

- 10009 - *Grevillea parviflora* subsp. *parviflora*
- 4067 - *Eucalyptus camfieldii*
- 4293 - *Syzygium paniculatum*
- 5847 - *Zieria smithii*
- 6206 - *Tetratheca juncea*
- 6339 - *Zannichellia palustris*
- 6809 - *Melaleuca biconvexa*
- 7752 - *Epacris purpurascens* var. *purpurascens*
- 9184 - *Muehlenbeckia costata*
- 9458 - *Senecio spatulatus*
- 4007 - *Callistemon linearifolius**
- 9027 - *Diuris praecox**

* Record is listed as sensitive under OEH's Sensitive Species Data Policy and cannot be shown at this scale

Figure 6: Threatened flora records within 5 km

0 400 800 1,200 1,600 2,000

Metres

Scale: 1:36,000 @ A3

Coordinate System: GDA 1994 MGA Zone 55

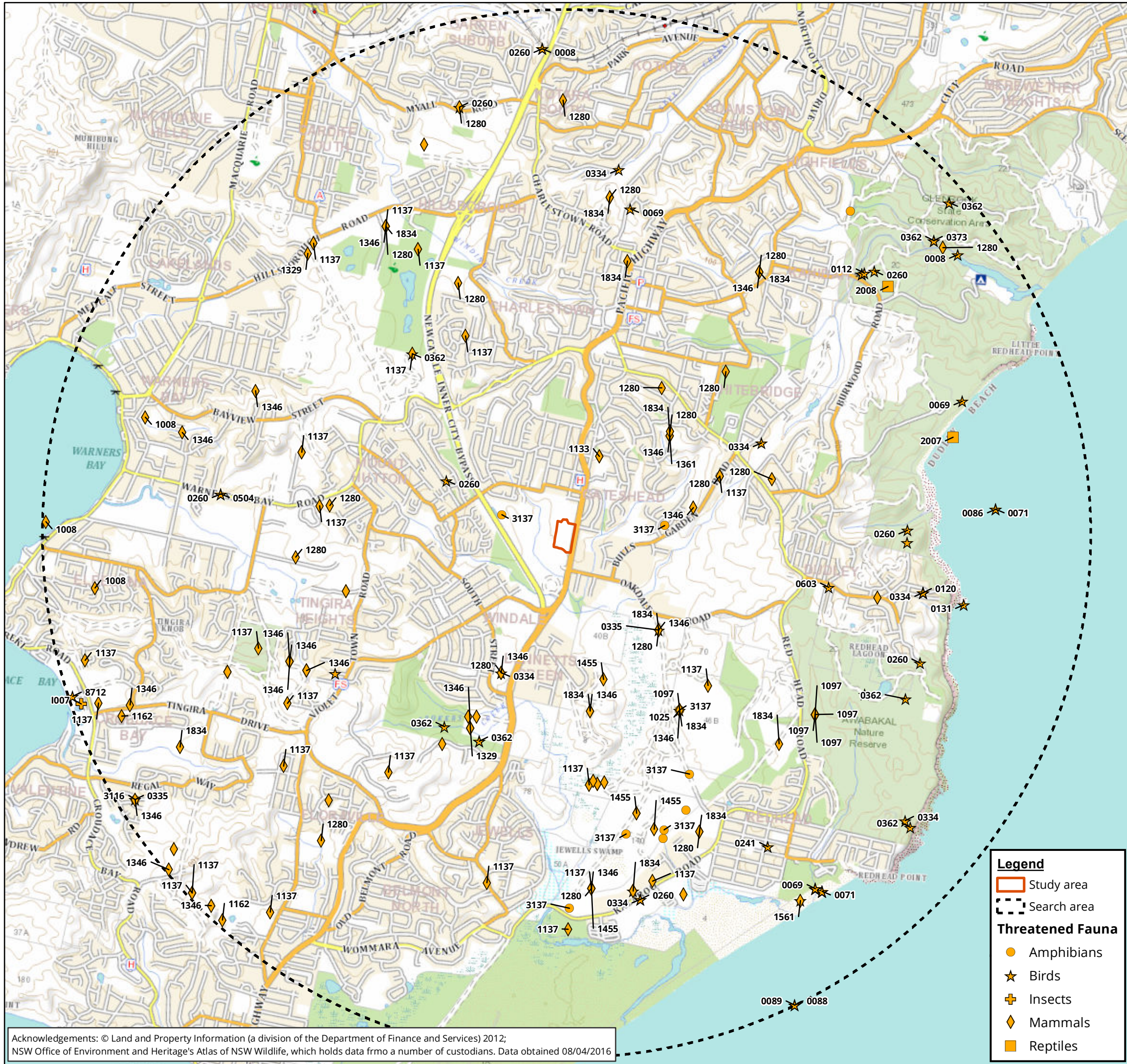
biosis

Biosis Pty Ltd

Ballarat, Brisbane, Canberra, Melbourne, Sydney, Wangaratta & Wollongong

Matter:
Date: 04 May 2016,
Checked by: 08/04/2016, Drawn by: SR, Last edited by: Iharley
Location: P:\22000s\22022\Mapping\22022_F6_ThrFlora

Acknowledgements: © Land and Property Information (a division of the Department of Finance and Services) 2012;
NSW Office of Environment and Heritage's Atlas of NSW Wildlife, which holds data from a number of custodians. Data obtained 08/04/2016



Acknowledgements: © Land and Property Information (a division of the Department of Finance and Services) 2012;
NSW Office of Environment and Heritage's Atlas of NSW Wildlife, which holds data from a number of custodians. Data obtained 08/04/2016

Species list

Amphibians

- Tusked Frog population in the Nandewar and New England Tableland Bioregions
- 3116 - Red-crowned Toadlet
- 3137 - Wallum Froglet

Birds

- 0005 - Little Penguin
- 0008 - Australian Brush-turkey
- 0086 - Wandering Albatross
- 0088 - Black-browed Albatross
- 0089 - Yellow-nosed Albatross
- 0120 - Sooty Tern
- 0131 - Sooty Oystercatcher
- 0241 - Osprey
- 0246 - Barking Owl*
- 0248 - Powerful Owl*
- 0250 - Masked Owl*
- 0260 - Little Lorikeet
- 0265 - Glossy Black-Cockatoo*
- 0268 - Gang-gang Cockatoo*
- 0302 - Turquoise Parrot*
- 0309 - Swift Parrot*
- 0448 - White-fronted Chat
- 0504 - Speckled Warbler
- 0603 - Regent Honeyeater
- 9924 - Sooty Owl*

Insects

- 1007 - Giant Dragonfly

Mammals

- 1008 - Spotted-tailed Quoll
- 1025 - Eastern Cave Bat
- 1097 - Long-nosed Bandicoot
- 1133 - Greater Glider
- 1137 - Squirrel Glider
- 1162 - Koala
- 1280 - Grey-headed Flying-fox
- 1329 - Eastern Freetail-bat
- 1346 - Little Bentwing-bat
- 1361 - Greater Broad-nosed Bat
- 1455 - New Holland Mouse
- 1561 - Southern Right Whale
- 1834 - Eastern Bentwing-bat

Reptiles

- 2007 - Green Turtle
- 2008 - Hawksbill Turtle

* Record is listed as sensitive under OEHS Sensitive Species Data Policy and cannot be shown at this scale

Figure 5: Threatened Fauna records within 5km

0 400 800 1,200 1,600 2,000
Metres

Scale: 1:36,000 @ A3
Coordinate System: GDA 1994 MGA Zone 55



Matter: 22022
Date: 04 May 2016,
Checked by: 08/04/2016, Drawn by: LH, Last edited by: Iharley
Location: P:\22000s\22022\Mapping\22022_F7_ThrFauna

Stage 2 – Impact Assessment (biodiversity values)

6. Impact assessment (biodiversity values)

This section identifies the potential impacts of proposed development on the ecological values of the study area and includes recommendations to assist de Witt Consulting and NSW Public Works to minimise impacts on biodiversity as a result of the project design.

This impact assessment is based on clearing of native vegetation and potential fauna habitat. It includes an assessment of all potential impacts arising from the project, direct and indirect.

6.1 Avoidance and minimisation

6.1.1 Potential impacts

Potential direct and indirect impacts arising from the development proposal are outlined below.

- Potential direct impacts:
 - Removal of 0.13 hectares of highly modified and simplified native vegetation from fragmented patches across the subject site for development.
 - Removal of a total of 80 exotic and native trees. Some of the trees will be removed due to their location in areas where new school infrastructure is required, while others have been recommended for removal by Terras (2016) due to their state of health, including their AZ (retention value) rating.
- Potential indirect impacts:
 - Decreased viability of retained vegetation due to edge effects and use of retained areas of native vegetation resulting from disturbance and degradation of habitat, including damage to seedlings and new growth.
 - Sedimentation and pollution of waterways from the proposed development, leading to a reduction in water quality along Johnsons Creek, and ultimately the SEPP 14 wetland Jewells Swamp downstream.
 - Encroachment of invasive exotic weeds species, leading to loss of habitat and suppression of native seedling establishment resulting in changes to vegetation communities over time.

6.1.2 Recommendations

The design of the development during the Planning Proposal phase sought to avoid and minimise impacts to higher value ecological features identified by Terras (2016) and de Witt Consulting (2016), however, incremental removal of native trees, some of which form part of highly modified native vegetation remnants, is unavoidable. Identification of the higher value clusters of native trees and remnant native vegetation has resulted in the recommendation by Terras (2016) to fence off these areas from the development. Protection of retained areas of native trees by temporary tree protection fencing has been incorporated into the project proposal (Terras 2016).

Additional measures undertaken to avoid and minimise impacts include:

- Implementation of stormwater controls to minimise impacts to aquatic environments from stormwater run-off.

- Retain trees wherever possible, particularly those identified in the Landscape Plan (Terras 2016).

Additional measures to mitigate any residual impacts arising from the development include:

- Installation of appropriate exclusion fencing to the boundary of the retained vegetation and any construction areas where there is some potential for accidental encroachment. This would include appropriate signage such as 'No Go Zone' or 'Environmental Protection Area'.
- Identify the location of any 'No Go Zones' in site inductions and a Construction Environmental Management Plan.
- Ensure construction impacts are retained within the development area, and no encroachment into retained vegetation results from the development. All material stockpiles, vehicle parking and machinery storage should be located within already cleared areas or the areas proposed for clearing, and not in areas of native vegetation that are to be retained.
- Develop and implement a Construction Environmental Management Plan.
- Wet down areas to reduce dust generation during construction.
- Development of an Ecological Management Plan, for inclusion in a Construction Environmental Management Plan. This Ecological Management Plan should outline measures for vegetation clearing to manage fauna species during tree removal, including having a spotter / catcher present. Removal of the two hollow-bearing trees (locations shown as tree nos. 4 and 32 in Terras 2016) should be undertaken separately following prior inspection by a spotter / catcher.
- Where feasible, relocate hollows removed from trees to areas of retained vegetation for reuse as either hollows attached to trees or hollow-bearing logs to be placed on the ground as habitat for ground-dwelling fauna.
- Native vegetation cleared from the subject site should be mulched for re-use on the site, to stabilise bare ground.
- All work boots, machinery and equipment should be cleaned prior to entering the study area, and before being transferred to another site, to minimise the risk of transferring soil-borne pathogens and fungi.
- Sediment and erosion control measures should be implemented prior to works commencing within the study area (e.g. silt fences, sediment traps), to protect terrestrial and aquatic habitats downstream, particularly the SEPP 14 wetland that is within the catchment. These measures should conform to relevant guidelines, should be maintained throughout the construction period and should be carefully removed following the completion of works.
- Weed control and management should be undertaken in areas of retained native vegetation within the study area, In particular, Bitou Bush within the construction area should be removed and disposed of appropriately, in such a manner as to avoid its spread and proliferation in areas of native vegetation that are to be retained. Elsewhere, it should be controlled and managed using appropriate removal/control methods for the situation.

Prescriptions for mitigation of potential impacts of construction activities on retained native vegetation and habitat should be addressed in a site-specific Construction Environmental Management Plan. An Ecological Management Plan should be prepared to guide removal of vegetation, including recommendations for vegetation management.

6.1.3 Residual impacts

NSW Public Works and de Witt Consulting have together designed a project that, where possible, avoids impacts to native vegetation. Following this process, and the subsequent implementation of the recommendations outlined in Section 6.1.2, the residual impacts to biodiversity include:

- The permanent removal of approximately 0.13 hectares of highly modified and degraded PCT 1619: Smooth-barked Apple – Red Bloodwood – Brown Stringybark – Hairpin Banksia heathy open forest of coastal lowlands.

6.2 Impact summary

6.2.1 Impact to Red Flag areas

The area of impacted vegetation within the subject site has not been identified as a Red Flag in the credit calculator. No consideration of red flag areas is required by the FBA.

Landscape features

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

Native vegetation

HU833 - *Smooth-barked Apple – Red Bloodwood – Brown Stringybark – Hairpin Banksia heathy open forest of coastal lowlands* is listed as being 45% cleared in the major catchment area. Vegetation in the study area is not in low condition; however it is at the lower end of Moderate-Good condition with a site value score of 21.88.

Threatened species and populations

The study area does not support threatened species or populations that cannot withstand further loss, a threatened species not previously recorded in the IBRA subregion or critical habitat listed under Section 55 of the TSC Act.

6.2.2 Impacts to Plant Community Types

This section provides an assessment of the PCT requiring offset in accordance with Section 9.3 of the NSW FBA (OEH 2014). The extent of this PCT is mapped in Figure 5.

One management zone has been delineated (Table 10), based on the presence of one PCT and the assumption that the vegetation within the zone will be completely cleared for the development.

Table 10: Impacts to the Plant Community Type, including Management Zone

Vegetation Zone	Plant Community Type	Site	Condition	Management Zone	Area
01	HU833 - Smooth-barked Apple – Red Bloodwood – Brown Stringybark – Hairpin Banksia heathy open forest of coastal lowlands.	Development	Moderate/Good-Poor	MZ01	0.13

All vegetation within the development site (Table 11: Site attributes scores for vegetation within the development area (MZ01) will be cleared, with all site attribute scores set to zero. Corresponding site attribute scores following development are provided in Table 11 (MZ01).

Table 11: Site attributes scores for vegetation within the development area (MZ01)

Site attribute	Current score (0-3)	Score with development (0-3)
Native plant species	1	0
Native over-storey cover	3	0
Native mid-storey cover	0	0
Native ground cover (grasses)	0	0
Native ground cover (shrubs)	0	0
Native ground cover (other)	0	0
Exotic plant cover	3	0
Number of trees with hollows	1	0
Overstorey regeneration	0	0
Total length of fallen logs	0	0

6.2.3 Impacts to threatened species

This section provides an assessment of threatened species requiring offsets in accordance with Section 9.3 of the NSW FBA (OEH 2014).

Based on the outcomes of Section 5.4, no offsets for threatened species are required.

6.2.4 Areas not requiring assessment

This section provides an assessment of those areas that do not require an offset in accordance with Section 9.4 of OEH (2014). Areas not mapped as a PCT in Figure 5 are not assessed as native vegetation, and do not provide habitat for threatened species. These areas do not require further assessment.

6.2.5 Indirect impacts

Indirect impacts could occur on the SEPP 14 wetland to the south-east of the study area as a result of siltation, sedimentation and unmitigated runoff if adequate controls are not implemented during and following construction. It is expected that standard mitigation measures will address the potential for such indirect impacts as part of the construction protocols and stormwater management structures implemented as part of the proposal. Details of broad measures required are provided in the recommendations

7. Biodiversity credits

This section provides a summary of biodiversity credits required to impact on the biodiversity values within the study area, following consideration of measures to avoid, minimise and mitigate impacts.

Table 12 provides a summary of ecosystem credits resulting from the proposed development. The full credit profile is provided in Appendix 4.

No species credits were generated by the assessment.

A Biodiversity Offset Strategy is required for submission with the EIS to address the two ecosystem credits required due to native vegetation removal. This is provided in section 9. These credits can be retired either from a suitable offset site or by purchasing the credits required on the market.

Table 12: Summary of ecosystem credits for the management zone

PCT code	Plant community type name	Red flag	Management zone area (ha)	Loss in LandScape Value	Loss in site value score	EEC Offset Multiplier	Credits req for TS	TS with highest credit req	TS offset multiplier	Ecosystem credits required
HU833	<i>Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands</i>	No	0.13	3.0	21.88	1.0	2	Eastern False Pipistrelle	2.2	2

8. Assessment of biodiversity legislation

8.1 Environment Protection and Biodiversity Conservation Act 1999

Matters of NES relevant to the project were summarised in Table 9 (section 5.5) and considered for likelihood of relevance in relation to the project. No significant impacts on any of the potential matters of NES identified were considered likely to be triggered by the proposal.

8.2 Noxious Weeds Act 1993

The NW Act was enacted to provide for the identification, classification and control of noxious weeds. Plants declared as noxious weeds are currently listed under Weed Control Order No. 28 Declaring Certain Plants to be Noxious Weeds published in the New South Wales Government Gazette No. 97 (Department of Premier and Cabinet 2011).

Declared noxious weeds identified in the study area include:

- Bitou Bush *Chrysanthemoides monilifera* subsp. *rotundata*
- Fireweed *Senecio madagascariensis*

Both species are also Weeds of National Significance (WoNS). The legal control requirements by landowners for these weeds on their land under the NW Act are given in Table 13.

Treatment for the noxious weeds listed above is recommended within NSW DPI (2011).

Table 13: Noxious weeds within the study area

Common Name	Class	Control Requirements
Bitou Bush	4	Locally Controlled Weed <i>The growth of the plant must be managed in a manner that continuously inhibits the ability of the plant to spread</i>
Fireweed	4	Locally Controlled Weed <i>The plant must not be sold, propagated or knowingly distributed</i>

9. Biodiversity Offset Strategy

As stated in section 7, two ecosystem credits for PCT 1619 (HU833) - *Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia* heathy open forest of coastal lowlands are required to offset the impacts on that vegetation type due to the proposed development.

Given the small number of credits required, NSW Public Works has elected to seek retirement of the credits by purchasing them on the open market, subject to availability, rather than identifying a suitable offset site to obtain the credits.

The pathway to be followed to retire the credits will follow the procedure and guidelines for retiring credits as set out in Appendix A of the NSW *Biodiversity Offsets Policy for Major Projects* (OEH 2014b).

In the first instance, every effort to obtain like-for-like offsets has been or will be pursued. The plan to address this requirement is as follows:

- The BioBanking public register has been checked for the availability of credits of the same PCT as that being impacted. There are no matching credits currently available on the public register.
- An expression of interest for the required credits was placed on the OEH 'Credits Wanted Register' on 23 May 2016 and can be viewed at:

<http://www.environment.nsw.gov.au/bimsprapp/SearchCWR.aspx?ID=65>

- The local (Newcastle) OEH office was consulted for advice regarding the availability of appropriate credits or potentially suitable offset sites for the PCT in the local area. No such credits or potential suitable offset sites are currently known to be available. OEH advised that local credit brokers may know of suitable credits that are available.
- Alex Cockerill (National Manager, Ecology - WSP Parsons Brinckerhoff, Newcastle) was contacted to check whether any credits are available for purchases that are not otherwise listed. At this point, Biosis is awaiting advice on this request.

Should all of the above strategies fail to yield the required credits, the following steps will be undertaken:

- Lake Macquarie City Council will be contacted to ascertain whether any suitable credits or land held by Council are available.
- As mentioned above, the low number of ecosystem credits required makes the purchase of an offset site impractical, therefore this strategy has been rejected as an appropriate option.
- Should a period of six months elapse since the expression of interest was placed on the public register with no positive outcome and all other reasonable steps have been exhausted, then a variation of the offset rules (section 10.5.4 of the FBA) will be applied in which credits can be sought from a PCT in the same vegetation formation as the PCT to which the required ecosystem credits relate (OEH 2014a).

10. Conclusion

The proposed development will result in minor losses of highly modified native vegetation and potential fauna habitat, with 0.13 hectares of vegetation across one PCT to be permanently removed. This vegetation type is not listed as a NSW or Commonwealth listed threatened ecological community. The study area does not support species credit species, but may provide limited habitat for some ecosystem credit species.

Measures to avoid and minimise impacts to vegetation were considered during planning for the school redevelopment and in the arborist report (Terras 2016), with additional impact minimisation and mitigation measures considered as a part of the current assessment.

The impacts to native vegetation and species habitat will require retirement of 2 biodiversity credits across one PCT, as outlined in Table 14. The strategy to achieve retirement of these credits has been outlined in section 9.

Table 14: Summary of ecosystem credits

PCT code	Plant community type name	Ecosystem credits required
1619 (HU833)	<i>Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands</i>	2

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Appendices

Appendix 1: Survey qualifications

Appendix 1.1 Nomenclature

The flora taxonomy (classification) used in this report follows the most recent Flora of NSW (Harden 1990, Harden 1991, Harden 1992, Harden 1993, Harden 2002). All doubtful species names were verified with the on-line Australian Plant Name Index (Australian National Botanic Gardens 2007). Flora species, including threatened species and introduced flora species, are referred to by both their common and then scientific names when first mentioned. Subsequent references to flora species cite the common names only, unless there is no common name, for which scientific name will be used. Common names, where available, have been included in threatened species tables and the complete flora list in Appendix 2.

Names of vertebrates follow the Census of Australian Vertebrates (CAVs) maintained by the Commonwealth *Department of Environment* (DoE) (DEWHA 2009a). In the body of this report vertebrates are referred to by both their common and scientific names when first mentioned. Subsequent references to these species cite the common name only.

Appendix 1.2 Permits and Licences

The flora and fauna assessment was conducted under the terms of Biosis' Scientific Licence issued by the Office of Environment and Heritage under the *National Parks and Wildlife Act 1974* (SL100758, expiry date 31 March 2017). Fauna survey was conducted under approval 11/355 from the NSW Animal Care and Ethics Committee (expiry date 31 January 2017). The BioBanking Assessment was carried out by Accredited BioBanking Assessor Stefan Rose (No. 0024).

Appendix 1.3 Limitations

Ecological surveys provide a sampling of flora and fauna at a given time and season. There are a number of reasons why not all species will be detected at a site during survey, such as species dormancy, seasonal conditions, ephemeral status of waterbodies and migration and breeding behaviours of some fauna. In many cases these factors do not present a significant limitation to assessing the overall biodiversity values of a site.

The current flora and fauna assessment was conducted in late summer / early autumn during warm and rainy weather, which is a suitable time to determine the presence of most threatened species. Desktop and habitat based surveys were sufficient to assess the general values of the study area and inform likelihood of occurrence for threatened species.

There are no seasonal or other external factors which limit the results.

Database searches, and associated conclusions on the likelihood of species to occur within the study area, are reliant upon external data sources and information managed by third parties.

Appendix 2: Native vegetation data (FBA)

Appendix 2.1 Flora species list

Table 15: Flora species recorded from the study area and BioBanking Plot

Scientific name	Common name	Study area	BioBanking Plot			
			Cover %	Count	Stratum	Growth form
<i>Acacia falcata</i>		x				
<i>Acacia floribunda</i>	White Sally	x				
<i>Acacia longifolia</i> subsp. <i>longifolia</i>	Sydney Golden Wattle	x	1	1	G	S
<i>Acacia longissima</i>	Long-leaf Wattle	x				
<i>Acacia myrtifolia</i>	Red-stemmed Wattle	x	1	1	G	S
* <i>Acacia saligna</i>	Golden Wreath Wattle	x	1	1	G	S
<i>Acacia terminalis</i> subsp. <i>longiaxialis</i>	Sunshine Wattle	x				
* <i>Agonis flexuosa</i>	West Australian Peppermint	x				
<i>Allocasuarina littoralis</i>	Black She-Oak	x				
* <i>Anagallis arvensis</i>	Pimpernel	x	1	5	G	H
<i>Angophora costata</i>	Sydney Red Gum	x	2	1	O	T
* <i>Araucaria cunninghamii</i>	Hoop Pine	x				
* <i>Axonopus fissifolius</i>	Narrow-leafed Carpet Grass	x				
<i>Banksia serrata</i>	Old Man Banksia	x				
<i>Banksia spinulosa</i> var. <i>collina</i>	Hill Banksia	x				
* <i>Bauhinia</i> sp.		x				
* <i>Bidens pilosa</i>	Cobbler's Pegs	x				
<i>Brachychiton acerifolius</i>	Illawarra Flame	x				
<i>Callistemon citrinus</i>	Crimson Bottlebrush	x				
<i>Callistemon salignus</i>	Willow Bottlebrush	x				
<i>Cayratia clematidea</i>	Native Grape	x				
* <i>Chloris gayana</i>	Rhodes Grass	x				
* <i>Chlorophytum comosum</i>	Spider Plant	x				
* <i>Chrysanthemoides monilifera</i> subsp. <i>rotundata</i>	Bitou Bush	x				
* <i>Cinnamomum camphora</i>	Camphor Laurel	x	1	1	G	T
* <i>Cirsium vulgare</i>	Spear Thistle	x	2	1	G	H
* <i>Citrus x limon</i>	Lemon Tree	x				
* <i>Conyza bonariensis</i>	Fleabane	x	1	10	G	H
<i>Corymbia gummifera</i>	Red Bloodwood	x	20	8	O	T
<i>Corymbia maculata</i>	Spotted Gum	x				

Scientific name	Common name	Study area	BioBanking Plot			
			Cover %	Count	Stratum	Growth form
<i>*Corymbia torelliana</i>	Cadaghi	x				
<i>*Cotoneaster glaucophyllus</i>	Cotoneaster	x				
<i>*Cupressus</i> sp.	Conifer	x				
<i>Cynodon dactylon</i>	Common Couch	x				
<i>*Cyperus eragrostis</i>	Umbrella Sedge	x	1	1	G	H
<i>Dianella caerulea</i> var. <i>producta</i>	Blue Flax-lily	x	1	1	G	H
<i>Doryanthes excelsa</i>	Gymea Lily	x				
<i>*Ehrharta erecta</i>		x	1	20	G	G
<i>*Eleusine indica</i>	Crowsfoot Grass	x	1	20	G	H
<i>Eragrostis brownii</i>	Brown's Lovegrass	x	1	5	G	G
<i>Eucalyptus capitellata</i>	Brown Stringybark	x	10	3	O	T
<i>*Eucalyptus globulus</i>	Tasmanian Bluegum	x				
<i>Eucalyptus haemastoma</i>	Scribbly Gum	x				
<i>Eucalyptus microcorys</i>	Tallowwood	x				
<i>Eucalyptus nicholii</i> (planted)	Narrow-leaved Black Peppermint	x				
<i>Eucalyptus paniculata</i>	Grey Ironbark	x				
<i>Eucalyptus piperita</i>	Sydney Peppermint	x				
<i>Eucalyptus robusta</i>	Swamp Mahogany	x				
<i>Eucalyptus saligna</i>	Sydney Blue Gum	x				
<i>*Eucalyptus</i> sp. (interstate – planted)		x				
<i>*Euphorbia peplus</i>		x	1	2	G	H
<i>*Plumeria</i> sp.	Frangipani	x				
<i>Gahnia sieberiana</i>	Red-fruit Saw-sedge	X	1	1	G	S
<i>*Gamochaeta coarctata</i>	Cudweed	x	1	10	G	H
<i>Glochidion ferdinandi</i> var. <i>ferdinandi</i>	Cheese Tree	x	1	1	G	S
<i>Glycine microphylla</i>	Small-leaf Glycine	x	1	2	G	H
<i>*Harpephyllum caffrum</i>	Kaffir Plum	x				
<i>Hardenbergia violacea</i>	False Sarsaparilla	x	1	1	G	H
<i>*Hedera helix</i>	English Ivy	x				
<i>Hibbertia aspera</i> subsp. <i>aspera</i>		x				
<i>*Hibiscus</i> sp.	Hibiscus	x				

Scientific name	Common name	Study area	BioBanking Plot			
			Cover %	Count	Stratum	Growth form
<i>*Hyparrhenia hirta</i>	Coolatai Grass	x				
<i>*Hypochaeris radicata</i>	Catsear	x				
<i>*Lagerstroemia indica</i>	Crepe Myrtle	x				
<i>Leptospermum polygalifolium</i>	Tantoon	x				
<i>Lomandra filiformis</i> subsp. <i>filiformis</i>	Wattle Matt-rush	x	1	1	G	H
<i>Lomandra longifolia</i>	Spiny-headed Mat-rush	x				
<i>*Lonicera japonica</i>	Honeysuckle	x				
<i>Lophostemon confertus</i>	Brush Box	x				
<i>*Medicago polymorpha</i>	Burr Medic	x	1	5	G	H
<i>Melaleuca linariifolia</i>	Snow-in-summer	x				
<i>Melaleuca quinquenervia</i>	Broadleaf Paperbark	x				
<i>Melaleuca thymifolia</i>	Thyme Honey-myrtle	x				
<i>Melia azedarach</i>	White Cedar	x				
<i>*Modiola caroliniana</i>	Redflower Mallow	X	1	1	G	H
<i>*Murraya paniculata</i>	Murraya	x				
<i>*Nephrolepis cordiolia</i>	Fishbone Fern	x				
<i>*Panicum maximum</i> var. <i>maximum</i>	Guinea Grass	x				
<i>Panicum simile</i>	Two-colour Panic	x	1	1	G	G
<i>*Paspalum dilatatum</i>	Paspalum	x	1	10	G	H
<i>*Pennisetum clandestinum</i>	Kikuyu	x	1	5	G	G
<i>Pittosporum undulatum</i>	Sweet Pittosporum	x				
<i>*Plantago lanceolata</i>	Lamb's Tongues	x	1	50	G	H
<i>Polyscias sambucifolia</i>		x	1	25	G	S
<i>Pteridium esculentum</i>	Bracken	x				
<i>Pulteaea villosa</i>	Hairy Bush-pea	x				
<i>Rytidosperma fulvum</i>	Wallaby Grass	x				
<i>*Schefflera actinophylla</i>	Umbrella Tree	x				
<i>*Senecio madagascariensis</i>	Fireweed	x	1	1	G	H
<i>*Setaria parviflora</i>	Pigeon Grass	x	1	1	G	H
<i>*Sida rhombifolia</i>	Paddy's Lucerne	x	1	1	G	H
<i>*Solanum nigrum</i>	Black-berry Nightshade	x				

Scientific name	Common name	Study area	BioBanking Plot			
			Cover %	Count	Stratum	Growth form
<i>*Solanum mauritianum</i>	Wild Tobacco Bush	x				
<i>*Soliva sessilis</i>	Bindii	x	1	20	G	H
<i>*Sonchus oleraceus</i>	Common Sowthistle	x	1	10	G	H
<i>Sporobolus creber</i>	Slender Rat's Tail Grass	x	1	2	G	G
<i>*Stellaria media</i>	Common Chickweed	x	1	10	G	H
<i>Stephania japonica</i>	Snake Vine	x				
<i>*Syagrus romanzoffiana</i>	Cocos Palm	x				
<i>*Taraxacum officinale</i>	Dandelion	x	1	1	G	H
<i>Themeda australis</i>	Kangaroo Grass	x				
<i>*Trifolium repens</i>	White Clover	x	1	2	G	H
<i>Tristaniopsis laurina</i>	Water Gum	x				
<i>*Verbena bonariensis</i>	Purpletop	x	1	1	G	H
<i>*Washingtonia filifera</i>	Cotton Palm	x				
<i>Westringia fruticosa</i>	Coastal Rosemary	x				
<i>Xanthorrhoea resinosa</i>	Grass Tree	x				
Total		106				

Notes to table

*indicates an exotic species, including non-indigenous to NSW

Cover: Recorded according to FBA (2014)

Count: Recorded according to FBA (2014)

Stratum: O = Overstorey; G = Ground layer

Growth form: T = Tree; S = Shrub; H = Herb; G = Grass

Numerous species native to NSW, including those that are locally native in the above list, have been artificially planted on site.

Appendix 2.2 Plot and transect summary

Table 16: Plot scores for the single vegetation zone within the development site

Red cells indicate the site attributes that are below the minimum benchmark values

Benchmark details	Site value score	Site attributes											
		Native plant species	Native over-storey cover	Native mid-storey cover	Native ground cover (grass)	Native ground cover (shrubs)	Native ground cover (other)	Exotic plant cover	Number of trees with hollows	Over-storey regen	Total length of fallen logs	Degraded (yes/no)	Out of benchmark
Benchmark	N/A	>=35	18 to 45	13 to 60	1 to 30	5 to 30	3 to 30	N/A	>=3	1	>=70		
Site Score													
Moderate/Good - Poor	21.88	15	28.5	0	0	0	0	N/A	1	0	0	Yes	8 of 10

Appendix 2.3 Plot and transect field data sheets

Vegetation Assessment (BioBanking)



Matter No	22022	Date	14.4.16
Observer(s)	SR + ABM	Camera & Photos	#1 5644 - 5649

Location			
GPS:	Waypoint: 076-078	Easting:	Northing:
Location description: SE corner of impact area			

Topographic and Habitat Features	
Slope: Gentle	Average Tree DBH (cm)
Aspect: S	0-10, 11-20, 21-30, 31-75, 75-100, 101-200, > 200
Outcropping(%): Nil Surface Rock(%): Nil	Soil Type: Clay loam - light mustard
Mapped vegetation community: PCT 1619	Vegetation source:
Specht Classification: HV 833	Vegetation type (Keith):
Mitchell Landscape Classification:	% of PCT cleared

Habitat Description and Comments	
Fire History (evidence): Nil	
Overall Vegetation condition: Good, Moderate, Poor, Unnatural	
Tree Age and Regeneration: 40-50 years	
Introduced species: Numerous - see list - mainly herbs + grasses	
% Native vegetation cover in the landscape:	
Adjacent land Use: Sports Fields, School, Road	
Connectivity value (links with surround native veg. on more than one compass quarter): Connected to S.	
Disturbances: Heavily cleared, shrub + groundlayer removed, gravel,	
Presence of threatened species: Nil.	
General Comments: Highly modified + disturbed - minor natural elements only	

Regeneration Criteria (recruiting overstorey species with dbh ≤ 5cm)					
O/storey sp 1	O/storey sp 2	O/storey sp 3	O/storey sp 4	O/storey sp 5	O/storey sp 6
-	-	-	-	-	-
Score (no of overstorey sp recruiting/total no overstorey sp)					

Native over-storey (10 pts on 50m transect)	Native mid storey (>1m to < overstorey; 10 pts on 50m transect)	Native ground cover (grasses) (<1m; 50 pts on 50m transect)	Native ground cover (shrubs) (<1m; 50 pts on 50m transect)	Native ground cover (other) (1m; 50 pts on 50m transect)	Exotic plants (1m; 50 pts on 50m transect)
5	5	0	0	0	0
10	10	0	0	0	0
15	15	0	0	0	0
20	20	0	0	0	0
25	25	0	0	0	0
30	30	0	0	0	0
35	35	0	0	0	0
40	40	0	0	0	0
45	45	0	0	0	0
50	50	0	0	0	0
28.5	0				
Total Length fallen Logs (m) = 0	No. of trees with Hollows = 1	Foliage cover (%) = 0	Foliage cover (%) = 0	Foliage cover (%) = 0	Foliage cover (%) = 0

Cover: from 1-5% and then to nearest 5%; Count: number of individuals or shoots, use the following intervals (1,2,3,4,5,6,7,8,9,10, 20, 50, 100, 500, 1000) - numbers above 20 are estimates only; Stratum and layer in which species occurs.

Scientific/Common Name	Cover	Count	Stratum/ Layer	Growth Form	Scientific/Common Name	Cover	Count	Stratum/ Layer	Growth Form
<i>Convolvulus guineensis</i>	20	8	T	T	<i>Panicum striale</i>	1	1		G
<i>Euclea glaberrima</i>	10	3	T	T	<i>Sporobolus creber</i>	1	2		G
<i>Acacia senegal</i>	1	25	G	S	<i>*Thilium repens</i>	1	2		H
<i>Polyscias lophophylla</i>	1	25	G	S	<i>*Cyperus erianthus</i>	1	1		H
<i>Pedelia longifolia</i>	1	20	G	S	<i>*Thaunus officinalis</i>	1	1		H
<i>*Euphorbia corollata</i>	1	20	G	H	<i>Lomandra filiforme</i>	1	1		H
<i>*Sorghum olivaceum</i>	1	10	G	H	<i>*Cinnamomum camphora</i>	1	1		H
<i>*Senecio madagascariensis</i>	1	10	G	H	<i>*Acacia drepanolobium</i>	1	1		S
<i>*Paspalum dilatatum</i>	1	10	G	H					
<i>*Pimpernel - Anagallis</i>	1	5	G	H					
<i>*Stellaria media</i>	1	10	G	H					
<i>*Medicago caroliniana</i>	1	1	G	H					
<i>*Medicago polymorpha</i>	1	50	G	H					
<i>*Plantago lanceolata</i>	1	50	G	H					
<i>*Sida rhombifolia</i>	1	1	G	H					
<i>*Verbena bonariensis</i>	1	1	G	H					
<i>*Solanum</i>	1	20	G	H					
<i>*Pennisetum clandestinum</i>	1	5	G	H					
<i>*Eleusine indica</i>	1	20	G	H					
<i>*Cirsium vulgare</i>	2	10	G	H					
<i>*Gomphocarpus physocarpus</i>	1	10	G	H					
<i>*Conyza bonariensis</i>	1	10	G	H					
<i>*Setaria gracilis</i>	1	1	G	H					
<i>Eragrostis brownii</i>	1	5	G	H					
<i>Amphiphora costata</i>	2	1	T	T					
<i>Quadrantaria sieberiana</i>	1	1	T	S					
<i>Hardyana violacea</i>	1	1	T	H					
<i>Dianella caerulea</i>	1	1	T	H					
<i>Citrichium setinoides</i>	1	1	T	H					
<i>Glycyne microphylla</i>	1	2	T	H					

39 spp. 15 native ; 24 exotic

Appendix 3: Threatened species listed under the TSC Act or EPBC Act

Appendix 3.1 Threatened flora species

Notes to tables:

EPBC Act:	TSC Act:
CR – Critically Endangered	E1 – endangered species (Part 1, Schedule 1)
EN – Endangered	E2 – endangered population (Part 2, Schedule 1)
VU – Vulnerable	E4 – presumed extinct (Part 4, Schedule 1)
	E4A – critically endangered
	V1 – vulnerable (Part 1, Schedule 2)
	<i>Codes identify the Legal Status of threatened biota within NSW under the TSC Act and the OEH Sensitive Species Data Policy (SSDP).</i>

Most Recent Record:

Year	recorded on OEH database
#	species predicted to occur by the DoE database (not recorded on other databases)
##	species predicted to occur based on natural distributional range and suitable habitat despite lack of records in the databases searched

Other Sources:

BB	species predicted to occur by BioBanking Credit Calculator
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The following table includes a list of the threatened flora species that have potential to occur within the study area. The list of species is sourced from the Atlas of NSW Wildlife, the Protected Matters Search Tool (accessed on 08/04/2016) and the BioBanking Credit Calculator version 4 (run 08/04/2016).

Table 17: Threatened flora species recorded, or predicted to occur, within five kilometres of the study area

Scientific name	Common name	Conservation status		Most recent record	Other sources	Likely occurrence in study area	Rationale for likelihood ranking	Habitat description*
		EPBC	TSC					
<i>Acacia bynoeana</i>	Bynoe's Wattle	VU	E1		BB	Negligible	Habitat unsuitable with no records for the locality.	Occurs in heath or dry sclerophyll forest on sandy soils. Seems to prefer open, sometimes slightly disturbed sites such as trail margins, edges of roadside spoil mounds and in recently burnt patches. Associated overstorey species include Red Bloodwood, Scribbly Gum, Parramatta Red Gum, Saw Banksia and Narrow-leaved Apple.
<i>Angophora inopina</i>	Charmhaven Apple	VU	V	#		Low	Habitat unsuitable and no records in locality.	Small to large tree endemic to the Central Coast region from Karuah to the Charmhaven - Morisset area. Grows in woodland with a dense shrubby understorey in a variety of communities including Sydney Coastal Dry Sclerophyll Forests, Coastal Floodplain Wetlands, Eastern Riverine Forests and Sydney Coastal Heaths. Grows on sandstone substrates in deep, white sandy soils.
<i>Astrotricha crassifolia</i>	Thick-leaf Star-hair	VU	V		BB	Low	Habitat marginal to unsuitable with no records for the locality.	Occurs in dry sclerophyll woodland on sandstone. Flowers in spring. Resprouter from root suckers or basal stem buds after fire.
<i>Caladenia porphyrea</i>	-		E1		BB	Low	Habitat marginal to unsuitable with no records for	Grows in coastal sclerophyll forest on sandy soils.

Scientific name	Common name	Conservation status		Most recent record	Other sources	Likely occurrence in study area	Rationale for likelihood ranking	Habitat description*
		EPBC	TSC					
							the locality.	
<i>Callistemon linearifolius</i>	Netted Bottle Brush		V	2015	BB	Low	Habitat marginal to unsuitable.	Shrub recorded from the Georges River to the Hawkesbury River, north of the Nelson Bay area and south at Coalcliff in the Illawarra region. Grows on the coast and adjacent ranges in a variety of communities including Cumberland Dry Sclerophyll Forests, Coastal Floodplain Wetlands, Sydney Coastal Heaths and North Coast Wet Sclerophyll Forests.
<i>Cryptostylis hunteriana</i>	Leafless Tongue Orchid	VU	V	#	BB	Low	Habitat marginal with no records for the locality.	Orchid with a distribution spanning from Gibraltar Range National Park southwards to the coastal area near Orbost in Victoria. Grows in a variety of communities including Sydney Coastal Dry Sclerophyll Forests, Coastal Heath Swamps, New England Dry Sclerophyll Forests and Sydney Coastal Heaths. Grows in sandy soils.
<i>Cynanchum elegans</i>	White-flowered Wax Plant	EN	E1	#		Negligible	Habitat unsuitable with no records for the locality.	Climbing vine restricted to eastern NSW from Brunswick Heads to Gerroa in the Illawarra region. Grows in rainforest gully scrub and scree slope on the edge of dry rainforests in a variety of communities including Coastal Floodplain Wetlands, Maritime Grasslands, Coastal Valley Grassy Woodlands and Northern Hinterland Wet Sclerophyll Forests.
<i>Diuris praecox</i>	Rough Double Tail	VU	V	2014/#	BB	Low	Habitat marginal to unsuitable.	Terrestrial orchid growing between Bateau Bay and Smiths Lake. Grows on hills and slopes of near-coastal districts in a variety of communities including Sydney Coastal Dry Sclerophyll Forests, Sydney Hinterland Dry Sclerophyll Forests, Coastal Floodplain Wetlands and

Scientific name	Common name	Conservation status		Most recent record	Other sources	Likely occurrence in study area	Rationale for likelihood ranking	Habitat description*
		EPBC	TSC					
								North Coast Wet Sclerophyll Forests.
<i>Epacris purpurascens</i> var. <i>purpurascens</i>			V	2006		Negligible	Habitat and soil type unsuitable.	Erect shrub distributed from Gosford in the north, Silverdale to the west, Narrabeen in the east and Avon Dam in the south. Grows in scrubs and swamps in a variety of communities including Cumberland Dry, Sydney Hinterland Dry, Northern Hinterland Wet, and Southern Tableland Wet Sclerophyll Forests, Eastern Riverine Forests, and Coastal Valley Grassy Woodlands. Grows in soils with a strong shale influence on sandstone substrates.
<i>Eucalyptus camfieldii</i>	Heart-leaved Stringybark	VU	V	1998/#		Low	Habitat marginal to unsuitable.	Mallee tree restricted to a narrow band stretching from Raymond Terrace to the north and Waterfall in the south. Grows in scattered, localised distributions including sites at Norah Head, Terrey Hills, North Head, Menai, Mt Colah, Peats Ridge and Elvina Bay Trail. Grows in scattered stands near the boundaries of tall coastal heath and low open woodland in a variety of communities including Sydney Coastal Dry Sclerophyll Forests, Eastern Riverine Forests, Sydney Coastal Heaths and Wallum Sand Heaths. Grows in sandy soils on Hawkesbury sandstone.
<i>Genoplesium insigne</i>	Variable Midge Orchid	CE	E4A	#	BB	Low	Habitat marginal with no records for the locality.	Grows in patches of <i>Themeda australis</i> (Kangaroo Grass) amongst shrubs and sedges in heathland and forest. Associated vegetation at Chain Valley Bay is described as dry sclerophyll woodland dominated by <i>Eucalyptus haemastoma</i> (Scribbly Gum), <i>Corymbia gummifera</i> (Red Bloodwood), <i>Angophora costata</i> (Smooth-barked Apple)

Scientific name	Common name	Conservation status		Most recent record	Other sources	Likely occurrence in study area	Rationale for likelihood ranking	Habitat description*
		EPBC	TSC					
								and <i>Allocasuarina littoralis</i> (Black She-oak).
<i>Grevillea parviflora</i> subsp. <i>parviflora</i>	Small-flower Grevillea	VU	V	2014/#	BB	Low	Habitat marginal.	Low spreading to erect shrub sporadically distributed throughout the Sydney Basin, most notably in the Picton, Appin and Bargo regions, in the Cessnock - Kurri Kurri area and isolated populations from Putty to Wyong and Lake Macquarie. Grows in Shale Sandstone Transition Forest, Kurri Sand Swamp Woodland, <i>Corymbia maculata</i> - <i>Angophora costata</i> Open Forest in the Dooralong Area, Sydney Sandstone Ridgetop Woodland at Wedderburn and Cooks River/Castlereagh Ironbark Forest at Kemps Creek. Grows in sandy or light clay soils including tertiary alluviums over thin shales and lateritic ironstone gravels.
<i>Melaleuca biconvexa</i>	Biconvex Paperbark	VU	V	2007/#		Low	Habitat marginal to unsuitable.	Large shrub or small tree confined to NSW with scattered, widely dispersed populations around the Jervis Bay area in the south and the Gosford-Wyong area to the north. Grows in damp places, often near streams or low lying areas on low slopes or sheltered aspects in a variety of communities including Hunter-Macleay Dry Sclerophyll Forests, Coastal Swamp Forests, Coastal Floodplain Wetlands, Coastal Freshwater Lagoon and North Coast Wet Sclerophyll Forests. Grows in alluvial soils.
<i>Melaleuca groveana</i>	Grove's Paperbark		V		BB	Negligible	Habitat unsuitable.	Grows in heath and shrubland, often in exposed sites, in low coastal hills, escarpment ranges and tablelands on outcropping granite, rhyolite and sandstone on rocky outcrops and cliffs. It also occurs in dry shrubby open forest and woodlands.

Scientific name	Common name	Conservation status		Most recent record	Other sources	Likely occurrence in study area	Rationale for likelihood ranking	Habitat description*
		EPBC	TSC					
<i>Muehlenbeckia costata</i>	Scrambling Lignum		V	1998		Negligible	Habitat unsuitable and distant from its known locality.	Scrambling climber with a scattered distribution ranging from Queensland to the Blue Mountains including populations in Bald Rock north of Tenterfield, Warra and Butterleaf National Park. Found growing in disturbed areas in rocky sites at high elevations in a variety of communities including New England Sclerophyll Forests, Northern Gorge Dry Sclerophyll Forests, Floodplain Transition Woodlands and Northern Montane Heaths. Grows on granite or acid volcanic outcrops in coarse sandy or peat soils.
<i>Prostanthera askania</i>	Tranquillity Mint Bush	EN	E1		BB	Negligible	Habitat unsuitable with no records for the locality.	Occurs adjacent to, but not immediately in, drainage lines on flat to moderately steep slopes formed on Narrabeen sandstone and alluvial soils derived from it. Occurs in moist sclerophyll forest and warm temperate rainforest communities, and the ecotone between them. These communities are generally tall forests with a mesic understorey; Sydney Blue Gum <i>Eucalyptus saligna</i> and Turpentine <i>Syncarpia glomulifera</i> are usually present, though canopy species present can be highly variable. Ecological knowledge about this species is very limited.
<i>Pterostylis gibbosa</i>	Illawarra Greenhood	EN	E1	#		Negligible	Habitat unsuitable.	Deciduous terrestrial orchid with a disjunct distribution from the Milbrodale in the Hunter Region, Albion Park and Yallah in the Illawarra Region and Nowra in the Shoalhaven Region. Found growing amongst grasses on flat or gently sloping land with poor drainage in woodland dominated by Forest Red Gum <i>Eucalyptus</i>

Scientific name	Common name	Conservation status		Most recent record	Other sources	Likely occurrence in study area	Rationale for likelihood ranking	Habitat description*
		EPBC	TSC					
								<i>tereticornis</i> , Woollybutt <i>E. longifolia</i> , and White Feather Honey-myrtle <i>Melaleuca decora</i> . In Nowra, the orchid can be found growing in association with Spotted Gum <i>Corymbia maculata</i> , Forest Red Gum and Grey Ironbark <i>E. paniculata</i> . In the Hunter Region, the orchid is associated with Narrow-leaved Ironbark <i>E. crebra</i> , Forest Red Gum and Black Cypress Pine <i>Callitris endlicheri</i> . Grows in red brown loam soils.
<i>Rutidosia heterogama</i>	Heath Wrinklewort	VU	V	#	BB	Low	Habitat marginal with no records for the locality.	Small perennial herb with populations located in the Cessnock to Kurri Kurri area with outlying occurrences at Howes Valley, from Wyong to Newcastle on the Central Coast and Wooli to Evans Head in Yuraygir and Bundjalung National Parks and in New England Tablelands from Torrington and Ashford south to Wandsworth south-west of Glen Innes. Grows mostly in heath and along roadsides in coastal districts in a variety of communities including North-west Slopes Dry Sclerophyll Woodlands, Western Slopes Dry Sclerophyll Forests, Northern Tableland Wet Sclerophyll Forests, Maritime Grasslands, Coastal Headland Heaths and Wallum Sand Heaths. Grows in sandy soils.
<i>Senecio spathulatus</i>	Coast Groundsel		E1	1920		Negligible	Habitat unsuitable.	Low growing perennial herb or shrub with populations occurring in Nadgee Nature Reserve and between Kurnell in Sydney and Myall Lakes National Park with additional populations occurring between Wilsons Promontory in Victoria to the NSW border. Found growing in coastal areas mostly on frontal dunes and forming low, broad clumps in Maritime Grasslands and

Scientific name	Common name	Conservation status		Most recent record	Other sources	Likely occurrence in study area	Rationale for likelihood ranking	Habitat description*
		EPBC	TSC					
								Sydney Coastal Heaths. Grows in soils ranging from clay to loamy sands.
<i>Syzygium paniculatum</i>	Magenta Lilly Pilly	VU	E1	2007/#		Low	Habitat marginal to unsuitable.	Small to medium sized rainforest tree restricted to a narrow, linear coastal strip from Upper Lansdowne to Conjola State Forest. Found growing on stabilized dunes near the sea in South Coast Sands Dry Sclerophyll Forests, Coastal Swamp Forests, Coastal Headland Heaths, Littoral Rainforests, Northern Hinterland Wet Sclerophyll Forests and Southern Lowland Wet Sclerophyll Forests. Grows on grey sandy, gravelly, silty or clay soils over sandstone substrates.
<i>Tetratheca glandulosa</i>	Glandular pink-bell		V		BB	Negligible	Habitat unsuitable with no records for the locality.	Associated with shale-sandstone transition habitat where shale-cappings occur over sandstone, with associated soil landscapes such as Lucas Heights, Gynea, Lambert and Faulconbridge. Topographically, the plant occupies ridgetops, upper-slopes and to a lesser extent mid-slope sandstone benches. Soils are generally shallow, consisting of a yellow, clayey/sandy loam. Stony lateritic fragments are also common in the soil profile on many of these ridgetops. Vegetation structure varies from heaths and scrub to woodlands/open woodlands, and open forest. Vegetation communities correspond broadly to Benson & Howell's Sydney Sandstone Ridgetop Woodland (Map Unit 10ar). Common woodland tree species include: <i>Corymbia gummifera</i> , <i>C. eximia</i> , <i>Eucalyptus haemastoma</i> , <i>E. punctata</i> , <i>E. racemosa</i> , and/or <i>E. sparsifolia</i> , with an understorey dominated by species from the families

Scientific name	Common name	Conservation status		Most recent record	Other sources	Likely occurrence in study area	Rationale for likelihood ranking	Habitat description*
		EPBC	TSC					
								Proteaceae, Fabaceae, and Epacridaceae.
<i>Tetraloche juncea</i>	Black-eyed Susan	VU	V	2013/#		Low	Habitat marginal to unsuitable.	Small shrub confined to the northern area of the Sydney Basin bioregion and the southern area of the North Coast bioregion in the Wyong, Lake Macquarie, Newcastle, Port Stephens, Great Lakes and Cessnock Local Government Areas. Found growing at well drained sites which experience annual rainfall levels between 1000 and 1200 mm at elevations below 200 metres in swampy heath and moist forests. Usually found growing in soils from the Awaba soil landscape comprising of low nutrient sandy, skeletal soils, sandy loam soils and clay soils on sandstone or conglomerate substrates.
<i>Zannichellia palustris</i>			E1	1990		Negligible	Habitat unsuitable.	Submerged aquatic plant confined to the Hunter Valley as well as Sydney Olympic Park. Found growing in fresh or slightly saline stationary or flowing water in Coastal Freshwater Lagoons and Saltmarshes.
<i>Zieria smithii</i>	Sandfly Zieria		E2 – N Coast	2010		Negligible	Habitat unsuitable. Endangered population occurs in a different locality.	Small sprawling shrub with an endangered population occurring from Diggers Head at Coffs Harbour with other closely related forms occurring on eight to ten headlands north to Byron Bay. Found growing on a coastal headland in low heath in association with Kangaroo Grass <i>Themeda australis</i> in Maritime Grasslands and Coastal Headland Heaths.

Appendix 4.2 Threatened fauna species

Notes to tables:

EPBC Act:	TSC Act:
CR – Critically Endangered	E1 – endangered species (Part 1, Schedule 1)
EN – Endangered	E2 – endangered population (Part 2, Schedule 1)
VU – Vulnerable	E4 – presumed extinct (Part 4, Schedule 1)
	E4A – critically endangered
	V1 – vulnerable (Part 1, Schedule 2)
	<i>Codes identify the Legal Status of threatened biota within NSW under the TSC Act and the OEH Sensitive Species Data Policy (SSDP).</i>

#	species predicted to occur by the DoE database (not recorded on other databases)
##	species predicted to occur based on natural distributional range and suitable habitat despite lack of records in the databases searched
Year	recorded on databases listed above
2016	recorded during current survey

The following table includes a list of the threatened fauna species that have potential to occur within the study area. The list of species is sourced from the Atlas of NSW Wildlife, BirdLife Australia data search and the Protected Matters Search Tool (accessed on 08/04/2016).

Table 18: Threatened fauna species recorded, or predicted to occur, within five kilometres of the study area

Scientific name	Common name	Conservation status		Most recent record	Likely occurrence in study area	Rationale for likelihood ranking	Habitat description*
		EPBC	TSC				
Mammals							
<i>Chalinolobus dwyeri</i>	Large-eared Pied Bat	VU	V	#	Low	No local records. No caves or mines near site.	Occurs from the Queensland border to Ulladulla, with largest numbers from the sandstone escarpment country in the Sydney Basin and Hunter Valley. Primarily found in dry sclerophyll forests and woodlands, but also found in rainforest fringes and subalpine woodlands. Forages on small, flying insects below the forest canopy. Roosts in colonies of between three and 80 in caves, Fairy Martin nests and mines, and beneath rock overhangs, but usually less than 10 individuals. Likely that it hibernates during the cooler months. The only known existing maternity roost is in a sandstone cave near Coonabarabran.
<i>Dasyurus maculatus</i>	Spotted-tailed Quoll	EN	V	2011	Low	Site likely to be too small and disturbed for this species.	Occurs along the east coast of Australia and the Great Dividing Range. Uses a range of habitats including sclerophyll forests and woodlands, coastal heathlands and rainforests. Occasional sightings have been made in open country, grazing lands, rocky outcrops and other treeless areas. Habitat requirements include suitable den sites, including hollow logs, rock crevices and caves, an abundance of food and an area of intact vegetation in which to forage. Seventy per cent of the diet is medium-sized mammals, and also feeds on invertebrates, reptiles and birds. Individuals require large areas of relatively intact vegetation through which to forage. The home range of a female is between 180 and 1000 ha, while males have larger

Scientific name	Common name	Conservation status		Most recent record	Likely occurrence in study area	Rationale for likelihood ranking	Habitat description*
		EPBC	TSC				
							home ranges of between 2000 and 5000 ha. Breeding occurs from May to August.
<i>Kerivoula papuensis</i>	Golden-tipped Bat	-	V	-	Low	No local records. Site likely to be too small and disturbed for this species.	Occurs in a narrow band down the coast from Cape York to Eden, in moist, closed forest that receives high rainfall. Important habitat features includes forest ecotones, streams and an abundance of vines. Primarily feeds on web-building spiders. Most nightly movements occur within 2km of the roost. Roosts in the nests of Yellow-throated Scrubwren and Brown Gerygone, as well as in tree hollows, foliage and roofs of houses.
<i>Miniopterus australis</i>	Little Bentwing-bat	-	V	2015	Medium	Potential foraging habitat present only.	Occurs from Northern Queensland to the Hawkesbury River near Sydney. Roost sites encompass a range of structures including caves, tunnels and stormwater drains. Young are raised by the females in large maternity colonies in caves in summer. Shows a preference for well timbered areas including rainforest, wet and dry sclerophyll forests, Melaleuca swamps and coastal forests. The Little Bentwing-bat forages for small insects (such as moths, wasps and ants) beneath the canopy of densely vegetated habitats.
<i>Miniopterus schreibersii oceanensis</i>	Eastern Bentwing-bat	-	V	2014	Medium	Potential foraging habitat present only.	Occurs from Victoria to Queensland, on both sides of the Great Dividing Range. Forms large maternity roosts (up to 100,000 individuals) in caves and mines in spring and summer. Individuals may fly several hundred kilometres to their wintering sites, where they roost in caves, culverts, buildings, and bridges. They occur in a

Scientific name	Common name	Conservation status		Most recent record	Likely occurrence in study area	Rationale for likelihood ranking	Habitat description*
		EPBC	TSC				
							broad range of habitats including rainforest, wet and dry sclerophyll forest, paperbark forest and open grasslands. Has a fast, direct flight and forages for flying insects (particularly moths) above the tree canopy and along waterways.
<i>Mormopterus norfolkensis</i>	Eastern Freetail-bat	-	V	2013	Medium	Potential foraging habitat present but a few dead spouts for roosting also present.	Distribution extends east of the Great Dividing Range from southern Queensland to south of Sydney. Most records are from dry eucalypt forests and woodland. Individuals tend to forage in natural and artificial openings in forests, although it has also been caught foraging low over a rocky river within rainforest and wet sclerophyll forest habitats. The species generally roosts in hollow spouts of large mature eucalypts (including paddock trees), although individuals have been recorded roosting in the roof of a hut, in wall cavities, and under metal caps of telegraph poles. Foraging generally occurs within a few kilometres of roosting sites.
<i>Falsistrellus tasmaniensis</i>	Eastern False Pipistrelle	-	V	-	Medium	No local records. Potential foraging and roosting habitat present.	Distribution extending east of the Great Dividing Range throughout the coastal regions of NSW, from the Queensland border to the Victorian border. Prefers wet high-altitude sclerophyll and coastal mallee habitat, preferring wet forests with a dense understorey but being found in open forests at lower altitudes. Apparently hibernates in winter. Roosts in tree hollows and sometimes in buildings in colonies of between 3 and 80 individuals. Often change roosts every night. Forages for beetles, bugs and moths below or near the

Scientific name	Common name	Conservation status		Most recent record	Likely occurrence in study area	Rationale for likelihood ranking	Habitat description*
		EPBC	TSC				
							canopy in forests with an open structure, or along trails. Has a large foraging range, up to 136 ha. Records show movements of up to 12 km between roosting and foraging sites.
<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheathtail-bat	-	V	-	Medium	No local records. Potential foraging and roosting habitat present.	Found throughout NSW. They have been reported from southern Australia between January and June. Reported from a wide range of habitats throughout eastern and northern Australia, including wet and dry sclerophyll forest, open woodland, acacia shrubland, mallee, grasslands and desert. They roost in tree hollows in colonies of up to 30 (but more usually two to six) and have also been observed roosting in animal burrows, abandoned Sugar Glider nests, cracks in dry clay, hanging from buildings and under slabs of rock. It is high-flying, making it difficult to detect. It forages above the canopy of eucalypt forests, but comes lower to the ground in mallee or open country.
<i>Phascogale tapoatafa</i>	Brush-tailed Phascogale	-	V	-	Low	No local records. Site likely to be too small and disturbed for this species.	The Brush-tailed Phascogale had a scattered distribution centred around the Great Dividing Range. It prefers open forests with a sparse ground cover, but also inhabits mallee and rainforests. It feeds on insects and nectar, particularly in rough-barked trees. The Brush-tailed Phascogale will Nests and shelter in tree hollows, tree stumps and occasionally birds nests, and can use more than 40 nests in a year. Suitable tree hollows have entrances 25-40 mm wide. Females have exclusive territories of approximately 20 - 60 ha, while males have overlapping territories of up to 100 ha.

Scientific name	Common name	Conservation status		Most recent record	Likely occurrence in study area	Rationale for likelihood ranking	Habitat description*
		EPBC	TSC				
							Breeding occurs from May to July, after which all the males die.
<i>Petaurus norfolcensis</i>	Squirrel Glider	-	V	2015	Low	Site likely to be too small, too isolated and too disturbed for this species.	Wagga Wagga and Barrenjoey peninsula (north Sydney) populations are endangered populations: Sparsely distributed along the east coast and immediate inland areas as far west as Coonabarabran in the northern part of the state and as far west as Tocomwal along the southern border of the state. Generally occurs in dry sclerophyll forests and woodlands but is absent from dense coastal ranges in the southern part of its range. Requires abundant hollow-bearing trees and a mix of eucalypts, banksias and acacias. Within a suitable vegetation community at least one species should flower heavily in winter and one species of eucalypt should be smooth barked. They live in family groups of 2-10 individuals and maintain home ranges of 0.65 and 10.5 ha, varying according to habitat quality and food resource availability. Family groups occupy multiple hollows over time.
<i>Phascolarctos cinereus</i>	Koala	VU	V	2006	Low	Low numbers of a few suitable forage tree species are present. Most have been planted (Tallowwood, Swamp Mahogany)	Pittwater LGA and Hawks Nest: In NSW the Koala mainly occurs on the central and north coasts with some populations in the western region. Koalas feed almost exclusively on eucalypt foliage, and their preferences vary regionally. Primary feed trees include <i>Eucalyptus robusta</i> , <i>E. tereticornis</i> , <i>E. punctata</i> , <i>E. haemastoma</i> and <i>E. signata</i> . They are solitary with varying home ranges. In high quality habitat home ranges may be 1-2 ha and overlap, while in semi-arid

Scientific name	Common name	Conservation status		Most recent record	Likely occurrence in study area	Rationale for likelihood ranking	Habitat description*
		EPBC	TSC				
							country they are usually discrete and around 100 ha.
<i>Potorous tridactylus tridactylus</i>	Long-nosed Potoroo	VU	V	#	Negligible	Habitat unsuitable and no local records.	Cobaki Lakes and Tweed Heads West population: Occurs from Queensland to Victoria, normally within 50 km of the coast. Inhabits coastal heath and wet and dry sclerophyll forests. Generally found in areas with rainfall greater than 760 mm. Requires relatively thick ground cover where the soil is light and sandy. Known to eat fungi, arthropods, fleshy fruit, seeds and plant tissue. It is solitary and sedentary, but tends to aggregate in small groups. It has two breeding seasons, one in late winter-early spring and the other in late summer. This species appears to benefit from a lack of recent disturbance.
<i>Planigale maculata</i>	Common Planigale	-	V	-	Low	No local records and site likely to be too small and disturbed for this species.	Occurs from the Queensland border and south to the Upper Hunter River. The southernmost record is from Gosford (). The Common Planigale is known to occur in a variety of habitats from weed-infested urban reserves to cool mountain forests (Burnett 2008), from sea level up to 400 m. Habitat selection is considered to be dependant on an adequate surface cover of grasses, hollow logs, rocks and leaf litter. It feeds on insects, spiders and small lizards. This species shelters under rocks, timber, rubbish (e.g. sheet iron) and in termite mounds. There is nothing known of its home range. Breeding occurs during spring and summer.
<i>Pseudomys gracilicaudatus</i>	Eastern Chestnut	-	V	-	Low	No local records. No swamps within the site	Occurs from Queensland to Jervis Bay. In NSW the Eastern Chestnut Mouse is mostly found in heathland

Scientific name	Common name	Conservation status		Most recent record	Likely occurrence in study area	Rationale for likelihood ranking	Habitat description*
		EPBC	TSC				
	Mouse					and no dense ground vegetation.	and is most common in dense, wet heath and swamps, but also occurs in open woodlands and dry sclerophyll forests with a grassy understorey. Density of the ground layer is a determining factor, and it is often found in areas burnt within the last four years. The species is sedentary, with home ranges of less than 0.5 ha. It relies on a variety of food sources, including fungi, seeds, insects and stems.
<i>Cercartetus nanus</i>	Eastern Pygmy-possum	-	V	-	Low	No local records. Site likely to be too small and disturbed for this species.	Patchily distributed from the coast to the Great Dividing Range, and as far as Pilliga, Dubbo, Parkes and Wagga Wagga on the western slopes. Inhabits rainforest through to sclerophyll forest and tree heath. Banksias and myrtaceous shrubs and trees are a favoured food source. Soft fruits are eaten when flowers are unavailable and it also feeds on insects. Will often nest in tree hollows, but can also construct its own nest. Because of its small size it is able to utilise a range of hollow sizes including very small hollows. Individuals will use a number of different hollows and an individual has been recorded using up to 9 nest sites within a 0.5 ha area over a 5 month period. It is mainly solitary, and each individual uses several nests. Home ranges of males are generally less than 0.75 ha, and those of females are smaller.
<i>Pseudomys novaehollandiae</i>	New Holland Mouse	VU	-	2009/#	Low	Site likely to be too small and disturbed for this species.	The New Holland Mouse currently has a disjunct, fragmented distribution across Tasmania, Victoria, New South Wales and Queensland. Across the species' range the New Holland Mouse is known to inhabit open

Scientific name	Common name	Conservation status		Most recent record	Likely occurrence in study area	Rationale for likelihood ranking	Habitat description*
		EPBC	TSC				
							heathlands, open woodlands with a heathland understorey, and vegetated sand dunes. The home range of the New Holland Mouse can range from 0.44 ha to 1.4 ha. The New Holland Mouse is a social animal, living predominantly in burrows shared with other individuals. The species is nocturnal and omnivorous, feeding on seeds, insects, leaves, flowers and fungi, and is therefore likely to play an important role in seed dispersal and fungal spore dispersal. It is likely that the species spends considerable time foraging above-ground for food, predisposing it to predation by native predators and introduced species. Breeding typically occurs between August and January, but can extend into autumn.
<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox	VU	V	2013/#	Medium	Possible foraging habitat only.	Occurs along the NSW coast, extending further inland in the north. This species is a canopy-feeding frugivore and nectarivore of rainforests, open forests, woodlands, melaleuca swamps and banksia woodlands. Roosts in large colonies (camps), commonly in dense riparian vegetation. Bats commute daily to foraging areas, usually within 15 km of the day roost although some individuals may travel up to 70 km.
<i>Scoteanax rueppellii</i>	Greater Broad-nosed Bat	-	V	2014	Medium	Small amount of possible foraging and roosting habitat.	Occurs along the Great Dividing Range, generally at 500 m but up to 1200 m, and in coastal areas. Occurs in woodland and rainforest, but prefers open habitats or natural or human-made openings in wetter forests. Often hunts along creeks or river corridors. Flies slowly and directly at a height of 30 m or so to catch beetles

Scientific name	Common name	Conservation status		Most recent record	Likely occurrence in study area	Rationale for likelihood ranking	Habitat description*
		EPBC	TSC				
							and other large, flying insects. Also known to eat other bats and spiders. Roosts in hollow tree trunks and branches.
<i>Vespadelus troungtoni</i>	Eastern Cave Bat	-	V	2009	Medium	Possible foraging habitat only.	Found in a broad band on both sides of the Great Dividing Range from Cape York to Kempsey, with records from the New England Tablelands and the upper north coast of NSW. It roosts in small groups, often in well-lit overhangs and caves, mine tunnels, road culverts, and occasionally in buildings.
Birds							
<i>Anthochaera phrygia</i>	Regent Honeyeater	CE	E4A	1983/#	Low	Site likely to be too small and disturbed for this species.	A semi-nomadic species occurring in temperate eucalypt woodlands and open forests. Most records are from box-ironbark eucalypt forest associations and wet lowland coastal forests. Key eucalypt species include Mugga Ironbark, Yellow Box, Blakely's Red Gum, White Box and Swamp Mahogany. Also utilises: <i>E. microcarpa</i> , <i>E. punctata</i> , <i>E. polyanthemos</i> , <i>E. mollucana</i> , <i>Corymbia robusta</i> , <i>E. crebra</i> , <i>E. caleyi</i> , <i>C. maculata</i> , <i>E. mckieana</i> , <i>E. macrorhyncha</i> , <i>E. laevopinea</i> and <i>Angophora floribunda</i> . Nectar and fruit from the mistletoes <i>A. miquelii</i> , <i>A. pendula</i> , <i>A. cambagei</i> are also eaten during the breeding season. Regent Honeyeaters usually nest in horizontal branches or forks in tall mature eucalypts and sheoaks. Also nest in mistletoe haustoria. An open cup-shaped nest is constructed of bark, grass, twigs and wool by the female.
<i>Botaurus</i>	Australasian	EN	E1	#	Low	No local records and	The Australasian Bittern is distributed across south-

Scientific name	Common name	Conservation status		Most recent record	Likely occurrence in study area	Rationale for likelihood ranking	Habitat description*
		EPBC	TSC				
<i>poiciloptilus</i>	Bittern					habitat unsuitable with no wet areas on site.	eastern Australia. Often found in terrestrial and estuarine wetlands, generally where there is permanent water with tall, dense vegetation including <i>Typha</i> spp. and <i>Elaecharis</i> spp. Typically this bird forages at night on frogs, fish and invertebrates, and remains inconspicuous during the day. The breeding season extends from October to January with nests being built amongst dense vegetation on a flattened platform of reeds.
<i>Callocephalon fimbriatum</i>	Gang-gang Cockatoo	-	V	1992	Low	Site likely to be too disturbed for this species.	In summer, occupies tall montane forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests. Also occur in subalpine Snow Gum woodland and occasionally in temperate or regenerating forest. In winter, occurs at lower altitudes in drier, more open eucalypt forests and woodlands, particularly in box-ironbark assemblages, or in dry forest in coastal areas. It requires tree hollows in which to breed.
<i>Calyptorhynchus lathami</i>	Glossy Black-Cockatoo	-	V	2009	Low	No large She-oaks present.	Inhabits forest with low nutrients, characteristically with key <i>Allocasuarina</i> species. Tends to prefer drier forest types. Often confined to remnant patches in hills and gullies. Breed in hollows stumps or limbs, either living or dead.
<i>Chthonicola sagittata</i>	Speckled Warbler	-	V	2000	Low	Site likely to be too disturbed for this species. No suitable habitat present.	This species occurs in eucalypt and cypress woodlands on the hills and tablelands of the Great Dividing Range. They prefer woodlands with a grassy understorey, often on ridges or gullies. The species is sedentary,

Scientific name	Common name	Conservation status		Most recent record	Likely occurrence in study area	Rationale for likelihood ranking	Habitat description*
		EPBC	TSC				
							living in pairs or trios and nests on the ground in grass tussocks, dense litter and fallen branches. They forage on the ground and in the understorey for arthropods and seeds. Home ranges vary from 6-12 hectares.
<i>Dasyornis brachypterus</i>	Eastern Bristlebird	EN	E1	#	Low	No local records and habitat unsuitable.	Found in coastal woodlands, dense scrub and heathlands, particularly where it borders taller woodlands.
<i>Epthianura albifrons</i>	White-fronted Chat	-	V	1972	Low	No damp habitats within site.	Sydney Metropolitan CMA: The White-fronted Chat occupies foothills and lowlands below 1000 m above sea level. In NSW it occurs mostly in the southern half of the state, occurring in damp open habitats along the coast, and near waterways in the western part of the state. The White-fronted Chat is found in damp open habitats, particularly wetlands containing saltmarsh areas that are bordered by open grasslands or lightly timbered lands. Along the coastline, they are found in estuarine and marshy grounds with vegetation less than 1 m tall. The species is also observed in open grasslands and sometimes in low shrubs bordering wetland areas. Inland, the species is often observed in open grassy plains, saltlakes and salt pans that are along the margins of rivers and waterways. In Victoria White-fronted Chats have been observed breeding from late July through to early March. Nests are built in low vegetation and in the Sydney region

Scientific name	Common name	Conservation status		Most recent record	Likely occurrence in study area	Rationale for likelihood ranking	Habitat description*
		EPBC	TSC				
							nests have also been observed in low isolated mangroves. An Endangered Population occurs in the Sydney Metropolitan CMA area, at Newington Nature Reserve near Homebush and at Towra Point Nature Reserve.
<i>Glossopsitta pusilla</i>	Little Lorikeet	-	V	2015	Low	Small amount of possible foraging habitat present, but site likely to be too disturbed for this species.	Distributed in forests and woodlands from the coast to the western slopes of the Great Dividing Range in NSW, extending westwards to the vicinity of Albury, Parkes, Dubbo and Narrabri. Mostly occur in dry, open eucalypt forests and woodlands. They feed primarily on nectar and pollen in the tree canopy. Nest hollows are located at heights of between 2 m and 15 m, mostly in living, smooth-barked eucalypts. Most breeding records come from the western slopes.
<i>Daphoenositta chrysoptera</i>	Varied Sittella	-	V	-	Medium	No local records but habitat potentially suitable.	The Varied Sittella is a sedentary species which inhabits a wide variety of dry eucalypt forests and woodlands, usually with either shrubby understorey or grassy ground cover or both, in all climatic zones of Australia. Usually inhabit areas with rough-barked trees, such as stringybarks or ironbarks, but also in mallee and acacia woodlands, paperbarks or mature Eucalypts. The Varied Sittella feeds on arthropods gleaned from bark, small branches and twigs. It builds a cup-shaped nest of plant fibres and cobweb in an upright tree fork high in the living tree canopy, and often re-uses the same fork or tree in successive years.

Scientific name	Common name	Conservation status		Most recent record	Likely occurrence in study area	Rationale for likelihood ranking	Habitat description*
		EPBC	TSC				
<i>Lophoictinia isura</i>	Square-tailed Kite	-	V	-	Medium	No local records but habitat potentially suitable as small part of a large home range.	Typically inhabits coastal forested and wooded lands of tropical and temperate Australia. In NSW it is often associated with ridge and gully forests dominated by <i>Eucalyptus longifolia</i> , <i>Corymbia maculata</i> , <i>E. elata</i> , or <i>E. smithii</i> . Individuals appear to occupy large hunting ranges of more than 100 km ² . They require large living trees for breeding, particularly near water with surrounding woodland /forest close by for foraging habitat. Nest sites are generally located along or near watercourses, in a tree fork or on large horizontal limbs.
<i>Hieraaetus morphnoides</i>	Little Eagle	-	V	-	Medium	No local records but habitat potentially suitable as small part of a large home range.	The Little Eagle is most abundant in lightly timbered areas with open areas nearby providing an abundance of prey species. It has often been recorded foraging in grasslands, crops, treeless dune fields, and recently logged areas. The Little Eagle nests in tall living trees within farmland, woodland and forests.
<i>Climacteris picumnus victoriae</i>	Brown Treecreeper	-	V	-	Low	No local records. Little fallen timber present	Lives in eucalypt woodlands, especially areas of relatively flat open woodland typically lacking a dense shrub layer, with short grass or bare ground and with fallen logs or dead trees present.
<i>Pomatostomus temporalis temporalis</i>	Grey-crowned Babbler	-	V	-	Low	No local records. Site likely to be too disturbed for this species.	The Grey-crowned Babbler is found in dry, open forests, scrubby woodlands, trees bordering roads and farmland with isolated trees.
<i>Burhinus</i>	Bush Stone-	-	E	-	Low	No local records. Site likely to be too	Lightly timbered open forest and woodland, or partly cleared farmland with remnants of woodland, with a

Scientific name	Common name	Conservation status		Most recent record	Likely occurrence in study area	Rationale for likelihood ranking	Habitat description*
		EPBC	TSC				
<i>grallarius</i>	curlew					disturbed for this species.	ground cover of short sparse grass and few or no shrubs where fallen branches and leaf litter are present.
<i>Melithreptus gularis gularis</i>	Black-chinned Honeyeater	-	V	-	Low	No local records and habitat unsuitable.	Found mostly in open forests and woodlands dominated by box and ironbark eucalypts. It is rarely recorded east of the Great Dividing Range.
<i>Grantiella picta</i>	Painted Honeyeater	VU	V	#	Low	No local records and low presence of mistletoe on site	Found mainly in dry open woodlands and forests, where it is strongly associated with mistletoe. Often found on plains with scattered eucalypts and remnant trees on farmlands.
<i>Lathamus discolor</i>	Swift Parrot	EN	E1	2003/#	Low	Small amount of possible foraging habitat only present, but site likely to be too disturbed for this species.	The Swift Parrot occurs in woodlands and forests of NSW from May to August, where it feeds on eucalypt nectar, pollen and associated insects. The Swift Parrot is dependent on flowering resources across a wide range of habitats in its wintering grounds in NSW. Favoured feed trees include winter flowering species such as Swamp Mahogany <i>Eucalyptus robusta</i> , Spotted Gum <i>Corymbia maculata</i> , Red Bloodwood <i>C. gummifera</i> , Mugga Ironbark <i>E. sideroxylon</i> , and White Box <i>E. albens</i> . Commonly used lerp infested trees include Grey Box <i>E. microcarpa</i> , Grey Box <i>E. moluccana</i> and Blackbutt <i>E. pilularis</i> . This species is migratory, breeding in Tasmania and also nomadic, moving about in response to changing food availability.
<i>Neophema pulchella</i>	Turquoise Parrot	-	V	1989	Low	Possible foraging and nesting habitat present, but site likely to be too	Occurs in open woodlands and eucalypt forests with a ground cover of grasses and understorey of low shrubs. Generally found in the foothills of the Great Divide,

Scientific name	Common name	Conservation status		Most recent record	Likely occurrence in study area	Rationale for likelihood ranking	Habitat description*
		EPBC	TSC				
						disturbed for this species.	including steep rocky ridges and gullies. Nest in hollow-bearing trees, either dead or alive; also in hollows in tree stumps. Prefer to breed in open grassy forests and woodlands, and gullies that are moist.
<i>Ninox connivens</i>	Barking Owl	-	V	2015	Medium	Possible roosting and foraging habitat present .	Generally found in open forests, woodlands, swamp woodlands and dense scrub. Can also be found in the foothills and timber along watercourses in otherwise open country. Territories are typically 2000 ha in NSW habitats.
<i>Ninox strenua</i>	Powerful Owl	-	V	2015	Low	Site likely to be too disturbed for this species.	The Powerful Owl occupies wet and dry eucalypt forests and rainforests. It may inhabit both un-logged and lightly logged forests as well as undisturbed forests where it usually roosts on the limbs of dense trees in gully areas. Large mature trees with hollows at least 0.5 m deep are required for nesting. Tree hollows are particularly important for the Powerful Owl because a large proportion of the diet is made up of hollow-dependent arboreal marsupials. Nest trees for this species are usually emergent with a diameter at breast height of at least 100 cm. It has a large home range of between 450 and 1450 ha.
<i>Pandion cristatus/haliaeetus</i>	(Eastern) Osprey	M	V	2013	Low	No foraging habitat, but may potentially roost within site.	Found in coastal waters, inlets, estuaries and offshore islands. Occasionally found 100 km inland along larger rivers. It is water-dependent, hunting for fish in clear, open water. The Osprey occurs in terrestrial wetlands, coastal lands and offshore islands. It is a predominantly coastal species, generally using marine cliffs as nesting

Scientific name	Common name	Conservation status		Most recent record	Likely occurrence in study area	Rationale for likelihood ranking	Habitat description*
		EPBC	TSC				
							and roosting sites. Nests can also be made high up in dead trees or in dead crowns of live trees, usually within one kilometre of the sea.
<i>Rostratula australis</i>	Australian Painted Snipe	EN	E1	#	Negligible	No wetlands or waterlogged grassland on site.	Usually found in shallow inland wetlands including farm dams, lakes, rice crops, swamps and waterlogged grassland. They prefer freshwater wetlands, ephemeral or permanent, although they have been recorded in brackish waters.
<i>Tyto novaehollandiae</i>	Masked Owl	-	V	2009	Medium	Unlikely to roost, but may forage within site for rats.	The Masked Owl may be found across a diverse range of wooded habitat that provide tall or dense mature trees with hollows suitable for nesting and roosting. It has mostly been recorded in open forests and woodlands adjacent to cleared lands. They nest in hollows, in trunks and in near vertical spouts or large trees, usually living but sometimes dead. The nest hollows are usually located within dense forests or woodlands. Masked Owls prey upon hollow-dependent arboreal marsupials, but terrestrial mammals make up the largest proportion of the diet. It has a large home range of between 500 and 1000 ha.
<i>Tyto tenebricosa</i>	Sooty Owl	-	V	2001	Low	No suitable old-growth habitat present.	The Sooty Owl is often found in tall old-growth forests, including temperate and subtropical rainforests. In NSW it is mostly found on escarpments with a mean altitude of <500 m. The Sooty Owl nests and roosts in hollows of tall emergent trees, mainly eucalypts, often located in gullies. Nests have been located in trees 125 to 161 cm in diameter.

Scientific name	Common name	Conservation status		Most recent record	Likely occurrence in study area	Rationale for likelihood ranking	Habitat description*
		EPBC	TSC				
Reptiles							
<i>Hoplocephalus bungaroides</i>	Broad-headed Snake	VU	E1	#	Negligible	No rock on rock habitat on the site.	Mainly occurs in association with communities occurring on Triassic sandstone within the Sydney Basin. Typically found among exposed sandstone outcrops with vegetation types ranging from woodland to heath. Within these habitats they generally use rock crevices and exfoliating rock during the cooler months and tree hollows during summer.
<i>Hoplocephalus bitorquatus</i>	Pale-headed Snake	-	V	-	Low	Site likely to be too disturbed for this species.	Found in a variety of habitats from wet sclerophyll forest to dry eucalypt forest on the western slopes of NSW. Feeds largely on frogs and lizards.
Frogs							
<i>Crinia tinnula</i>	Wallum Froglet		V	2014	Negligible	No swamps or wetlands within the site.	The Wallum Froglet is a coastal species, confined to acid, paperbark swamps and sedge swamps of the "wallum" country. The species occurs from near Noosa in southern Queensland south to the central coast of NSW, with a disjunct population on Kurnell Peninsula. The species is a late winter breeder and males call in choruses from within sedge tussocks or at the water edge.
<i>Litoria aurea</i>	Green and Golden Bell Frog	VU	E1	#	Negligible	No swamps or wetlands within the site.	Most existing locations for the species occur as small, coastal, or near coastal populations, with records occurring between south of Grafton and northern VIC. The species is found in marshes, dams and stream sides, particularly those containing bullrushes or spikerushes. Preferred habitat contains water bodies that are unshaded, are free of predatory fish, have a

Scientific name	Common name	Conservation status		Most recent record	Likely occurrence in study area	Rationale for likelihood ranking	Habitat description*
		EPBC	TSC				
							grassy area nearby and have diurnal sheltering sites nearby such as vegetation or rocks, although the species has also been recorded from highly disturbed areas including disused industrial sites, brick pits, landfill areas and cleared land. Breeding usually occurs in summer. Tadpoles, which take approximately 10-12 weeks to develop, feed on algae and other vegetative matter. Adults eat insects as well as other frogs, including juveniles of their own species.
<i>Litoria littlejohni</i>	Littlejohn's Tree Frog	VU	V	#	Negligible	No swamps or wetlands located within the site and site is near coast.	The species is distributed along the eastern slopes of the Great Dividing Range from Watagan State Forest near Wyong, south to Buchan in north-eastern VIC. It is not known from coastal habitats. Occurs in wet and dry sclerophyll forests and heath communities associated with sandstone outcrops between 280 and 1000 m. Littlejohn's Tree Frog prefers permanent and semi-permanent rock flowing streams, but individuals have also been collected from semi-permanent dams with some emergent vegetation. Forages both in the tree canopy and on the ground, and has been observed sheltering under rocks on high exposed ridges during summer. The species breeds in autumn but will also breed after heavy rainfall in spring and summer. The species has been recorded calling in all seasons with variously reported peak calling periods. Eggs are laid in loose gelatinous masses attached to submerged twigs; eggs and tadpoles are most often recorded in slow-flowing pools that receive extended exposure to

Scientific name	Common name	Conservation status		Most recent record	Likely occurrence in study area	Rationale for likelihood ranking	Habitat description*
		EPBC	TSC				
							sunlight.
<i>Pseudophryne australis</i>	Red-crowned Toadlet	-	V	1999	Negligible	No swamps, creeks or wetlands within the site.	Occurs on wetter ridge tops and upper slopes of sandstone formations on which the predominant vegetation is dry open forests and heaths. This species typically breeds within small ephemeral creeks characterised by a series of shallow pools that feed into larger semi-perennial streams. Breeds all year round.
<i>Litoria brevipalmata</i>	Green-thighed Frog	-	V	-	Negligible	No swamps, creeks or wetlands within the site.	The majority of records for the species are in the NSW North Coast. There are disjunct records near Bulahdelah and in the ranges behind the Central Coast. Populations in NSW have declined over the last century. The Green-thighed Frog occurs within wet forests (swamp forests, wet sclerophyll forest and rainforest), although records from dry sclerophyll forest have been reported within the northern part of its range. Habitat of the species is poorly known however, the species is thought to forage and shelter in areas of deep leaf litter, dense low vegetation, or both, during non-breeding times. Breeding occurs in flooded paddocks or waterholes next to forest (Barker, 1995 272 /id). The Green-thighed Frog is also considered to be partially arboreal, where it is thought to utilise trees and vegetation within only a few metres of the ground.
Invertebrates							
<i>Petalura gigantea</i>	Giant Dragonfly	-	E1	2011	Negligible	No suitable swamp habitat on site.	Live in permanent swamps and bogs with some free water and open vegetation. Adults spend most of their time settled on low vegetation on or adjacent to the

Scientific name	Common name	Conservation status		Most recent record	Likely occurrence in study area	Rationale for likelihood ranking	Habitat description*
		EPBC	TSC				
							swamp.

Appendix 3.3 Migratory species (EPBC Act listed)

The following table includes a list of the migratory fauna species that have potential to occur within the study area. The list of species is sourced from the NSW BioNet Wildlife Atlas, BirdLife Australia data search and the Protected Matters Search Tool (accessed on 08/04/2016).

Table 19: Migratory fauna species recorded, or predicted to occur, within five kilometres of the study area

Scientific name	Common name	Conservation status		Most recent record
		EPBC	TSC	
<i>Apus pacificus</i>	Fork-tailed Swift			1999/#
<i>Ardea ibis</i>	Cattle Egret			#
<i>Ardea modesta</i>	Eastern Great Egret			2013
<i>Cuculus optatus</i>	Oriental Cuckoo			#
<i>Cuculus saturatus</i>	Himalayan Cuckoo			#
<i>Gallinago hardwickii</i>	Latham's Snipe			#
<i>Hirundapus caudacutus</i>	White-throated Needletail			2012/#
<i>Merops ornatus</i>	Rainbow Bee-eater			1983/#
<i>Monarcha melanopsis</i>	Black-faced Monarch			2007/#
<i>Monarcha trivirgatus</i>	Spectacled Monarch			#
<i>Motacilla flava</i>	Yellow Wagtail			#
<i>Myiagra cyanoleuca</i>	Satin Flycatcher			2009/#
<i>Pandion cristatus</i>	Osprey		V	2013
<i>Rhipidura rufifrons</i>	Rufous Fantail			2012/#

Appendix 4: Credit profile report

Biodiversity credit report



This report identifies the number and type of biodiversity credits required for a major project.

Date of report: 20/04/2016

Time: 4:44:42PM

Calculator version: v4.0

Major Project details

Proposal ID:	0024/2016/3579MP
Proposal name:	Hunter Sports High School, Gateshead
Proposal address:	2 Pacific Highway Gateshead NSW 2290
Proponent name:	NSW Public Works
Proponent address:	117 Bull Street Newcastle West NSW 2302
Proponent phone:	(02) 4908 4905
Assessor name:	Stefan Rose
Assessor address:	39 Platt St Waratah NSW 2298
Assessor phone:	49684901
Assessor accreditation:	0024

Summary of ecosystem credits required

Plant Community type	Area (ha)	Credits created
Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands	0.13	2.00
Total	0.13	2

Credit profiles

1. Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands, (HU833)

Number of ecosystem credits created	2
IBRA sub-region	Wyong

Offset options - Plant Community types	Offset options - IBRA sub-regions
Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands, (HU833) Scribbly Gum - Smooth-barked Apple - Red Bloodwood shrubby forest of the Lower Hunter, Sydney Basin Bioregion, (HU715) Red Bloodwood - Sydney Peppermint - Podocarpus spinulosus shrubby open forest of the southern Central Coast, (HU839) Scribbly Gum - Red Bloodwood - Angophora inopina heathy woodland on lowlands of the Central Coast, (HU850) Smooth-barked Apple - Red Bloodwood - Scribbly Gum grass - shrub woodland on lowlands of the Central Coast, (HU852)	Wyong and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

Summary of species credits required