North Silverdale: Development Site Biodiversity Assessment Report

FINAL REPORT (version 2)

Prepared for SitePlus on behalf of North Silverdale Centre Landowner Group

27 April 2017

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Biosis staff involved in this project were:

- Mathew Misdale and Craig Dunne (assistance in the field)
- Ashleigh Pritchard (mapping)

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Glossary

APZ	Asset Protection Zone
Assessment circles	Two circles (the inner and outer assessment circle) in which the percent native vegetation cover in the landscape is assessed, taking into account both cover and condition of vegetation (OEH 2014).
BA	Birdlife Australia
BBAM	BioBanking Assessment Methodology
CEEC	Critically Endangered Ecological Community
DCDB	Land and Property Information(LPI) digital cadastral database
DEE	Commonwealth Department of the Environment and Energy
Development site	The area of zoning subject to of direct impacts resulting from the development, including the development footprint and associated APZs within non-E3 zoned land.
DIWA	Directory of Important Wetlands
DP&I	Department of Planning and Infrastructure, now the Department of Planning and the Environment
DPE	NSW Department of Planning and Environment
DPI	NSW Department of Primary Industries
DTDB	Digital topographic databases
Ecosystem credit species	A measurement of the value of EECs, CEECs and threatened species habitat for species that can be reliably predicted to occur with a plan community type. Ecosystem credits measure the loss in biodiversity values at a development.
EP&A Act	NSW *Environmental Planning and Assessment Act 1979*
EPBC Act	Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*
FM Act	*Fisheries Management Act 1994*
GIS	Global Information System
HBT	Hollow-bearing Tree
LEP	Local Environment Plan
LGA	Local Government Area
Locality	Area located within 10 kilometres radius from the study area
LPI	NSW Land and Property Information
Matters of NES	Matters of National Environmental Significance protected by a provision of Part 3 of the EPBC Act
NV Act	NSW *Native Vegetation Act 2003*
NW Act	NSW *Noxious Weed Act 1993*

OEH	NSW Office of Environment and Heritage
PCT	Plant Community Type
RoTAP	Rare or Threatened Australian Plant
SALIS	NSW Soil and Land Information System
SEPP	NSW State Environmental Planning Policy
Separate assessment area	Areas of proposed vegetation clearing and potential development located within the E3 zone. This includes access roads and residential building envelops. The area is excluded from the BioBanking development site (see Summary and Section 1.1).
SIS	Species Impact Statement
SIX maps	Spatial Information Exchange maps
study area	68.09 hectares of privately owned land located along Silverdale Road, North Silverdale including the broader area in which zone proposed to encompass the development site, separate assessment area, APZs and the proposed BioBank site is located (c.f. Development Site).
Tg value	The ability of a species to respond to improvement in site value or other habitat improvement at an offset site with management actions
TPSD	Threatened Species Profiles Database maintained by OEH for TSC Act listed species and communities.
TSC Act	NSW *Threatened Species Conservation Act 1995*
VIS	NSW Vegetation Information System
WM Act	*Water Management Act 2000*

Summary

Biosis Pty Ltd was commissioned by SitePlus, on behalf of North Silverdale Centre Landowner Group, to prepare a Biodiversity Assessment Report to inform a Planning Proposal for the rezoning and future development of 46.10 hectares of the 68.09 hectares of privately owned land located along Silverdale Road, North Silverdale (the project; Figure 1). Biodiversity offsets are required for this development because of impacts to Shale Sandstone Transition Forest in the Sydney Basin Bioregion, a critically endangered ecological community (CEEC), the Cumberland Plain Land Snail *Meridolum corneovirens* and Juniper-leaved Grevillea *Grevillea juniperina* subsp. *juniperina*. This report has been prepared in support of an application to offset losses of native vegetation and species habitat that will result from the project under the NSW BioBanking Scheme. It has been prepared in accordance with the NSW BioBanking Assessment Methodology (BBAM; OEH 2014).

The objective of the Planning Proposal is to allow for the rezoning of the study area to facilitate future residential and commercial development as well as retention of land for environmental conservation purposes. The Planning Proposal will involve the rezoning of 46.10 hectares of RU2 - Rural Landscape and B1 - Neighbourhood Centre, as zoned under the provisions of the *Wollondilly Local Environmental Plan 1991* (LEP; Wollondilly Shire Council 2011a), to R2 – Low Density Residential, R3 – Medium Density Residential, B2 – Local Centre and B4 - Mixed Use zones. The residual 21.99 hectares will be rezoned to E3 – Environmental Management and contain eight large residential lots. Building envelopes will be sited at the boundary to R2 and R3 zones and the remainder of the lot proposed to be a BioBank site, including the recommended asset protection zones (APZs). The portion of the property proposed to be rezoned as R2, R3, B2 and B4 zones has been assessed as part of a BioBanking statement and forms the 'development site', while the majority of the E3 zone will be assessed as part of a BioBanking agreement, forming the 'BioBank site' (Figure 2). This report considers the development site (Figure 2).

In addition to the BioBanking assessment areas (being the development site and the potential BioBank site), the building envelopes proposed to be located within the E3 zone will requiring clearing of native vegetation and threatened species habitat (Figure 2). A separate development application will be required to construct a residential dwelling in these areas following the rezoning of the site.

In accordance with Section 127ZJ of the *Threatened Species Conservation Act 1995* (TSC Act) and the *Threatened Species Conservation (Biodiversity Banking) Regulation 2008* (the BioBanking Regulation), the portion of works occurring in the E3 zone cannot form part of a BioBanking Statement for the development as clearing of vegetation in this area is subject to approval under the *Native Vegetation Act 2003* (NV Act). The area has also been excluded from the proposed BioBank site, as the works are inconsistent with the conservation of this area. Impacts relating to biodiversity in the E3 zone building envelops have therefore not been included in the BioBanking assessment; however have been assessed separately in Section 8 and Appendix 4 and 5. This area is also shown on Figure 2.

Ecological values

Key ecological values identified within the study area include:

- 10.29 hectares of native vegetation in the form of *1395 - Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin (HN556)*, equivalent to the Shale Sandstone Transition Forest CEEC.
- Habitat for a number of threatened species including 2.85 hectares of the Cumberland Plain Land Snail and five individuals of Juniper-leaved Grevillea.

- 16.66 hectares of vegetation within an E3 Environmental Management zone contains threatened biota and forms part of a fauna habitat linkage. Specifically within the area proposed for ongoing conservation (BioBank site), the following two PCTs as well as confirmed Cumberland Plain Land Snail habitat are present and encompass a total of 15.66 hectares:
  - 9.67 hectares of *1395 - Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin (HN556)*, equivalent to the Shale Sandstone Transition Forest CEEC.
  - 5.99 hectares of *1081 - Red Bloodwood - Grey Gum woodland on the edges of the Cumberland Plain, Sydney Basin (HN564)*.
- The study area forms part of a large patch of vegetation greater than 1000 hectares in size.

The following table provides a summary of the ecological values within the study area:

Assessment areas based on proposed zoning	Total area	Shale Sandstone Transition Forest CEEC	Red Bloodwood - Grey Gum woodland (not a TEC)	Cumberland Plain Land Snail habitat	Juniper-leaved Grevillea
Total development site	46.10 ha	10.29 ha (9.52 ha EPBC)	0 ha	2.85 ha	5 individuals
Proposed construction footprint	45.16 ha	10.04 ha (9.29 ha EPBC)	0 ha	2.73 ha	5 individuals
APZ	0.94 ha	0.24 ha (0.23 ha EPBC)	0 ha	0.12 ha	0
Total E3 Zone	21.99 ha	10.67 ha (10.63 ha EPBC)	5.99 ha	8.55 ha	0
Separate assessment	2.69 ha	1.00 ha (1.00 ha EPBC)	0 ha	0.64 ha	0
APZ	4.38 ha	2.07 ha (2.04 ha EPBC)	0 ha	1.21 ha	0
BioBank site (conservation)	14.92 ha	7.60 ha (7.59 ha EPBC)	5.99 ha	6.70 ha	0
Total	**68.09 ha**	**20.95 ha**	**5.99 ha**	**11.40 ha**	**5 individuals**

Impact avoidance, minimisation and mitigation

Throughout the development of the Planning Proposal, rezoning layout has sought to avoid and minimise impacts to sensitive ecological features by siting residential development adjacent in areas of greatest disturbance and in proximity to adjoining development.

Additional measures to avoid and minimise impacts have been undertaken 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 development following the successful rezoning of the study area include:

- The permanent removal of 10.29 hectares of 1395 - Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest, equating to the TSC Act listed CEEC Shale Sandstone Transition Forest and 9.52 hectares of the EPBC Act listed CEEC Shale Sandstone Transition Forest. An additional one hectare of CEEC Shale Sandstone Transition Forest will be removed to allow for access roads and the building envelops in the E3 zone. This has been assessed separately in Appendix 4 and Appendix 5.
- The permanent removal of 2.85 hectares of Cumberland Plain Land Snail habitat.
- The permanent removal of five individuals of Juniper-leaved Grevillea.

Residual impacts are proposed to be offset by the development of a BioBank site within E3 zoned land, resulting in the in-perpetuity conservation and management of 13.59 hectares of native vegetation, including 9.67 hectares of CEEC Shale Sandstone Transition Forest, and retention of habitat connectivity along the eastern edge of the study area.

PCT 1395 - Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest is a red flag area. As such, the Chief Executive of the Office of Environment and Heritage (OEH) must be satisfied that the viability of the red flag area is low and its contribution to regional biodiversity is low. Evidence to support this has been provided in Section 6.2 and Appendix 2.

It is the intention of the proponents to submit separate BioBanking statement applications for the development of each lot once the Planning Proposal has been approved. The information provided herein will used as part of the assessment of impacts to biodiversity ensuring that cumulative impacts have been adequately considered.

Biodiversity credits

Ecosystem and species credit requirements arising from the proposed development are outlined below.

PC type code	Plant community type name	Red flag	Ecosystem credits required
HN556	Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion	Yes (7.95 ha)	**401**

Scientific name	Common name	Red flag	Species credits required
***Meridolum* corneovirens**	Cumberland Plain Land Snail	No	**37**
Grevillea juniperina subsp. juniperina	Juniper-leaved Grevillea	No	**100**

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:

- On the basis of potential for significant impacts on Shale Sandstone Transition Forest CEEC, the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is likely to be triggered. Referral of the proposed action to the Australian Government Minister for the Environment is recommended as part of future development applications.

- Following the successful rezoning of the study area, approval for clearing of vegetation for access roads and the building envelopes in land zoned E3 - Environmental Management will require approval from Wollondilly Shire Council in accordance with Clause 49 of *the Native Vegetation Regulation 2013* and would be considered as part of future developments for these sites. Consideration has also been given to threatened species, populations or ecological communities in accordance with Section 5A of the *Environmental Planning and Assessment Act 1979* (EP&A Act):
  - Of the 2.69 hectares of land, clearing of one hectare of native vegetation in the form of Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest (equivalent to Shale Sandstone Transition Forest CEEC) will be required, including 0.64 hectares of habitat for Cumberland Plain Land Snail.
  - Clearing for the building envelops and associated construction of infrastructure is not considered to result in a significant impact to threatened species, populations or ecological communities.
- Noxious weeds identified on site must be managed in accordance with the requirements of the *Noxious Weeds Act 1993* (NW Act).

Stage 1 – Biodiversity assessment

1 Introduction

1.1 Project background

Biosis Pty Ltd was commissioned by SitePlus, on behalf of North Silverdale Centre Landowner Group (the proponent), to undertake a biodiversity assessment of 68.09 hectares of privately owned land located along Silverdale Road, North Silverdale (Figure 1). The study area includes the following ten properties located north of Silverdale Township:

- Lot 6 DP1086326
- Lot A DP 161634
- Lot 7 DP 38123
- Lot 2 DP519533
- Lot 199 and 200 DP1092447
- Lot 10 and 11 DP38123
- Lot 121 and 122 DP747833.

The requirement for biodiversity offsets has resulted from mapping of *Shale Sandstone Transition Forest in the Sydney Basin Bioregion* (Shale Sandstone Transition Forest) within the study area as part of the original flora and fauna assessment completed by Biosis in June 2014 (Biosis 2014). This vegetation community is listed as a critically endangered ecological community (CEEC) under the NSW *Threatened Species Conservation Act 1995* (TSC Act) and the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

Under Section 127ZJ of the TSC Act BioBanking is not available for clearing of native vegetation that would otherwise be subject to a development consent granted in accordance with the *Native Vegetation Act 2003* (NV Act). The study area is currently zoned RU2 - Rural Landscape under the *Wollondilly Local Environmental Plan 2011* (Wollondilly Shire Council 2011a) and therefore clearing is subject to approval under the NV Act. Under the proposed future zones (see below) clearing of native vegetation will not be subject to approval under the NV Act.

Following consultation with Biosis, Wollondilly Shire Council, the Department of Planning and Environment (DPE) and Office of Environment and Heritage (OEH) between 2013 and 2016, it was recommended that a BioBanking Assessment of the Planning Proposal be undertaken to ensure the rezoning results in no net loss of biodiversity values and to provide surety to prospective lots buyers that biodiversity values have been adequately considered.

It is the intention of the proponents to submit separate BioBanking statement applications for the development of each lot once the Planning Proposal has been approved. The information provided herein will used as part of the assessment of impacts to biodiversity ensuring that cumulative impacts have been adequately considered.

Each lot would then be responsible for the retirement of credits prior to vegetation removal or construction.

1.2 Planning proposal

The study area is located within the Wollondilly Shire local government area (LGA) and the majority of the study area is currently zoned RU2 - Rural Landscape under the *Wollondilly Local Environmental Plan 2011* (Wollondilly Shire Council 2011a) with the remainder being B1 - Neighbourhood Centre. The North Silverdale Land Owner Group has engaged SitePlus to prepare a planning proposal to rezone 46.10 hectares R2 – Low Density Residential, R3 – Medium Density Residential, B2 – Local Centre and B4 – Mixed Use zones. The residual 21.99 hectares will be rezoned to E3 – Environmental Management and contain eight large residential lots. Access roads and building envelopes will be sited at the boundary to R2 and R3 zones and the remainder of the lot proposed to be a BioBank site, including the recommended asset protraction zones (APZs).

The land proposed to be zoned E3 under the Wollondilly LEP will allow for a dwelling in the western portion of each lot, as well as an area to be retained as a BioBank site to partially offset losses of vegetation and fauna habitat arising from the developable zones outlined above. This area will incorporate Asset Protection Zones (APZs) and will be subject to a separate application/s to establish a BioBanking agreement/s.

The proposed access roads and building envelopes within the E3 zone cover 2.69 hectares and will require clearing of one hectare of native vegetation. Under Section 127ZJ of the TSC Act BioBanking is not available for this clearing as it is subject to a development consent granted in accordance with the *Native Vegetation Act 2003* (NV Act). Therefore, impacts arising from this clearing have been assessed separately under Section 5A of the EP&A Act in Section 8 and Appendix 4 and 5.

The development of lots following the approval of the planning proposal will be completed on a lot-by-lot basis. As such, Biosis has provided a breakdown of the required credits for each Lot and DP.

1.3 Site description

The study area is located within the suburb of Silverdale in Wollondilly Local Government Area (LGA) (Figure 1) and covers approximately 68.09 hectares of privately owned land currently zoned RU2 Rural Landscape and B1 - Neighbourhood Centre. The study area includes all land within the lots outlined above, including land proposed for future development and land proposed for conservation. The development site, which is the subject of this report, includes 46.10 hectares of land proposed for future R2, R3, B2 and B4 zones. A further 2.69 hectares of land, forming access roads and building envelopes within E3 land, has been assessed separately. A breakdown of the study area is provided below.

Table 1 Breakdown of the study area, including development site, land subject to seperate assessment and proposed BioBank site

Assessment areas based on proposed zoning	Total area
Total development site	46.10 ha
Proposed construction footprint	45.16 ha
APZ	0.94 ha
Total E3 Zone	21.99 ha
Land subject to separate assessment (access roads and building envelopes)	2.69 ha
BioBank site (APZ)	4.38 ha

Assessment areas based on proposed zoning	Total area
BioBank site (conservation)	14.92 ha
Total	**68.09 ha**

The majority of the study area has been used for residential, light industrial and agricultural purposes and has been extensively modified. Undisturbed areas, including undisturbed remnant native vegetation, are present within the easternmost sections of the properties. The proposed E3 rezoning for this portion of the site has therefore been designed to protect this remnant vegetation and associated biodiversity values.

The study area is within the:

- Sydney Basin Interim Biogeographic Regionalisation for Australia (IBRA) Bioregion and the Cumberland IBRA subregion.
- Hawkesbury - Nepean River catchment via Scotcheys Creek and the Nepean River.
- Silverdale Slopes and Kurrajong Fault Scarp Mitchell Landscapes.
- Wollondilly LGA.

The study area is situated in between two local native vegetation corridors extending north-south. The corridor to the west consists of vegetation extending from the Warragamba Special Area, along Megarritys Creek, which eventually joins with the Warragamba River approximately 2.5 kilometres north. The corridor to the east extends along the eastern boundary of the study area and provides connectivity from Bents Basin and the Nepean River in the south through to the Blue Mountains National Park in the north.

The study area is located on the outskirts of the Cumberland Plain, in areas where the gently undulating rises associated with the Wianamatta Shales become dissected, eroding into the underlying Hawkesbury Sandstone. The Blacktown soil landscape occurs across the upper western portion of the study area. As the topography slopes to the east, the soil landscape intergrades to Gymea and eventually drops down to the Hawkesbury soil landscape beyond the study area in the east (NSW Soil and Land Information System (SALIS)).

1.4 Information sources

1.4.1 Publications and databases

In order to provide a context for the study area and to further inform threatened species and vegetation assessments within the online BioBanking calculator, 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:

- Department of the Environment and Energy (DEE) 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 1998-2017 (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.
- The NSW Department of Primary Industries (DPI) predicted distribution maps for Fisheries Management Act 1994 (FM Act) listed threatened species and populations.
- NSW Vegetation Information System (VIS): Classification (Version 2.1).
- Other sources of biodiversity information:
  - Flora and fauna assessment of Lot 19 and 20 in DP 1015250, Silverdale Road, Silverdale (Kevin Mills & Associates 2011).
  - North Silverdale: flora and fauna assessment. Report prepared for SitePlus Pty Ltd (Biosis 2014).
  - OEH Vegetation Information System (VIS) Mapping through the Spatial Information eXchange (SIX) Vegetation Map Viewer.
  - Native vegetation of southeast NSW: a revised classification and map for the coast and eastern tablelands (SCIVI) (Tozer et al. 2010).
  - Native Vegetation of the Cumberland Plain, Western Sydney – 1:25 000 Map Series (Map 1). (NPWS 2002).
  - Final determinations and conservation listing advice for threatened biodiversity.

1.4.2 Spatial data

Aerial photography was supplied by NearMap (dated 6 November 2016). Basemap data was obtained from NSW Land and Property Information (LPI) 1:25,000 digital topographic databases (DTDB), with cadastral data obtained from LPI digital cadastral database (DCDB). Mapping of stream order was undertaken using tools within ArcGIS based the Hydroline layer available within the DTDB.

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

- Catchment data was obtained from the Catchment Boundaries of New South Wales dataset.
- Interim Biogeographic Regionalisation of Australia Version 7.
- Spatial data associated with Tozer et al. (2010) and NPWS (2002) vegetation mapping.
- Mitchell Landscapes Version 3.0.
- NSW Soil and Land Information System (SALIS).
- Directory of Important Wetlands (DIWA).
- State Environmental Planning Policy (SEPP) 14 Wetlands.

Site plans were supplied by SitePlus (drawing file issue A; dwg no. P04/05) on 6 February 2017.

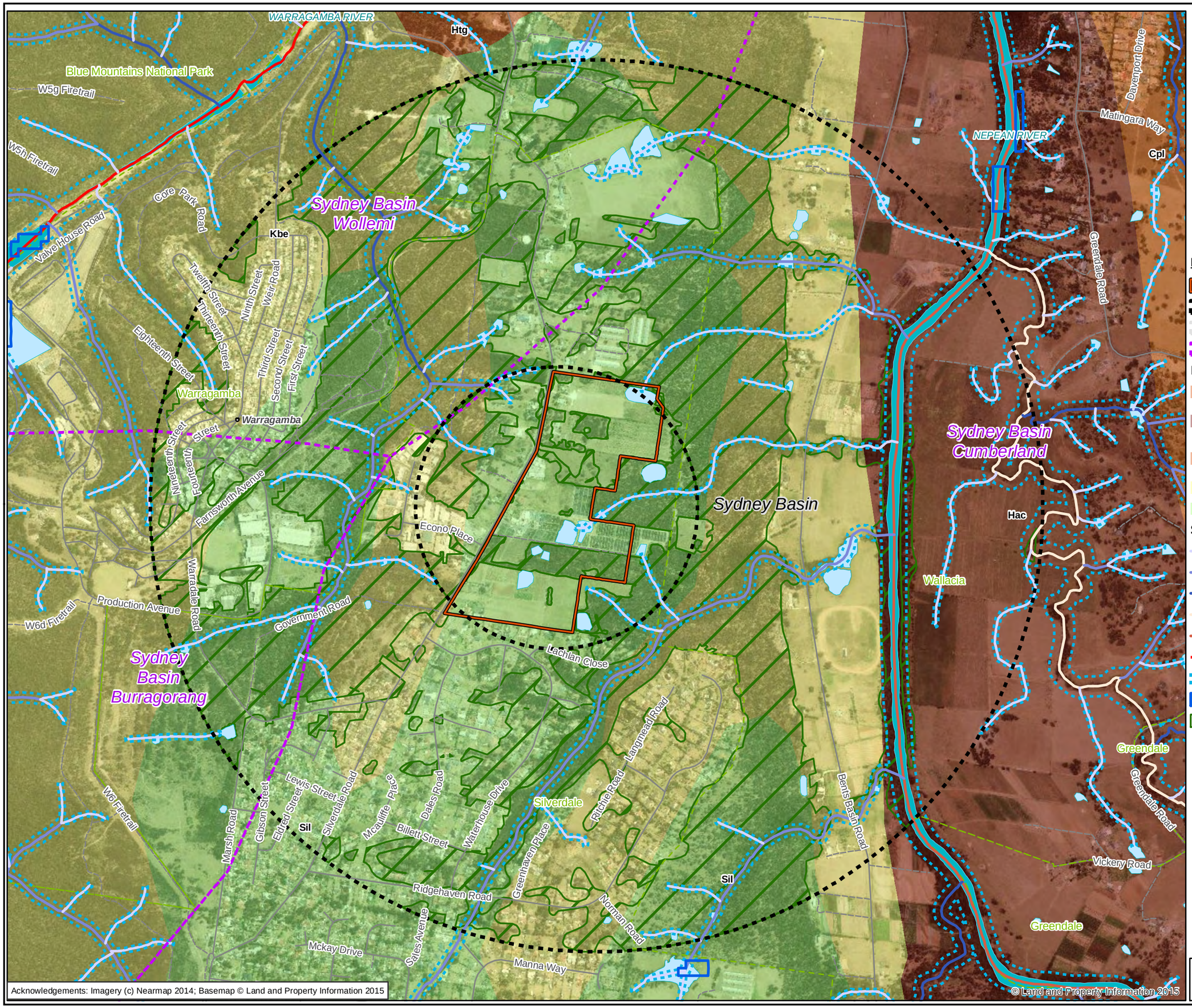
Mapping in the field was conducted using hand-held (uncorrected) GPS units (GDA94), mobile tablet computers running Collector for ArcGIS™ and aerial photo interpretation. The accuracy of this mapping is therefore subject to the accuracy of the GPS units (generally ± 7 metres) and dependent on the limitations of aerial photo rectification and registration.

Mapping has been produced using a Geographic Information System (GIS). Electronic GIS files containing the relevant flora and fauna spatial data are available for provision to the client. However, this mapping may not be sufficiently precise for detailed design purposes.

1.5 Additional legislative requirements

The project has been assessed against key biodiversity legislation and government policy, including:

- *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)
- *Environmental Planning and Assessment Act 1979* (EP&A Act)
- *Threatened Species Conservation Act 1995* (TSC Act)
- *Fisheries Management Act 1994* (FM Act)
- *Water Management Act 2000* (WM Act)
- *Native Vegetation Act 2003* (NV Act)
- *Noxious Weeds Act 1993* (NW Act)
- Wollondilly Local Environment Plan 2011.



Legend

- Development site
- Assessment circles
- IBRA bioregion
- IBRA Sub-region

MItchell landscape v3

- Cpl, Cumberland Plain
- Hac, Hawkesbury - Nepean Channels and Floodplains
- Htg, Hawkesbury - Nepean Terrace Gravels
- Kbe, Kurrajong Fault Scarp
- Sil, Silverdale Slopes

Streams

- 1st Order
- 2nd Order
- 3rd Order
- 5th Order
- 7th Order
- 9th Order
- Stream buffers
- Local wetlands
- Native Vegetation extent

Figure 1: Location map for the North Silverdale project, NSW

0 140 280 420 560 700

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

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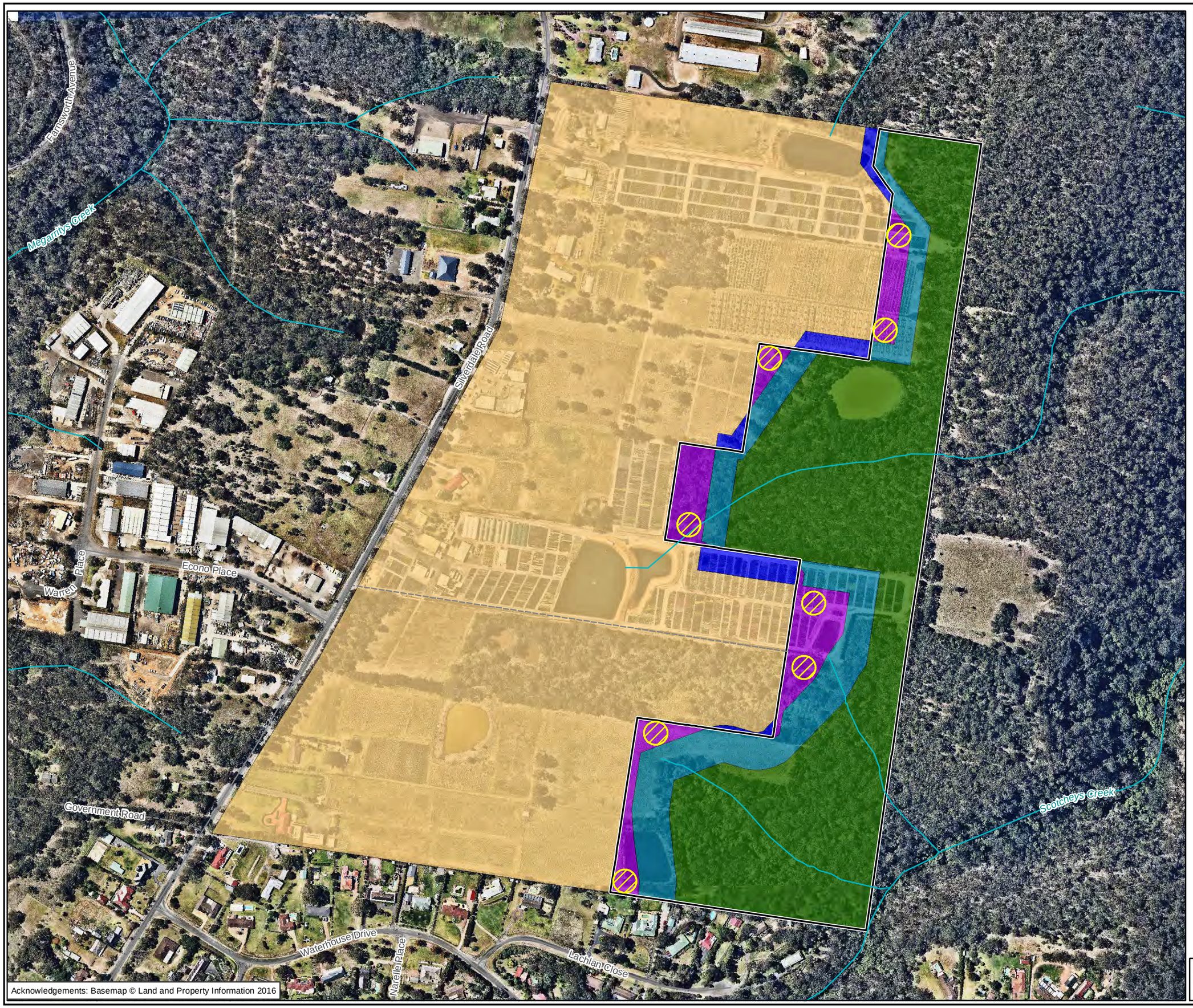

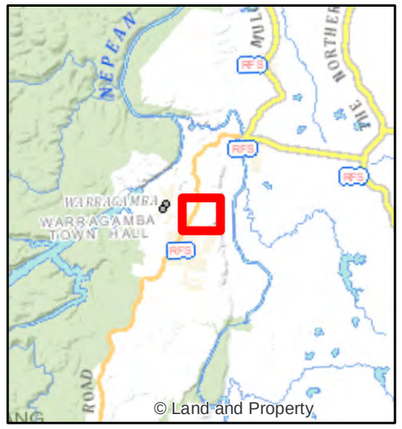

Legend

- Development area
- Development area, APZ
- E3
- E3, APZ
- E3, Separate assessment
- Residential footprint
- E3 zone

Figure 2: Site map

0 40 80 120 160 200

Metres
Scale: 1:4,500 @ A3
Coordinate System: GDA 1994 MGA Zone 56

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Biosis Pty Ltd

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

Acknowledgements: Basemap © Land and Property Information 2016

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2 Biodiversity legislation and government policy

This section provides an overview of key biodiversity legislation and government policy against which the project has been assessed. 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 ecological communities and species protected by the EPBC Act are outlined in Section 4.3 and 5 respectively. 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 DPE.

The EP&A Act provides the overarching structure for planning in NSW and is supported by other statutory environmental planning instruments. Sections of the EP&A Act of primary relevance to the natural environment are outlined further below.

Assessment of Significance (Section 5A)

Section 5A of the EP&A Act is an integral part of environmental impact assessment and requires proponents and consent authorities to consider if a development will have a significant effect on threatened species, populations or communities listed under the TSC Act and FM Act. The objective of the Assessment of Significance (AoS) (formally known as the "7-part test") is to improve the standard of, and make transparent, the considerations given to threatened species, populations and ecological communities, and their habitats, and Section 5A (and Section 94 of the TSC Act and Section 220ZZ of the FM Act). The AoS outlines seven factors that must be taken into account. Typically, where any AoS determines that a development will result in a significant effect to a threatened species, population or community, a Species Impact Statement (SIS) is required.

The proposed residential subdivision(s) will result in clearing of Shale Sandstone Transition Forest CEEC. Due to the degree of impact to this CEEC an SIS would likely be required under the typical Part 4 assessment pathway. BioBanking offers an alternative to a SIS. Thus, impacts to biodiversity have been assessed in accordance with the NSW BioBanking Assessment Methodology (BBAM; OEH 2014) under Part 7A of the TSC Act (see below) with the intent of obtaining a BioBanking statement. If issued, the development is deemed to not result in a significant effect on any threatened species, population or ecological community under the TSC Act. AoSs are not required for impacts to threatened species, populations and communities arising from the residential subdivision.

A total of 2.69 hectares of the E3 – Environmental Management zone will be set aside to allow for access roads, the building envelopes and associated clearing for the proposed eight large lots. As this land is not eligible for BioBanking in accordance with Section 127ZJ of the TSC Act and the works are inconsistent with the objectives of a BioBanking agreement, consideration has been made to threatened species, populations and endangered ecological communities in Section 4.3.4, and AoSs have been completed in Appendix 4.

Sections of the EP&A Act of primary relevance to the natural environment are considered further below in relation to the current proposal.

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. 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 in councils listed in Schedule 1 to the SEPP.

The study area is located within the Wollondilly LGA, a Schedule 1 listed Council. Therefore SEPP No. 44 is relevant to the current assessment and the methodology and results of the Koala assessment is discussed further in Section 5 and Appendix 3.

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 Wollondilly LEP and is currently zoned RU2 Rural Landscape. Given the restrictions of the TSC Act and BioBanking Regulation, the current BioBanking assessment is proposed to align with the future zoning of the Planning Proposal for the study area. The following zones are proposed:

- R2 Low Density Residential – approximately 16.38 hectares is proposed to be rezoned to R2 which encourages detached housing.
- R3 Medium Density Residential – approximately 8.77 hectares is proposed to be rezoned to R3 which encourages terraces, units, small scale residential flat buildings and other forms of medium density development.
- B2 Local Centre – approximately 3.02 hectares is proposed to be rezoned to B2 which encompasses the existing B1 Neighbourhood Centre zoning of the Silverdale Shopping Centre and further encourages local services within a larger centre to facilitate the surrounding growth of the area.
- B4 Mixed Use – approximately 2.88 hectares is proposed to be rezoned to B4 which allows for both commercial and residential development.

A portion of the study area will be rezoned E3 - Environmental Management. Whilst some, minimal development will occur in this area to allow for one dwelling per lot and the associated APZs, the majority will be retained within the proposed BioBank site, allowing for the protection and management of ecological values therein.

Further consideration of 'sensitive land' mapped on the *Natural Resources – Biodiversity Map* and *Natural Resources – Water Map* under the WLEP 2011 is provided in Section 8.2.1.

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.

Biodiversity Banking and Offsets Scheme

Part 7A of the TSC Act establishes the Biodiversity Banking and Offsets Scheme, which enables the establishment of biodiversity banking sites, the creation and trading of biodiversity credits and the use of credits to offset development otherwise impacting on biodiversity values. Development for which a BioBanking statement is issued is taken to be development that is not likely to significantly affect any threatened species, population or ecological community under this Act, or its habitat.

This assessment seeks the issuing of a BioBanking statement for this development under Part 7A of the TSC Act. If issued, the development is deemed to not result in a significant effect on any threatened species, population or ecological community under the TSC Act. As such, the assessment of threatened species listed under the TSC Act through an AoS is not required for the residential subdivision areas located within the development site that have been assessed in accordance with the BBAM (OEH 2014).

Under Section 127ZJ of the TSC Act BioBanking is not available given the current zones (see Section 1.1) It is the intention of the proponents to submit separate BioBanking statement applications for the development of each lot once the Planning Proposal has been approved.

AoSs will be prepared for impacts arising from proposed E3 access roads and building envelopes outlined over the page.

Assessment of Significance (Section 5A)

Section 5A of the EP&A Act requires proponents and consent authorities to consider if a development will have a significant effect on threatened species, populations or communities listed under the TSC Act and FM Act. Section 5A (and Section 94 of the TSC Act) outlines seven factors that must be taken into account in an Assessment of Significance (formally known as the "7-part test"). Where any Assessment of Significance (AoS) determines that a development will result in a significant effect to a threatened species, population or community an SIS is required.

Threatened biota that may be impacted by the removal of native vegetation as a result of the proposed access roads and building envelopes located within in the E3 zone have been further assessed in Section 4.3.4 and Appendix 4. These areas have been excluded from the BioBanking assessment in accordance with Clause 11 of the BioBanking Regulation and Section 127ZJ of the TSC Act.

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).

Two key objectives of the FM Act are to; conserve fish stocks and key fish habitats, and conserve threatened species, populations and ecological communities of fish and marine vegetation. When reviewing applications Department of Primary Industries (DPI) will assess the likelihoods of impacts to waterways in relation to their sensitivity (TYPE) and waterway class (CLASS).

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 and has not been discussed further.

2.2.4 Water Management Act 2000

The *Water Management Act 2000* (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.

Certain works within 40 metres of the top bank of a waterway require a controlled activity approval under the WM Act. The WM Act is supported by a series of interpretation guidelines including *Controlled activities on waterfront land - guidelines for riparian corridors on waterfront land* (NSW Office of Water, 2012). This guideline defines a riparian management envelope referred to as the vegetated riparian zone (VRZ). The width of the VRZ within a riparian corridor has been pre-determined and standardised for first, second, third and fourth order and greater watercourses according to the Strahler System of ordering watercourses and is measured from the top of the highest bank on both sides of the watercourse. This guideline also presents the riparian corridor matrix that assists applicants for controlled activity approvals to identify certain works and activities that can occur on waterfront land and in riparian corridors. The guideline also includes overarching management measures for works on waterfront land.

An assessment of whether a Controlled Activity Approval from DPI Water is required under the WM Act is provided in Section 8.4.

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. In areas subject to 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 Local Land Services (LLS).

The development site is proposed to be rezoned to R2 Low Density Residential, R3 Medium Density Residential, B2 Local Centre and B4 Mixed Use. These zones are not subject to the NV Act. Clearing within the proposed E3 zone will be subject to the NV Act.

An assessment of whether approval is required under the NV Act is provided in Section 8.5.

2.2.6 Noxious Weeds Act 1993

The NW Act was enacted to provide for the identification, classification and control of noxious weeds. Plants 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 8.6.

3 Landscape

3.1 Bioregions and landscapes regions

The study area occurs within the Sydney Basin IBRA bioregion and the Cumberland IBRA subregion. The Cumberland IBRA subregion covers the entire development site and is the subregion used in this assessment. While the majority of the inner assessment circle is located within this subregion, the outer assessment also spans the Wollemi (north-west) and Burragorang (south-west) IBRA subregions (Figure 1).

The study area spans two Mitchell Landscapes. The Silverdale Slopes Mitchell Landscape occurs across the majority of the site with a small slither of the Kurrajong Fault Scarp Mitchell Landscape occurring in the south-western corner. Silverdale Slopes is therefore the Mitchell Landscape used in this assessment. Both of these Mitchell Landscapes also occur in the inner assessment circle. One additional Mitchell Landscape, Hawkesbury - Nepean Channels and Floodplains, occurs along the eastern boundary of the outer assessment circle, along the Nepean River (Figure 1).

3.2 Waterways and wetlands

The development site is located within the Hawkesbury-Nepean River catchment, one of the largest coastal basins in NSW. The catchment includes the coastal reaches from Turimetta Headland to Barrenjoey near its mouth, and captures an area of 21,400 square kilometres (NOW 2015).

The development site drains into two first order streams running toward the Nepean River, approximately one kilometre to the east (Figure 1). These streams form in the study area, starting as dams used for agricultural purposes. The two southern streams run south-east through the adjoining proposed BioBank site and directly into the Nepean River. A stream located in the middle of the development site runs north-east into the Nepean River. The northern stream runs north, then west to a second order tributary before reaching the Nepean River. The upper reaches of three streams will be partially impacted by the proposed development following the successful rezoning of the study area.

No SEPP No. 14 wetlands or Directory of Important Wetlands (DIWA) listed wetlands were located within the study area or outer assessment circle.

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 capture the study area. The assessment circles were both placed on the centre of the proposed development site, encompassing the area of greatest change.

Mapping of vegetation within the outer assessment circle was undertaken using a combination of NPWS (2002) and Tozer et al. (2010) vegetation mapping data. A review of both datasets across the outer assessment circle reveals that there are large areas of native vegetation to the south and south-west of the study area that have not been mapped by Tozer et al. (2010) yet appear to contain vegetation based on aerial photo interpretation and when compared to the NPWS (2002) mapping. The NPWS (2002) dataset however contains large areas mapped as Unclassified Vegetation.

Due to the gaps within the two datasets, both were combined and reviewed against recent aerial photography to provide the most accurate extent of vegetation within the outer assessment circle (Figure 3).

The combined dataset maps 467.31 hectares of native vegetation within the outer assessment circle, with a native vegetation cover of 47 per cent 'before development'. There is 40.81 hectares of native vegetation within the inner assessment circle, with a native vegetation cover of 41 per cent 'before development'.

3.4 Assessment of landscape value

Landscape value has been calculated using the method for site-based developments, outlined in Appendix 4 of the BBAM.

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 using the methodology outlined in Section 3.3.

To determine the extent of native vegetation cover after development, the extent of vegetation required for removal (10.29 hectares) was subtracted from the extent of native vegetation cover before development.

Table 2 provides a summary of the extent of native vegetation cover within the inner and outer assessments circles, before and after development.

Table 2 Extent of native vegetation cover before and after development.

Assessment circle	Before Development		After development	
	Area (ha)	% range	Area (ha)	% range
Outer assessment circle	467.31	46-50	**456.76**	**41-45**
Inner assessment circle	40.89	41-45	**30.34**	**26-30**

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 development site was assessed as being part of two connective links, with native vegetation to the east of the study area providing connectivity with native vegetation that extends to the west of the study area via narrow links through the proposed development site (Figure 3). The development site does not contain a connective link running north-south due to the level of disturbance associated with horticultural practices operating within the site.

Both links will be severed following development. The southern connective link was deemed to be the most limited, with a minimum linkage width of about 17 metres prior to development. This linkage width will be

affected by the proposed development reducing the connectivity width category before development from >5 metres - 30 metres down to 0-5 metres. Therefore one linkage width threshold will be crossed as a result of the development.

Overstorey condition for the inner and outer assessments circles was assessed based on aerial photo interpretation and assessments undertaken in the local area. Overstorey vegetation within the assessed connective link is largely intact. Percentage Foliage Cover (PFC) was assessed as being at benchmark condition on average. Due to the small portion of this link occurring within the development footprint, PFC is unlikely to change across the link following development.

Midstorey/groundcover condition was assessed based on a rapid assessment of vegetation within the locality, with vegetation reviewed from roadsides. Midstorey/groundcover vegetation to the west of the study area contains weeds and varying levels of disturbance associated with residential, industrial and agricultural clearing. Areas to the east however are largely intact, with a moderate to high diversity in most areas. Across the link, the average PFC for mid-storey and ground cover vegetation is considered to be >50% of the lower benchmark. Again, no change to midstorey/groundcover condition of the link will result from the proposed development.

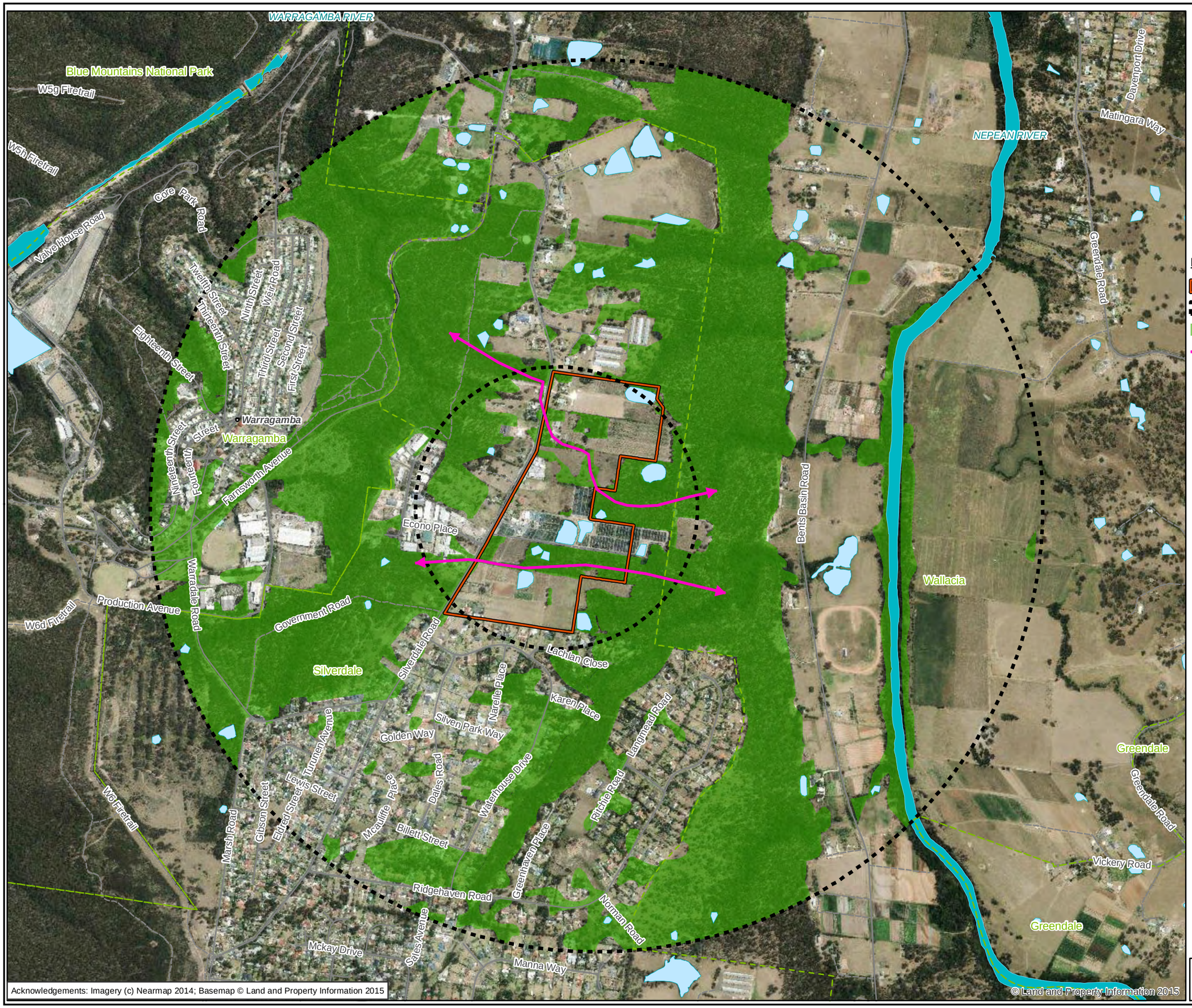
The proposed development will not result in any change in linkage condition classes.

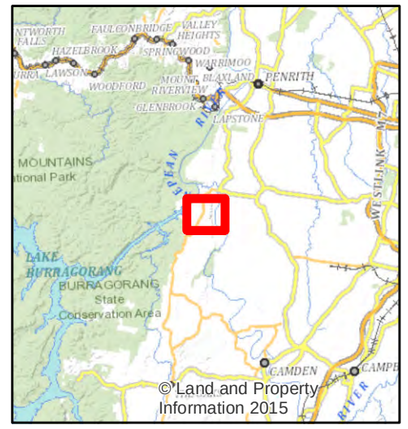
3.4.3 Assessment of patch size

Patch size was assessed by calculation of total areas of connecting patches using a Geographic Information System (GIS). 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 the edge of a large patch of vegetation along the north-south corridor to the east of the study area. This patch extends north into the Warragamba Special Area, Burragorang State Conservation Area and Blue Mountains National Park and south to Bents Basin and the Nepean River. The study area was assessed as having a patch size of more than 1000 hectares.

The Silverdale Slopes Mitchell Landscape is estimated to be 41 per cent cleared. A patch size of greater than 200 hectares is deemed to be 'Extra Large' for Mitchell Landscapes with a percent native vegetation cleared of 30 to 70 per cent.

The study area fits into the 'Extra Large' patch size class.





Legend

- Development site
- Assessment circles
- Native Vegetation extent
- Connective link

Acknowledgements: Imagery (c) Nearmap 2014; Basemap © Land and Property Information 2015

Figure 3: Vegetation within the outer assessment circle (NPWS 2002; Tozer 2010; API), including connective links

0 140 280 420 560 700

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

N

Biosis Pty Ltd

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

Matter:
Date: 13 March 2017,
Checked by: , Drawn by: , Last edited by: apritchard
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4 Native vegetation

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

4.1 Background review

A review of regional vegetation mapping by NPWS (2002) and Tozer (2010) was undertaken to inform the site investigation. The NPWS (2002) mapping identifies a patch of Shale Sandstone Transition Forest through the central area of the development site. Areas of vegetation in the eastern portion of the study area however are mapped as Unclassified Vegetation with a small section of Western Sandstone Gully Forest (NPWS 2002). While the Tozer (2010) mapping has been undertaken at a larger scale resulting in low resolution compared to other available resources, the polygons provided for the study area were more reflective of likely vegetation types. The upper slopes through the centre of the study area are mapped as Shale Sandstone Transition Forest and the lower slopes, forming part of the proposed BioBank site, are mapped as Sydney Hinterland Transition Woodland and Hinterland Sandstone Gully Forest (Tozer 2010).

Detailed mapping of vegetation within the study area was undertaken for this assessment and in accordance with the OEH Plant Community Types (PCTs; Figure 4). The methodology is outlined in Section 4.2 and results presented in Section 4.3.

4.2 Methods

An initial assessment of a portion of the study area was undertaken by Kevin Mills & Associates (2011) who provided preliminary ecological advice to inform a Planning Proposal. The assessment identified that the eastern portion of the study area was likely to contain species of ecological significance (Kevin Mills & Associates 2011). A flora and fauna assessment was the completed by Biosis (2014) to confirm the findings of the previously completed assessment (Kevin Mills & Associates 2011) and to collect sufficient field survey data in accordance with the previous version of the BBAM (DECC 2009). Due to the changes in the BBAM; and following feedback from DPE, OEH and Wollondilly Shire Council regarding the initial Planning proposal; Biosis has undertaken additional assessment in accordance with the current BBAM (OEH 2014).

Detailed mapping of vegetation communities was undertaken on 28 and 29 November 2016 using hand-held (uncorrected) tablet units (Samsung Galaxy Tab 3) using the ArcGIS Collector application and aerial photo interpretation. Mapping of point data or tracks was conducted using hand-held (uncorrected) GPS units (GDA94) and aerial photo interpretation. The accuracy of this mapping is therefore subject to the accuracy of the GPS units (generally ± 5 metres) and dependent on the limitations of aerial photo rectification and registration. Mapping has been produced using a GIS.

Identification of vegetation communities within the study area was confirmed with reference to the community profile descriptors (and diagnostic species tests) held within the Tozer (2010) and NPWS (2002) mapping projects.

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. PCTs were identified using the NSW Vegetation Information System (VIS): Classification Version 2.1. PCTs were stratified into Vegetation Zones based on condition (low or moderate/good) and ancillary code.

Following stratification of Vegetation Zones, site value was assessed using plot and transect survey data, as per the methodology outlined in Section 5 of the BBAM. Plots and transect data was collected from the study area on 30 November and 1 December 2016 and transect surveys included:

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

The minimum number of plots/transects per Vegetation Zone was determined using Table 3 of the BBAM. A total of nine plots/transects were completed within the proposed development site (Figure 4).

A list of flora species was compiled for each vegetation type. Records of all flora species will be submitted to OEH for incorporation into the Atlas of NSW Wildlife.

4.3 Results

4.3.1 Vegetation description

The development site supports 10.29 hectares of native vegetation, with varying level of disturbance dependent on location within the study area (Figure 4). Vegetation within the proposed development site is highly modified and has been maintained through land management practices including vegetation clearing, ongoing slashing, dumping of soil and horticultural debris and the thinning of understorey.

This native vegetation includes 0.77 hectares of low condition vegetation, characterised by particularly heavy weed infestations and historical clearing. The vegetation is therefore characterised by a canopy of mature and semi-mature native trees over an understorey of native and exotic herbs and grasses.

Several areas were also determined to be in a derived form, lacking the midstorey or canopy species typical of remnant vegetation. This derived vegetation, in the form of a shrubland and a grassland, was mapped across the study area. These communities are interspersed with areas of low and moderate/good vegetation and consist of areas dominated by monocultures of native grasses or shrubs. It was determined that the derived communities of the study area are a simplified form of the Shale Sandstone Transition Forest CEEC.

Very few hollow-bearing trees were identified during the field investigation.

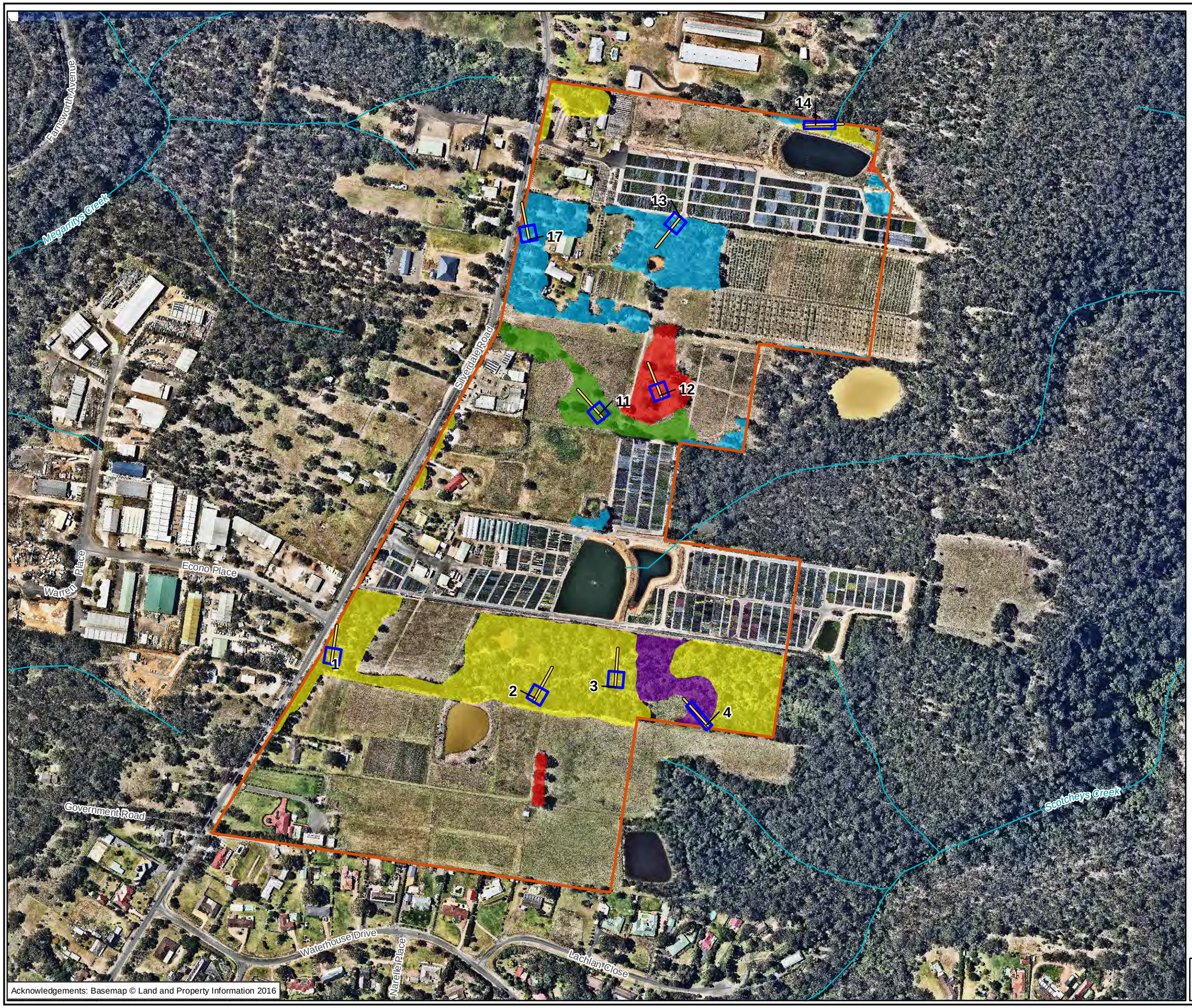
4.3.2 Plant community types

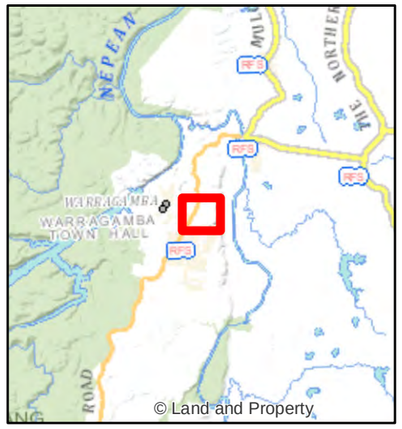
Site investigations, including determination of PCTs using the methodology outlined in Section 4.2 above, confirmed the presence of *1395 - Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin (HN556),* equating to Shale Sandstone Transition Forest CEEC, in patches across the middle of the study area (Figure 4). The corresponding Tozer (2010) name, TSC Act final determination, PCT, BioMetric vegetation type, vegetation formation and vegetation class (Keith 2004) is provided in Table 3 below.

Table 3 Summary of vegetation naming conventions for Shale Sndstone Transition Forest

Naming convention	Corresponding vegetation name/code
Vegetation community (Tozer et al. 2010)	Cumberland Shale Sandstone Transition Forest (GW p2)
TSC Act final determination	*Shale Sandstone Transition Forest Sydney Basin Bioregion Critically Endangered Ecological Community* (Shale Sandstone. Transition Forest CEEC)
PCT	Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest

Naming convention	Corresponding vegetation name/code
	of the edges of the Cumberland Plain, Sydney Basin
PCT code	1395
BioMetric vegetation type	HN556
Vegetation formation (Keith 2004)	Dry Sclerophyll Forests (Shrub/grass subformation)
Vegetation class (Keith 2004)	Cumberland Dry Sclerophyll Forests





Legend

- Development site
- Quadrat
- Transect

Vegetation communities (Biosis 2016)

1395 – Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest (HN556)

- Low, Poor
- Moderate/good, Derived grassland
- Moderate/good, Derived shrubland
- Moderate/good, Medium
- Moderate/good, Poor

Figure 4: Biosis mapped native vegetation within the development site including plot/transect locations

0 40 80 120 160 200

Metres
Scale: 1:4,500 @ A3
Coordinate System: GDA 1994 MGA Zone 56

N

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

Matter: 22832
Date: 26 April 2017
Checked by: KJR, Drawn by: ANP, Last edited by: apritchard
Location: P:\22800s\22832\Mapping\Report Figures - Development Site\22832_BBDS_F4_BiosisVegetation_20170226

Acknowledgements: Basemap © Land and Property Information 2016

The vegetation of the study area was assessed as being in both moderate/good and low condition classes. The moderate/good condition was also split into four ancillary codes in accordance with the BBAM. This resulted in a total of five vegetation zones across the study area (Table 4 and Figure 5).

Table 4 Vegetation zones mapped within the study area.

Vegetation zone	Plant Community Type	Condition	Ancillary code	Area (ha)
1	1395 - Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin (HN556)	Low	Poor	0.77
2	1395 - Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin (HN556)	Moderate/ Good	Derived grassland	0.92
3	1395 - Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin (HN556)	Moderate/ Good	Other (derived shrubland)	0.65
4	1395 - Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin (HN556)	Moderate/ Good	Poor	5.33
5	1395 - Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin (HN556)	Moderate/ Good	Medium	2.62
Total				**10.29**

A detailed description of each vegetation zone is provided in Table 5 below.

Table 5 Plant community type description

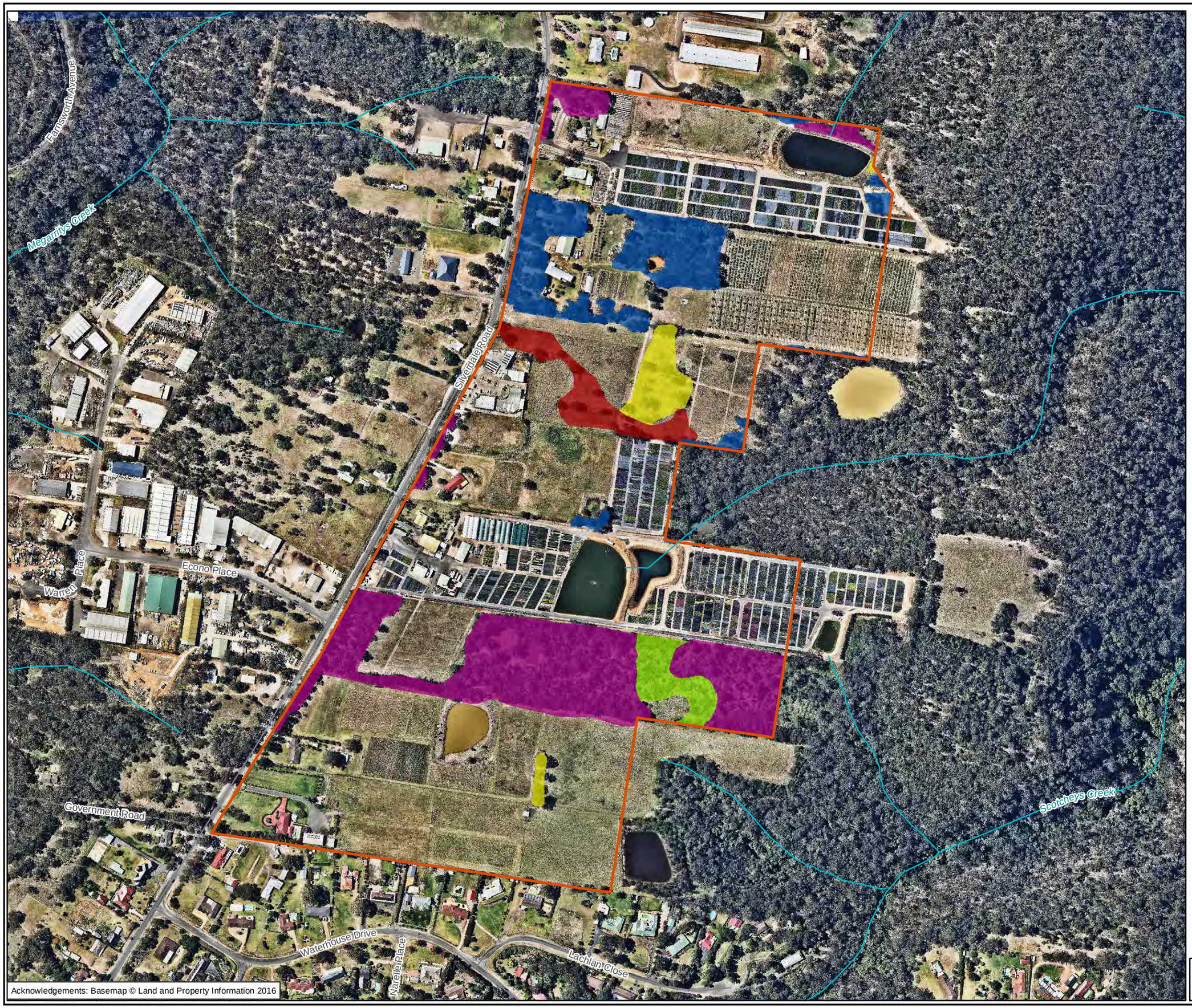
1395 – Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin (HN556)	
Common name	Shale Sandstone Transition Forest
Condition	Low – 0.77 ha Moderate/good – 9.52 ha
Ancillary codes/vegetation zones (Figure 5)	Vegetation zone 1 – Low, poor (0.77 ha) This vegetation zone supports characteristic tree cover less than 25% below benchmark levels within a groundcover than contains less than 50% native species cover.
	Vegetation zone 2 – Moderate/good, derived grassland (0.92 ha) This vegetation zone supports characteristic tree cover less than 25% below benchmark levels within a groundcover than contains greater than 50% characteristic native species cover.
	Vegetation zone 3 – Moderate/good, other (0.65 ha) This vegetation zone supports characteristic tree cover less than 25% below benchmark levels, a canopy up to 5m contains characteristic shrubs/ small trees, and a low diversity groundcover that contains greater than 50% characteristic native species cover. Areas of this vegetation were also dominated by woody exotic shrubs.
	Vegetation zone 4 – Moderate/good, poor (5.33 ha)

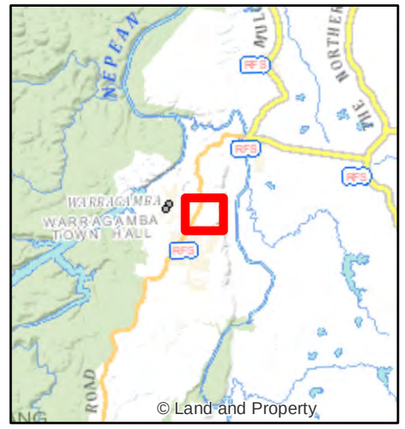
1395 – Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin (HN556)	
	This vegetation zone supports characteristic tree cover greater than 25% of benchmark levels, occasional characteristic midstorey species with areas up to 40% dominated by exotic cover monocultures (Lantana) and a low diversity groundcover that contains greater than 50% characteristic native species cover. It is a simplified form of 1395 - Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest that has been previously cleared and now contains evidence of simplified regeneration.
	Vegetation zone 5 – Moderate/good, medium (2.62 ha) This vegetation zone supports canopy species within benchmark, occasional midstorey species and a diversity of groundcover species characteristic of 1395 - Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest. It vegetation zone containing the best condition 1395 - Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest within the development site.
Total extent within study area	10.29 ha
Description	1395 - Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest occurs across the study area in remnant patches. The most commonly recorded canopy species are Narrow-leaved Ironbark *Eucalyptus crebra,* Grey Gum *Eucalyptus punctata,* and White Stringybark *Eucalyptus globoidea,* while Fine-leaved Stringybark *Eucalyptus eugenoides* occurs sporadically as sandstone influence increases. Taller mid-storey species were sparse within areas containing canopy, or dominant in derived communities (ancillary code Other). Green Wattle *Acacia decurrens* is most common, with Sydney Green Wattle *Acacia parramattensis,* and Hickory Wattle *Acacia implexa* less commonly. Black She-oak *Allocasuarina littoralis* was also scattered within this vegetation type. For the most part, areas with canopy and lacking Lantana thickets, supported a very sparse shrub cover up to 2m of Tick Bush *Kunzea ambigua* and Blackthorn *Bursaria spinosa.* Where in medium condition, this vegetation type supports an open grassy native groundcover with herbs and ferns that tend to occur within both shale and sandstone derived soils. Low shrubs and herbs most commonly recorded include Rough Guinea Flower *Hibbertia aspera*, *Poranthera microphylla,* Blue Trumpet *Brunioniella australis, Calotis dentex,* Kidney Weed *Dichondra repens*, Whiteroot *Pratia purpurascens* and Netted Shaggy Pea *Podolobium scandens.* Grasses, sedges and ferns recorded within the groundcover included Kangaroo Grass *Themeda australis*, Weeping Grass *Microlaena stipoides*, Shorthair Plumegrass *Dichelachne micrantha, Rytidosperma tenuius,* Wiry Panic *Entolasia stricta*, Three-awn Speargrass *Aristida vagans*, Many-flowered Mat-rush *Lomandra multiflora*, and Rock Fern *Cheilanthes sieberi. Austrostipa pubescens* is also present occasionally.
Survey effort	A total of nine (9) plots/transects were completed in this PCT (Figure 4) located in the following vegetation zones: • Vegetation Zone 1 (0.77 ha) – 1 • Vegetation Zone 2 (0.92 ha) – 1 • Vegetation Zone 3 (0.65 ha) – 1 • Vegetation Zone 4 (5.33 ha) – 4 • Vegetation Zone 5 (2.62 ha) – 2
Disturbance	Clearing modification, cultivation and nursery operations within the development site, associated with the past and present land use, has resulted in a patchy extant canopy within this PCT. Disturbances include slashing, invasion by exotic plant cover and fire wood collection; areas of medium condition have only minor levels of these impacts. African Love Grass *Eragrostis curvula* and Lantana were dominant in areas of Poor condition.

1395 – Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin (HN556)	
Species relied upon for identification of vegetation type and relative abundance	Vegetation was mapped as 1395 - Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest when the canopy was dominated by Narrow-leaved Ironbark in co-occurrence with Grey Gum and White Stringbark. Commonly occurring midstorey and groundcover shrubs included the presence of Blackthorn and Rough Guinea Flower, while Black She-Oak was locally abundant at times. Groundcover species that were commonly found within these vegetation types included Three-awn Grass, Kangaroo Grass, Rock Fern, Kidney Weed, Weeping Grass and Many-flowered Mat-rush.
Justification of evidence used to identify a PCT	The landscape position (in areas of outcropping shale lenses), underlying soils (including podozolic soils) and geographic position (at the edge of the Cumberland Plain) are consistent with the vegetation description within Tozer et al. (2010), NSW Scientific Committee (2014) and the Threatened Species Scientific Committee (2014). Floristic data obtained from plots was used to confirm the vegetation community identification, using the methodology outlined in Appendix 3 of Tozer et al (2010), NSW Scientific Committee (2014) and Threatened Species Scientific Committee (2014).
EEC Status	NSW TSC Act: 10.29 ha of TSC Act listed CEEC is located within the development site. Commonwealth EPBC Act: A total of 9.52 ha of EPBC Act listed CEEC is located within the development site. All vegetation within the development site forms as a single patch in accordance with the *Approved Conservation Advice (including listing advice) for Shale Sandstone Transition Forest of the Sydney Basin Bioregion* (Commonwealth of Australia 2014). Vegetation zone 1 does not meet the moderate condition class for the EPBC Act listed community as summarised below: • Vegetation Zone 1 (0.77 ha) – 13% (not consistent with the EPBC Act community) • Vegetation Zone 2 (0.92 ha) – 77% (high condition EPBC Act community in a derived form) • Vegetation Zone 3 (0.65 ha) – 65% (moderate condition EPBC Act community in a derived form) • Vegetation Zone 4 (5.33 ha) – 54% (moderate condition EPBC Act community) • Vegetation Zone 5 (2.62 ha) – 99% (high condition EPBC Act community)
Estimate of percent cleared value of PCT	80%
Plate 1 Vegetation zone 1 – PCT 1395 Low, poor (plot/transect 12)	

1395 – Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin (HN556)	
Plate 2 Vegetation zone 2 – PCT 1395 Moderate/good, derived (plot/transect 11)	
Plate 3 Vegetation zone 3 – PCT 1395 Moderate/good, other (Quadrat 4)	

1395 – Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin (HN556)	
Plate 4 Vegetation zone 4 – PCT 1395 Moderate/good, poor (Quadrat 1)	
Plate 5 Vegetation zone 5 – PCT 1395 Moderate/good, medium (Quadrat 13)	





Legend

Development site

Vegetation zone

- VZ1
- VZ2
- VZ3
- VZ4
- VZ5

Figure 5: Location of vegetation zones within the development site

0 40 80 120 160 200

Metres
Scale: 1:4,500 @ A3
Coordinate System: GDA 1994 MGA Zone 56

N

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Location:P:\22800s\22832\Mapping\Report Figures - Development Site\22832_BBDS_F5_VegetationZones_20170226

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4.3.3 Site value scores

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 2. Current site value for each vegetation zone is outlined in Table 6.

Table 6 Site value scores for all vegetation zones

Vegetation zone	Plant Community Type	Area (ha)	Score
1	1395 - Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin (HN556)	0.77	13.04
2	1395 - Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin (HN556)	0.92	21.01
3	1395 - Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin (HN556)	0.65	24.64
4	1395 - Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin (HN556)	5.33	50.72
5	1395 - Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin (HN556)	2.62	61.11

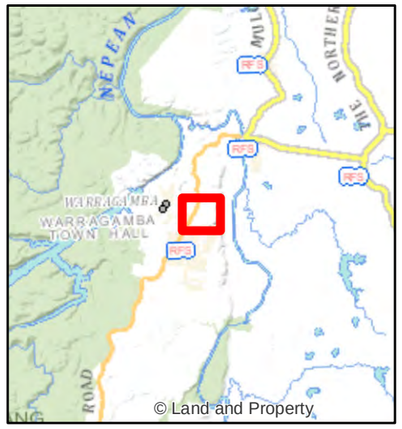
4.3.4 Native vegetation of the E3 zone proposed access roads and building envelopes

A total of one hectare of 1395 - Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest occurs within the 2.69 hectare area proposed to contain access roads and building envelops within the E3 zone (Figure 6). This vegetation corresponds to the Shale Sandstone Transition Forest CEEC listed under both the TSC Act and the EPBC Act.

Vegetation within this area comprises the following condition classes:

- Moderate/good, derived shrubland = 0.01 hectares.
- Moderate/good, poor = 0.34 hectares.
- Moderate/good, medium = 0.65 hectares.

It is expected that the future owners of each lot will be required to assess impacts to threatened species, populations and ecological communities in accordance with Section 5A of the EP&A Act. To provide surety to prospective buyers, an AoS has been provided in Appendix 5 which provides an assessment of the cumulative loss of one hectare of vegetation within this area.



Legend

- Separate assessment area

Vegetation communities (Biosis 2016)

1395 – Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest (HN556)

- Moderate/good, Derived shrubland
- Moderate/good, Medium
- Moderate/good, Poor

Figure 6 Native vegetation of the separate assessment area (building envelops located within E3 zone)

0 40 80 120 160 200

Metres
Scale: 1:4,500 @ A3
Coordinate System: GDA 1994 MGA Zone 56

N

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5 Threatened species

5.1 Geographic /habitat features

An assessment of the occurrence of geographic habitat features, in accordance with Section 6.3 of the BBAM 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, along with the results of this assessment are outlined in Table 7.

Table 7 Assessment of geographic habitat features within the study area.

Common name	Scientific name	Impact?	Feature	Justification
Hibbertia superans	*Hibbertia superans*	No	Ridgetops	The development site does not support sandstone ridgetops. The species is not assessed further.
Rosenberg's Goanna	*Varanus rosenbergi*	No	Land within 250 m of termite mounds or rock outcrops	No termite mounds or rock outcrops are located with 250m of the development site. The species is not assessed further.
Giant Burrowing Frog	*Heleioporus australiacus*	Yes	Land within 40 m of heath, woodland or forest	Study area contains woodland and forest habitat. The presence of the species is assessed in Section 5.4.2.
Green and Golden Bell Frog	*Litoria aurea*	Yes	Land within 100 m of emergent aquatic or riparian vegetation	The development site contains a number of dams supporting emergent aquatic vegetation. The presence of the species is assessed in Section 5.4.2.
Red-crowned Toadlet	*Pseudophryne australis*	Yes	Heath or eucalypt forest on sandstone with a build-up of litter or other debris and containing, or within 40 m of, ephemeral or intermittent drainage lines	Four ephemeral drainage start within or are within 40m of the development site. All streams within the development site have been substantially altered with farm dams and heavy infestations of groundcover weeds. The presence of the species is assessed in Section 5.4.2.
Cumberland Plain Land Snail	*Meridolum corneovirens*	Yes	Land containing bark or leaf litter accumulation	The development site supports areas of bark and leaf litter accumulation. The presence of the species is assessed in Section 5.4.2.

Common name	Scientific name	Impact?	Feature	Justification
Large-eared Pied Bat	*Chalinolobus dwyeri*	No	Land containing escarpments, cliffs, caves, deep crevices, old mine shafts or tunnels	None of the identified habitat features are present within the development site. The species is not assessed further.

5.2 Methods

Flora and fauna assessments of the study area were undertaken in January and April 2014 and again in November and December 2016. Weather observation for each survey data are shown in Table 8.

Table 8 Weather observations during flora and fauna surveys (068192 Camden AWS).

Survey date	Temperature (°C)		Rain (mm)
	Minimum	Maximum	
21 January 2014*	15.9	30.9	0
10 April 2014*	12.2	24.2	0
28 November 2016	17.8	32.8	0.2
29 November 2016	16.9	28.2	0
1 December 2016	14.3	33.9	0
2 December 2016	13.3	36.3	0
12 December 2016	17.5	32.5	0

* Minimum and maximum temperature data has been taken from the Camden AWS 2014 monthly average.

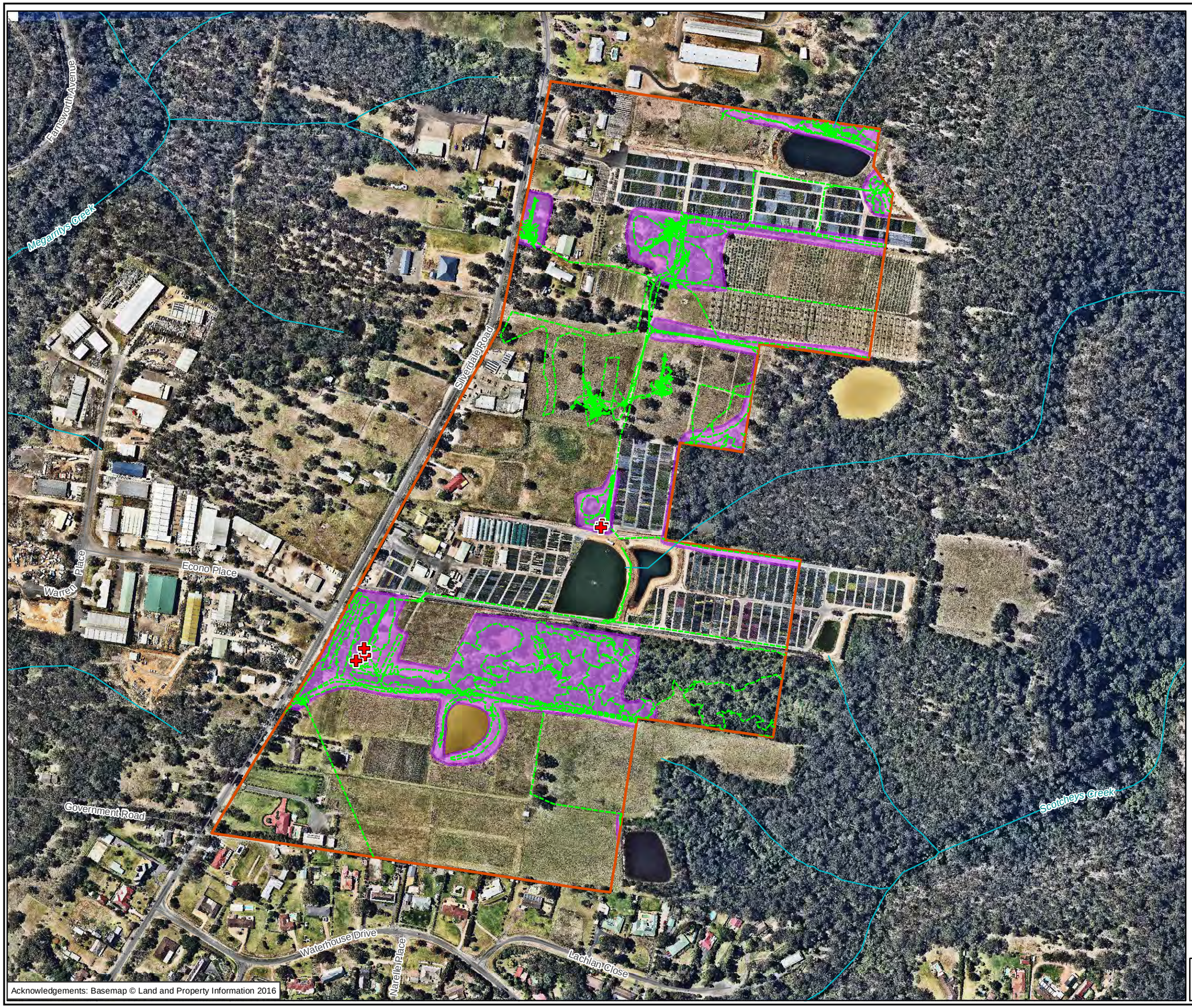
5.2.1 Targeted threatened flora survey

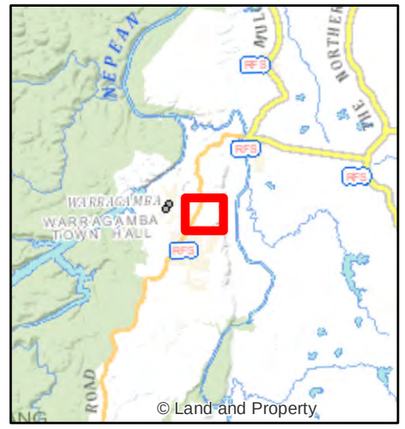
Flora surveys have included a variety of survey techniques, including random meanders, BioBanking plots/transect surveys, spot locations and parallel line surveys. Initial surveys were completed by Biosis on 21 January 2014 and 10 April 2014 to determine the vegetation communities present and to complete preliminary BioBanking plots/transects in accordance with the previous version of the BBAM (DECC 2009).

Random meanders and plot/transect surveys were undertaken by Biosis as a part of the current assessment on 30 November 2016 and again on the 1 and 2 of December 2016. Surveys included stratified traverses of the site on foot, and an additional ten plot/transect surveys, undertaken in accordance with the BBAM. Specific microhabitats, including creeks and high condition vegetation were targeted.

Targeted flora surveys were undertaken on 29 November 2016 and 12 December 2016. Surveys were undertaken in accordance with NSW Guide to Surveying Threatened Plants (OEH 2016) and included 10 metre parallel line surveys across the development site where appropriate habitat was recorded (Figure 7).

These surveys provide a comprehensive assessment of the potential for the study area to support threatened species.





Legend

- Development site
- Flora survey effort
- Grevillea juniperina subsp. juniperina (Vulnerable TSC Act)
- Threatened flora habitat
- No threatened flora habitat

Figure 7: Threatened flora survey effort and species located within the development site

0 40 80 120 160 200

Metres
Scale: 1:4,500 @ A3
Coordinate System: GDA 1994 MGA Zone 56

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