Biodiversity Development Assessment Report

328 – 330 Annangrove Road
Rouse Hill
The Hills LGA

For: ABAX Contracting Pty Ltd

REF: HiSC 15-756

15th July 2020

KEYSTONE
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Date	Version	Detail
9th November 2018	1.0	Draft for consultant team distribution.
14th November 2018	1.1	Final draft for consultant team distribution.
27th May 2020	2.0	Update to address final footprint and Council comments.
15th July 2020	2.1	Update to address Council comments.

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Cover photograph: The most recent aerial photograph showing the existing conditions of the two lots that comprise the proposed development site.

Source: Nearmap Imagery dated 1st February 2020

SUMMARY

Keystone Ecological has been contracted by ABAX Contracting Pty Ltd to prepare an assessment of the likely impacts upon biodiversity matters of a proposed development at 328 – 330 Annangrove Road, Rouse Hill in The Hills Local Government Area (LGA).

This Biodiversity Development Assessment Report has been prepared in accordance with the *Biodiversity Conservation Act 2016* and the Biodiversity Assessment Method (2017), and has been triggered by the proposed removal of native vegetation within an area mapped as containing High Biodiversity Values.

THE PROPOSAL

Principally, the proposal is for a staged development of a mixed use / bulky goods commercial centre. Works will ultimately include:

- Demolition of existing houses and facilities on numbers 328 and 330 Annangrove Road;
- Clearing of vegetation within the footprint;
- Excavation for construction of the basement car parking;
- Construction of the new buildings;
- Construction of stormwater infrastructure;
- Upgrades to the public roadway and construction of footpaths;
- Implementation of the Landscape Plan in the areas immediately surrounding the building;
- Implementation of conservation measures in the retained native vegetation in accordance with an approved Biodiversity Management Plan; and
- The realignment and expansion of part of Annangrove Road.

THE SITE

The site currently supports cleared lands, areas of natural vegetation, and plantings surrounding existing residential dwellings.

The current operational footprint comprises the existing residential dwelling within 328 Annangrove Road, including the house, garage, ancillary buildings, driveway and gardens; this area totals approximately 0.22 hectares. The remainder of the site is unused (i.e. "non-operational") and comprises the derelict house, cleared land, and native vegetation. The native vegetation is in a variety of forms and conditions, being isolated canopy trees, small patches of canopy trees over cleared land, patches of canopy trees over weed infestations, patches of canopy trees over native grass, fully structured patch of recent regrowth, and an older patch of fully structured regrowth.

The construction footprint for the proposed development within the two subject lots totals 2.72 hectares, with 0.44 hectares of retained vegetation to be rehabilitated. Temporary construction facilities are to be located within the development site in the construction footprint.

THE IMPACTS

The native vegetation of the site is comprised of two Critically Endangered Ecological Communities: Cumberland Plain Woodland (CPW) and Shale Sandstone Transition Forest

(SSTF), as well as realised and potential habitat for a number of threatened species.

The total area of CPW on the development site is 0.37 hectares, while the total area of SSTF on the development site is 1.45 hectares.

The proposal will retain and rehabilitate 0.44 hectares of the SSTF, supplemented by CPW and SSTF plantings in some of the landscaped parts along Annangrove Road, at the interface between the development and the retained vegetation, and along the rear and north eastern boundaries. Most importantly, the proposed area of SSTF to be retained is contiguous with the substantial area of bushland that is retained along Second Ponds Creek at the rear of the site.

The retained and rehabilitated area of SSTF on site will be subject to an approved Biodiversity Management Plan and other parts will be subject to an approved Landscape Plan. The over-arching objective of the Biodiversity Management Plan will be the reinstatement of fully structured vegetation and important habitats. The Landscape Plan will serve amenity objectives as well as contribute to biodiversity outcomes.

THE POTENTIAL FOR SERIOUS AND IRREVERSIBLE IMPACTS

The intention of the *Biodiversity Conservation Act 2016* is to avoid and minimise loss of biodiversity in the first instance, and enable a mechanism for offsetting the unavoidable losses through the Biodiversity Offset Scheme (BOS). The ultimate objective is that biodiversity is maintained or improved in the long run at the landscape scale.

However, it is acknowledged that some components of our natural heritage are too precious to lose and cannot be offset.

This concept was embodied in the forerunner of the BOS – the BioBanking Assessment Methodology (or BBAM) - by the application of "red flags". If an area or species attracted a red flag, then their loss could not be offset, except under exceptional circumstances. For highly cleared vegetation types (generally Endangered and Critically Endangered Ecological Communities), the minimum threshold was 4 hectares: any patches of highly cleared vegetation of 4 hectares or more were assigned a red flag under the BBAM.

This concept has persisted in the BOS with the recognition of the potential for a proposal to result in a "Serious and Irreversible Impact" (or SAII). Although the jargon has changed and thresholds are no longer applied, the principle is the same. The guidelines for a consent authority to determine if a SAII is likely to occur include consideration of a number of factors that are reminiscent of the Assessment of Significance and include:

- an exploration of measures to avoid and minimise the impact;
- the size and condition of the subject patch in relation to the extent and condition of the vegetation in the local and regional context;
- a consideration of the scale of the proposed loss in the local and regional context;
- an estimate of how well-represented the entity is in the reserve system across the IBRA region and sub-region;
- the potential for the proposal to impact on abiotic factors (such as groundwater) that are critical to the survival of the threatened community;

- the potential for the proposal to impact on species that are vital to the survival of the threatened community (such as a critical pollinator);
- the role of the proposal in the continued degradation of the integrity of the community by (such as by the introduction or enhancement of invasive species);
- the role of the proposal in the fragmentation and isolation of an important area of the community; and
- the capacity of the proposal to contribute to the recovery of the community.

In this case, the entities that are candidates for SAII are CPW and SSTF, as they are Critically Endangered Ecological Communities. The area of CPW and SSTF to be impacted by the proposal cannot be avoided without the nature and viability of the project being compromised. The patches are too small to be viable – they could only persist on site with intensive management, and in perpetuity. Their value to other species would be minimal, particularly given their separation from other patches of vegetation by significant development barriers. Their contribution to the overall conservation of these entities across the landscape would be minimal, far less than the contribution to conservation of the communities by any offset areas, chosen for their strategic conservation value.

It is acknowledged that the proposed layout trades off the areas of highest measured integrity on site for what is considered to be the best configuration. If the areas in the front of the site were to be retained, they could not be connected with the wildlife corridor at the rear, thus losing a very important functional advantage. The retained patch would be separated from the important bushland corridor at the rear, and become an isolated pocket hemmed in on all sides by roads and development.

However, this trade off is considered to be acceptable as the proposal is considered unlikely to result in a Serious and Irreversible Impact, and thus should be approved pursuant to the implementation of the offset package.

DEFINITIONS

Some terms require definition for the Biodiversity Development Assessment Report and largely include those as per the Biodiversity Conservation Act (2016) and Biodiversity Assessment Method (2017) for matters listed under NSW legislation.

BAM: The Biodiversity Assessment Method.

Critically endangered ecological community (CEEC): an ecological community specified as critically endangered in Schedule 2 of the BC Act and/or listed under Part 13, Division 1, Subdivision A of the EPBC Act

Development: has the same meaning as development at section 4 of the NSW Environmental Planning and Assessment Act 1979 (EP&A Act), or an activity in Part 5 of the EP&A Act. It also includes development as defined in section 115T of the EP&A Act.

Development footprint: the area of land that is directly impacted on by a proposed development, including access roads, and areas used to store construction materials.

Development site: an area of land that is subject to a proposed development that is under the EP&A Act.

Endangered ecological community (EEC): an ecological community specified as endangered in Schedule 2 of the BC Act, or listed under the EPBC Act.

Habitat: an area or areas occupied, or periodically or occasionally occupied, by a species, population or ecological community, including any biotic or abiotic component.

Habitat component: the component of habitat that is used by a threatened species for either breeding, foraging or shelter.

High threat exotic plant cover: plant cover composed of vascular plants not native to Australia that if not controlled will invade and outcompete native plant species.

Hollow bearing tree: a living or dead tree that has at least one hollow. A tree is considered to contain a hollow if: (a) the entrance can be seen; (b) the minimum entrance width is at least 5cm; (c) the hollow appears to have depth (i.e. you cannot see solid wood beyond the entrance); (d) the hollow is at least 1m above the ground. Trees must be examined from all angles.

IBRA region: a bioregion identified under the Interim Biogeographic Regionalisation for Australia (IBRA) system, which divides Australia into bioregions on the basis of their dominant landscape-scale attributes.

IBRA subregion: a subregion of a bioregion identified under the IBRA system.

Major project: State Significant Development and State Significant Infrastructure.

Native ground cover: all native vegetation below 1m in height, including all such species native to NSW (i.e. not confined to species indigenous to the area).

Native ground cover (grasses): native ground cover composed specifically of native grasses.

Native ground cover (other): native ground cover composed specifically of non-woody native vegetation (vascular plants only) <1m that is not grass (e.g. herbs, ferns).

Native ground cover (shrubs): native ground cover composed specifically of native woody vegetation <1m.

Native mid-storey cover: all vegetation between the over-storey stratum and a height of 1m (typically tall shrubs, under-storey trees and tree regeneration) and including all species native to NSW (i.e. native species not local to the area can contribute to mid-storey structure).

Native over-storey cover: the tallest woody stratum present (including emergent) above 1m and including all species native to NSW (i.e. native species not local to the area can contribute to over-storey structure). In a woodland community the over-storey stratum is the tree layer, and in a shrubland community the over-storey stratum is the tallest shrub layer. Some vegetation types (e.g. grasslands) may not have an over-storey stratum.

Number of trees with hollows: a count of the number of living and dead trees that are hollow bearing.

CONTENTS

PREAMBLE - STRUCTURE OF THE REPORT

Keystone Ecological has been contracted by ABAX Contracting Pty Ltd to prepare an assessment of the likely impacts upon biodiversity matters of a proposed development at 328 – 330 Annangrove Road, Rouse Hill in The Hills Local Government Area (LGA).

This Biodiversity Development Assessment Report (BDAR) has been prepared in accordance with the *Biodiversity Conservation Act 2016*. Specifically, this BDAR follows the procedures detailed in the Biodiversity Assessment Method (BAM) as declared in the *Biodiversity Assessment Method Order 2017*, dated the 24th August 2017.

Overall, the BAM[1] requires the BDAR to be presented in two parts: Stage 1 Biodiversity Assessment, and Stage 2 Impact Assessment. This BDAR reflects that required format:

- Stage 1 Biodiversity Assessment includes the following sections:
  - Section 1 – Introduction
  - Section 2 – Landscape Features
  - Section 3 – Native Vegetation
  - Section 4 – Threatened Species
- Stage 2 Impact Assessment includes the following sections:
  - Section 5 – Avoid and Minimise Impacts
  - Section 6 – Impact Summary
  - Section 7 – Biodiversity Credit Report
- Section 8 – Conclusions
- Section 9 - References
- Appendix 1 – Figures
- Appendix 2 – Photographs
- Appendix 3 – Tables
- Appendix 4 – Data sheets
- Appendix 5 – BAM outputs - Biodiversity Credit Reports

An initial desktop assessment of the development site revealed that a BDAR is required. The development footprint is located within at least part of the site that is shown as containing areas of High Biodiversity Values, including Threatened Ecological Communities (TECs); a BDAR is therefore required. Furthermore, the proposal triggers the requirement of a BDAR by the amount of native vegetation to be cleared, exceeding the threshold areas provided within Section 7.2 of the *Biodiversity Conservation Regulation (BCR) 2017* and Section 3.2 of the *Biodiversity Assessment Method (BAM) (2017)*.

[1] Items to be addressed within each Stage of the BDAR are detailed in Table 25 (Stage 1) and Table 26 (Stage 2) of the Biodiversity Assessment Method (2017).

STAGE 1 BIODIVERSITY ASSESSMENT

1 INTRODUCTION

1.1 The Site and the Proposal

The overall development site consists of three large lots zoned as B6 Enterprise Corridor under *The Hills Local Environment Plan (HLEP) 2012* and occupies a total of approximately 6.1 hectares. However, one of these lots is already cleared as part of a previous development consent, and therefore does not form part of this BDAR, although the proposed footprint on the remaining two lots (the subject of this BDAR) is integrated with that third lot. The remaining subject lots occupy approximately 3.43 hectares.

The site currently supports cleared lands, areas of natural vegetation, and plantings surrounding existing residential dwellings.

The subject lots are approximately rectangular, with a frontage on Annangrove Road of approximately 80 metres width, a long axis in the order of 200 metres, and and skewed to run north west to south east. The front sections of each lot are relatively flat, with a gentle south east facing slope leading to the riparian lands associated with Second Ponds Creek at the rear.

Specifically:

- **328 Annangrove Road (Lot 34 DP 834050)** contains a dwelling house at the Annangrove Road frontage in the lot's northern corner. This house has long been occupied, and associated development includes an in-ground swimming pool, front and rear gardens, ancillary buildings (garage, shed), and a small dam. These developed features occupy approximately 20% of the lot. Closely-mown lawn with scattered native and exotic trees occupies approximately 50% of the lot across the rest of the front and centre. The remaining 20% is a band of vegetation on the steepest part at the rear, made up of native and exotic trees over a dense cover of native grass with occasional patches of weeds. This lot occupies approximately 1.70 hectares.
- **330 Annangrove Road (Lot 12 DP 833069)** contains a vandalised and almost completely collapsed house near the centre of the lot, which is surrounded by (mostly) native trees over closely mown lawn; this occupies approximately 20% of the lot. To the rear of the house paddock is a band of native trees over severe infestations of weeds across approximately 20% of the lot. The front section of the lot comprises half native vegetation and half cleared and regularly mown exotic grassland. This lot occupies approximately 1.73 hectares.
- **332 Annangrove Road (Lot 13 DP 833069)** is on the corner of Annangrove Road and Withers Road. This is the lot that has been cleared in accordance with the existing Development Consent (number 172/2018/HC) and therefore does not form part of this BDAR. However, it is mentioned as the proposed development footprint is integrated with this lot. Clearing and excavation has occurred, with a narrow band of young regenerating native vegetation (approximately 20 metres wide) remaining along the rear boundary

This lot is the largest of the three, occupying approximately 2.68 hectares.

Aerial imagery of the development site and its landscape features are shown in Figures 1 and 2 in Appendix 1. Features of the development lot are illustrated in Photographs 1 to 16 in Appendix 2.

Principally, the proposal is for a staged development of a mixed use / bulky goods commercial centre. Works will ultimately include:

- Demolition of existing houses and facilities on numbers 328 and 330 Annangrove Road;
- Clearing of vegetation within the footprint;
- Excavation for construction of the basement car parking;
- Construction of the new buildings;
- Construction of stormwater infrastructure;
- Upgrades to the public roadway and construction of footpaths;
- Implementation of the Landscape Plan in the areas immediately surrounding the building;
- Implementation of conservation measures in the retained native vegetation in accordance with an approved Biodiversity Management Plan; and
- The realignment and expansion of part of Annangrove Road.

The proposed layout of the development is shown in Figure 3 in Appendix 1.

The current operational footprint comprises the existing residential dwelling within 328 Annangrove Road, including the house, garage, ancillary buildings, driveway and gardens; this area totals approximately 0.22 hectares. The remainder of the site is unused (i.e. "non-operational") and comprises the derelict house, cleared land, and native vegetation. The native vegetation is in a variety of forms and conditions, being isolated canopy trees, small patches of canopy trees over cleared land, patches of canopy trees over weed infestations, patches of canopy trees over native grass, fully structured patch of recent regrowth, and an older patch of fully structured regrowth.

The construction footprint for the proposed development within the two subject lots totals 2.72 hectares, with 0.44 hectares of retained vegetation to be rehabilitated. Temporary construction facilities are to be located within the development site in the construction footprint.

1.2 Information Sources

The following project plans and consultant reports were relied upon for this BDAR:

- Plans prepared by Leffler Simes Architects, drawings:
    - DA-001, revision 4 – Cover, drawing register and locality plan;
    - DA-010, revision 4 – Site analysis plan;
    - DA-020, revision 3 – Site plan;
    - DA-100, revision 5 - Lower ground floor plan;
    - DA-101, revision 5 – Ground floor plan;
    - DA-102, revision 5 – Upper ground floor plan;
    - DA-200, revision 4 – Shadow diagrams;

- Arboricultural Impact Assessment prepared by Advanced Treescape Consulting, Dated 21/11/2018;
- Acoustic report prepared by Atkins Acoustics, dated 12th August 2019;
- Bulk Earthworks Plan prepared by Robert Moore and Associates, dated 06/08/19;
- Bushfire Assessment Report prepared by Building Code and Bushfire Hazard Solutions, dated 15/08/19;
- Concept Landscape Plan prepared by Pds Landscape Architects, dated 12/08/19;
- Erosion and Sediment Control Plan prepared by Robert Moore and Associates, dated 07/08/19;
- Preliminary contamination assessment prepared by GeoEnviro Consultancy, dated January 2019;
- Pre-lodgement meeting notes for DA/165/2019/PRE prepared by The Hills LGA, dated 05/07/19;
- Site Survey prepared by Robert Moore and Associates, dated August 2018;
- Site-wide concept stormwater plan prepared by Robert Moore and Associates, dated 13/08/19;
- Statement of Environmental Effects, prepared by City Plan, dated August 2019;
- Traffic Impact Assessment prepared by Stantec, dated 16/08/2019;
- Tree Removal Plan prepared by Robert Moore and Associates, dated 01/08/19; and
- Waste Management Plan prepared by Lennon Project Management, dated 05/08/19.

The following external sources of information were relied upon for this BDAR:

- Blacktown City Council (2018) Online mapping tool. (http://maps.blacktown.nsw.gov.au/);
- NearMaps (2018-2020) NearMaps aerial imagery tool. Latest access of imagery 10th March 2020. (http://maps.au.nearmap.com/);
- NSW Government (2018) SIXMaps Aerial Imagery Tool. Accessed 4th November 2018. (https://maps.six.nsw.gov.au/); and
- SEED (2020) Sharing and enabling environmental data online portal. NSW Government, Sydney. (https://www.seed.nsw.gov.au/edphome/home.aspx).
- The Hills Shire Council (2020) Online mapping tool. (http://mapping.thehills.nsw.gov.au/IntraMaps90/);

1.3 Digital Shape Files

The following list of digital shape files have been generated as part of the BDAR:

- *Development_site.shp* – Cadastral boundary of the development site.
- *Operational_footprint.shp* – proposed operational footprint of the development site.
- *VZ1_849_CPW_fully structured+canopy over mown native us+isolated trees.shp* – extent of Vegetation Zone identified on site by Keystone Ecological from ground-truthing surveys.
- *VZ2_1395_SSTF_fully structured+trees over mown native us.shp* – extent of Vegetation Zone identified on site by Keystone Ecological from ground-truthing surveys.
- *VZ3_1395_SSTF_trees over slashed native grasses.shp* - extent of Vegetation Zone identified

on site by Keystone Ecological from ground-truthing surveys.

- *VZ4_1395_SSTF_trees over exotic understorey.shp* - extent of Vegetation Zone identified on site by Keystone Ecological from ground-truthing surveys.
- *Buffer_area.shp* – 1500 metre buffer area around the development site as per the BAM.
- *Corridor_second_ponds_ck.shp* – Movement corridor along Second Ponds Creek identified by Keystone Ecological by aerial imagery.
- *Corridors_minor.shp* – secondary movement corridors identified by Keystone Ecological from aerial imagery and site surveys.
- GGBF_species_polygon – Species polygon of suitable habitat for *Litoria aurea* Green and Golden Bell Frog.
- CPLS_species_polygon – Species polygon of suitable habitat for *Meridolum corneovirens* Cumberland Plain Land Snail.
- Myotis_species_polygon – Species polygon of suitable habitat for *Myotis macropus* Southern Myotis.

2 LANDSCAPE FEATURES

2.1 IBRA and NSW landscapes

The subject lands are wholly within the Sydney Basin IBRA bioregion, the Cumberland IBRA subregion and Cumberland Plain NSW Mitchell Landscape. The relationship between the site and these features are shown in Figure 4 and Figure 5 in Appendix 1.

Sydney Basin IBRA region occupies over 3.6 million hectares and extends from just north of Batemans Bay to Nelson Bay on the central coast, and almost as far west as Mudgee. It includes a significant proportion of the catchments of the Hawkesbury-Nepean, Hunter and Shoalhaven River systems, all of the smaller catchments of Lake Macquarie, Lake Illawarra, Hacking, Georges and Parramatta Rivers, and smaller portions of the headwaters of the Clyde and Macquarie Rivers.[2]

Cumberland IBRA subregion contains low rolling hills and wide valleys in areas of rain shadows below the Blue Mountains on Triassic Wianamatta shales and sandstones. It has intrusions by small volcanic vents that are partly covered by tertiary river gravels and sands, with quaternary alluvial soils occurring along the main streams.

Soils are typically red and yellow with brown clays on volcanics. At least three terrace levels are evident in gravel splays with volcanics occurring from low hills in shale landscapes. Swamps and lagoons occur in floodplain areas of the Nepean River.

Vegetation is typically divided by the soil influences. *Eucalyptus moluccana* Grey Box, *Eucalyptus tereticornis* Forest Red Gum, *Eucalyptus crebra* Narrow-leaved Ironbark woodland with some *Corymbia maculata* Spotted Gum occurring on shale hills. *Eucalyptus sclerophylla* Hard-leaved Scribbly Gum, *Angophora floribunda* Rough-barked Apple and *Banksia serrata* Old Man Banksia on alluvial sands and gravels. *Angophora subvelutina* Broad-leaved Apple, *Eucalyptus amplifolia* Cabbage Gum, and *Eucalyptus tereticornis* Forest Red Gum with abundant *Casuarina glauca* Swamp Oak occur on river flats, with tall rushes with *Eucalyptus parramattensis* Parramatta Red Gum in lagoons and swamps.

The **Cumberland Plain Mitchell Landscape**[3] occurs between 30 metres to 120 metres ASL on low rolling hills and valleys within rain shadow areas between the Blue Mountains and the coast, and where local relief is 50 metres. It occurs on horizontal Triassic shales and lithic sandstones. It contains small intrusions from volcanic vents and is partly covered by Tertiary river gravels and sands. Quaternary alluvial occur along main streams. This landscape can be affected by salt in tributary valley floors.

Vegetation in this Mitchell Landscape is generally made up of Woodlands and Open Forest

[2] Sydney Basin Bioregion, at http://www.environment.nsw.gov.au/bioregions/SydneyBasinBioregion.htm Department of Environment and Climate Change NSW (2002) Descriptions for NSW (Mitchell) landscapes, version 2, based on descriptions compiled by Dr. Peter Mitchell

[3] Mitchell, P. (2002) Descriptions for NSW (Mitchell) Landscapes, version 2 (2002) Department of Environment and Climate Change NSW, Sydney

containing *Eucalyptus moluccana* Grey Box, *Eucalyptus tereticornis* Forest Red Gum, *Eucalyptus crebra* Narrow-leaved Ironbark, *Eucalyptus eugenioides* Thin-leaved Stringybark *Eucalyptus amplifolia* Cabbage Gum and *Angophora subvelutina* Broad-leaved Apple. Grassy to shrubby understories are dominated by *Bursaria spinosa* Blackthorn, with areas of poorly drained valley floors (that are often salt affected) dominated by *Casuarina glauca* Swamp Oak and *Melaleuca* species.

2.2 Native Vegetation and Cleared Areas

The value of the habitats provided by the native vegetation within the development area is assessed in the context of a 1.5 kilometre buffer, measured from the outer boundaries of the development site. The area subtended by such a polygon for this development site is approximately 881 hectares.

The buffer is shown in Figures 5, 6, and 8, and is currently composed of a complex of residential, commercial, industrial and agricultural development, with native vegetation generally restricted to riparian corridors. The buffer area is divided by Annangrove Road, and Blacktown LGA occurs to the south west of Windsor Road. Residential development is a mixture of small lots and large rural-residential style sites. Existing industrial development includes the Rouse Hill water recycling plant, east of the development site.

The development site is adjacent to part of the north west growth centre, and land zoning reveals the ultimate development pattern intended for this area:

- B6 Enterprise Corridor is spread along both sides of Annangrove Road, of which the development site is a part;
- IN2 Light Industrial on Annangrove Road to the south of the development site and to the south east beyond Second Ponds Creek;
- RU6 Transition in the Nelson and Annangrove areas to the north; and
- A mixture of Residential zone densities to the north west and south east.

There are few reserves in this buffer area, and none capturing large expanses of native vegetation. Instead, the most significant areas of natural woody vegetation within public land is concentrated in the protected riparian corridor associated with Second Ponds Creek, Caddies Creek, and Smalls Creek in the Sydney Water trunk drainage land. This forms part of the stormwater management system for the growth centre as well as providing biodiversity benefits.

Confirmation of the current extent of woody vegetation in the buffer was made by:

- Analysis of vegetation mapping prepared by
    - The Office of Environment and Heritage for the metropolitan area (VIS 4489)[4];
    - The most recent and comprehensive mapping data of the western Cumberland

[4] OEH (2013) The Native Vegetation of the Sydney Metropolitan Area. Volumes 1 and 2 and maps. Version 2.0. NSW Office of Environment and Heritage, Sydney

subregion (VIS 4207) prepared by Office of Environment and Heritage[5]; and
    - The vegetation mapping for the Hills LGA (2008)[6]; and
- Inspection of the entire buffer area using the most current aerial photography (the latest dated 1st February 2020) available from Nearmap at http://maps.au.nearmap.com/.

Native vegetation within the buffer includes private and public lands, and occupies approximately 17% (or 120 hectares) of the extent of the buffer area (approximately 704 hectares). It is noted that some of the vegetation within the buffer are part of the "certified" lands of the North West Growth Centre. As vegetation within certified lands have been approved for eventual removal, these patches are therefore removed from consideration of the area of vegetation within the buffer.

Digital map layers for the North West Growth Centre were downloaded from the NSW Government's SEED database[7] and the area of certified and protected vegetation within the buffer area calculated by GIS applications. When the area of native vegetation certified for removal in the buffer (6.32 hectares) is removed from the calculation, the total reduces from 120 hectares to 114 hectares, and from 17% to 16%. This is a negligible change.

The cover of native vegetation in the buffer area is therefore assignable to the cover class <10% to 30%. The remaining 84% (or 591 hectares) comprises already cleared and developed lands, and non-native vegetation.

The distribution of vegetation within the 1.5 kilometre buffer is detailed in Figure 6 in Appendix 1.

Approximately 48% (or 1.63 hectares) of the development site is made up of hardstand, buildings, gardens, and cleared land.

2.3 Rivers, Streams and Wetlands

Rivers and streams recognised under the *Water Management Act 2010* are those mapped as blue lines on 1:25,000 topographic maps. The significance of the streams and the protections they attract are determined by their stream order, according to the Strahler system. In essence, this is defined by the number and types of upper branches.

Within the buffer area of the development site there are a number of mapped streams, and their orders have been determined by inspection of the 9030-1S Riverstone 1:25,000 topographic map. The resultant distribution of rivers and streams within the buffer area is shown in Figure 2 in Appendix 1.

[5] OEH (2015) available at https://datasets.seed.nsw.gov.au/dataset/remnant-vegetation-of-the-western-cumberland-subregion-2013-update-vis_id-4207fd1f4
[6] The Hills vegetation mapping available at http://mapping.thehills.nsw.gov.au/IntraMaps90/
[7] H:\KEYSTONE GIS-DWG FILES\NSW SPATIAL DATA\Spatial data files for GIS\Growth centres\Vegetation_SydneyGrowthCentre2011_07_4116\data\SydneyGrowthCentre2011_07_E_4116.shp

Second Ponds Creek and its associated riparian lands occur directly adjacent to the east of the development site. It flows from south to north arising in the Quakers Hill area, and joins Caddies Creek approximately 1.2 kilometres north east of development site. This then flows to the north west meeting Cattai Creek and eventually flowing into the Hawkesbury River approximately 12 kilometres to the north of he development site.

Although not a stream that is otherwise mapped or recognised under the *Water Management Act 2010*, The Hills Shire Council has recognised and mapped a first order stream and associated riparian zone in the north-western corner of the development site on 328 Annangrove Road. This traverses cleared mown grass in a shallow depression, and links a large dam on the property on the north western side of Annangrove Road with the small dam on the development site (see Figure 2 in Appendix 1).

There are no wetlands recognised under the *State Environmental Planning Policy Coastal Management 2018* within the buffer area or otherwise nearby.

2.4 Connectivity Features

The more connected that habitats are, the more valuable they are to biodiversity. This is partially a result of a larger area of habitat being available, which may support more individuals simply due to its greater size. However, a larger area of habitat may also provide for a more diverse suite of species, due to the chance of it supporting a greater diversity of habitat niches. Larger areas may also cater for species that require large home ranges, such as owls.

Linked habitats also provide movement corridors for dispersing animal young or plant propagules, or for refuge from catastrophic events such as fire. This is particularly so for species that have limited mobility, such as snails or plants.

Separated patches of habitat also have value as “stepping stones” for more mobile species such as birds and bats.

Within the buffer area, habitats are connected only by narrow riparian corridors, and small areas of bushland on private and public lands connecting to Rouse Hill Regional Park to the south-west. Much of the buffer area consists of cleared rural and residential lands. The largest barrier within the buffer area is the main thoroughfare of Windsor Road, a divided 4-lane road with turning lanes within a defined corridor of between 50 and 80 metres width.

The existing native and exotic vegetation on the development site is directly connected to habitats in the bushland corridor associated with Second Ponds Creek. This riparian corridor runs north-south, but there is little to no connectivity in other directions, due to existing residential, commercial, and rural developments.

Figures 1 and 2 in Appendix 1 show the likely movement corridors available for a range of fauna species that are known to occur in the local area. These habitat corridors may also serve a number of species of conservation significance.

2.5 Geology and Soils

Information regarding soils and geology is maintained in a number of spatial databases, including SEED[8], eSPADE 2.0, and within the local council mapping. The available data are sourced mainly from the NSW Soil and Land Information System (SALIS) and includes soil hazards and soil landscape mapping.

The available soil hazard mapping shows the site as having no risk of acid sulphate soils.

Soil landscape mapping of the Penrith 1:100,000 map sheet reveals the underlying patterns of geology and landform, and also describes the vegetation and land uses it supports (Bannerman and Hazelton 1990, Hazelton et al. 1989)[9].

The development site is located in the lower part of a low, broad landscape. The Blacktown soil landscape generally dominates in the local area, although Gymea soil landscape occurs across most of the subject lots and extends downstream along Second Pond Creek. South Creek soil landscape is also closely associated with the Second Ponds Creek upstream to the south. An extract of this mapping is shown in Figure 7 in Appendix 1.

The **Blacktown** soil landscape is a well-drained residual soil landscape occurring extensively on the Cumberland Lowlands between the Georges and Parramatta Rivers. It occurs as gently undulating rises on Wianamatta Group – Ashfield shales, with local reliefs occurring between 10 and 30 metres ASL, and slopes generally being greater than 5% but up to 10% in gradient. Crests and ridges are broad and rounded at between 200 to 600 metres ASL, with convex upper slopes that grade into concave lower slopes. Rocky outcrops do not occur naturally, but may occur where soils have been removed.

The limitations to development on this soil landscape are:

- Strongly acid
- Hard setting
- Low fertility
- High aluminium toxicity
- High shrink swell (localised)
- Low wet strength
- Low permeability
- Low available water capacity
- Localised salinity
- Localised sodicity

[8] Sharing and Enabling Environmental Data (2018) Office of Environment and Heritage. Most recently accessed 10th March 2020
(https://geo.seed.nsw.gov.au/Public_Viewer/index.html?viewer=Public_Viewer&locale=en-AU).

[9] Bannerman, S.M. and Hazelton, P.A. (1990) Soil Landscapes of the Penrith 1:100,000 sheet. Soil Conservation Service of NSW, Sydney
Hazelton, P.A., Bannerman, S.M. and Tille, P.J. (1989) Soil Landscapes of the Penrith 1:100,000 sheet map. Soil Conservation Service of NSW, Sydney

- Very low fertility
- Stoniness
- High erodibility (localised)

This soil landscape may experience minor sheet and gully erosion where surface vegetation is not maintained.

The **Gymea** soil landscape is an erosional soil landscape that occurs extensively throughout the Hornsby Plateau and along the foreshores of Sydney Harbour on Hawkesbury sandstone. Typical topography includes undulating to rolling low hills where local relief is between 20 metres to 80 metres ASL, and where slopes have a gradient between 10% to 25%. Sideslopes have narrow to wide outcropping sandstone rock benches (10-100 metres), often forming broken scarps of <5 metres in height. In this soil landscape, severe sheet erosion occurs following bushfires which reduce the stability of soils.

The limitations to development on this soil landscape are:

- Erosion hazard
- Rock outcrop
- Rockfall hazard (localised)
- Steep slopes (localised)
- Shallow soil

In general, the soils of the Gymea soil landscape are shallow, stony, moderately acid and highly permeable with low available water capacities. They also have a low to very low nutrient status with very low phosphorus and nitrogen levels.

The **South Creek** soil landscape occurs on floodplains on Quaternary Alluvium on the Cumberland Plain derived from deposits of the Wianamatta Group shale and Hawkesbury sandstone parent materials. The topography is a predominantly flat to gently sloping (0-3%) active floodplain, with occasional terraces or levees providing low relief (0-10 metres) , and found at an altitude of 3-159 metres ASL. Rock outcropping is absent.

The limitations to development on this soil landscape are:

- Localised seasonal and permanent waterlogging
- Widespread flood hazards
- Salinity hazards
- Foundation hazards
- Low fertility
- Erosion hazards (localised sheet and gully erosion, and widespread streambank erosion)

The dominant soil material is layered plastic clays and loams over rock or residual soils. Subsoils are sometimes saline, and this is evident in surface scalds where water tables are close to the surface.

There are no areas of formally or informally recognised geological significance with the buffer area or on the development site.

2.6 Areas of High Biodiversity Values

The vast majority of the development site (82% or 2.76 hectares) is mapped as having Biodiversity values as shown in the Biodiversity Values Map and Threshold Tool (BVMATT)[10]. An extract of this mapping is shown in Figure 8 in Appendix 1.

This mapping has been produced at a coarse scale and therefore contains discrepancies evident only at a fine scale. Aerial imagery of the site overlain with the BVMATT mapping in Figure 8 shows approximately 0.8 hectares of the area mapped as containing Biodiversity Values are in fact cleared and / or developed.

No Areas of Outstanding Biodiversity Values (AOBVs) are yet recognised on site or in the buffer area. Currently, the areas previously declared as critical habitat under the *Threatened Species Conservation Act 1995* for the Little Penguin and Wollemi Pine are the first and only AOBVs in NSW.

[10] Biodiversity Values Map and Threshold Tool (Version 3) available at https://www.lmbc.nsw.gov.au/Maps/index.html?viewer=BOSETMap

3 NATIVE VEGETATION

3.1 Background Information

A number of sources of information were used to aid in the sampling and identification of vegetation types and Vegetation Zones on the development site. This includes recent high quality aerial photography, the published scientific literature, and scientific databases.

Soil landscape

The soil landscape mapping program (Hazelton et al. 1989, Bannerman and Hazelton 1990) identifies vegetation assemblages typically found within each soil landscape. In the case of the development site, the relevant soil landscapes are Blacktown, Gymea and South Creek.

Vegetation on the **Blacktown** soil landscape has been extensively cleared for agriculture, and residential and industrial development. Typically, vegetation consists of tall open wet sclerophyll forest and open woodlands characterised by *Eucalyptus saligna* Sydney Blue Gum, *Eucalyptus pilularis* Blackbutt, *Eucalyptus crebra* Narrow-leaved Ironbark, *Eucalyptus moluccana* Grey Box, and *Eucalyptus tereticornis* Forest Red Gum.

The original vegetation of **Gymea** soil landscapes in the Sydney area was dry sclerophyll woodland and open forest, however, this has been extensively cleared due to urban development. On ridges and upper slopes, low dry sclerophyll open woodland dominates. Common species found include *Corymbia gummifera* Red Bloodwood, *Eucalyptus eximia* Yellow Bloodwood, *Eucalyptus haemastoma* Scribbly Gum, *Eucalyptus capitellata* Brown Stringybark and *Banksia serrata* Old Man Banksia. Where this soil landscape occurs on more sheltered slopes, *Eucalyptus sieberi* Black Ash, *Eucalyptus piperita* Sydney Peppermint, and *Angophora costata* Smooth-barked Apple are commonly found. Understorey species are largely made up from families Epacridaceae, Myrtaceae, Fabaceae and Proteaceae.

In its natural state, the vegetation of **South Creek** soil landscape is either Alluvial Woodland or River Flat Forest, but due to its flat topography and richer alluvial soil on floodplains, the original vegetation has been extensively cleared. The canopy is typically dominated by *Eucalyptus amplifolia* Cabbage Gum, *Eucalyptus tereticornis* Forest Red Gum, and *Angophora floribunda* Rough-barked Apple, with occasional occurrences of *Eucalyptus moluccana* Grey Box, *Angophora subvelutina* Broad-leaved Apple, and *Eucalyptus eugenioides* Thin-leaved Stringybark. Small trees often include *Acacia parramattensis* subsp. *parramattensis* Parramatta Wattle, *Casuarina glauca* Swamp Oak, and *Melaleuca linariifolia* Flax-leaved Paperbark. *Bursaria spinosa* Blackthorn often dominates the shrub stratum, particularly where fire has been excluded for some time.

Vegetation mapping

The vegetation of the Cumberland Plain has been the focus of many long term investigations, culminating in a series of maps and scientific papers (NSW NPWS 1997, NSW NPWS 2002, Tozer 2003, Tindell et al. 2004, Tozer et al. 2010). These bodies of work have grown out of each other and reflect the development of modern vegetation survey, analysis, and mapping. The Urban

Bushland Biodiversity Survey (NSW NPWS 1997) laid the groundwork and was mostly descriptive. Tozer's original paper (2003) is an updated version of the previous mapping released by the National Parks and Wildlife Service (2002) and details rules to apply in defining vegetation communities on the Cumberland Plain. The 2010 paper is a synthesis of this vegetation mapping from Sydney and extended south to the Victorian border, building on and from the Tindall et al. (2004) paper.

The study area of NPWS (2002) and Tozer (2003) did not include part of The Hills LGA, and Council therefore contracted mapping of its own (The Hills 2008). Subsequent mapping projects (Tozer et al. 2010) addressed those gaps and elucidated the vegetation classification further by the addition of a much larger data set. This continues to be refined, with the latest additions being the mapping of the western Cumberland subregion (VIS 4207) prepared by Office of Environment and Heritage (2015).

As a consequence of this evolution of mapping, the area within which the development site occurs has been variously depicted as supporting Cumberland Plain Woodland (CPW), Shale Sandstone Transition Forest (SSTF), and River-flat Eucalypt Forest (RfEF). This ambiguity has arisen from the harsh land use history, the generally poor condition and dominance of exotic species in the remnant and regrowth vegetation, and the local abiotic factors that determine vegetation type.

One of the most important of these abiotic factors is soil, and the soil landscape mapping indicates that this area occurs at a junction of three soil landscapes: Blacktown, Gymea, and South Creek. These are formed by different processes, respectively residual, erosional, and alluvial. Their underlying geologies are different, as are their topographic positions and exposure. Thus, it is unsurprising that the vegetation types in such a transitional area are difficult to determine.

Nevertheless, the more recent and comprehensive mapping of OEH (2015) is preferred as it reflects this complexity.

The vegetation so mapped within the extent of the buffer is shown in Figure 6 in Appendix 1, and their affinity to the identified PCTs are detailed in Table 1 in Appendix 3. This mapping depicts three vegetation communities within the buffer area, of which two are considered to occur on site:

- Shale Sandstone Transition Forest (High Sandstone influence); and
- Shale Plains Woodland.

Shale Sandstone Transition Forest (High Sandstone influence) is mapped across the north-eastern corner of the site and along the eastern boundary that adjoins to Second Ponds Creek. This vegetation community extends to the north and south, and is the dominant vegetation type north of the development site in the local area.

This community is listed as a Critically Endangered Ecological Community (CEEC) under both the NSW *Biodiversity Conservation Act 2016* and the Commonwealth *Environmental Protection and Biodiversity Conservation Act 1999*.

This community is generally dominated by *Eucalyptus punctata* Grey Gum and *Eucalyptus crebra*

Narrow-leaved Ironbark, with a small tree stratum containing *Allocasuarina littoralis*, *Syncarpia glomulifera*, *Persoonia linearis* and *Acacia decurrens*. It usually has a well-developed shrub layer dominated by *Kunzea ambigua*, *Persoonia linearis* and *Bursaria spinosa*. The ground layer is characterised by *Entolasia stricta, Themeda australis, Austrostipa pubescens, Lepidosperma laterale, Aristida vagans* and *Pomax umbellata*.

Shale Plains Woodland is mapped as occurring on the north-western corner of the development site adjoining Annangrove Road. This community extends to the south of the development site and is the dominant community to the south and west in the local area. Shale Plains Woodland is the most widely distributed community on the Cumberland Plain

This community is representative of Cumberland Plain Woodland, a Critically Endangered Ecological Community under both the *Biodiversity Conservation Act 2016* and the *Environmental Protection and Biodiversity Conservation Act 1999*.

It occurs on soils derived from Wianamatta shales and on Holocene alluvium in well drained areas. The canopy is characterised by the presence of *Eucalyptus moluccana* and *Eucalyptus tereticornis* with *Bursaria spinosa* occurring constantly in the understorey. The ground layer is an important determinant with a large number of species positively diagnostic, including *Dichondra repens, Aristida vagans, Microlaena stipoides* var *stipoides, Themeda australis, Brunoniella australis, Desmodium varians, Opercularia diphylla, Wahlenbergia gracilis* and *Dichelachne micrantha*.

BioNet Vegetation Classification

This used to be known as the Vegetation Information System (VIS), is the standard database for plant community types for NSW, and underpins the analytical tools applied as part of the Biodiversity Assessment Method. The database facilitates vegetation classification by a series of queries of critical features (e.g. structure, location, canopy dominants), and inspection of all related data relevant to each recognised plant community type.

This database was used in the clarification of the vegetation observed on and near the development site and is further discussed below.

3.2 Sampling

A desktop analysis was undertaken for the development site, as well as for bushland in adjacent lands to better inform on-ground assessment and survey.

The vegetation on the development site was sampled by way of random meander and full floristic quadrats/transects in accordance with the BAM (2017). Vegetation surveys were conducted from 2015 to 2018 in autumn, winter and spring:

- 6th July 2015
    - Initial inspection of site and surrounds
    - To determine the most likely vegetation types present:
        - Floristic list compiled by way of a random meander inspection of the

vegetation on numbers 332-334, 330, and along the Sydney Water land at the rear of these lots
        - Structural components of the vegetation noted on numbers 332-334, 330, and along the Sydney Water land at the rear of these lots
    - A species list was generated and habitat notes made
- 24th June 2016
    - To check on the state of the vegetation and determine the most likely vegetation types present:
        - Floristic list compiled by way of a random meander inspection of the vegetation on number 332-334
- 21st August 2017
    - To aid in the identification of the vegetation types present, random meander and structural analysis of vegetation in the Sydney Water land at the rear of number 328
- 12th September 2017
    - Floristic list compiled by way of a random meander inspection of the vegetation on numbers 328, 330, and 332-334
- 17th October 2017
    - To aid in the determination of vegetation types and ground-truth vegetation mapping, trees at the rear of numbers 328 and 330 were located by GPS and identified
    - Hollow-bearing trees located by GPS and characterised
- 11th July 2018
    - Investigation of community boundaries and delineation of Vegetation Zones
- 23rd July 2018
    - To aid in the determination of vegetation types and ground-truth vegetation mapping, trees at the rear of numbers 328 and 330 were located by GPS and identified
    - Investigation of community boundaries and delineation of Vegetation Zones
- 17th September 2018
    - Collection of vegetation composition, structure, and function data per Biodiversity Assessment Method (2017) in quadrats of 20 x 20 metres and associated transect of 50 metre length in each Vegetation Zone
- 21st October 2018
    - Collection of vegetation composition, structure, and function data per Biodiversity Assessment Method (2017) in quadrats of 20 x 20 metres and associated transect of 50 metre length in each Vegetation Zone
- 18th December 2019
    - Site inspection with Council to check vegetation mapping
- 23rd June 2020
    - Site inspection with Council to further check vegetation mapping
- 12th July 2020
    - Collection of vegetation data in BAM plot located in the area agreed as potentially representative of derived native grassland.

This sampling was intended to achieve the following:

- Compile as comprehensive a species list as possible by surveying many times and through different seasons;
- Determine the boundaries of the vegetation types and zones;
- Identify the condition of vegetation across the site;
- Identify indicator / positive diagnostic species of the vegetation communities;
- Better understand the context of the development site's vegetation and habitats by inspection of surrounding areas;
- Identify threatening processes; and
- Understand the habitat features of the development site and its relationship with surrounding lands.

All flora species observed during survey, as well as those tree species reported in the arboricultural assessments for this site and the adjacent site at 332 Annangrove Road, have been collated for this report and are provided in Table 2 in Appendix 3.

3.3 Plant Community Types (PCTs)

Using recent aerial photography, a map was created of each of the patches of vegetation across the site. A species list for each was compiled and its condition noted. These lists, together with abiotic factors such as landscape position, were compared with published mapping and vegetation community descriptions. The Community Identification tool of the BioNet Vegetation Classification database was also used.

It was determined that the naturally occurring vegetation types are most like those mapped by NPWS (2002) and OEH (2015), with Cumberland Plain Woodland at the top of the development site and Shale Sandstone Transition Forest at the rear. The pattern of vegetation types on site is illustrated in Figure 9 in Appendix 1.

It is important to note that the degree of certainty assigned to this mapping is only "medium", with the uncertainty arising from its condition. The vegetation on site has been highly modified by past land uses, and continues to be disturbed by weed infestations and slashing. Therefore, despite repeated sampling over several years, the floristic composition remained depauperate and none of the diagnostic "rules" for community identification developed by Tozer (2003) could be applied. The candidate communities share many species in common, and Shale Sandstone Transition Forest in particular is highly variable. Also, many of the trees at the rear of the site could not be reliably differentiated between *Eucalyptus tereticornis* Forest Red Gum and *Eucalyptus amplifolia* Cabbage Gum.

However, the selection of Shale Sandstone Transition Forest as the rear vegetation type was reinforced by the presence of some small shallow protrusions of fine-grained sandstone, and the presence of a patch of *Pterostylis concinna* Trim Greenhood near the rear boundary. This species is listed in Tozer (2003) and Tozer et al. (2010) as a positive diagnostic species for Shale Sandstone Transition Forest.

Summaries of the ecological profiles of these vegetation communities are provided below.

Cumberland Plain Woodland (Shale Plains Woodland sub-type)

Vegetation formation: Grassy Woodlands
Vegetation class: Coastal Valley Grassy Woodlands

Plant Community Type (PCT): 849 – Grey Box – Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion.

Pre-European extent: approximately 44,000 hectares.
Current extent: approximately 6,800 hectares.
Percent cleared: 93%

BC Act 2016 status: Critically Endangered
EPBC Act 1999 status: Critically Endangered

Description:
This is the most widely distributed vegetation community on the Cumberland Plain and typically occurs at elevations up to 350 metres ASL and in areas where the mean annual rainfall is between 700 and 900 millimetres ASL[11].

It typically has a canopy cover dominated by *Eucalyptus moluccana* and *Eucalyptus tereticornis* with a small tree stratum characterised by *Acacia decurrens, Acacia parramattensis* and *Exocarpos cupressiformis*. The shrubby understorey is represented by the presence of *Bursaria spinosa* with ground layers commonly including *Dichondra repens, Aristida vagans, Microlaena stipoides* var *stipoides, Themeda australis, Brunoniella australis, Desmodium varians, Opercularia diphylla, Wahlenbergia gracilis* and *Dichelachne micrantha*[12].

However, in areas where the woody canopy has been removed, the NSW Scientific Committee has determined that it may present as a derived native grassland.

Shale Sandstone Transition Forest

Vegetation formation: Grassy Woodlands
Vegetation class: Coastal Valley Grassy Woodlands

Plant Community Type (PCT): 1395 – Narrow-leaved Ironbark – Broad-leaved Ironbark – Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion.

Pre-European extent: approximately 48,000 hectares.

[11] NSW Scientific Committee (2010) Cumberland Plain Woodland in the Sydney Basin Bioregion – critically endangered ecological community listing, NSW Scientific Committee – final determination
[12] Tozer, M.G. Turner, K. Keith, D. A. Tindall, D. Pennay, C. Simpson, C. Mackenzie, B. Beukers, P. Cox, S. (2010) Native vegetation of southeast NSW: a revised classification and map for the coast and eastern tablelands. NSW Department of Environment and Climate Change, Hurstville, NSW

Current extent: approximately 9,600 hectares.
Percent cleared: 80%

BC Act 2016 status: Critically Endangered
EPBC Act 1999 status: Critically Endangered

Description:
Shale Sandstone Transition Forest is found on the fringes of the Cumberland Plain where annual rainfall is between 800 to 1,100 millimetres on clay-rich soils and coarse sandy substrates of the sandstone plateau, and where elevations are below 350 metres ASL.

It is highly variable in floristic composition, with its species composition responding to the degree of sandstone influence in the soil. Remnants close to outcropping sandstone may contain a large component of sclerophyll shrub species, while those remote from the sandstone boundary contain more grasses and herbs, and resemble Cumberland Shale Plains Woodland. It is typically dominated by *Eucalyptus punctata* and *Eucalyptus crebra* in high sandstone influenced areas with a small tree stratum typically dominated by *Allocasuarina littoralis, Syncarpia glomulifera, Persoonia linearis* and *Acacia decurrens*. It has a well-developed shrub layer characterised by *Kunzea ambigua, Persoonia linearis* and *Bursaria spinosa*. Ground covers are dominated by native grasses, including *Entolasia stricta, Themeda australis, Stipa pubescens, Aristida vagans* and *Pomax umbellata*[13].

3.4 Vegetation Integrity Assessment

The biodiversity value of vegetation in a development site, including the threatened species they may support (and therefore ultimately the offsets required), is determined by its "integrity". In order to fulfil the vegetation integrity assessment, a number of features need to be defined and measured.

Vegetation Zones

Vegetation polygons are defined as constituting the same Vegetation Zone if they contain the same PCT in the same overall condition.

Only native vegetation can be assessed for its integrity in the BAM calculator. Two PCTs were recognised as occurring on site:

- PCT 849 Grey Box – Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion (the Cumberland Plain Woodland); and
- PCT 1395 Narrow-leaved Ironbark – Broad-leaved Ironbark – Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion (the Shale Sandstone Transition Forest).

Five Vegetation Zones were identified across these PCTs. Their extent and locations are shown in

[13] NSW National Parks and Wildlife Service (2002) Interpretation guidelines for the native vegetation maps of the Cumberland Plain, Western Sydney, Final edition NSW NPWS, Hurstville

Figure 9 in Appendix 1.

Patch Size

Patch size is an integral component of the BAM as it assists in the calculation and identification of the threatened species likely to use the habitats available on the development site, according to the respective PCTs. Species so identified are those likely to be impacted by the proposed development and therefore are subject to further assessment.

Patch size is categorised within the BAM as <5 hectares, 5 to 24 hectares, 25 to 100 hectares, and ≥100 hectares. The close proximity of continuous vegetation to each of the identified Vegetation Zones on site impose the same patch size of ≥100 hectares to each of the Vegetation Zones. The patch size does not change after consideration of the certified lands.

The area of each Vegetation Zone determines the total number of quadrats / transects to be sampled as part of the assessment. In accordance with the BAM, one full sampling quadrat / transect was required for each of the Vegetation Zones, totalling 4 sample sites.

Five sample sites were measured (one being in the adjacent lot), and their locations in relation to the their corresponding Vegetation Zones are shown in Figure 10 in Appendix 1. Raw data collected at each sample site are provided in Appendix 4.

Vegetation Integrity Score

Vegetation integrity is an overall measure of the site's ecological value and is made up of a measure of its composition, structure and function. The integrity scores of the sample site are compared with the benchmark scores of the relevant PCT in order to judge its relative ecological value.

Benchmark data provided in the BAM tool for the PCTs of interest for composition, structure and function are detailed in Tables 3 to 7 in Appendix 3.

Composition condition scores are initially scored out of 100 and are calculated using the mean species richness of the growth form group. The average observed values for each growth form group are converted to unweighted condition score.

Structure condition scores are calculated initially out of 100 and by the mean of all observed cover values for a growth form within a vegetation zone and is converted to a continuous unweighted condition score.

Function condition score is determined for a PCT classified as:

- vegetation formations that are rainforests, wet sclerophyll forests, dry sclerophyll forests, forested wetlands, grassy woodlands, semi-arid woodlands, and
- vegetation classes that are Wallum Sand Heaths, Sydney Coastal Heaths, Northern Montane Heaths, and Sydney Montane Heaths.

The current vegetation integrity score for VZ 1 (PCT 849) on site is 41.2, which is made up of:

- Composition condition score: 17.9
- Structure condition score: 47.6
- Function condition score: 82

The current vegetation integrity score for VZ 2 (PCT 1395) on site is 43.6, which is made up of:

- Composition condition score: 17.6
- Structure condition score: 76.1
- Function condition score: 61.7

The current vegetation integrity score for VZ 3 (PCT 1395) on site is 13.3, which is made up of:

- Composition condition score: 5.9
- Structure condition score: 44.3
- Function condition score: 9

The current vegetation integrity score for VZ 4 (PCT 1395) on site is 19.4, which is made up of:

- Composition condition score: 5.3
- Structure condition score: 25.7
- Function condition score: 54.3

The current vegetation integrity score for VZ 5 (PCT 807/849) on site is 2.3, which is made up of:

- Composition condition score: 7.2
- Structure condition score: 30.0
- Function condition score: 0.1

Attributes within each vegetation zone have been assessed appropriately against the benchmark data provided in Tables 3 to 7 in Appendix 3 and summarised below.

Vegetation Zone 1

Plant Community Type: 849 Grey Box – Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion.

Condition: Good – with intact native understorey.

Patch Size: ≥100 hectares

Extent on the development site: 0.30
Total percent of the development site: approximately 9%

Brief description: Small number of mature canopy trees typical of CPW (*Eucalyptus moluccana* and *Eucalyptus crebra*). Mid storey dominated by *Acacia parramattensis*. Some scattered patches of *Bursaria spinosa* and sparse ground covers occurring across its extent.

Vegetation Zone 2

Plant Community Type: 1395 Narrow-leaved Ironbark – Broad-leaved Ironbark – Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion.

Condition: Good – with intact native understorey, some parts regenerating.

Patch Size: ≥100 hectares

Extent on the development site: 0.17 hectares
Total percent of the development site: approximately 5%

Brief description: Fully structured and regenerating SSTF occurring in the centre of the site. Mature canopy trees restricted to *Eucalyptus tereticornis* and *Eucalyptus amplifolia.* Understorey similar to adjacent CPW.

Vegetation zone 3

Plant Community Type: 1395 Narrow-leaved Ironbark – Broad-leaved Ironbark – Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion.

Condition: Moderate - trees over dense native grasses with occasional patches of weeds

Patch Size: ≥100 hectares

Extent on the development site: 0.76 hectares
Total percent of the development site: approximately 22%

Brief description: Canopy trees of SSTF over a 'meadow' of high slashed native grasses with patches of *Cestrum parqui* and occasional mature *Olea europea*.

Vegetation Zone 4

Plant Community Type: 1395 Narrow-leaved Ironbark – Broad-leaved Ironbark – Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion.

Condition: Low – weed infested SSTF

Patch Size: ≥100 hectares

Extent on the development site: 0.52 hectares
Total percent of the development site: approximately 15%

Brief description: Canopy trees of *Eucalyptus tereticornis* and *Eucalyptus amplifolia* over dense infestations of weeds *Cestrum parqui*, *Lantana camara,* and *Ligustrum sinense*. Weeds recently cleared but regenerating.

Vegetation Zone 5

Plant Community Type: 807 Derived grasslands on shale plains of the Cumberland Plain (<100m ASL).

Condition: Good – with intact native ground cover. Exotic grasses (some high threat exotic weeds) also present.

Patch Size: ≥100 hectares

Extent on the development site: 0.07
Total percent of the development site: approximately 2%

Brief description: Located at the edge of PCT 849 where canopy has been removed, and recent rains has resulted in good flush of native grass growth. As this PCT is a derived form of PCT 849, its vegetation integrity is compared with the benchmarks of PCT 849, in accordance with the BAM (2017).

4 THREATENED SPECIES

Background information was gathered on threatened species known to occur in the local area, principally an interrogation of BioNet for threatened species recorded within 10 kilometres of the site, further filtered to a buffer area of 1.5 kilometres radius. This was combined with expert habitat assessment of the site and surrounds, and a list of species compiled that were considered worthy of targeted survey.

4.1 Predicted Threatened Species (Ecosystem Credit Species)

The vegetation type (PCT), patch size, and vegetation integrity assessment are used by the BAM calculator to predict what threatened species are likely to occur at a given site. Those species thought to be reliably predicted to occur in any particular PCT are referred to as "ecosystem credit species" and loss of their habitat can be adequately addressed by the offsetting of ecosystem credits (which are, in essence, PCT or vegetation type credits).

The list of predicted threatened species were generated by the BAM calculator for the PCTs identified across the development site.

Each of these predicted threatened species and their sensitivity profile are detailed in Table 8 in Appendix 3.

Survey confirmed that the site provides potential habitat for all but four of the ecosystem credit species produced by the BAM:

- *Anthochaera phrygia* Regent Honeyeater (Foraging). The development site is not within any of the areas mapped as important habitat for this species, and critical foraging resources (such as dense stands of winter-flowering trees) are absent.
- *Calyptorhynchus lathami* Glossy Black-Cockatoo (Foraging). This species is a specialist feeder on the seeds of *Allocasuarina* trees, which is absent from the site.
- *Grantiella picta* Painted Honeyeater. This species relies on trees carrying dense infestations of Mistletoe. No species of Mistletoe were observed.
- *Varanus rosenbergi* Rosenberg's Goanna. The development site occurs outside of the geographic limitations required for these ecosystem credits. Also, it does not provide any of the specialist sheltering or breeding habitat features.

During survey, the calls were recorded of what are possibly the threatened species *Falsistrellus tasmaniensis* Eastern False Pipistrelle or *Scoteanax rueppellii* Greater Broad-nosed Bat. These are both ecosystem credit species and have been added to the analysis.

4.2 Candidate Threatened Species (Species Credit Species)

Some species are considered less reliably accounted for by ecosystem credits and may require species credits. They therefore require specific attention and potentially targeted survey.

A total of 52 candidate species were identified within the BAM database to be associated with the PCTs identified on the development site.

The habitat requirements of each of these 52 candidate species are addressed in Table 9 in Appendix 3, and 34 species on that list were excluded from survey on the basis of that habitat analysis.

4.3 Threatened Species Survey

Flora and fauna surveys were undertaken across the development site from 2015 to 2018 during winter and spring. As well as generalised survey techniques, it included targeted surveys for the 18 Candidate species identified as potentially occurring on the development site.

4.3.1 Flora

A number of flora species were targeted for survey, because they were considered to have a high likelihood to occur, or were generated by the BAM tool as requiring consideration as a result of the PCT, patch size and other landscape features.

The following 10 threatened flora species are considered the most likely to occur and were the subject of targeted survey:

1. *Cynanchum elegans* White-flowered Wax Plant
2. *Epacris purpurascens* var*. purpurascens*
3. *Grevillea juniperina* subsp*. juniperina*
4. *Grevillea parviflora* subsp*. supplicans*
5. *Hibbertia superans*
6. *Leucopogon fletcheri*
7. *Persoonia nutans* Nodding Geebung
8. *Pimelea spicata* Spiked Rice-flower
9. *Pultenaea pedunculata* Matted Bush-pea
10. *Thesium australe* Austral Toadflax

Suitable survey times for each of these threatened flora species (as per their known detectability and according to the BAM calculator), and the survey efforts undertaken are detailed in Table 10 in Appendix 3.

Floristic surveys for all of the listed species above were undertaken during suitable seasons and survey techniques for each species, including targeted random meander and full floristic sampling quadrats/transects.

4.3.2 Fauna

A number of fauna species were targeted for survey, because they were considered to have a high likelihood to occur, or were generated by the BAM tool as requiring consideration as a result of the PCT, patch size and other landscape features.

The following 7 threatened fauna species are considered the most likely to occur:

1. *Haliaeetus leucogaster* White-bellied Sea-eagle
2. *Hieraaetus morphnoides* Little Eagle
3. *Litoria aurea* Green and Golden Bell Frog
4. *Lophoictinia isura* Square-tailed Kite
5. *Meridolum corneovirens* Cumberland Plain Land Snail
6. *Myotis macropus* Large-footed Myotis
7. *Pommerhelix duralensis* Dural Woodland Snail

Fauna surveys were conducted from 2015 to 2018 and were intended to sample the various habitats present on site and to detect any fauna species likely to use the development site. Suitable survey times for each of these threatened fauna species (as per their known detectability and according to the BAM calculator) and the survey efforts undertaken are detailed in Table 10 in Appendix 3.

Most survey was conducted in the appropriate season for each species, with the exception of *Litoria aurea* Green and Golden Bell Frog and *Myotis macropus* Large-footed Myotis. Survey techniques were appropriate for each fauna group, including call detection (audio and ultrasonic recorders), visual observation (stag watching, spotlighting, diurnal bird counts), habitat searching, including specific targeted searches for snails, and searches for other signs of fauna presence (tracks or traces).

4.4 Survey Results

Where appropriate, results from this survey were supplemented with findings from surveys of surrounding lots at numbers 314[14], 316[15], 318[16], 332-334[17], and 338-340[18] Annangrove Road.

4.4.1 Flora

The list of flora species recorded on site, their status, and location are provided in Table 2 in Appendix 3.

A total of 46 native and 40 exotic species were recorded on the development site, made up of a total of 31 families. The most dominant families are Poaceae (23 species), Asteraceae (8 species), Myrtaceae (5 species), Fabaceae (4 species), Mimosaceae (4 species), Polygonaceae (4 species) and Solanaceae (4 species).

[14] Ashby, E. and Suesse, R. (2007) Flora and Fauna Impact Assessment, 314 Annangrove Road, Rouse Hill. Unpublished report. Keystone Ecological

[15] Ashby, E., Fraser, A. and McTackett, A. (2016) Amended Vegetation Management Plan, 316 Annangrove Road, Rouse Hill. Unpublished report. Keystone Ecological

[16] Ashby, E. and McTackett, A. (2017) Flora and Fauna Impact Assessment, 318 Annangrove Road, Rouse Hill. Unpublished report. Keystone Ecological

[17] Ashby, E. and McTackett, A. (2015) Impact Assessment, Annangrove Road, Rouse Hill, The Hills LGA. Unpublished report, Keystone Ecological

[18] Ashby, E. (2013) Flora and Fauna Impact Assessment, 338-340 Annangrove Road, Rouse Hill. Unpublished report. Keystone Ecological

Of the 40 exotic species recorded on site, 17 are identified as High Threat Weeds, of which 5 are also listed as Weeds of National Significance (WONS):

1. *Asparagus aethiopicus* Asparagus Fern
2. *Asparagus asparagoides* Bridal Creeper
3. *Senecio madagascariensis* Fireweed
4. *Rubus fruticosis* sp. agg. Blackberry
5. *Lantana camara* Lantana

No threatened flora species were recorded on the development site during surveys or on other surrounding lots.

4.4.2 Fauna

A full list of the fauna species recorded during this and previous surveys is provided at Table 11 in Appendix 3.

A total of 73 fauna species were recorded on site or nearby during surveys, comprising 64 native and 9 introduced species. Of these, 5 are listed threatened species, of which only one is identified as a Species Credit species.

1. ***Meridolum corneovirens*** **Cumberland Plain Land Snail**. Two living individuals and one dead shell of this species were observed within the gutter along the edge of the accessway for 330 Annangrove Road. This gutter was targeted for repeated survey as it has many suitable habitat features for snails: it collects and retains moisture; has deep and complex litter; and occurs along the outer edge of the area of CPW and SSTF. This species is listed as a Species Credit species and the area of potential habitat in the development footprint requires offsetting in accordance with the BAM.
2. ***Glossopsitta pusilla*** **Little Lorikeet**. This species was observed nearby at #314 Annangrove Road during previous surveys in similar habitats. This species is listed as an Ecosystem Credit Species and habitat on site for this species has already been identified and accounted for within the BAM credit calculations for each PCT.
3. ***Micronomus norfolkensis*** **Eastern Coastal Free-tailed Bat**. "Definite" calls of this species were recorded both on the development site and nearby during other previous surveys. This species is listed as an Ecosystem Credit Species and habitat on site for this species has already been identified and accounted for within the BAM credit calculations for each PCT.
4. ***Miniopterus orianae oceanensis*** **Eastern Bent-wing Bat.** "Possible" calls of this species were recorded nearby during previous surveys. This species is listed as an Ecosystem Credit Species and habitat on site for this species has already been identified and accounted for within the BAM credit calculations for each PCT.
5. ***Miniopterus australis*** **Little Bentwing-bat.** "Probable" calls of this species were recorded nearby during previous surveys. This species is listed as an Ecosystem Credit Species and habitat on site for this species has already been identified and accounted for within the BAM credit calculations for each PCT.
6. ***Falsistrellus tasmaniensis*** **Eastern False Pipistrelle**. "Possible" calls of this species

were recorded near the development site during previous surveys. Calls of this species cannot be reliably differentiated from *Scoteanax rueppellii* Greater Broad-nosed Bat and *Scotorepens orion* Eastern Broad-nosed Bat. This species is listed as an Ecosystem Credit Species and habitat on site for this species has already been identified and accounted for within the BAM credit calculations for each PCT.

7. ***Scoteanax rueppellii* Greater Broad-nosed Bat**. "Possible" calls of this species were recorded near the development site during previous surveys. Calls of this species cannot be reliably differentiated from *Falsistrellus tasmaniensis* Eastern False Pipistrelle and *Scotorepens orion* Eastern Broad-nosed Bat. This species is listed as an Ecosystem Credit Species and habitat on site for this species has already been identified and accounted for within the BAM credit calculations for each PCT.

No roosting or nesting animals were found on the development site during surveys. A nest of *Manorina melanophrys* Bell Miner containing young chicks and a bower of *Ptilonorhynchus violaceus* Satin Bowerbird were both observed within the riparian lands of Second Ponds Creek below 328 Annangrove Road.

STAGE 2 IMPACT ASSESSMENT

5 AVOID AND MINIMISE IMPACTS

The site supports CPW and SSTF, as well as realised and potential habitat for a number of threatened species.

The total area of CPW on the development site is 0.37 hectares (Vegetation Zones 1 and 5) (see Figure 9), which is made up mostly of a single patch of regrowth dating from post 1977 (see Figure 11).

The total area of SSTF on the development site is 1.45 hectares, which is partially made up of post-1977 regrowth (Vegetation Zone 2 – 0.17 hectares), and older regrowth with highly disturbed understorey (Vegetation Zones 3 – 0.76 hectares and 4 – 0.52 hectares).

The proposal will retain and rehabilitate some of the SSTF, supplemented by CPW and SSTF plantings in some of the landscaped parts along Annangrove Road, at the interface between the development and the retained vegetation, and along rear and north eastern boundaries.

The retained and rehabilitated area of SSTF on site will be subject to an approved Biodiversity Management Plan and other parts will be subject to an approved Landscape Plan. The over-arching objective of the Biodiversity Management Plan will be the reinstatement of fully structured vegetation and important habitats. The Landscape Plan will serve amenity objectives as well as contribute to biodiversity outcomes.

The management objectives and strategies for the development site will be detailed in the approved BMP, a summary of which is provided in Table 12 in Appendix 3.

5.1 Impacts Avoided

The BAM details a number of ways in which a development proposal can demonstrate avoidance and minimisation of impact. Relevant clauses are paraphrased and addressed below:

- **Project footprint located according to biodiversity values and may be iterative, depending on findings.**

  The footprint has partially responded to the biodiversity values of the site, in the following ways:

  - Intensive and extended surveys over 3 years and across seasons using targeted methodologies provides a high degree of confidence regarding the likelihood of presence of the subject threatened species. Most of the site provides poor habitat for flora and fauna. The most valuable areas are those that support CPW and SSTF, albeit in small and highly modified patches of regrowth.
  - The areas to be retained at the rear of the development are of high value for

biodiversity, as they contain SSTF and are continuous with the protected riparian lands of Second Ponds Creek.

- Impacts on 0.44 hectares of existing SSTF will be avoided by its retention.
- The SSTF is more widespread across the rear of the site, and the retained areas are located within some of the oldest regrowth, as evidenced by historical aerial photography.
- Together with the protected vegetation within the riparian lands associated with Second Ponds Creek, there will be a vegetated corridor of between 113 and 145 metres width for the length of the development site.
- In order to maximise the benefit of this broad connected corridor for microbats, it is recommended that design responses include no unnecessary lighting along the rear of the buildings or facing the retained vegetation.

- **Direct impacts avoided and minimised by locating the project in areas where there are no biodiversity values.**

  - The areas of the site that are already cleared and developed are within the development footprint.

- **Direct impacts avoided and minimised by locating the project in areas where the native vegetation or threatened species habitat is in the poorest condition.**

  This is partially fulfilled by the proposal:

  - None of the native vegetation on site is in particularly good condition, with the highest vegetation integrity score being 43.6 for Vegetation Zone 2. The small sizes of the patches and their landscape context mean that they are nearly all edge, and impacted by serious weeds.
  - The areas in the best condition (most structurally diverse with highest integrity scores) are located at the front of the site. These areas are slated for removal and so the proposal does not satisfy this overall objective. However, this is a necessary compromise solution as the proposal must be economically viable and also work efficiently as a commercial centre; the development footprint does not serve biodiversity outcomes exclusively.
    The proposed layout trades off the areas of highest measured integrity on site for what is considered to be the best configuration. If the areas in the front of the site were to be retained, they could not be connected with the wildlife corridor at the rear, thus losing a very important functional advantage. The retained patch would be separated from the important bushland corridor at the rear, and become an isolated pocket hemmed in on all sides by roads and development.

- **Direct impacts avoided and minimised by locating the project in areas that avoid habitat for species that have a high biodiversity risk weighting or native vegetation that is a critically endangered ecological community or an endangered ecological community.**

This objective cannot be achieved, as the only types of vegetation on site are CEECs:

- For reasons detailed above, the proposed development will unavoidably impact on areas of CEEC CPW and SSTF, which have a high biodiversity risk weighting. As well as connectivity issues, the retention of all of these areas is not possible without sterilising the development potential of the site in line with Council's objectives for B6 Enterprise Corridor:
  - *To promote businesses along main roads and to encourage a mix of compatible uses;*
  - *To provide a range of employment uses (including business, office, retail and light industrial uses); and*
  - *To maintain the economic strength of centres by limiting retailing activity.*
- *Meridolum corneovirens* Cumberland Plain Land Snail has a high biodiversity risk weighting and was recorded on site in a narrow moist gutter alongside CPW and SSTF on number 330 Annangrove Road. This species has poor mobility and is virtually isolated in the narrow gutter in which 2 live animals were found, being surrounded by hostile open country and access tracks. It is proposed that animals are rescued from this narrow gutter and relocated into enhanced habitat in the conservation area that adjoins the extensive habitat in the wildlife corridor along Second Ponds Creek; this mitigation is further detailed below.
- *Litoria aurea* Green and Golden Bell Frog has a high biodiversity risk weighting and while potential habitat occurs in the dam, this species has not been recorded on site or within nearby habitat. For the purposes of the analysis, its presence has been assumed as survey was not undertaken under optimum conditions.
- *Myotis macropus* Large-footed Myotis has a high biodiversity risk weighting but has not been recorded on or near the site. As survey was not undertaken under optimum conditions, for the purposes of the analysis and offsets, its presence has been assumed. Being a fishing bat, the site does not provide foraging habitat, but does provide potential roost sites in hollow-bearing trees and the buildings to be removed due to their proximity to potential foraging habitat. Such potentially important habitat features lost in the footprint can also be offset with the installation of appropriate artificial roost sites.

- **Direct impacts avoided and minimised by locating the project such that connectivity enabling movement of species and genetic material between areas of adjacent or nearby habitat is maintained.**

  This objective is fully satisfied:

  - The maintenance and enhancement of connectivity has been a major driver in the chosen configuration of the proposal. SSTF is to be retained at the rear of the site, which is directly connected to the protected riparian lands associated with Second Ponds Creek.
  - This reflects the pattern of existing connectivity, with the riparian corridor being the only well-connected area of woody habitat within 5 kilometres of the development site.

- **Detail other constraints to the footprint location.**

    - The operational requirements of the development and its financial viability have imposed constraints on the pattern of vegetation retention. The central areas of CPW and SSTF (comprising most of Vegetation Zones 1, 5, and 2) could not be accommodated for the type of development proposed.
    - As CPW is generally restricted to the Annangrove Road frontage, it is also impacted by the planned widening of the road, which is independent of the proposed development. This widening encroaches on the subject lot and removes CPW and the opportunity for additional areas to be retained and / or restored.

- **Detail how prescribed impacts *sensu* the *Biodiversity Conservation Regulation 2017* are avoided and minimised.**

    - The removal of the **human-made structures** on site is unavoidable, and the removal of the derelict building is essential.
    - The types of important potential habitat provided by the buildings on site are restricted generally to roosts for microbats. Their removal has two potential adverse outcomes: harming fauna during the removal process and the loss of roosting / breeding sites. The former is controlled by ecological supervision of the demolition process, and the latter is mitigated by habitat enrichment (installation of suitable nest boxes and / or modified salvaged natural hollows).
    - The **non-native vegetation to be removed** is almost entirely comprised of exotic open grassland or infestations of high threat weeds. The removal of these areas and their partial replacement with rehabilitated SSTF and landscaped gardens is of benefit to the TECs on site and other vegetation in the immediate vicinity. Clearing of weeds from the footprint and control of weeds in the retained areas will be addressed in the approved Biodiversity Management Plan to minimise their spread during works and ultimately deliver control on site.
    - The **small dam to be removed** is not needed for the management of stormwater on site, and as it is an artificial landscape feature, will be reinstated as SSTF. Its loss is not likely to impose a significant impact on important aquatic fauna as it provides very low quality habitat in its current condition: almost dry with the prolonged drought conditions, and overgrown with *Typha*, providing no habitat diversity. The connection of the site's hydrological processes with the adjacent trunk drainage land will be delivered by the stormwater management plan, using conventional water sensitive urban design principles.
    - The development of the site has the potential to further interrupt **connectivity of habitat and movement of wildlife**. However, this impact is minimised by virtue of the existing configuration of the woody vegetation and condition of habitats on site. The major route for the movement of flora and fauna is via the network of bushland along riparian corridors. The connectivity to the important corridor along Second Ponds Creek will be maintained and enhanced by the rehabilitation of the patch of SSTF at the rear. The vegetation in the centre of the site leads from the wildlife corridor to Annangrove Road and surrounding cleared land,

developed land, or land soon to be developed. It is separated from the uninterrupted riparian corridor by very low integrity vegetation around the dwellings and contributes little to connectivity.

- The transformation of the site will have the potential to introduce **edge effects** tat have the potential to reduce the viability of the adjacent vegetation in the Second Ponds Creek riparian corridor. However, potential impacts can be controlled by standard erosion and sediment controls, stormwater control, appropriate management of litter and rubbish, and implementation of weed control in the retained SSTF patch and the landscaped areas.
- The bushland at the edge of the development has the potential to be impacted by **light and noise** emanating from the development. It is recommended that the bushland at the interface is therefore protected from such impacts by an appropriate design solution: no lights are to be directed into the bushland and noise is to be buffered by architectural means.
- **Weeds and pathogens** have the potential to impact adjacent habitats, but such things are controlled by the implementation of the Biodiversity Management Plan and the Landscape Plan.
- **Predators and pest species** could increase as a result of access to rubbish generated by the development. Amelioration of such impacts can be achieved by good hygiene and implementation of the waste management plan and targeted pest species control (such as rodent bait stations).

5.2 Unavoidable Impacts and their Control

- **Loss of CPW (CEEC).** A total of 0.37 hectares of existing CPW on the development site will be permanently removed due to the construction and occupation of the proposed development and road widening. This will be offset primarily by the biodiversity credit offset obligation (see Appendix 5), but will be partially ameliorated by the planting of CPW trees and understorey in parts of the landscaped areas.

- **Loss of SSTF (CEEC).** A total of 1.00 hectares of SSTF on the development site will be permanently removed by the proposed development. In addition to the retirement of the required ecosystem credits (see Appendix 5), this will be offset by the retention and conservation management of 0.44 hectares of existing SSTF on site, and the regeneration of an additional 0.04 hectares currently occupied by the small dam. The ultimate area of SSTF on site will therefore be 0.49 hectares, representing a loss of 0.96 hectares.

- **Loss of non-native vegetation.** Across the development site there are a number of large clumps of non-native vegetation. The removal of weeds will represent a loss of dense understorey in some areas – which may be used by small birds as shelter and forage – but this is made up almost exclusively of significant weeds such as Lantana, Privet and Cestrum. In accordance with the *BCA 2016* and *BCR 2017*, such losses do not necessarily have to be offset but will be compensated for by the implementation of an approved Biodiversity Management Plan and Landscape Plan for the development site. The species list for planting will be informed by locally-native species in this area and is to be mindful of the need to restore floristic and structural diversity. These plans will also remove

significant weeds and exotics that have the potential to become environmental weeds. This will improve habitats on site as well as off site, as it will remove a source of weed propagules otherwise raining down on sensitive downslope environments, including the riparian lands of Second Ponds Creek.

- **Loss of hollow-bearing trees.** Hollow-bearing trees on site were few with only 5 recorded during survey. Their locations are shown in Figure 10 in Appendix 1.

  Tree hollows provide important sheltering and breeding habitat for many species, including threatened species. This is particularly so in urban environments, where such trees are becoming very rare, being removed because of their perceived or real instability and conflict with human safety.

  The proposal will require the removal of at least one hollow-bearing tree within the extent of SSTF on site and the removal of at least 2 dead trees containing potential roosting habitat for microbats. The retention of the remaining hollow-bearing trees will be the subject of ongoing arboricultural assessment.

  Hollow tree removal has the potential to directly impact animals resident in the hollows at the time of felling, as well as impact them due to the removal of the habitat. Thus, In addition to the retirement of the required ecosystem and species credits for specific hollow-dependant species (see Appendix 5), these potential impacts will be further ameliorated by:

  - The installation of nest boxes and salvaged natural hollows in retained trees as a replacement for the hollows to be lost and as an enrichment strategy of the retained vegetation. The numbers of replacement hollows will be at a ratio of at least 1:1 to those lost. The boxes will be of a design suitable for the species likely to be displaced (e.g. Kookaburra, Brushtail Possum, Ringtail Possum), or those considered to need further habitat support (e.g. microbats, and small parrots such as Little Lorikeet).
  - The hollow-bearing trees will be removed under ecological supervision to protect animal welfare. Clearing protocols will be implemented that protect the contractors, resident fauna, and surrounding retained vegetation. Felling techniques will be determined by the individual circumstances of each tree. Rescued animals will be relocated into nest boxes / salvaged hollows as appropriate, or given veterinary care if injured.

- **Loss of suitable habitat for *Meridolum corneovirens* Cumberland Plain Land Snail.** At least two living individuals of this species were observed within the existing gutter adjoining the accessway of 330 Annangrove Road. The proposed development will require the removal of potential and realised habitat.

  In addition to the retirement of the required species credits (see Appendix 5), this will be offset by the retention and enrichment of existing habitat and the creation of new habitat. An important feature of habitat enrichment will be the introduction of coarse woody

debris, using trunks of felled trees on site. This type of habitat enrichment has been successfully implemented in south western Sydney by Local Land Services and the protocol to be applied will be guided by their successful strategies.

An approved Relocation Protocol will be implemented prior to works as part of an approved Biodiversity Management Plan. In summary, standard relocation protocols entail:

- Identification of suitable recipient areas in the retained bushland on site;
- Habitat enrichment of the recipient areas (e.g. by addition of coarse woody debris);
- Intensive searching of the suitable habitat for snails (live or dead) prior to clearing;
- Relocation of live animals together with the litter and soil habitat to the recipient site. This helps to minimise relocation shock as well as seed the recipient site with the fungal spores and hyphae from the donor site; and
- Monitoring of the recipient sites to maintain optimal conditions for the habitat of this species.

- **Loss of suitable habitat for *Myotis macropus* Large-footed Myotis.** This species was not recorded on site but potential habitat occurs in the hollow-bearing trees and the existing buildings due to their proximity to potential foraging habitat in the settlement ponds of Second Ponds Creek.

  In addition to the retirement of the required species credits (see Appendix 5), this impact will be offset by the retention and enrichment of existing habitat and the creation of new habitat. The most important feature of habitat enrichment for this species will be installation of suitable nest boxes, and the protection of large trees that may form natural hollows in the long term.

- **Loss of suitable habitat for *Litoria aurea* Green and Golden Bell Frog.** This species was not recorded on site but is known in the local area from a number of records arising from an unauthorised release program in nearby Riverstone.

  In addition to the retirement of the required species credits (see Appendix 5), the loss of habitat and potential harm to individuals will be mitigated by the retention and enrichment of movement habitat. The existing dam will be removed, and so an approved Relocation Protocol will be implemented prior to works as part of an approved Biodiversity Management Plan. This will involve careful filtering of dam water during the dewatering process, capture and relocation of individuals, and enhancement of on site habitat by the management of weeds.

- **Loss of suitable habitat for *Glossopsitta pusilla* Little Lorikeet.** This species was recorded nearby during previous surveys of number 314 Annangrove Road. The development site provides appropriate nesting and foraging habitat for this species and is contiguous with the riparian habitats that are particularly suitable for this species.

In addition to the retirement of the required ecosystem credits (see Appendix 5), the loss of potential nest sites will be specifically offset by the installation of suitable nest boxes within the retained bushland on site at a minimum ratio of 1:1. Furthermore, suitable foraging habitats remaining on site will be enriched under an approved Biodiversity Management Plan and Landscape Plan.

- **Loss of suitable habitat for *Micronomus norfolkensis* Eastern Coastal Free-tailed Bat and *Falsistrellus tasmaniensis* Eastern False Pipistrelle.** The proposal will require the removal of suitable potential roosting habitats (i.e. hollow-bearing trees) on the development site.

  In addition to the retirement of the required ecosystem credits (see Appendix 5), nest boxes at a minimum ratio of 1:1 will be installed within the retained vegetation on site to offset the losses of potential roost sites in the small number of hollow-bearing trees impacted by the development.

  The loss of vegetation on site is considered to be of little consequence to these highly mobile species. Suitable foraging habitats will remain on site, as well as in the adjoining riparian lands of Second Ponds Creek. Nevertheless, in order to enhance the remaining habitats on site, an approved Biodiversity Management Plan will improve the condition and enhance the diversity of native vegetation on site, which is considered to be of advantage to these species.

- **The loss of suitable foraging habitats for *Miniopterus* species.** Calls of both *Miniopterus australis* Little Bentwing-bat and *Miniopterus orianae oceanensis* Eastern Bent-wing Bat were recorded on and nearby the development site during surveys. These species are cave-roosting species and prefer to forage where dense canopies occur. Thus, the site only provides marginally suitable foraging habitat.

  The loss of vegetation on site is considered to be of little consequence for these highly mobile species with suitable foraging habitats to remain on site, adjoining the riparian lands of Second Ponds Creek. In addition to the retirement of the required ecosystem credits (see Appendix 5), the remaining habitats on site will be enhanced by the implementation of an approved Biodiversity Management Plan. This will improve the condition and diversity of native vegetation on site, which is considered to be of advantage to these species.

- **Potential sedimentation of downslope environments.** As demolition proceeds and vegetation is cleared, there is the potential for the mobilisation of soil and the deposition of sediment downslope into Second Ponds Creek. Such hazards can be easily controlled by the implementation of standard sediment and erosion controls and will routinely be part of a construction management plan.

- **Potential indirect impacts from stormwater collection and discharge.** The development will result in an increase in impervious surfaces, but water management controls will be implemented as per the Stormwater Management Plan. The concept plan

indicates that the stormwater pipe will by installed in existing clearings on site and into the trunk drainage lands. The outlet is standard for all such developments along Annangrove Road, containing scour protection (rocky rip rap) and regenerated in accordance with the specifications set by Sydney Water.

The potential for hydrological changes to impose indirect impacts on the retained vegetation downslope will be mitigated by active management as part of the approved Biodiversity Management Plan.

- **Potential indirect impacts through shading.** The shadow diagrams prepared by Leffler Simes Architects (drawing no. DA-200, revision 4) show the shadows cast by the proposed buildings in mid-winter. Although the proposed buildings are not tall, they will cast shadows towards the retained vegetation to its south and south east. The buildings will not throw shadow on the conservation area on site at all, but will shade the vegetation in the trunk drainage land from mid afternoon. The impact of this additional shade is not considered to impose a significant adverse impact on the adjacent vegetation as it is already shady, with a relatively dense canopy cover located at the bottom of the landscape in a gully.

- **Potential accidental damage to retained areas.** Areas of vegetation to be retained and individual trees to be retained will be fenced off during construction and protected using standard protection protocols such as those in AS4970 Protection of Trees on Development Sites.

- **Potential spread of disease.** The opening up of soil has the potential to mobilise soil-borne disease (such as the root rot fungus *Phytophthora* cinnamomi). Best practice hygiene protocols are to be observed if there is any indication of *Phytophthora* infection.

Additional credit obligations to offset prescribed impacts are not considered necessary as they are either minor or adequately controlled by active management.

6 IMPACT SUMMARY

The proposal will result in the following:

- clearing the existing CPW (PCT 849) and of some of the SSTF (PCT 1395) (see summary table below);
- retention and regeneration of some of the existing SSTF (see summary table below);
- planting and rehabilitation of some currently cleared parts as CPW and SSTF (see summary table below);
- removal of realised and potential habitat of *Meridolum corneovirens* Cumberland Plain Land Snail in the CPW to be cleared;
- rehabilitation of new habitat and enrichment of existing retained habitat for *Meridolum corneovirens* Cumberland Plain Land Snail;
- removal of potential roosting habitat of microbats in 5 hollow-bearing trees;
- removal of potential roosting habitat of microbats in the buildings;
- enrichment of potential roosting habitat for microbats by the installation of at least 5 artificial roost sites;
- removal of potential habitat for *Litoria aurea* Green and Golden Bell Frog within the small dam; and
- rehabilitation of potential habitat for *Litoria aurea* Green and Golden Bell Frog within the detention basin / stormwater management system to be installed.

PCT /EEC	Pre-development (Area ha)	Remove	Retain	Reinstate (landscape)	Revegetate (existing cleared to native vegetation	Post-development (Area ha)	Outcome (ha)
849 CPW	0.37	0.37	0	0.06	0.12	0.18	-0.19
1395 SSTF	1.45	1.00	0.44	0	0.12	0.57	-0.88

6.1 Serious and Irreversible Impacts (SAII)

6.1.1 Background

The consideration of serious and irreversible impacts (SAII) is intended to function as an additional and final measure in the BOS to protect threatened species and threatened ecological communities that are most at risk of extinction from potential development impacts. In general, the consent authority is required to determine whether or not any of the residual impacts of a proposal are serious and irreversible – residual impacts being those that remain after avoidance and / or mitigation measures have been implemented.

Such impacts are likely to contribute significantly to the risk of extinction of a threatened species or ecological community in NSW in the following ways (referred to as the four principles):

- cause a further decline of the species or ecological community that is currently observed,

estimated, inferred or reasonably suspected to be in a rapid rate of decline; or
- further reduce the population size of the species or ecological community that is currently observed, estimated, inferred or reasonably suspected to have a very small population size; or
- impact on the habitat of a species or ecological community that is currently observed, estimated, inferred or reasonably suspected to have a very limited geographic distribution; or
- impact on a species or ecological community that is unlikely to respond to measures to improve habitat and vegetation integrity and is therefore irreplaceable.

An assessment of the potential for the development to impose Serious and Irreversible Impacts (SAIIs) has therefore been undertaken in accordance with the *Guidance to assist a decision-maker to determine a serious and irreversible impact* (DoPIE 2019), hereafter referred to as the Guidelines.

The first consideration is whether a subject species or community qualifies as an SAII entity. To assist in this consideration, criteria have been established for the four principles, which are detailed in Appendix A of the Guidelines and summarised below.

Principle 1 – Species or ecological community currently in a rapid rate of decline are those that fulfil any of the following criteria:
- An entity listed as Critically Endangered under the *BC Act 2016*; or
- A species with a population reduction of 80% or more in 10 years or three generations (whichever is longer); or
- A community that has undergone a very large reduction in its distribution, being 90% or more since 1750 (historical decline) or 80% or more over a 50 year period.

Principle 2 – Species or ecological communities with very small population size are those that fulfil any of the following criteria:
- An entity listed as Critically Endangered under the *BC Act 2016*; or
- A species with a very small population size (fewer than 50 mature individuals); or
- A species with a a known population of fewer than 250 mature individuals and is in continuing decline:
    - of at least 25% in three years or one generation (whichever is longer); or
    - where the number of mature individuals in each subpopulation is <50; or
    - the percentage of mature individuals in one subpopulation is 90-100%; or
    - the population is subject to extreme fluctuations in the number of individuals; or
- A community suffering very high environmental degradation, or disruption of biotic processes.

Principle 3 – Species or area of ecological community with very limited geographic distribution are those that fulfil any of the following criteria:
- An entity listed as Critically Endangered under the *BC Act 2016*; or
- A species with a very limited geographic distribution, being:
    - Those with an area of occupancy of 10 square kilometres or less; or
    - Those with an extent of occurrence of 100 square kilometres or less; and

  - Those that have at least two of the following conditions:
    - Are severely fragmented or only known from one location
    - Continuing decline
    - Extreme fluctuations; or
  - Those that inhabit three or fewer locations in NSW.
- An ecological community with a known area of occupancy of up to 2 10x10 kilometre grid cells or an extent of occurrence of up to 1,000 square kilometres and one of the following:
  - An observed or inferred continuing decline in:
    - A measure of spatial extent appropriate to the community; or
    - A measure of environmental; quality appropriate to the characteristic biota of the community; or
    - A measure of disruption to biotic interactions appropriate to the characteristic biota of the community
  - Observed or inferred threatening processes that are likely to cause continued decline in geographic distribution, environmental quality, or biotic interactions within the next 20 years; or
  - The community exists in only one location.

Principle 4 - Species or ecological community that is unlikely to respond to management and is therefore irreplaceable are those that have the following traits:

- An entity unlikely to respond to management because:
  - The capacity to control key threats at the site scale is negligible. This is generally applicable to species that are significantly threatened by uncontrollable diseases such as frogs and the chytrid fungus, or some species of Myrtaceae and Myrtle Rust; or
  - Reproductive characteristics of some species severely limit their ability to increase the existing population on, or occupy new habitat at, a stewardship site. In general, these are plants that are sterile or largely clonal with no or very limited capacity to increase in number through seed production and recruitment.
- An impact will occur to an irreplaceable habitat or entity and therefore cannot be offset:
  - The potential to achieve an offset gain for species that are unlikely to respond to management is extremely low or uncertain; and / or
  - Impacts to essential habitats that cannot be readily re-created, such as caves or cliff lines used by microbats for roosting and breeding.

These criteria have been applied to the list of threatened communities and species, and potential SAII entities are listed in the Guidelines.

No threatened species that occur on site that are candidate SAII entities, and therefore this factor needs no further consideration. However, as CEEC, both CPW and SSTF are listed as candidate SAII entities in the Guidelines – CPW is listed in accordance with Principles 1 and 2, and SSTF in accordance with Principles 2 and 3. Therefore, the potential for impacts on these entities to be a SAII are considered below in Additional Assessments, using the 9 factors detailed per Appendix B of the Guidelines, and provided below for both communities.

6.1.2 Additional Assessment – SAII and CPW

a. the action and measures taken to avoid the direct and indirect impact on the potential entity for a SAII

Response:

The opportunity to avoid direct impact on CPW on this site is not available due to operational and financial viability issues.

The configuration of retained vegetation as proposed is a compromise solution that delivers a superior connectivity outcome. If the CPW was to be retained, there would be no opportunity for it to be directly connected to the large expanse of retained corridor vegetation along the Second Ponds Creek riparian system and beyond.

b. the area (ha) and condition of the threatened ecological community (TEC) to be impacted directly and indirectly by the proposed development. The condition of the TEC is to be represented by the vegetation integrity score for each vegetation zone

Response:

The area of CPW mapped on site and within the footprint is small - 0.37 hectares - and comprises an area of fully structures woodland with a moderate vegetation integrity score (Vegetation Zone 1 – 41.2) and as a derived native grassland that has a very low integrity score (Vegetation Zone 5 – 2.3).

Being a small patch surrounded by cleared and developed lands, the patch comprises all "edge" habitat. As a result, it contains significant weeds, including *Asparagus asparagoides* Bridal Creeper, *Ligustrum sinense* Small-leaved Privet, *Olea europaea* subsp*. cuspidata* African Olive, and *Eragrostis curvula* African Lovegrass. These are all High Threat Exotics and / or Weeds of National Significance.

c. a description of the extent to which the impact exceeds the threshold for the potential entity

Response:

No thresholds have been set for this community, and it is advised by the Department of Planning, Industry, and Environment[19] that "*In the absence of thresholds, the consent authority can disregard references to considering thresholds in the guidance when making their determination*".

d. the extent and overall condition of the potential TEC within an area of 1000 ha, and then 10,000 ha, surrounding the proposed development footprint

[19] https://www.environment.nsw.gov.au/topics/animals-and-plants/biodiversity/biodiversity-offsets-scheme/serious-and-irreversible-impacts

Response:

The extent and nature of CPW within the 1,000 and 10,000 hectare assessment circles are to be considered for context. These assessment circles are complex in that they involve two LGAs (Blacktown and The Hills), and also partially contain bio-certified lands in the North West Growth Centre SEPP.

To determine the area occupied by CPW in these assessment circles, the available vegetation mapping for the Hills[20] and Blacktown[21] LGAs were interrogated. Within the 1,000 hectare assessment circle, CPW occurs in a total 58.9 hectares (5.9%), and in 918.8 hectares (or 9.2%) of the 10,000 hectare assessment circle.

The proposal will reduce the area of CPW by 0.37 hectares, which represents 0.6% of that within the 1,000 hectare circle, and 0.04% of that within the 10,000 hectare circle.

CPW is highly fragmented, occurring mostly in small patches within a highly disturbed landscape of increasingly urbanised rural lands. As a consequence of this pattern, these patches are generally in poor condition, with low floristic diversity and a high incidence of weeds. Many of the weeds present in CPW are significant, being transformer weeds, High Threat Weeds, or Weeds of National Significance. This is reflected in the condition of the vegetation on site.

As part of the strategic planning for the growth areas, some of the CPW has been judged unworthy of conservation action at all, and instead certified for loss and offset elsewhere in accordance with the BioBanking methodology.

Using the 2006 protected lands mapping provided by Council, none of the 58.9 hectares of CPW mapped in the Growth Centre within the 1,000 hectare assessment circle falls within protected areas. Similarly, only 44 hectares of the 918.8 hectares within the 10,000 hectare assessment circle are in protected lands.

Thus, in the immediate local context (1,000 hectares), it appears that no CPW is guaranteed to be retained. However, the CPW losses in the Growth Centre have been offset: small fragmented patches scattered across the semi-rural and urban lands (such as on the subject site) have been offset with areas of the highest conservation value – such as large remnants – and enhanced by active rehabilitation actions in strategic locations – such as wildlife corridors. These offsetting actions are considered to have delivered an "overall improvement or maintenance of biodiversity values" (DECC 2007).

Thus, although there are apparently no areas of CPW guaranteed for retention in the immediate area and little in the larger assessment context, they continue to exist elsewhere as offset areas that have been enhanced and conserved. The absence of other

[20] The Hills Shire Council (2020) Online mapping tool. (http://mapping.thehills.nsw.gov.au/IntraMaps90/)
[21] Vegetation Map – Cumberland Plain West - VIS 4207 (https://geo.seed.nsw.gov.au/Public_Viewer/index.html?viewer=Public_Viewer&locale=en-AU)

CPW in the immediate local area makes the patch of CPW on site even less viable, being even more isolated and unable to contribute to conservation of this community across the local landscape.

e. an estimate of the extant area and overall condition of the potential TEC remaining in the IBRA subregion before and after the impact of the proposed development has been taken into consideration

Response:

CPW is confined to the Cumberland Plain, which is largely coincident with the Cumberland IBRA subregion. The most reliable estimate of the extent of CPW in the subregion is contained within the Recovery Plan (DECCW 2011), where it is stated that approximately 11,000 hectares of CPW occurs in patches with relatively intact canopies, and 14,500 hectares occurs in patches with only scattered native canopy.

The area to be removed from the subject site is 0.37 hectares of CPW, comprising 0.30 hectares with a relatively intact canopy, and 0.07 hectares as a derived grassland. This represents approximately 0.003% of the intact vegetation within the subregion, and 0.001% of the occurrence of total CPW in all condition classes.

f. an estimate of the area of the candidate TEC that is in the reserve system within the IBRA region and the IBRA subregion

Response:

CPW occurs in a number of reserves, including Kemps Creek, Mulgoa, Prospect, and Windsor Downs Nature Reserves, Scheyville National Park, and Leacock, Rouse Hill, Western Sydney, and Wianamatta Regional Parks (NSW Scientific Committee 2009), totalling just over 1,000 hectares (DECCW 2011). It also occurs in other reserved lands that are managed for conservation, such as Mt Annan Botanic Garden.

g. the development, clearing or biodiversity certification proposal's impact on:

i. abiotic factors critical to the long-term survival of the potential TEC; for example, how much the impact will lead to a reduction of groundwater levels or the substantial alteration of surface water patterns

Response:

The main abiotic determinants of the distribution of CPW are soil type, underlying geology, rainfall, and altitude. The proposal will have no impact on any of these factors.

CPW has been identified as a potential groundwater dependent ecosystem (or GDE) (Kuginis et al. 2012) and the vegetation along Second Ponds Creek (including that on the subject site) is mapped as a terrestrial GDE (BOM 2020), but dependent

on inflow, not the expression of groundwater at the surface.

The increase in hard surfaces has the potential to result in a minor reduction in groundwater recharge, but this is anticipated to be a small change. The underlying clay soils would have a low permeability and therefore most rainfall would be released as overland flow.

Any hydrological changes are considered unlikely to be of a scale to have an adverse impact on remaining CPW in the local area.

ii. characteristic and functionally important species through impacts such as, *but not limited to*, inappropriate fire/flooding regimes, removal of understorey species or harvesting of plants

Response:

As a grassy woodland, characteristic and functionally important species to CPW are principally canopy trees and grasses. The loss of the 0.37 hectares of an isolated patch of CPW vegetation from the subject site will not interfere with the persistence of these species in the landscape, will not interrupt the movement of pollinators, or have any impact on the fire regime.

iii. the quality and integrity of an occurrence of the potential TEC through threats and indirect impacts including, *but not limited to*, assisting invasive flora and fauna species to become established or causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants which may harm or inhibit growth of species in the potential TEC

Response:

The proposal will remove the small patch of CPW on site. There are no proximate patches of CPW in the landscape, and so any potential impacts arising from the development can only come from indirect impacts.

The only such potential adverse impact is considered to occur from the planting of *Cupaniopsis anacardioides* Tuckeroo as proposed in the concept Landscape Plan. This species is an emerging environmental weed in western Sydney woodlands, and it is therefore recommended that this species be deleted from the Landscape Plan and replaced with a species known to occur naturally in CPW, or one that does not have weedy tendencies.

h. direct or indirect fragmentation and isolation of an important area of the potential TEC

Response:

Important areas of CPW have been identified in the investigation by (the then) Department of Environment, Climate Change and Water for "Priority Conservation Lands" (DECCW 2010). These lands were chosen using an iterative process filtered initially for large patches of vegetation (minimum 50 hectares) that were within 500 metres of records of threatened species. Size was the fundamental criterion as only large areas are considered to be viable in the long term. The suitability of these candidate areas were then further refined by the removal of narrow linear patches, or those patches compromised by urban development, or otherwise identified for urban growth by zoning or other strategic planning instruments.

The forerunner to the BOS – the BioBanking Assessment Methodology (or BBAM) – had "red flags" assigned to vegetation or species that were considered unable to withstand a proposed impact. For Threatened Ecological Communities that were over-cleared (i.e. Endangered or Critically Endangered Ecological Communities), a patch of vegetation that was 4 hectares or more in area was deemed too important to be considered for offsetting.

This concept has been continued in the current BOS with the SAII concept. Although no area thresholds have been set explicitly, it is instructive to consider that 4 hectares was the previous yardstick when considering the potential for the loss of CPW on site to constitute a SAII.

The area of CPW on site is already very small (0.37 hectares), relatively isolated in a fragmented landscape, and comprises relatively young regrowth (as evidenced by historical aerial photography). It is part of a corridor of land zoned as B6 Enterprise Corridor.

When compared with the areas recognised by government authorities as priority lands for conservation, the CPW on site falls far short of the 50 hectare threshold. It also fails the previous BBAM threshold of 4 hectares for unsustainable loss.

The subject site is distant from any of the areas identified as priority conservation lands (DECCW 2011), with the closest being 6.5 kilometres to the north at Maraylya.

The CPW patch on site cannot be regarded as an important area of CPW due to its small size, lack of connectivity, and location in a matrix of cleared land being increasingly developed for residential and commercial purposes.

i. the measures proposed to contribute to the recovery of the potential TEC in the IBRA subregion.

Response:

The biggest contribution that the proposal can make to the recovery of CPW in the subregion is by the conservation management of part of the vegetated area on site where weed loads will be drastically reduced, and by the retirement of biodiversity credits off site.

It is considered that the proposal is unlikely to result in a SAII for CPW, largely due to the small scale of the loss and the highly modified and fragmented nature of the existing vegetation. Its loss is not considered serious or irreversible, and can be offset adequately in accordance with the BAM-C.

6.1.3 Additional Assessment – SAII and SSTF

a. the action and measures taken to avoid the direct and indirect impact on the potential entity for a SAII

Response:

Direct impact on SSTF will be avoided in the 0.44 hectares mooted for conservation management at the rear of the site. Other direct impacts cannot be avoided due operational reasons and the financial viability of the proposal. The retention of the remaining areas of SSTF in the centre of the site is incompatible with the type of proposed development and the necessary layout.

The configuration of retained vegetation as proposed is a compromise solution that delivers a superior connectivity outcome for SSTF that will be directly connected to the large expanse of retained corridor vegetation along the Second Ponds Creek riparian system and beyond.

b. the area (ha) and condition of the threatened ecological community (TEC) to be impacted directly and indirectly by the proposed development. The condition of the TEC is to be represented by the vegetation integrity score for each vegetation zone

Response:

The area of SSTF estimated to be removed by the footprint is 1.00 hectare, and comprises 0.17 hectares with a moderate vegetation integrity score (Vegetation Zone 2 – 43.6) and 0.83 hectares with a low vegetation integrity score (Vegetation Zone 4 - 19.4).

Being highly modified patches surrounded by cleared and developed lands, the areas of SSTF to be removed also contain significant weeds, including *Ehrharta erecta* Panic Veldtgrass, *Asparagus asparagoides* Bridal Creeper, and *Olea europaea* subsp*. cuspidata* African Olive. These are all High Threat Exotics and / or Weeds of National Significance.

c. a description of the extent to which the impact exceeds the threshold for the potential entity

Response:

No thresholds have been set for this community, and it is advised by the Department of

Planning, Industry, and Environment[22] that "*In the absence of thresholds, the consent authority can disregard references to considering thresholds in the guidance when making their determination*".

d. the extent and overall condition of the potential TEC within an area of 1000 ha, and then 10,000 ha, surrounding the proposed development footprint

Response:

SSTF is confined to the edges of the Cumberland Plain and while it is less fragmented than CPW, it has been extensively cleared for agriculture and urban development (NSW Scientific Committee 2014). Remnants are overwhelmingly small - 90% being <10 hectares (Tozer 2003) – and considered to be one of the most fragmented vegetation types in the Sydney region (NSW Scientific Committee 2014). As a consequence of this pattern, these patches are generally in poor condition, with low floristic diversity and a high incidence of weeds. Many of the weeds present in SSTF are significant, being transformer weeds, High Threat Weeds, or Weeds of National Significance.

To determine the area occupied by SSTF in the target areas, the same procedure as that for CPW was followed. The vegetation maps revealed that 74.7 hectares of SSTF occur within the 1,000 hectare assessment circle (representing 7.5% of the circle) and 1,057.8 hectares of SSTF occur within the 10,000 hectare assessment circle (representing 10.6% of the circle).

The proposal will reduce the area of SSTF by 1 hectare, which represents 1.3% of that within the 1,000 hectare circle, and 0.09% of that within the 10,000 hectare circle.

The influence of the certified lands within the Growth Centre is less than that for the CPW calculations, which is a reflection of the natural distribution of SSTF. Nevertheless, the 2006 mapping provided by Council shows that in the immediate local area (1,000 hectare assessment circle), 4.61 hectares of SSTF is guaranteed to be retained. Similarly, 75.5 hectares is guaranteed for retention in the 10,000 hectare circle.

The proposed loss of 1 hectare represents 22% of that in the immediate area and 1.3% of that in the surrounding 10,000 hectares.

e. an estimate of the extant area and overall condition of the potential TEC remaining in the IBRA subregion before and after the impact of the proposed development has been taken into consideration

Response:

The area of SSTF within the subregion is unknown, but its natural distribution is more or less restricted to the edges of the Cumberland Plain, which is a reasonable surrogate for

[22] https://www.environment.nsw.gov.au/topics/animals-and-plants/biodiversity/biodiversity-offsets-scheme/serious-and-irreversible-impacts

the Cumberland subregion. The most reliable estimate of the extent of SSTF is contained within the Recovery Plan (DECCW 2011), where it is stated that approximately 9,600 hectares of SSTF occurs in patches with relatively intact canopies, and 7,900 hectares occurs in patches with only scattered native canopy.

The area of SSTF to be removed from the subject site with a relatively intact canopy is 0.17 hectares, which represents 0.01% of the intact vegetation within the subregion. The total area of SSTF to be removed (1.0 hectare) is 0.006% of the total occurrence of SSTF in all condition classes.

f. an estimate of the area of the candidate TEC that is in the reserve system within the IBRA region and the IBRA subregion

Response:

Small areas of SSTF have been recorded from Bargo State Conservation Area, Blue Mountains National Park, Cattai National Park, Georges River National Park, Nattai National Park, Parramatta Regional Park, Scheyville National Park, Gulguer Nature Reserve and Upper Nepean State Conservation Area (NSW Scientific Committee 2014), totalling just 420 hectares (DECCW 2011).

g. the development, clearing or biodiversity certification proposal's impact on:

i. abiotic factors critical to the long-term survival of the potential TEC; for example, how much the impact will lead to a reduction of groundwater levels or the substantial alteration of surface water patterns

Response:

SSTF is confined to the edges of the Cumberland Plain, where shale soils are thin and there is influence of the underlying sandstone. The proposal will have no impact on any of these factors.

SSTF has been identified as a potential groundwater dependent ecosystem (or GDE) (Kuginis et al. 2012) and the vegetation along Second Ponds Creek (including that on the subject site) is mapped as a terrestrial GDE (BOM 2020), but dependent on inflow, not the expression of groundwater at the surface.

The increase in hard surfaces has the potential to result in a minor reduction in groundwater recharge, but this is anticipated to be a small change.

Any hydrological changes are considered unlikely to be of a scale to have an adverse impact on remaining SSTF in the local area.

ii. characteristic and functionally important species through impacts such as, *but not limited to*, inappropriate fire/flooding regimes, removal of understorey species or harvesting of plants

Response:

As a grassy woodland and forest, characteristic and functionally important species to SSTF are canopy trees and understorey (shrubs and grasses). The loss of the 1.0 hectare of SSTF vegetation from the subject site will not interfere with the persistence of these species in the landscape, will not interrupt the movement of pollinators, or have any impact on the fire regime.

iii. **the quality and integrity of an occurrence of the potential TEC through threats and indirect impacts including, *but not limited to*, assisting invasive flora and fauna species to become established or causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants which may harm or inhibit growth of species in the potential TEC**

Response:

The proposal will remove some SSTF on site but will retain an area of 0.44 hectares that will be subject to conservation management in accordance with an approved Biodiversity Management Plan. As this is concentrated in an area of very low condition, the potential degree of improvement is large. It will be closely managed so that any adverse impacts from adjacent development will be controlled. SSTF is also known for its resilience, once threatening processes have been removed and active conservation management is imposed.

h. **direct or indirect fragmentation and isolation of an important area of the potential TEC**

Response:

The area of SSTF on site is already small and isolated, with much of it in low condition. Its location and configuration does not support the contention that this is an important area of SSTF and would not have attracted a red flag under the BBAM. Also, it is not within or close to any of the areas identified as priority conservation lands (DECCW 2011).

i. **the measures proposed to contribute to the recovery of the potential TEC in the IBRA subregion.**

Response:

The biggest contribution that the proposal can make to the recovery of SSTF in the subregion is by the conservation management of some of the area of SSTF on site (where weed loads will be drastically reduced and its vegetation integrity greatly improved as it is a highly resilient vegetation type), and by the retirement of biodiversity credits off site.

It is considered that the proposal is unlikely to result in a SAII for SSTF, largely due to the small

scale of the loss and the highly modified and fragmented nature of the existing vegetation.

6.2 Impacts Requiring Offset

The impacts requiring offsetting are those related to:

- clearing within the area of mapped high biodiversity value;
- removal of CEEC CPW in vegetation zones with a vegetation integrity score of > 15 (see Figure 16 in Appendix 1);
- removal of CEEC SSTF in vegetation zones with a vegetation integrity score of > 15 (see Figure 16 in Appendix 1);
- removal of potential habitat of *Litoria aurea* Green and Golden Bell Frog (see Figure 17 in Appendix 1);
- removal of realised and potential habitat of *Meridolum corneovirens* Cumberland Plain Land Snail (see Figure 18 in Appendix 1); and
- removal of potential habitat of *Myotis macropus* Large-footed Myotis (see Figure 19 in Appendix 1).

6.3 Impacts Not Requiring Offset

Impacts not requiring offset are those related to:

- clearing of areas that do not contain native vegetation, such as the open cleared exotic grassland across the majority of the development site;
- clearing of vegetation within Vegetation Zone 3, as the vegetation integrity score was < 15 (being 13.3); and
- prescribed impacts as per Part 6 Division 6.1 of the *BCR 2017,* and indirect impacts.

Prescribed impacts and indirect impacts are detailed in Table 13 in Appendix 3, and the relevant impacts summarised below:

- removal of man-made structures;
- removal of non-native vegetation;
- impact on hydrological processes arising from the removal of a small farm dam;
- impacts on connectivity and movement;
- reduced viability of adjacent habitat through edge effects;
- reduced viability of adjacent habitat through noise and light spill;
- transport of weeds and pathogens;
- increase in populations of predatory species; and
- increase in populations of pest animals.

7 BIODIVERSITY CREDIT REPORT

Outputs from the BAM calculator are provided in Appendix 5, and include:

- **Vegetation Zones Report**

  This report identifies the 5 Vegetation Zones that occur on the development site. This report shows that one sampling plot is required per Vegetation Zone to satisfy the model.

- **Predicted Species Report**

  This report lists the species that are considered by the model as reliably predicted to use the site, based on the vegetation types present.

  No surveys are required for these species as Ecosystem credits apply.

- **Candidate Species Report**

  This report shows the number of candidate species requiring survey. A total of 0 candidate species required survey. Of these, the presence of 1 was confirmed as present, and 2 were assumed to be present.

- **Credit Summary Report**

  This report shows that a total of 13 Ecosystem credits, including **8 credits for PCT 849** *Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion* and **5 credits for PCT 1395** *Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion* are required with a further 27 species credits required to offset impacts to Species Credit Species, including:

  - 6 credits for *Litoria aurea* Green and Golden Bell Frog;
  - 10 credits for Meridolum corneovirens Cumberland Plain Land Snail; and
  - 10 credits for *Myotis macropus* Southern Myotis.

- **Biodiversity Credit report**

  This report details the like-for-like biodiversity credits that need to be traded for the biodiversity credits required.

  <u>Ecosystem credit summary</u>

  - 8 Ecosystem Credits for the loss of 0.37 hectares of PCT 849-is to be offset from any PCT that occurs within the TEC Cumberland Plain Woodland in the Sydney Basin Bioregion (including PCT's 849, 850) with hollow-bearing trees and within the IBRA subregions of Cumberland, Burragorang, Pittwater, Sydney Cataract,

Wollemi and Yengo, or any IBRA subregion that is within 100 kilometres of the outer edge of the impacted site.

- Clearing of 1 hectare of PCT 1395-Narrow-leaved Ironbark - Broad-leaved Ironbark – Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion requires 5 Ecosystem credits to be purchased. These credits must come from any PCT that is associated with the TEC Shale Sandstone Transition Forest in the Sydney Basin Bioregion (including PCT's 792, 1281, 1395) with hollow-bearing trees and within the IBRA subregions of Cumberland, Burragorang, Pittwater, Sydney Cataract, Wollemi and Yengo, or any IBRA subregion that is within 100 kilometres of the outer edge of the impacted site.

Species credit summary

- Clearing of 0.9 hectares of suitable habitat for *Litoria aurea* Green and Golden Bell Frog will require 6 Species credits to be purchased. These credits are only allowed to be traded for *Litoria aurea* Green and Golden Bell Frog however, they can be traded within any IBRA subregion within NSW.
- Clearing of 0.5 hectares of suitable habitat for *Meridolum corneovirens* Cumberland Plain Land Snail will require 10 Species credits to be purchased. These credits can only be traded with credits for *Meridolum corneovirens* Cumberland Plain Land Snail however, they can be traded within any IBRA subregion in NSW.
- The proposed development will require the removal of 0.8 hectares of suitable habitat for *Myotis macropus* Southern Myotis, thus requiring 10 Species credits to be purchased. These credits can only be traded with credits of *Myotis macropus* Southern Myotis however, they can be traded within any IBRA subregion in NSW.

- **Biodiversity Credit Report (Variation Options)**

In the event of no suitable credits being available after a suitable period of time has elapsed, the Biodiversity Conservation Trust may approve a variation offset for Species credit species:

- *Litoria aurea* Green and Golden Bell Frog – If no suitable credits can be purchased for this species over a suitable period of time, variation options allow for credit trading for this species with any fauna species listed as Endangered under Part 4 of the *BC Act 2016* within the IBRA subregions of Cumberland, Burragorang, Pittwater, Sydney Cataract, Wollemi and Yengo, or any IBRA subregion that is within 100 kilometres of the outer edge of the impacted site.
- *Meridolum corneovirens* Cumberland Plain Land Snail – Variation options allow for credit trading for this species with any fauna species listed as Endangered under Part 4 of the *BC Act 2016* within the IBRA subregions of Cumberland, Burragorang, Pittwater, Sydney Cataract, Wollemi and Yengo, or any IBRA subregion that is within 100 kilometres of the outer edge of the impacted site.
- *Myotis macropus* Southern Myotis – Variation options allow for credits of this species to be traded with any fauna species listed as Vulnerable under Part 4 of the *BC Act 2016* within the IBRA subregions of Cumberland, Burragorang,

Pittwater, Sydney Cataract, Wollemi and Yengo, or any IBRA subregion that is within 100 kilometres of the outer edge of the impacted site.

No variations to Ecosystem credits are proposed.

8 CONCLUSIONS

In consideration of the biodiversity impacts of the proposed development of 328 – 330 Annangrove Road, Rouse Hill for a mixed use commercial centre, it was established that the site contains some important biodiversity features. These include patches of regrowth CEECs CPW and SSTF, and realised and potential habitats for a number of threatened species. For unavoidable losses of these areas of habitat, a Biodiversity Offsets Package has been formulated in accordance with the *BC Act 2016*, the *BC Regulations 2017* and the BAM (2017).

It is concluded that the proposal is unlikely to result in Serious and Irreversible Impacts to the subject CEECs CPW and SSTF due to the small scale of the losses.

In addition to the biodiversity offsets package, the proposal includes many on-site offset activities, including:

- Retention of 31% of the existing SSTF. The retained vegetation will be managed under an approved Biodiversity Management Plan.
- The Landscape Plan will rely largely on CPW and SSTF species in strategic locations around the site.
- Retention of habitat and creation of new habitat for *Meridolum corneovirens* Cumberland Plain Land Snail. These areas of habitat on site will be rehabilitated and enriched under an approved Biodiversity Management Plan, including a relocation protocol for individuals found within the footprint.
- Retention and enrichment of roosting and foraging habitat available on site for microchiropteran bats. This will be achieved by conservation management of retained and planted areas and the installation of nest boxes.
- On-site conservation management of bushland and the installation of nest boxes will also be of benefit to other ecosystem credit species (such as *Glossopsitta pusilla* Little Lorikeet) that are likely to use the site.
- The proposed footprint will not interfere with the existing corridor along Second Ponds Creek. The resultant protected wildlife corridor will be wide alongside the development site (between 113 and 145 metres width) and comprise fully structured SSTF on site. This will enhancing the existing corridor and habitats available.
- Prescribed impacts have been assessed and ameliorated.

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APPENDIX 1 - FIGURES

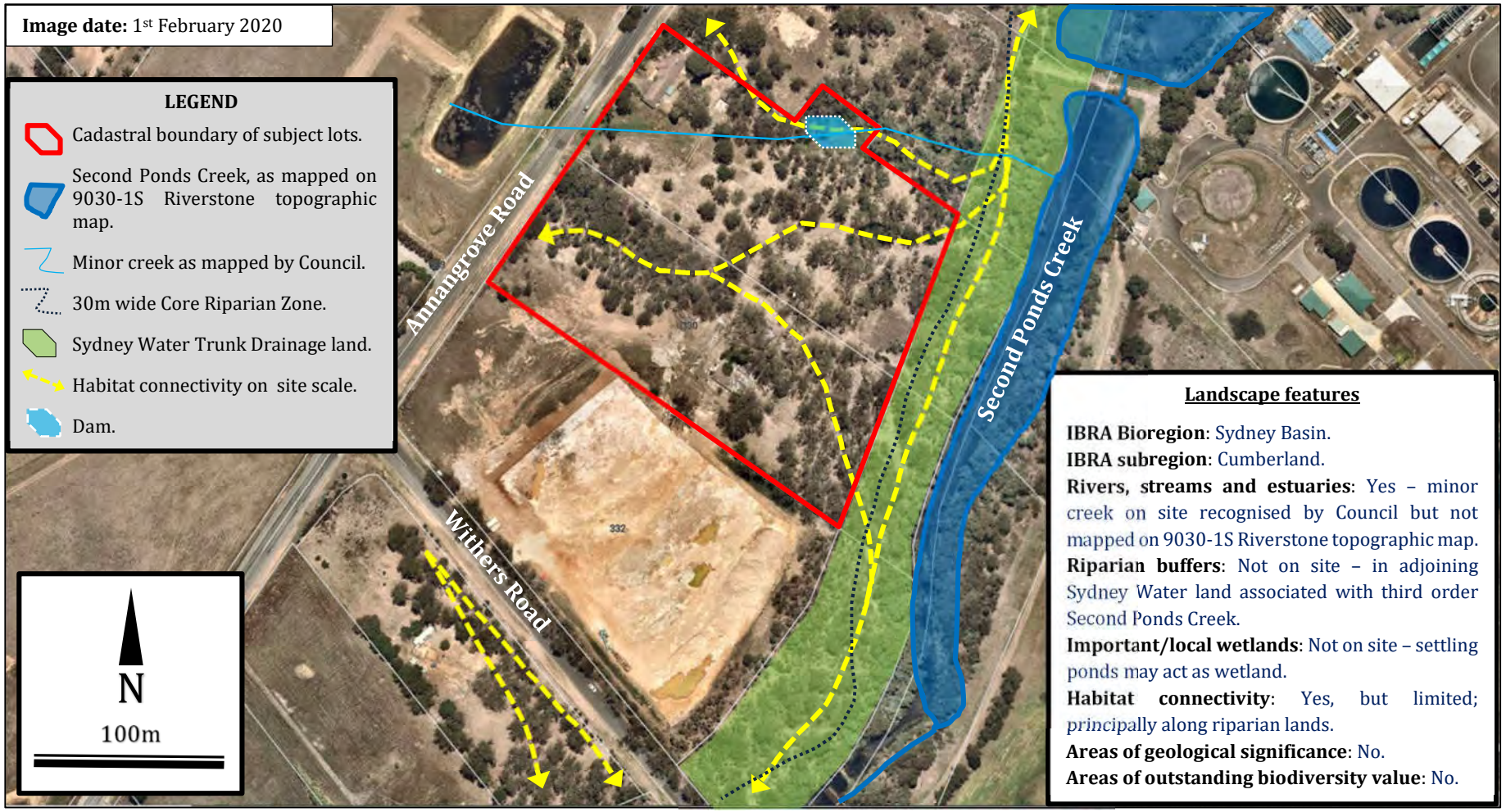


Figure 1: Site map showing boundary and landscape features of the development area. Source: NearMaps aerial imagery (http://maps.au.nearmap.com/).

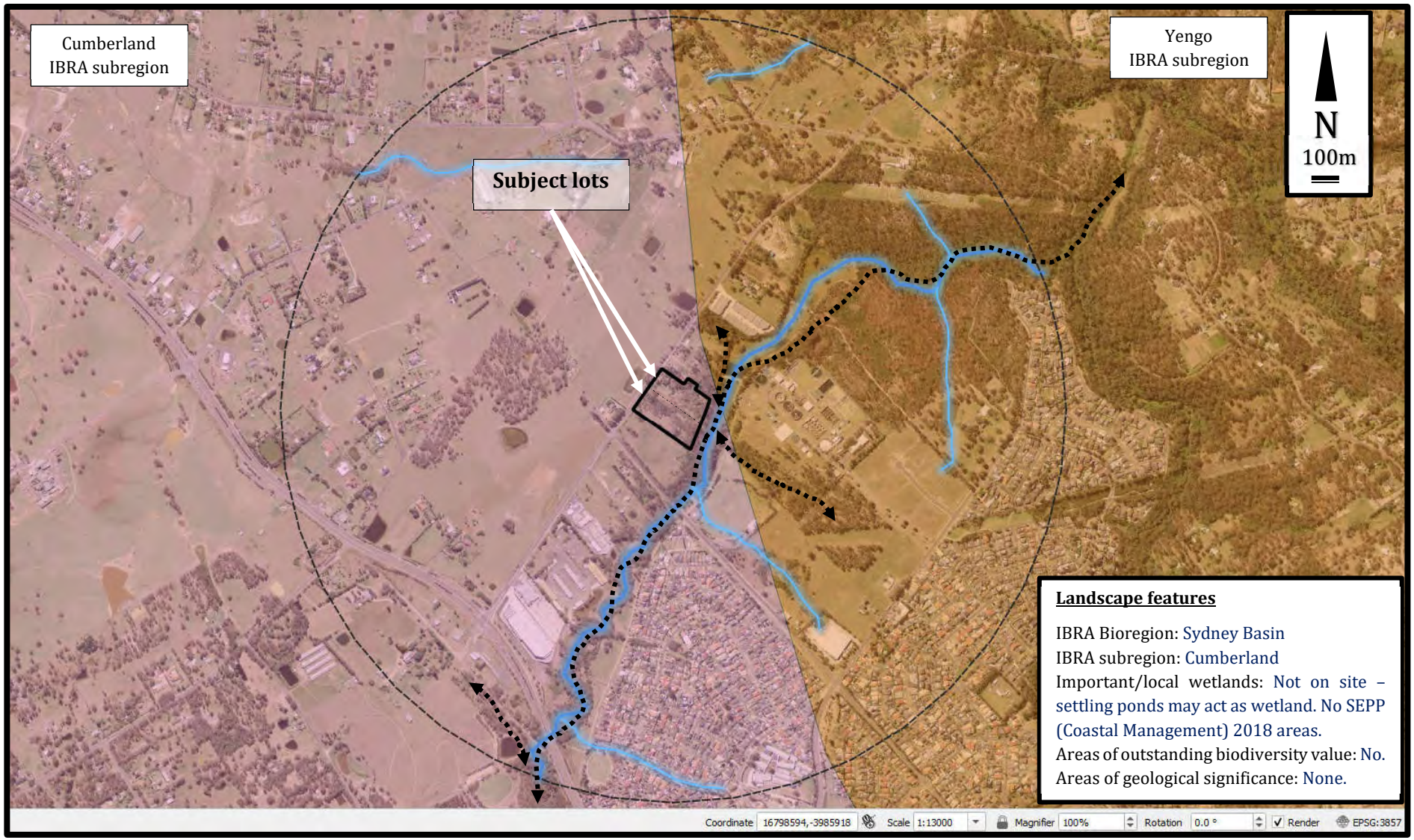


Figure 2: Location map showing the development site (red) in relation to landscape features in the 1.5km buffer area (black). Potential wildlife corridors are shown in yellow and mostly restricted to the riparian habitats. Source aerial: Google Earth.

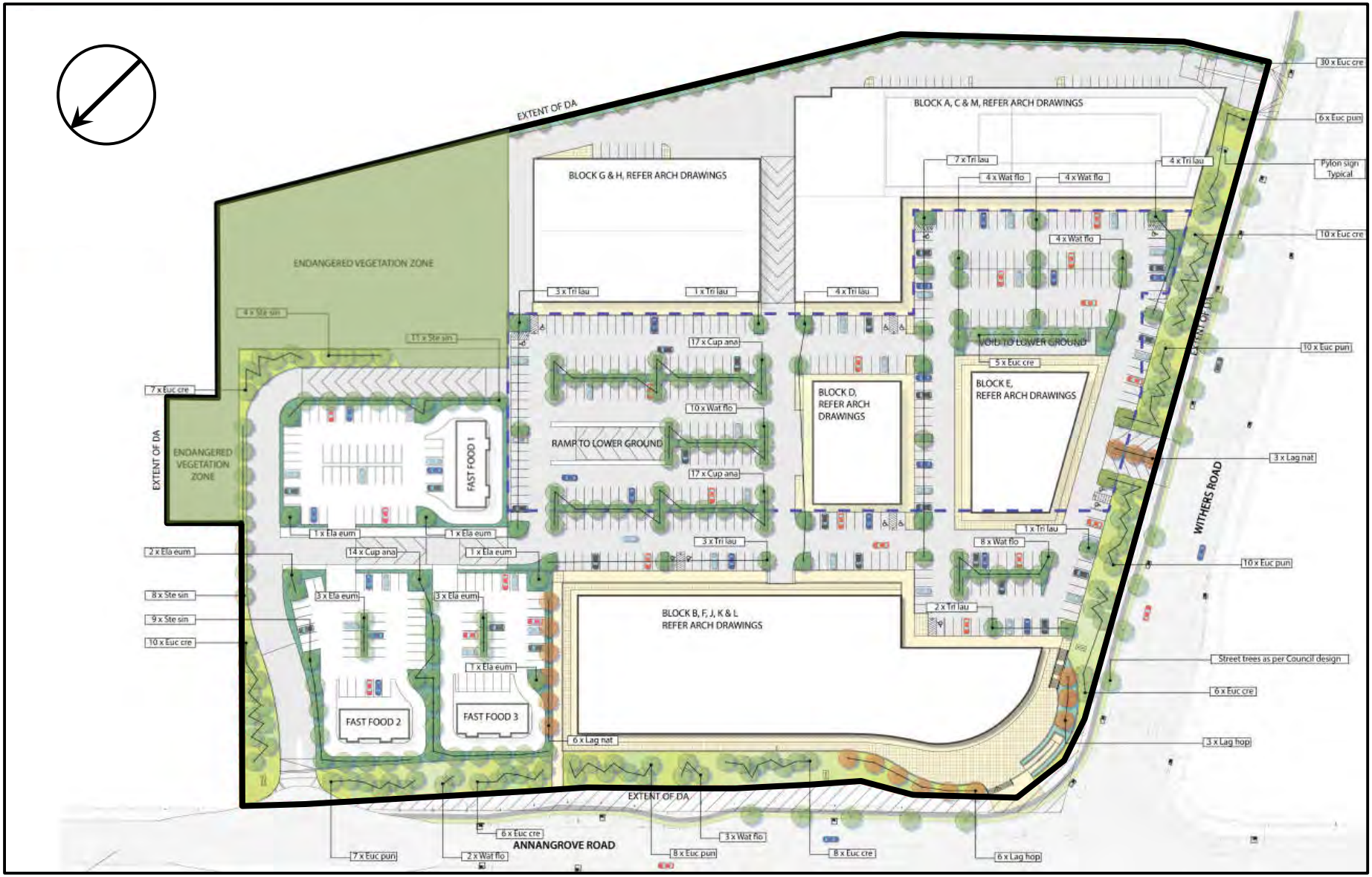


Figure 3: Proposed development and concept landscaping. Source: PdS Landscape Architects, Concept Landscape Plan, drawing LA02, dated 12.08.19, revision D.

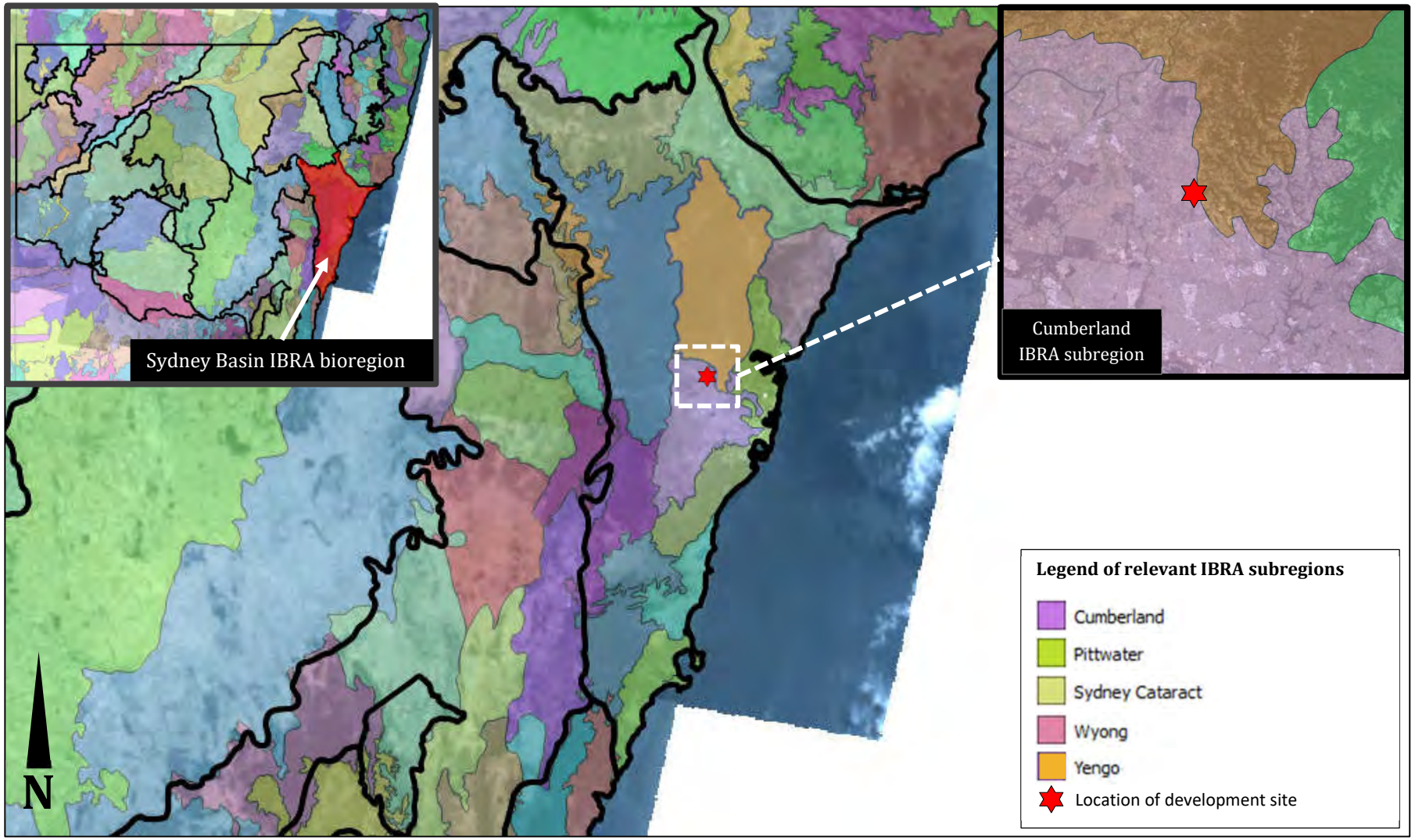


Figure 4: The site in relation to IBRA regions. The development site occurs wholly within the Cumberland IBRA subregion of the Sydney Basin Bioregion.

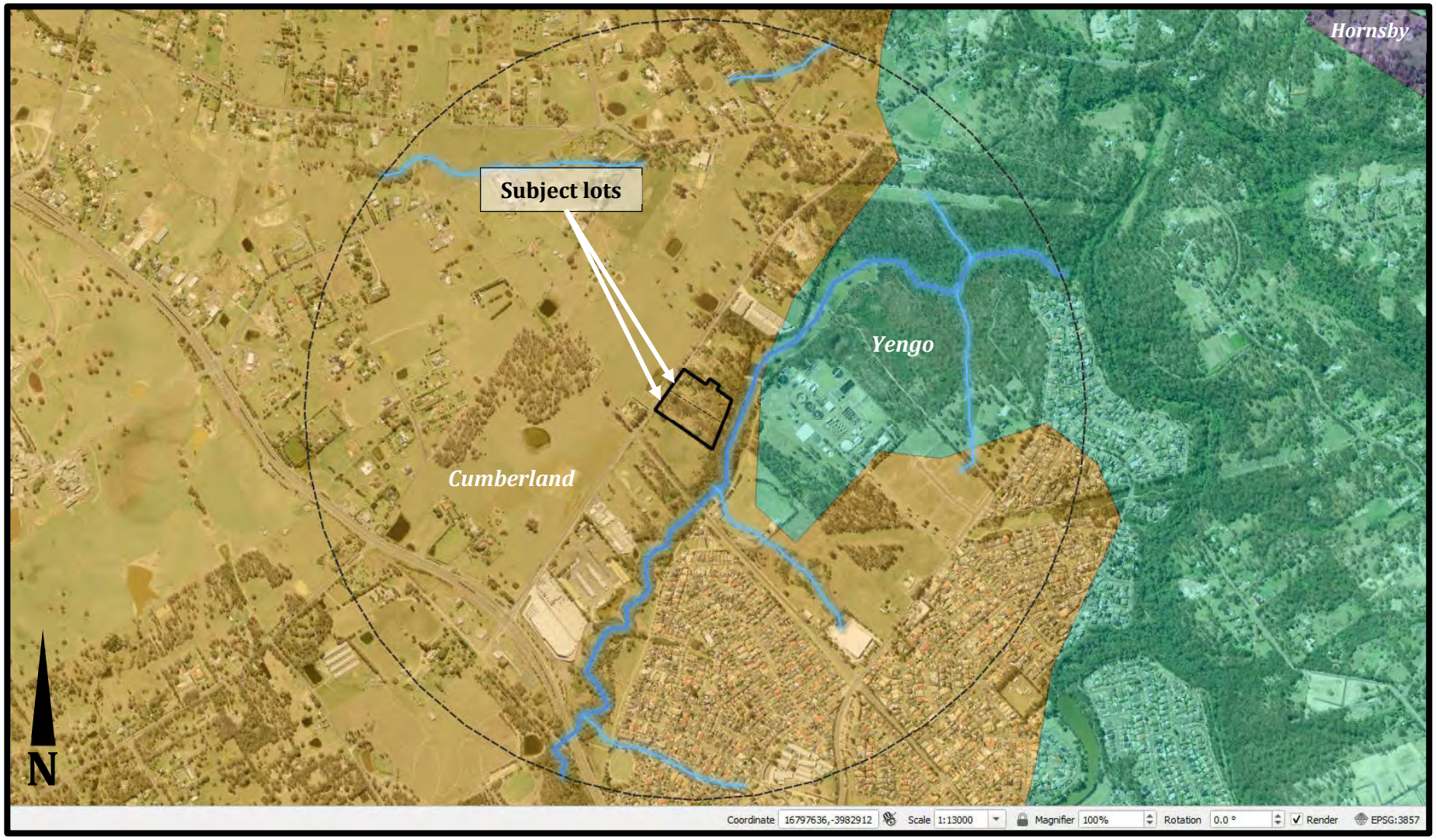


Figure 5: The development site and 1.5km buffer area in relation to the NSW Mitchell landscapes.

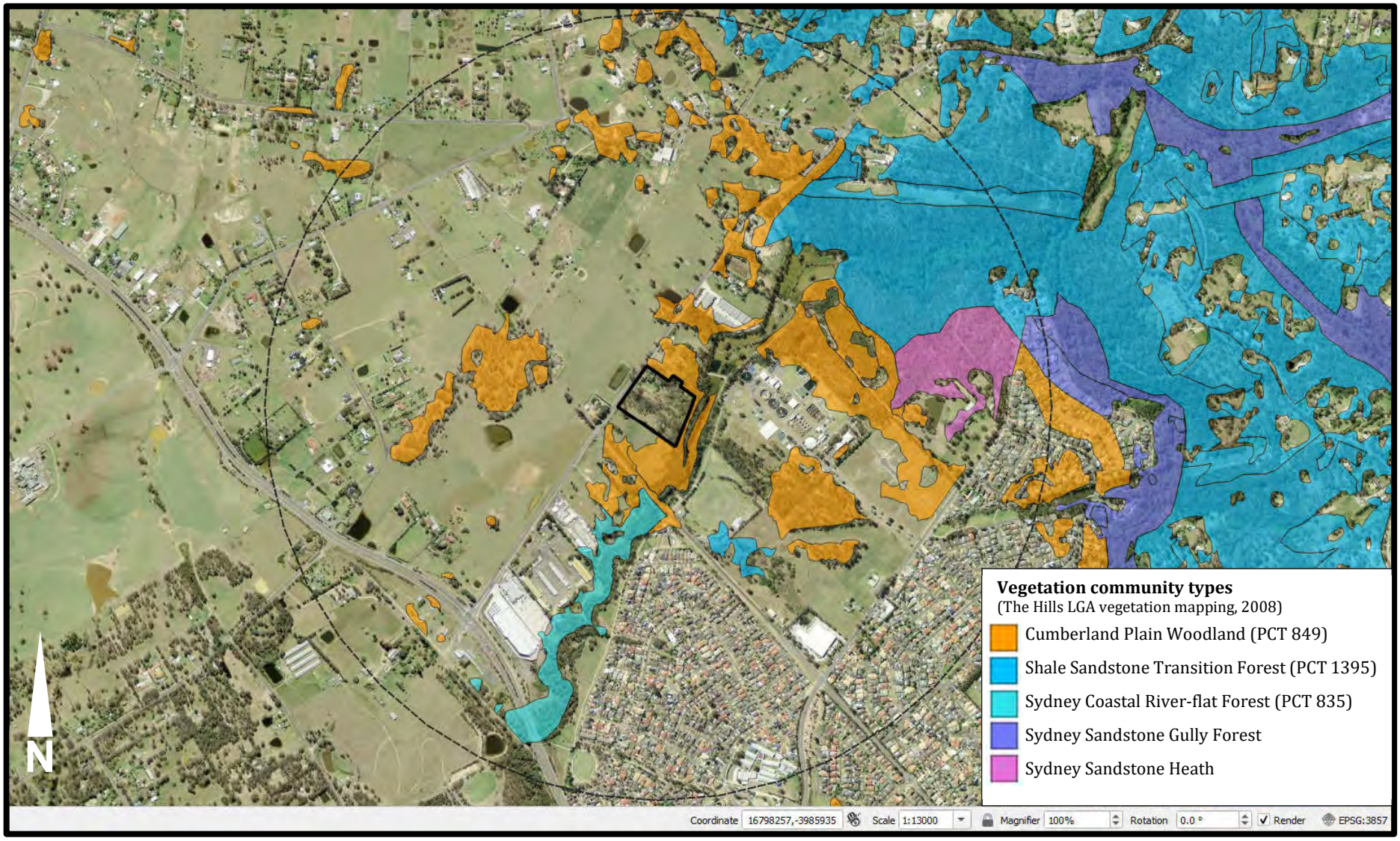


Figure 6a: The Hills LGA native vegetation mapping of the development site and within the 1.5km buffer area. Source: (https://mapping.thehills.nsw.gov.au/IntraMaps97/).

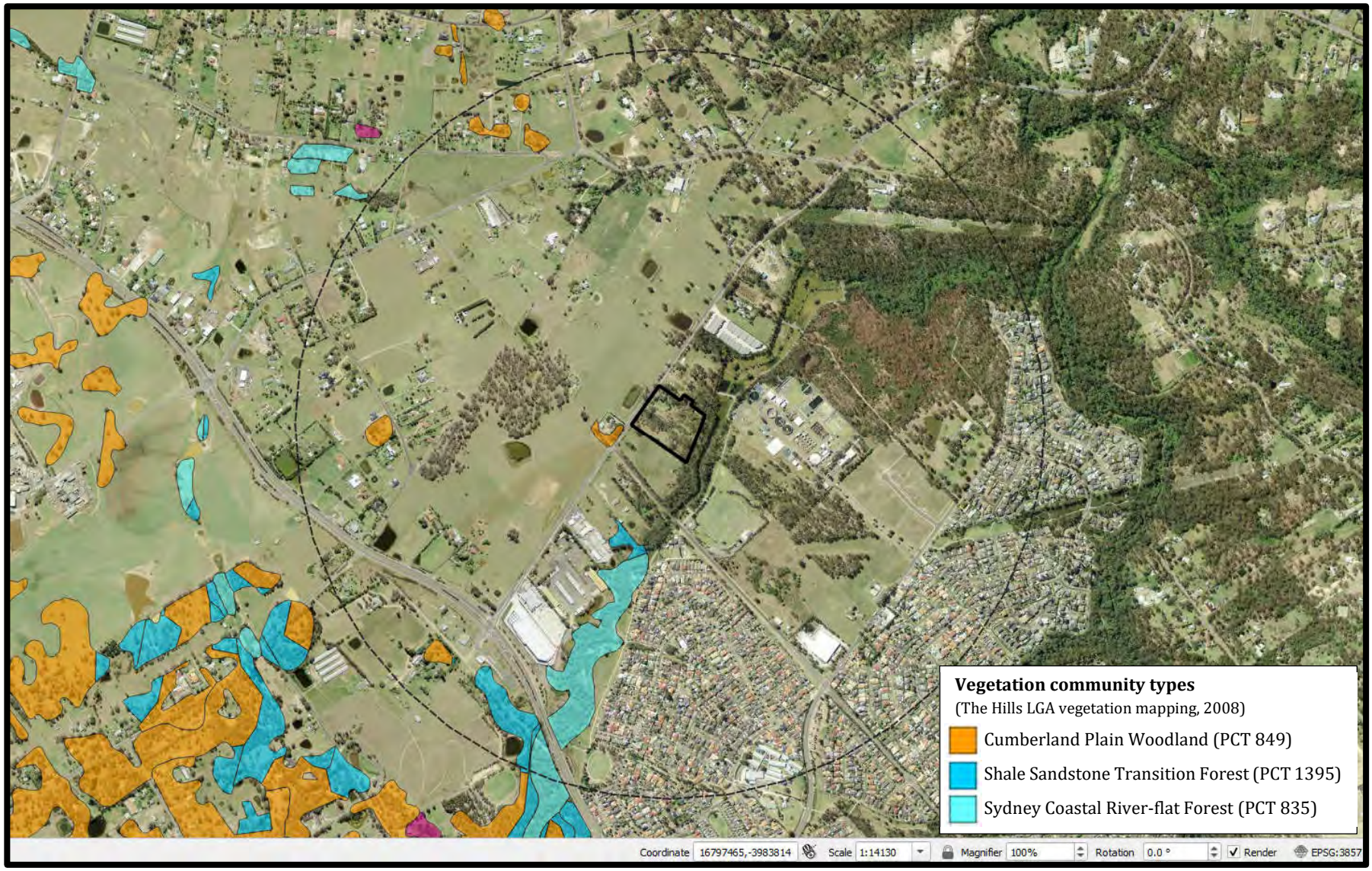


Figure 6b: The Cumberland Plain West native vegetation mapping of the development site and within the 1.5km buffer area. Source: (https://mapping.thehills.nsw.gov.au/IntraMaps97/).

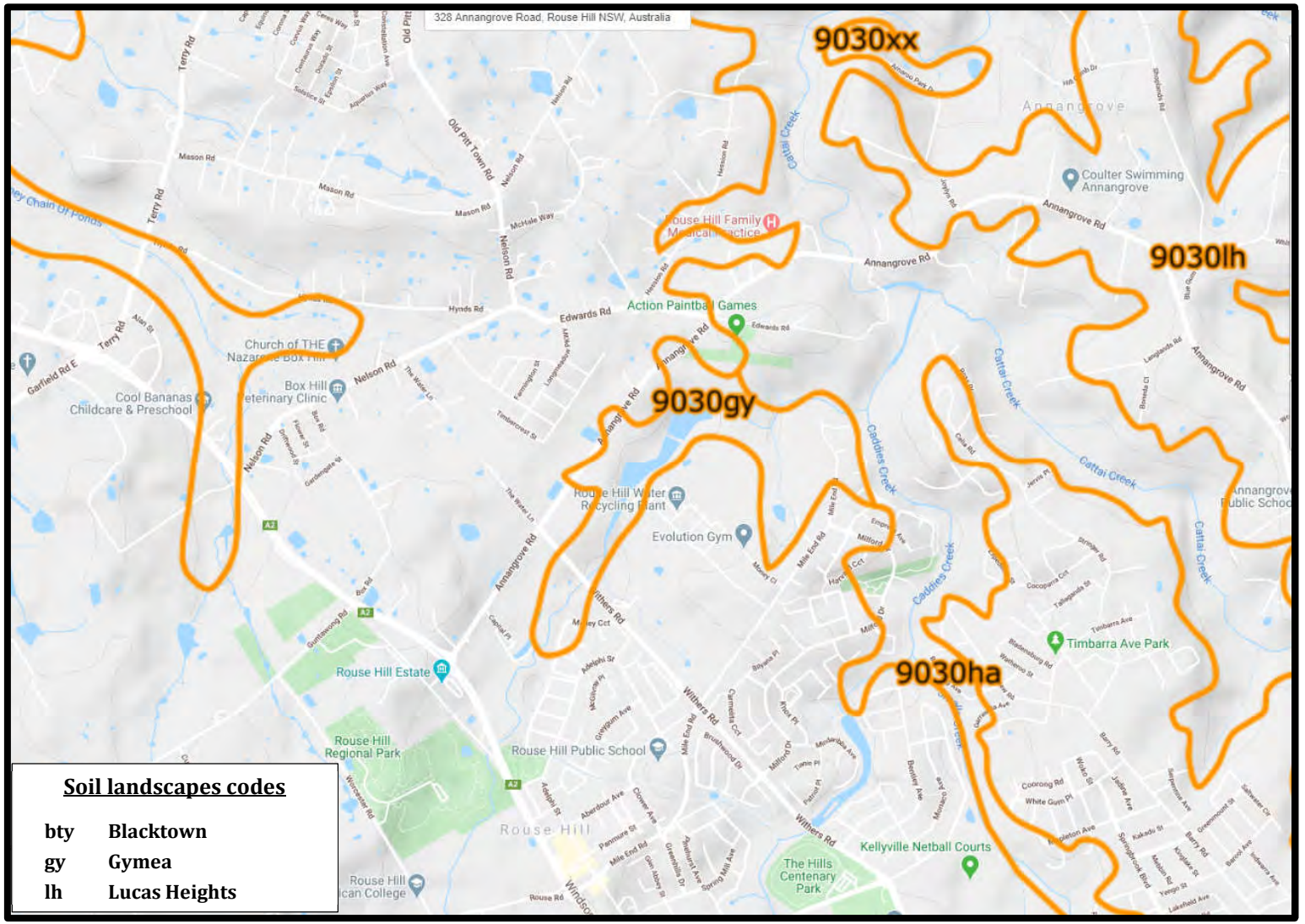


Figure 7: Soil landscape mapping in relation to the site and 1.5km buffer area. Source: Soil Landscapes of the Hawkesbury-Nepean https://maprod1.environment.nsw.gov.au/arcgis/services/Soil/SoilLandResources2008_HNC_EDP/MapServer/WMSServer?request=GetCapabilities&service=WMS

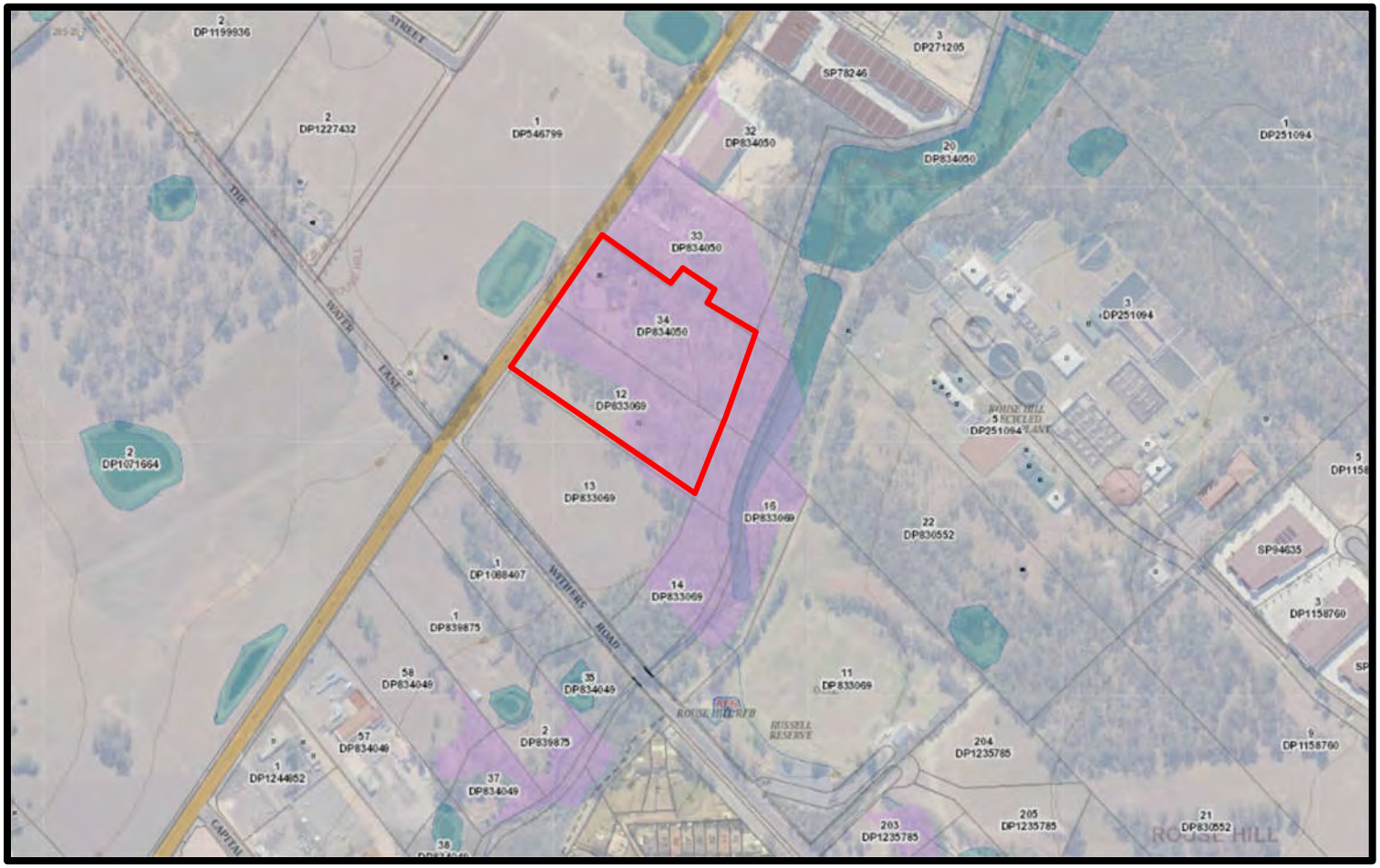


Figure 8: Areas mapped as containing high biodiversity values (purple) in relation to the subject lots (red) and the local area. Source: Biodiversity Values Map and Threshold Tool (https://www.lmbc.nsw.gov.au/Maps/index.html?viewer=BOSETMap), map produced 10th March 2020.

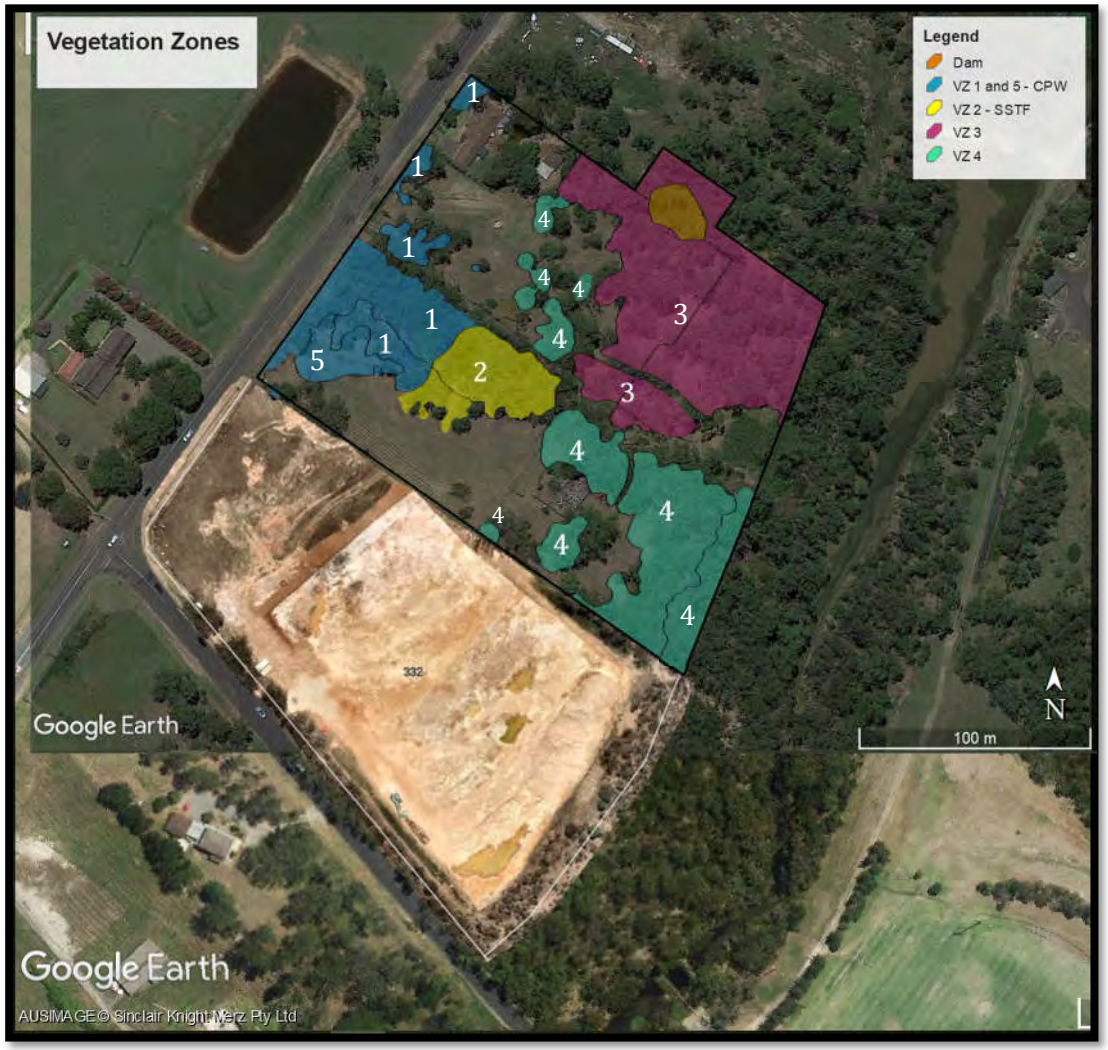


Figure 9: Native vegetation on the subject lots. CPW = Cumberland Plain Woodland EEC, SSTF = Shale Sandstone Transition Forest. * = includes small patches / isolated trees over mown grass along the edge of the larger remnant. Aerial image: main – Google Earth 12th March 2018; number 332 – Nearmap 1st February 2020.

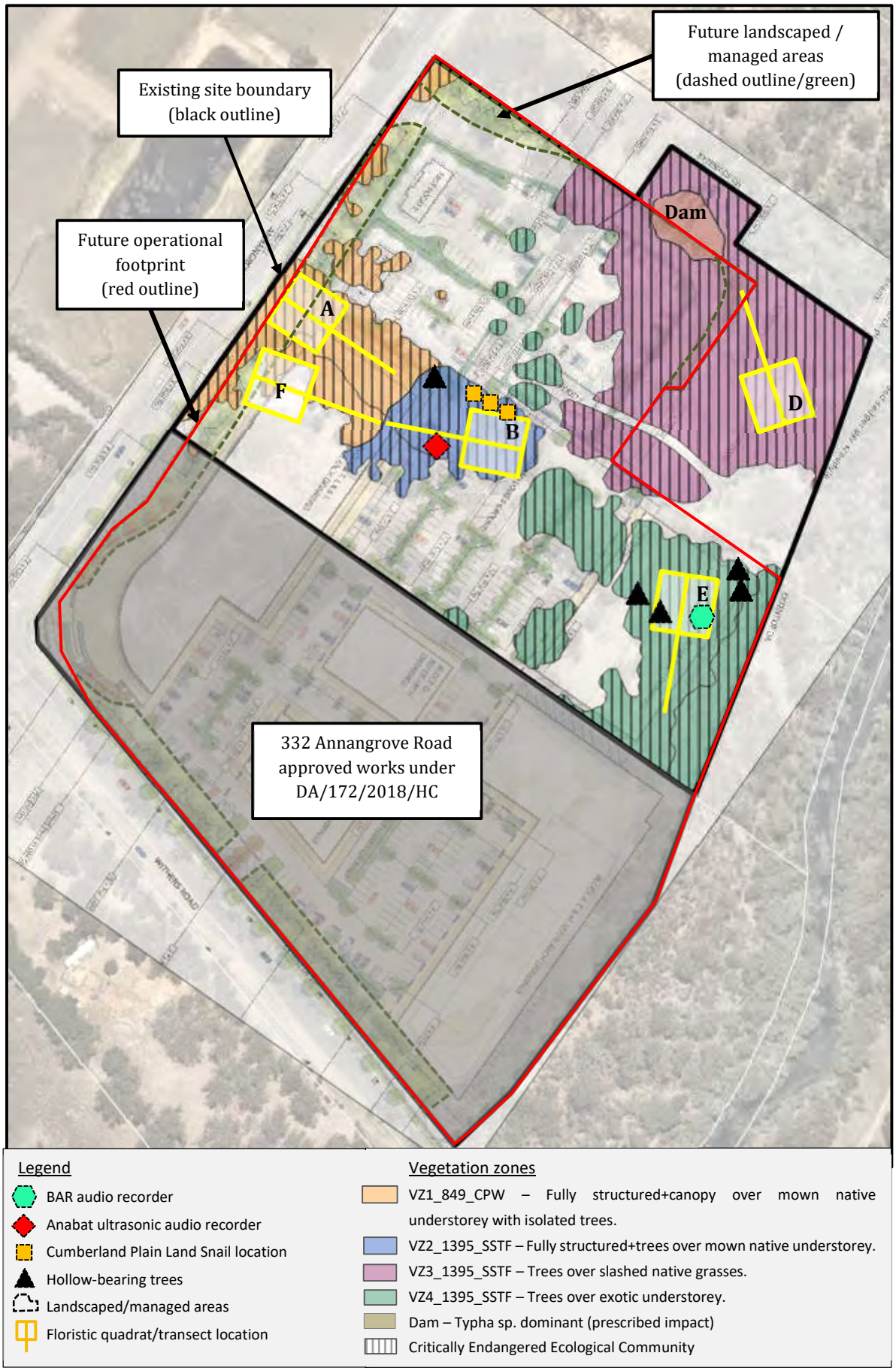


Figure 10: Flora and fauna survey sampling activities and vegetation delineation on the development site.

Figure 11: Vegetation zones shown on aerial photograph dating from 1977.

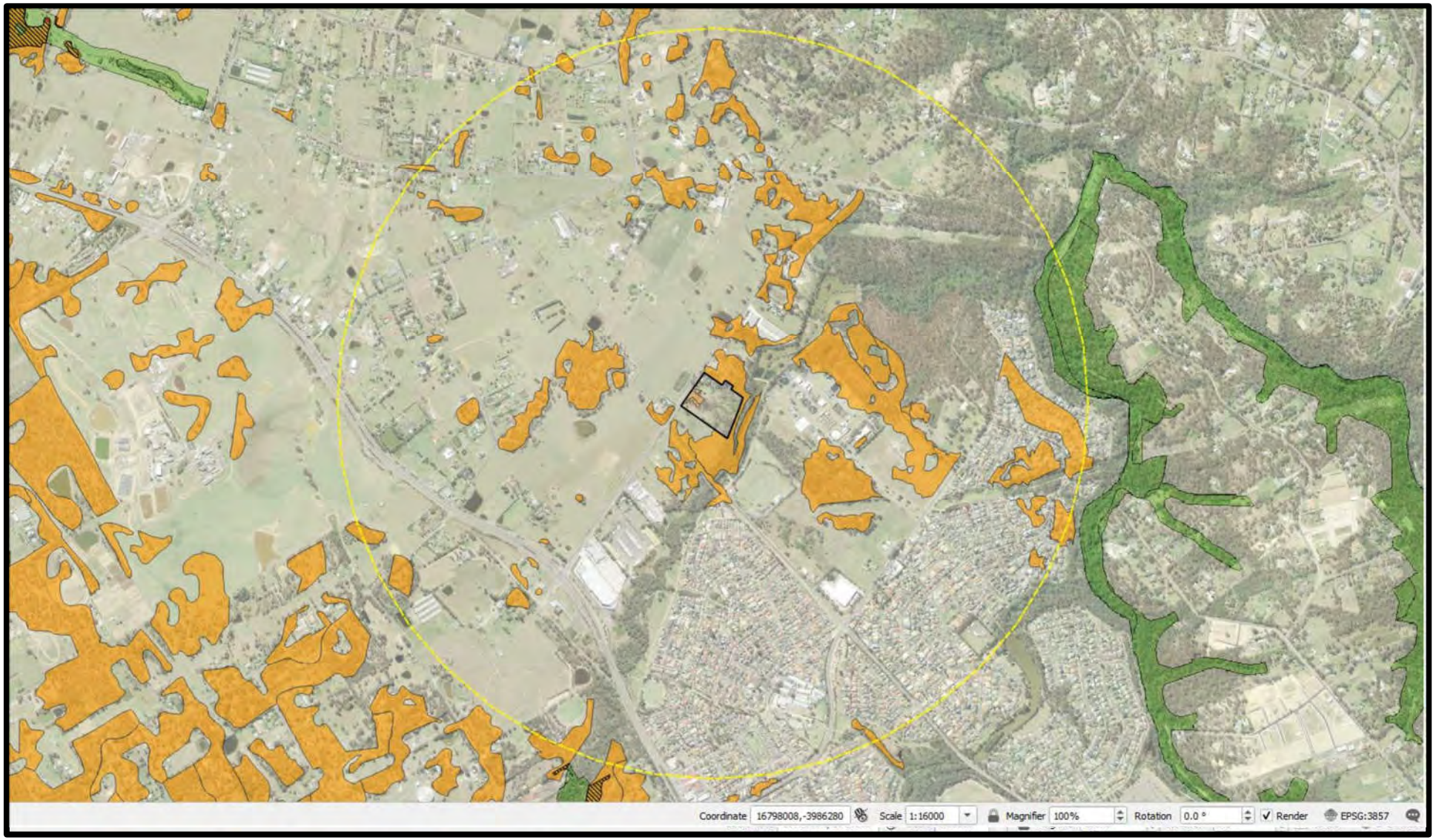


Figure 12: CPW within a 1,000ha area (yellow). Green = protected lands under the Growth Centre SEPP.

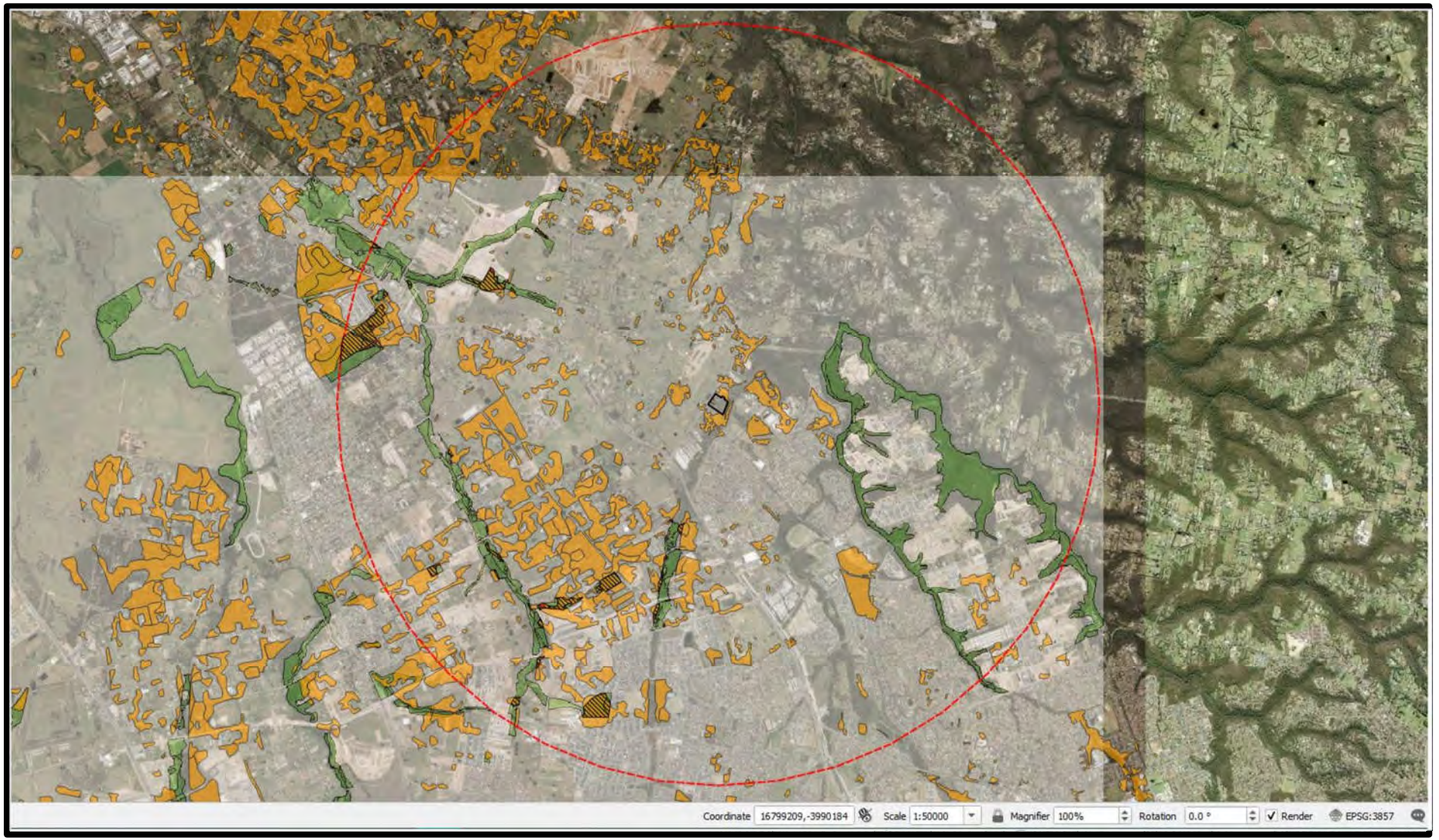


Figure 13: CPW within a 10,000ha area (red). Black hatch = protected under SEPP Growth Centre.

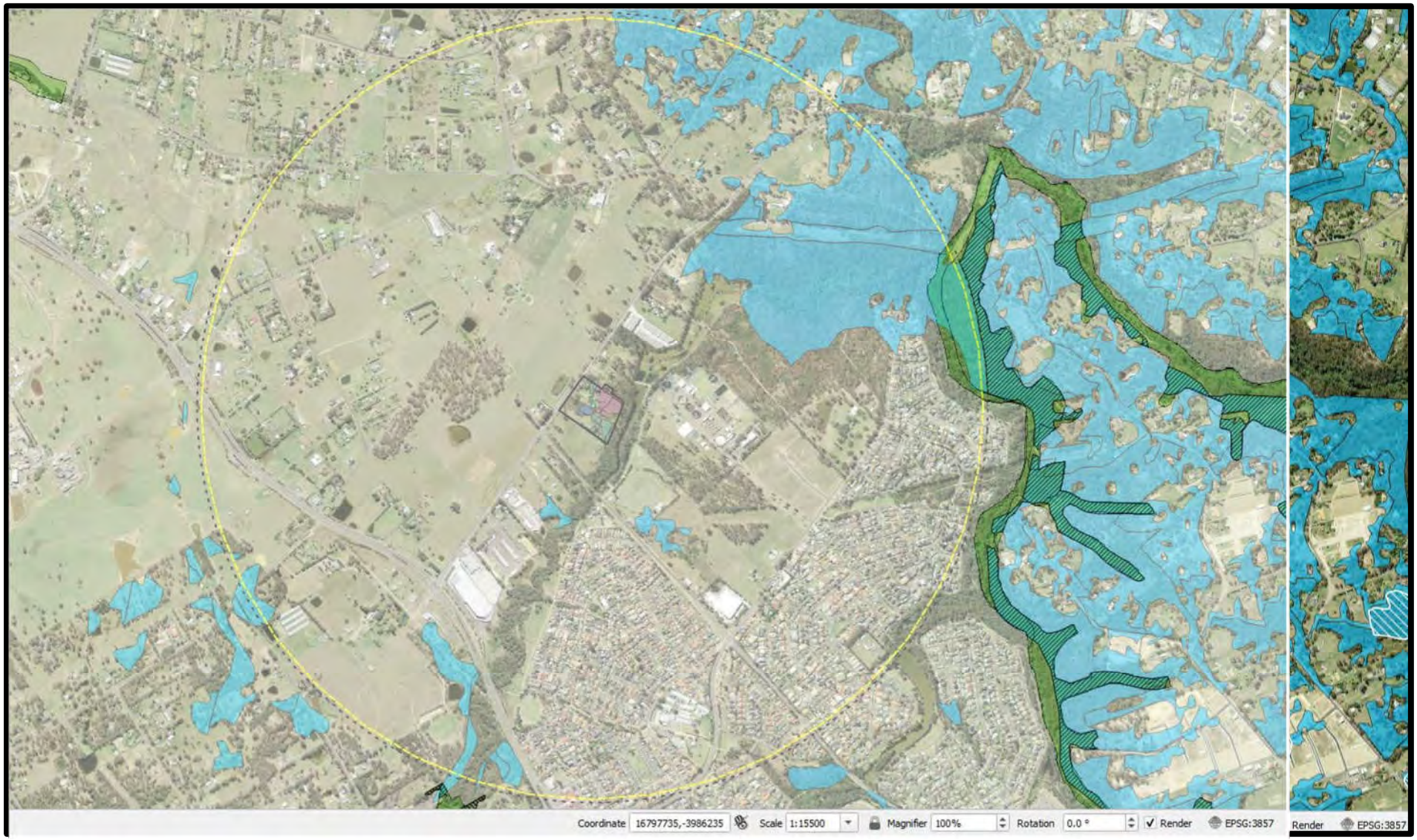


Figure 14: SSTF within a 1,000ha area (yellow). Black hatch = protected under SEPP Growth Centre.

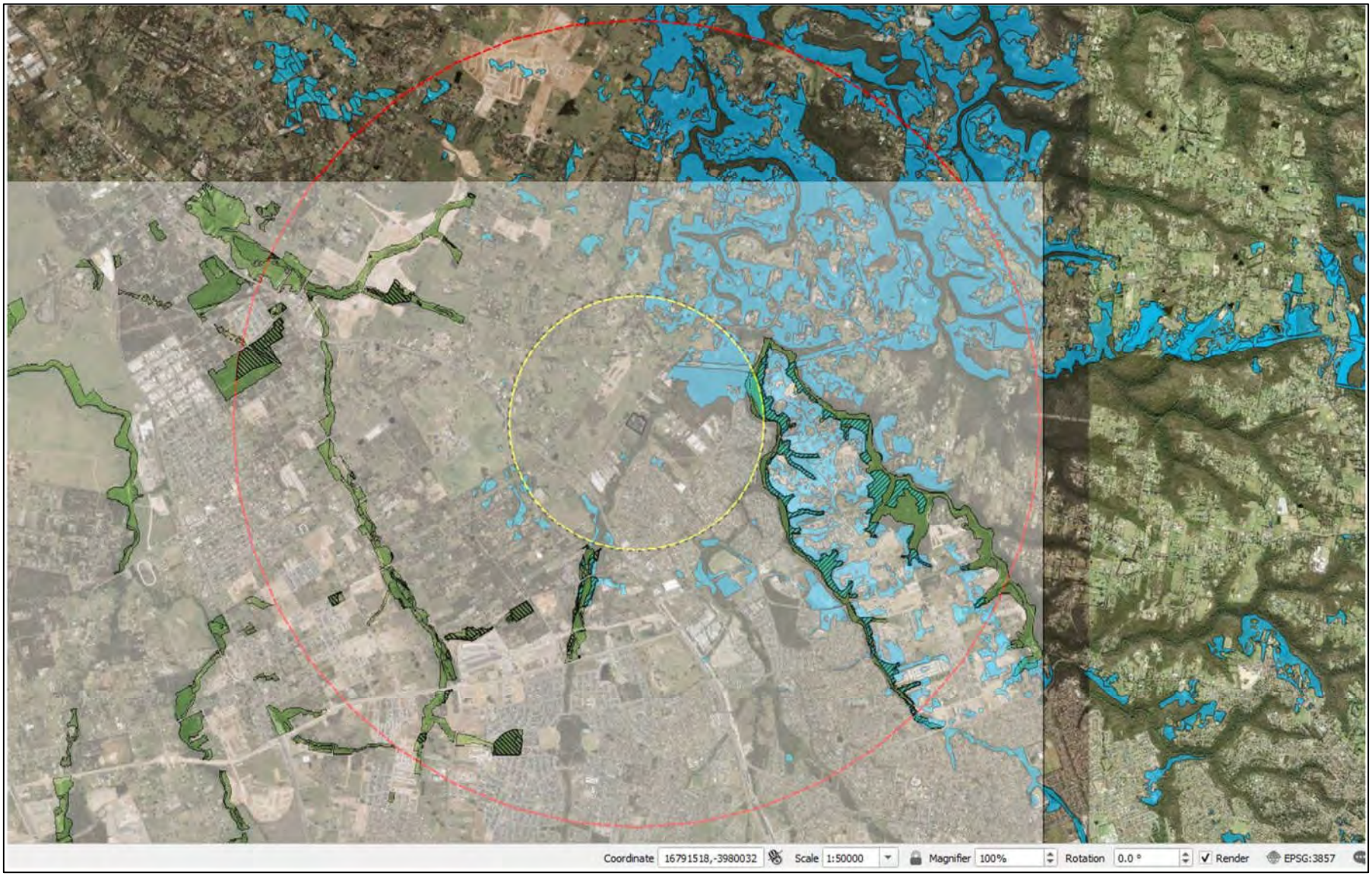


Figure 15: SSTF within a 10,000ha area (red). Black hatch = protected under SEPP Growth Centre.

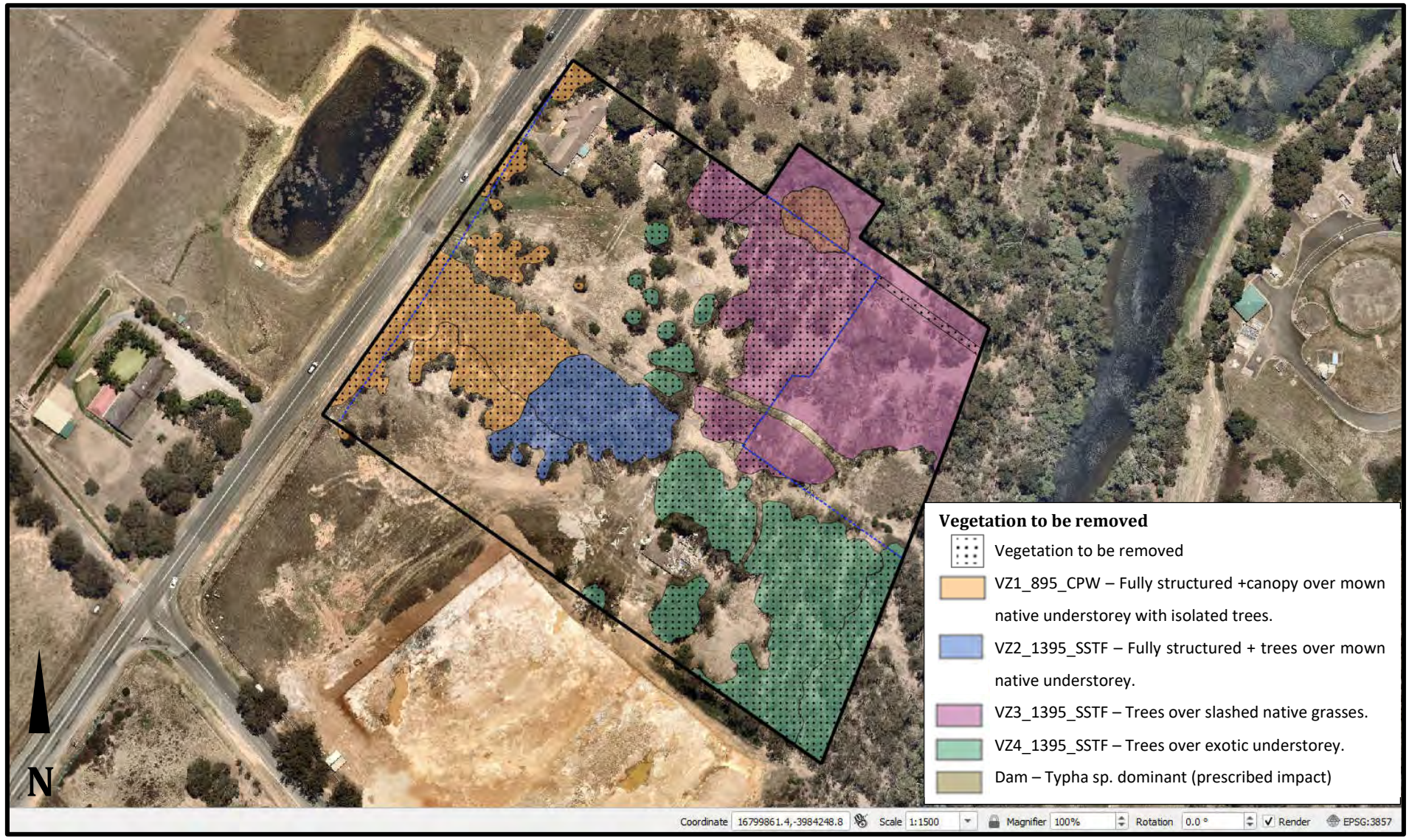


Figure 16: Impacts to native vegetation on the development site (black) and the development footprint (blue)..

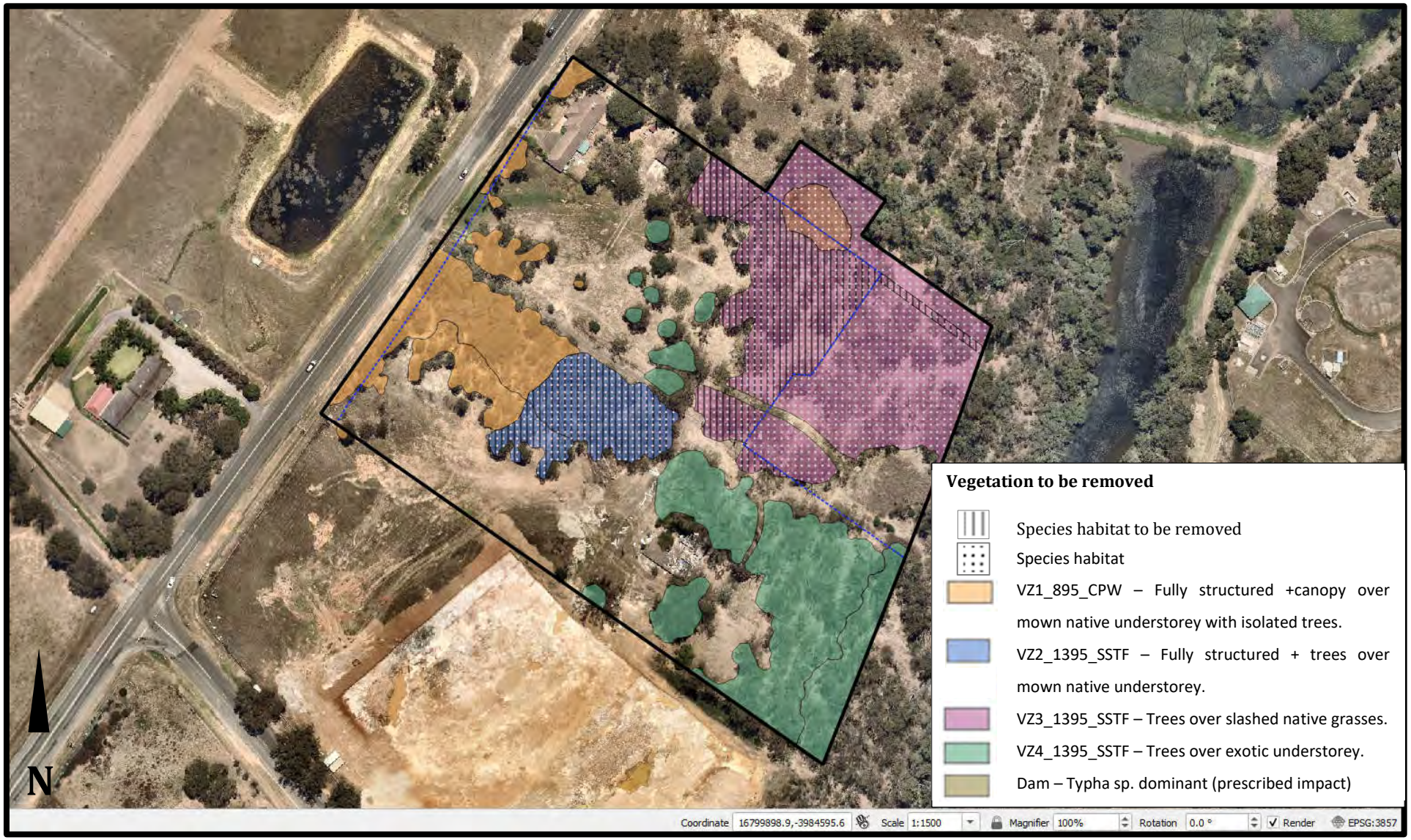


Figure 17: Species polygons for Green and Golden Bell Frog and areas of species polygon to be removed.

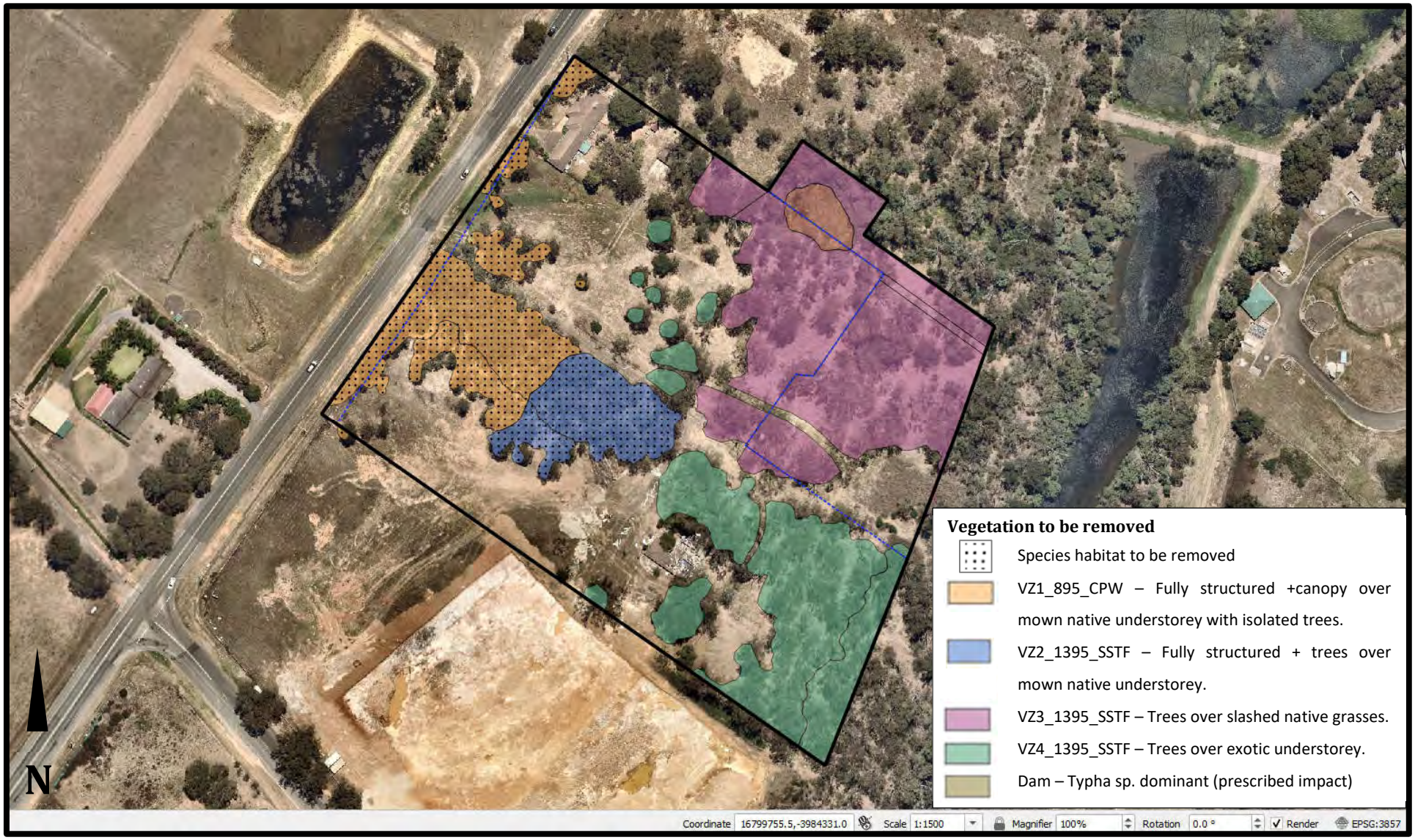


Figure 18: Species polygons for Cumberland Plain Land Snail and areas of species polygon to be removed.

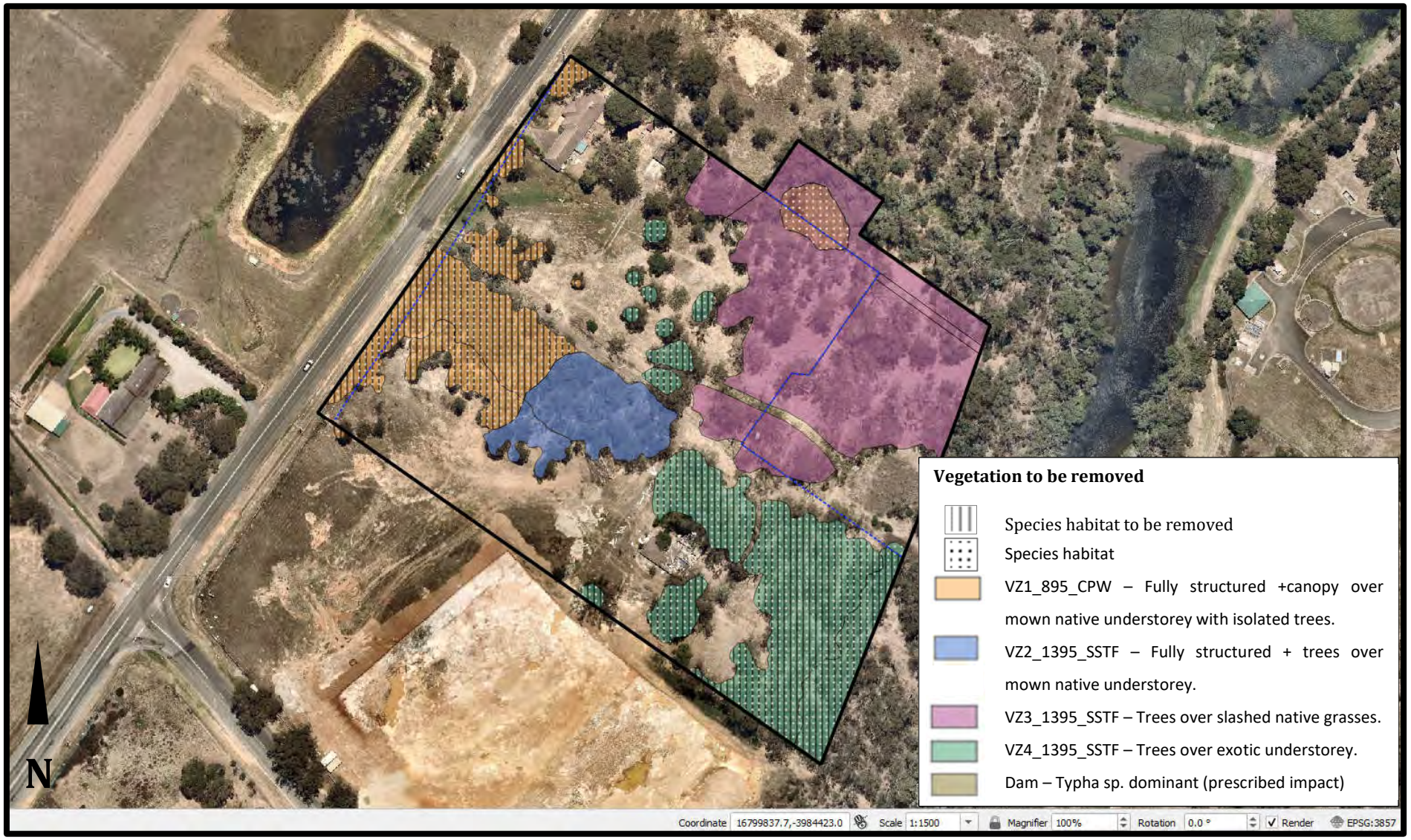
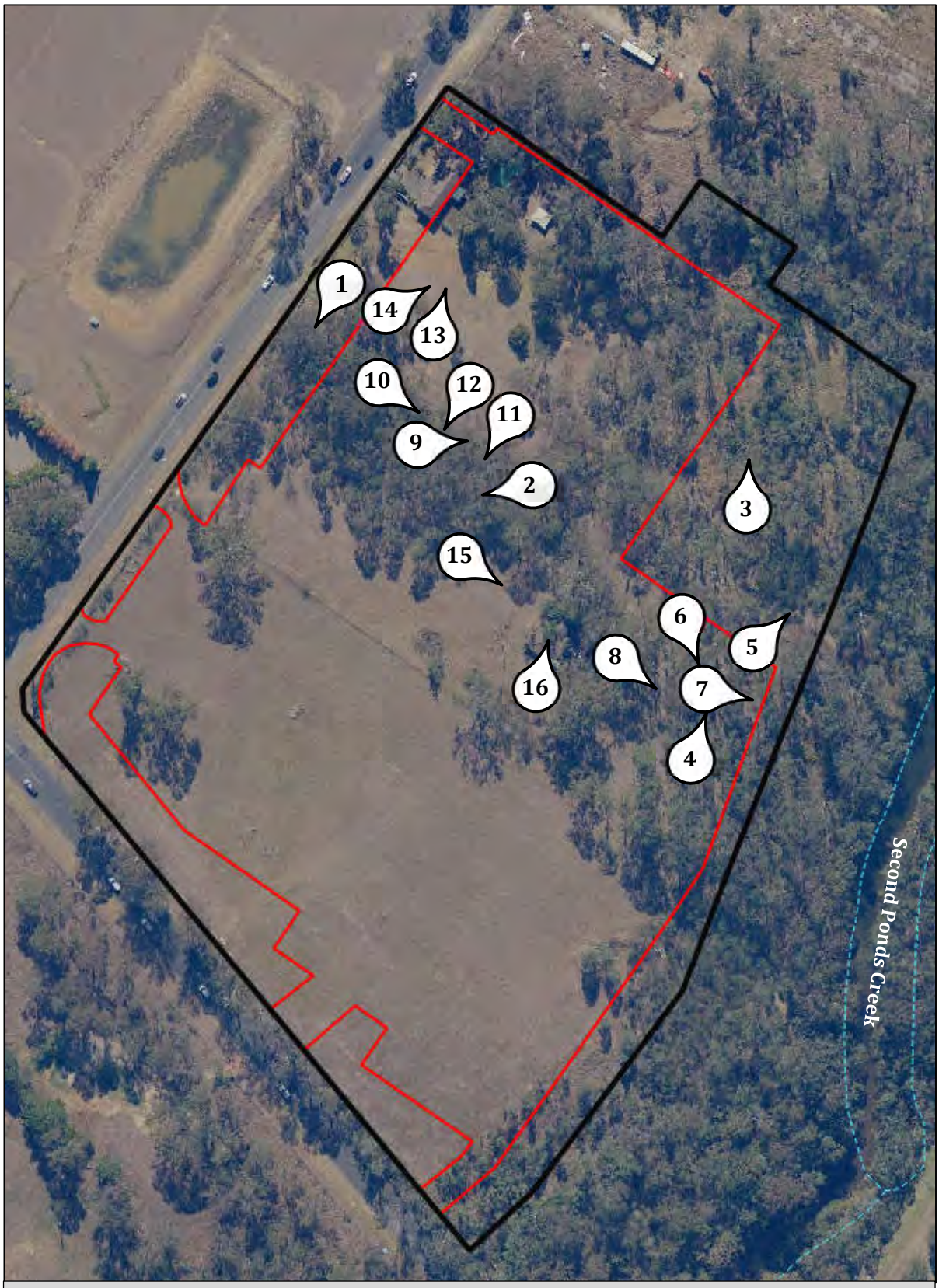


Figure 19: Species polygons for Southern Myotis and areas of species polygon to be removed.

APPENDIX 2

PHOTOGRAPHS



KEY GUIDE FOR PHOTOGRAPH LOCATIONS

Photograph 1: Vegetation Zone 1 (PCT 849) showing the CPW and area of Quadrat A location at the front of number 330 Annangrove Road.

Photograph 2: Vegetation Zone 2 (PCT 1395) showing SSTF in the location of Quadrat B in the centre of number 330 Annangrove Road.

Photograph 3: Looking north over Vegetation Zone 3 (PCT 1395) showing SSTF (CEEC) over slashed native grasses within the area of Quadrat D at the rear of number 328 Annangrove Road.

Photograph 4: Vegetation Zone 4 (PCT 1395) with SSTF (CEEC) trees over exotic understorey within the location of Quadrat E at the rear of in number 330 Annangrove Road. Note regenerating *Cestrum parqui*.

Photograph 5: Dense patch of *Cestrum parqui* occurring between Vegetation Zones 3 and 4.

Photograph 6: Shallow protrusions of fine grained sandstone at the rear of 330 Annangrove Road. These protrusions assisted in defining the extent of SSTF (CEEC) on site.

Photograph 7: *Pterostylis concinna* positive diagnostic species of SSTF at the rear of 330 Annangrove Rd.

Photograph 8: A single scat of *Trichosurus vulpecula* Common Brushtail Possum on site and being the only evidence of their occurrence on site.

Photograph 9: Suitable habitat for *Meridolum corneovirens* Cumberland Plain Plan Snail within the gutter along the accessway of 330 Annangrove Road.

Photograph 10: An example of targeted surveys undertaken for *Meridolum corneovirens* Cumberland Plain Plan Snail within the gutter along the accessway of 330 Annangrove Road.

Photograph 11: An individual live *Meridolum corneovirens* Cumberland Plain Plan Snail observed within the gutter along the accessway of 330 Annangrove Road.

Photograph 12: Suitable habitat for *Meridolum corneovirens* Cumberland Plain Plan Snail within the gutter along the accessway of 330 Annangrove Road with fungal hyphae present.

Photograph 13: View of the cleared and mown lawns at 328 Annangrove Road surrounding the existing dwelling with some isolated trees of CPW and SSTF.

Photograph 14: View of scattered trees of SSTF within 328 Annangrove Road with the small dam in the background.

Photograph 15: The existing dwelling at 330 Annangrove Road that has been vandalised.

Photograph 16: Closer view of the rear of the vandalised dwelling at 330 Annangrove Road.

APPENDIX 3

TABLES

Table 1: Vegetation communities within 1.5 kilometres of the development site. Source: OEH (2018)[1]

Name in common usage	Identified PCT	PCT extent cleared	Threatened Ecological Communities (*BC Act 2016*; *EPBC Act 1999*).
Cumberland Riverflat forest	835 - Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion.	93%	River-flat Eucalypt Forest on Coastal Floodplains of the Sydney Basin Bioregion (Endangered *BC Act 2016*)
Cumberland shale plains woodland	849 - Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion	93%	Cumberland Plain Woodland in the Sydney Basin Bioregion (Critically Endangered *BC Act 2016 and EPBC Act 1999*)
Cumberland shale - sandstone Ironbark forest	1395 - Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion	80%	Shale Sandstone Transition Forest in the Sydney Basin Bioregion (Critically Endangered *BC Act 2016 and EPBC Act 1999*)

[1] Office of Environment and Heritage (2018) BioNet vegetation classification: PCT data. Accessed 4th November 2018 (http://www.environment.nsw.gov.au/NSWVCA20PRapp/search/pctsearch.aspx).

Table 2: Flora species recorded during survey by Keystone Ecological on and nearby the development site.

Family	Scientific Name	Common Name	Native Growth Form (BAM)	Provenance	Random meander	Vegetation zones - quadrats					
						1 – A	2 – B	2 – C	3 – D	4 - E	5 - F
Acanthaceae	*Brunoniella australis*	Blue Trumpet	Forb	Locally native		x					
Apiaceae	*Centella asiatica*	Swamp Pennywort	Forb	Locally native	x			x			
Asparagaceae	*Asparagus aethiopicus**	Asparagus Fern	-	High Threat Weed Weed of National Significance	x						
Asparagaceae	*Asparagus asparagoides**	Bridal Creeper	-	High Threat Weed Weed of National Significance	x	x	x		x		
Asteraceae	*Bidens pilosa**	Cobbler's Pegs	-	High Threat Weed	x						
Asteraceae	*Conyza bonariensis**	Flax-leaf Fleabane	-	Exotic	x						
Asteraceae	*Coreopsis lanceolata**	-	-	Exotic	x						
Asteraceae	*Ozothamnus diosmifolius*	Ball Everlasting	Shrub	Locally native	x			x			
Asteraceae	*Hypochaeris glabra**	Smooth Catsear	-	Exotic	x						
Asteraceae	*Hypochaeris radicata**	Flatweed	-	Exotic	x						
Asteraceae	*Senecio madagascariensis**	Fireweed	-	High Threat Weed Weed of National Significance	x			x			x
Asteraceae	*Sonchus oleraceus**	Common Sowthistle	-	Exotic	x						
Chenopodiaceae	*Einadia hastata*	Berry Saltbush	Forb	Locally native						x	
Commelinaceae	*Commelina cyanea*	Native Wandering Jew	Forb	Locally native	x						
Convolvulaceae	*Dichondra repens*	Kidney Weed	Forb	Locally native	x	x					x
Cyperaceae	*Cyperus eragrostis**	Umbrella Sedge	-	High Threat Weed	x						
Cyperaceae	*Gahnia sieberiana*	Red-fruited Saw-sedge	Sedge	Native	x	x	x		x		
Cyperaceae	*Lepidosperma laterale*	Variable Sword-sedge	Sedge	Native	x						
Dennstaedtiaceae	*Pteridium esculentum*	Bracken	Ferns and fern allies	Native	x						
Ericaceae	*Lissanthe strigosa*	Peach Heath	Heath shrub	Locally native	x			x			
Fabaceae	*Glycine clandestina*	Twining Glycine	Vine	Locally native	x						
Fabaceae	*Pultenaea microphylla*	-	Shrub	Locally native	x						
Fabaceae	*Trifolium repens**	White Clover	-	Exotic	x						
Fabaceae	*Vicia sativa subsp. nigra**	Narrow-leaf Vetch	-	Exotic	x			x			x
Juncaceae	*Juncus usitatus*	Common Rush	Rush	Locally native	x			x			
Lomandraceae	*Lomandra glauca* subsp. *glauca*	-	Rush	Native	x						
Lomandraceae	*Lomandra longifolia*	Spiky-headed Mat-rush	Rush	Locally native	x			x			

Family	Scientific Name	Common Name	Native Growth Form (BAM)	Provenance	Random meander	Vegetation zones - quadrats					
						1 – A	2 – B	2 – C	3 – D	4 - E	5 - F
Lomandraceae	*Lomandra multiflora*	Many-flowered Mat-rush	Rush	Locally native	x	x					
Malvaceae	*Sida rhombifolia**	Paddy's Lucerne	-	Exotic	x			x			x
Mimosaceae	*Acacia decurrens*	Black Wattle	Tree	Locally native	x						
Mimosaceae	*Acacia floribunda*	Sally Wattle	Shrub	Native				x			
Mimosaceae	*Acacia implexa*	Hickory	Shrub	Native		x					
Mimosaceae	*Acacia parramattensis*	Sydney Green Wattle	Tree	Locally native	x	x	x	x	x	x	
Myrsinaceae	*Myrsine variabilis*	Muttonwood	Shrub	Native	x						
Myrtaceae	*Angophora floribunda*	Rough-barked Apple	Tree	Locally native	x			x			
Myrtaceae	*Eucalyptus amplifolia*	Cabbage Gum	Tree	Locally native	x						
Myrtaceae	*Eucalyptus crebra*	Narrow-leaved Ironbark	Tree	Locally native		x					
Myrtaceae	*Eucalyptus moluccana*	Grey Box	Tree	Locally native	x	x					
Myrtaceae	*Eucalyptus tereticornis*	Forest Red Gum	Tree	Locally native	x	x	x	x	x	x	
Oleaceae	*Ligustrum lucidum**	Large-leaved Privet	-	High Threat Weed	x						
Oleaceae	*Ligustrum sinense**	Small-leaved Privet	-	High Threat Weed	x	x				x	
Oleaceae	*Olea europaea* subsp. *cuspidata**	African Olive	-	High Threat Weed	x	x	x	x	x		
Orchidaceae	*Pterostylis concinna*	Trim Greenhood	Forb	Native	x					nearby	
Oxalidaceae	*Oxalis corniculata**	Yellow Wood Sorrel	-	Exotic	x						
Passifloraceae	*Passiflora mollissima**	Banana Passionfruit	-	Exotic			x				
Pittosporaceae	*Bursaria spinosa* var. *spinosa*	Blackthorn	Shrub	Locally native	x	x		x			
Pittosporaceae	*Pittosporum undulatum*	Sweet Pittosporum	Shrub	Native	x						
Plantaginaceae	*Plantago lanceolata**	Ribwort	-	Exotic	x						x
Poaceae	*Andropogon virginicus**	Whisky Grass	-	High Threat Weed	x			x			
Poaceae	*Aristida vagans*	Three-awn Speargrass	Tussock Grass	Locally native	x			x			x
Poaceae	*Austrostipa ramosissima*	Stout Bamboo Grass	Tussock Grass	Native	x						
Poaceae	*Avena sativa**	Oats	-	Exotic	x						
Poaceae	*Axonopus fissifolius**	Narrow-leaved Carpet Grass	-	High Threat Weed	x						
Poaceae	*Bromus catharticus**	Prairie Grass	-	Exotic	x						
Poaceae	*Chloris gayana**	Rhodes Grass	-	High Threat Weed	x						

Family	Scientific Name	Common Name	Native Growth Form (BAM)	Provenance	Random meander	Vegetation zones - quadrats					
						1 – A	2 – B	2 – C	3 – D	4 - E	5 - F
Poaceae	*Chloris virgata**	Feathertop Rhodes Grass	-	Exotic	x						
Poaceae	*Cynodon dactylon*	Common Couch	Other Grass	Native	x						
Poaceae	*Digitaria parviflora*	Small-flowered Finger Grass	Tussock Grass	Locally native	x						
Poaceae	*Ehrharta erecta**	Panic Veldtgrass	-	High Threat Weed			x				
Poaceae	*Entolasia stricta*	Wiry Panic	Tussock Grass	Locally native	x		x				
Poaceae	*Eragrostis brownii*	Brown's Lovegrass	Tussock Grass	Locally native	x						
Poaceae	*Eragrostis curvula**	African Lovegrass	-	High Threat Weed	x	x		x			x
Poaceae	*Imperata cylindrica* var. *major*	Blady Grass	Tussock Grass	Native				x			
Poaceae	*Lachnagrostis filiformis*	Blown Grass	Tussock Grass	Native	x						
Poaceae	*Microlaena stipoides* var. *stipoides*	Weeping Rice Grass	Tussock Grass	Locally native	x			x	x		x
Poaceae	*Paspalum dilatatum**	Paspalum	-	High Threat Weed	x						x
Poaceae	*Pennisetum clandestinum**	Kikuyu	-	Exotic	x			x			x
Poaceae	*Poa annua**	Winter Grass	-	Exotic	x						
Poaceae	*Rytidosperma tenuius*	Wallaby Grass	Tussock Grass	Native	x						
Poaceae	*Setaria parviflora**	Slender Pigeon Grass	-	Exotic	x						
Poaceae	*Sporobolus creber*	Rats Tails Grass	Tussock Grass	Locally native	x						x
Poaceae	*Themeda triandra*	Kangaroo Grass	Tussock Grass	Locally native		x	x				x
Polygonaceae	*Persicaria decipiens*	Slender Knotweed	Forb	Native	x						
Polygonaceae	*Rumex brownii*	Swamp Dock	Forb	Native	x						
Polygonaceae	*Rumex conglomeratus**	Clustered Dock	-	Exotic	x						
Polygonaceae	*Rumex crispus**	Curled Dock	-	Exotic	x						
Ranunculaceae	*Clematis aristata*	Old Man's Beard	Vine	Native	x						
Rosaceae	*Rubus fruticosis* sp. agg.*	Blackberry	-	High Threat Weed Weed of National Significance	x						
Sapindaceae	*Cupaniopsis anacardioides*	Tuckeroo	Tree	Native	x	x					
Solanaceae	*Cestrum parqui**	Chilean Cestrum	-	High Threat Weed	x				x	x	
Solanaceae	*Solanum nigrum**	Black Nightshade	-	Exotic	x						x
Solanaceae	*Solanum prinophyllum*	Forest Nightshade	Forb	Locally native			x		x	x	
Solanaceae	*Solanum pseudocapsicum**	-	-	Exotic		x	x				

Family	Scientific Name	Common Name	Native Growth Form (BAM)	Provenance	Random meander	Vegetation zones - quadrats					
						1 – A	2 – B	2 – C	3 – D	4 - E	5 - F
Typhaceae	*Typha* sp.	Cumbungi	Rush	Locally native	dam						
Urticaceae	*Parietaria judaica**	Pellitory	-	Exotic	x						
Urticaceae	*Urtica incisa*	Stinging Nettle	Forb	Native	x						
Verbenaceae	*Lantana camara**	Lantana	-	High Threat Weed Weed of National Significance	x					x	
Verbenaceae	*Verbena bonariensis**	Purpletop	-	Exotic	x						

Table 3: Current vegetation integrity scores for Vegetation Zone 1.

Vegetation Zone 1							
Plant Community Type:			PCT 849 Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion				
Area: 0.30 hectares			**Condition class:** Moderate – native understorey				
Composition condition score							
Plot 1	**Tree**	**Shrub**	**Grass and grass like**	**Forb**	**Fern**	**Other**	**Current composition condition score**
	5	2	3	2	0	0	**17.9**

Calculation results						
Plot 1	**Tree**	**Shrub**	**Grass and grass like**	**Forb**	**Fern**	**Other**
Benchmark	5	8	12	15	2	5
Observed mean (x̄)	5	2	3	2	0	0
Unweighted composition score (UCSi)	100	14.6	14.6	3.2	0	0
Weighted composition score (WCSi)	10.6	2.5	3.7	1	0	0
Dynamic weighting (wi)	0.11	0.17	0.26	0.32	0.04	0.11

Structure condition score							
Plot 1	**Tree**	**Shrub**	**Grass and grass like**	**Forb**	**Fern**	**Other**	**Current structure condition score**
	75.2	30	0.4	0.2	0	0	**47.6**

Calculation results						
Plot 1	**Tree**	**Shrub**	**Grass and grass like**	**Forb**	**Fern**	**Other**
Benchmark	52	18	61	10	1	5
Observed mean (x̄)	75.2	30	0.4	0.2	0	0
Unweighted structure score (USSi)	100	100	0	0	0	0
Weighted structure score (WSSi)	35.4	12.2	0	0	0	0
Dynamic weighting (wi)	0.35	0.12	0.41	0.07	0.01	0.03

Vegetation Zone 1												
Plant Community Type:		PCT 849 Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion										
Area: 0.30 hectares		**Condition class:** Moderate – native understorey										
Zone function data												
Plot 1	**Regenerating stems <5cm DBH**	**Stem classes**					**No. of large trees (>50cm DBHOB)**	**Hollow-bearing trees**	**Litter cover**	**Coarse woody debris**	**High threat weed cover**	**Current function condition score**
		5-9	**10-19**	**20-29**	**30-49**	**50-79**						
	Present	x	x	x	x		6	0	94	8.5	57	**82**

Calculation results						
Plot 1	**Regenerating stems <5cm DBH**	**Stem size class**	**No. of large trees**	**Litter cover**	**Coarse woody debris**	**High threat weed cover**
Benchmark	Present	4	3	35	40	-
Observed mean (x̄)	1	4	6	94	8.5	57
Weighted function score (WFSi)	15	15	35	15	2	-
Weighting (wi)	0.15	0.15	0.35	0.15	0.2	-
Overall current vegetation integrity score						
41.2						

Table 4: Current vegetation integrity scores for Vegetation Zone 2.

Vegetation Zone 2							
Plant Community Type:	PCT 1395 Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion.						
Area: 0.17 hectares	**Condition class:** Good – fully structured / regeneration						
Composition condition score							
Plot	**Tree**	**Shrub**	**Grass and grass like**	**Forb**	**Fern**	**Other**	**Current composition condition score**
Plot 1	2	1	3	1	0	0	**17.6**
Plot 2	3	4	5	1	0	0	

Calculation results						
Item	**Tree**	**Shrub**	**Grass and grass like**	**Forb**	**Fern**	**Other**
Benchmark	5	8	12	15	2	5
Observed mean (x̄)	2.5	2.5	4	1	0	0
Unweighted composition score (UCSi)	59.1	24	27.6	0.6	0	0
Weighted composition score (WCSi)	6.3	4.1	7.1	0.2	0	0
Dynamic weighting (wi)	0.11	0.17	0.26	0.32	0.04	0.11

Structure condition score							
Plot	**Tree**	**Shrub**	**Grass and grass like**	**Forb**	**Fern**	**Other**	**Current structure condition score**
Plot 1	79	0.1	66	0.1	0	0	**76.1**
Plot 2	60	0.4	42.1	0.1	0	0	

Calculation results						
Item	**Tree**	**Shrub**	**Grass and grass like**	**Forb**	**Fern**	**Other**
Benchmark	52	18	61	10	1	5
Observed mean (x̄)	69.5	0.3	54.1	0.1	0	0
Unweighted structure score (USSi)	100	0	98.2	0	0	0
Weighted structure score (WSSi)	35.4	0	40.7	0	0	0
Dynamic weighting (wi)	0.35	0.12	0.41	0.07	0.01	0.03

Vegetation Zone 2												
Plant Community Type:	PCT 1395 Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion.											
Area: 0.17 hectares	**Condition class:** Good – fully structured / regeneration											
Zone function data												
Plot	**Regenerating stems <5cm DBH**	**Stem classes**					**No. of large trees (>50cm DBHOB)**	**Hollow-bearing trees**	**Litter cover**	**Coarse woody debris**	**High threat weed cover**	**Current function condition score**
		5-9	**10-19**	**20-29**	**30-49**	**50-79**						
Plot 1	Absent	x	x	x	x		5	1	36	3	16	**61.7**
Plot 2	Absent	x	x	x	x		0	0	12	0	15.4	

Calculation results						
Item	**Regenerating stems <5cm DBH**	**Stem size class**	**No. of large trees**	**Litter cover**	**Coarse woody debris**	**High threat weed cover**
Benchmark	Present	4	3	35	40	-
Observed mean (x̄)	0	4	2.5	24	1.5	15.7
Weighted function score (WFSi)	0	15	33.8	12.9	0	-
Weighting (wi)	0.15	0.15	0.35	0.15	0.2	-
Overall current vegetation integrity score						
43.6						

Table 5: Current vegetation integrity scores for Vegetation Zone 3.

Vegetation Zone 3	
Plant Community Type:	PCT 1395 Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion.
Area: 0.76 hectares on site, of which 0.32 hectares is in the development area	**Condition class:** Very Low – grass / meadow

Composition condition score							
Plot 1	**Tree**	**Shrub**	**Grass and grass like**	**Forb**	**Fern**	**Other**	**Current composition condition score**
	2	0	2	1	0	0	**5.9**

Calculation results						
Plot 1	**Tree**	**Shrub**	**Grass and grass like**	**Forb**	**Fern**	**Other**
Benchmark	5	8	12	15	2	5
Observed mean (x̄)	2	0	2	1	0	0
Unweighted composition score (UCSi)	40	0	5.5	0.6	0	0
Weighted composition score (WCSi)	4.3	0	1.4	0.2	0	0
Dynamic weighting (wi)	0.11	0.17	0.26	0.32	0.04	0.11

Structure condition score							
Plot 1	**Tree**	**Shrub**	**Grass and grass like**	**Forb**	**Fern**	**Other**	**Current structure condition score**
	10.1	0	90.1	0.1	0	0	**44.3**

Calculation results						
Plot 1	**Tree**	**Shrub**	**Grass and grass like**	**Forb**	**Fern**	**Other**
Benchmark	52	18	61	10	1	5
Observed mean (x̄)	10.1	0	90.1	0.1	0	0
Unweighted structure score (USSi)	8	0	100	0	0	0
Weighted structure score (WSSi)	2.8	0	41.5	0	0	0
Dynamic weighting (wi)	0.35	0.12	0.41	0.07	0.01	0.03

Vegetation Zone 3											
Plant Community Type:	PCT 1395 Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion.										
Area: 0.76 hectares on site, of which 0.32 hectares is in the development area	**Condition class:** Very Low – grass / meadow										
Zone function data											
Plot 1	**Regenerating stems <5cm DBH**	**Stem classes**					**No. of large trees (>50cm DBHOB)**	**Hollow-bearing trees**	**Litter cover**	**Coarse woody debris**	**High threat weed cover**	**Current function condition score**
		5-9	**10-19**	**20-29**	**30-49**	**50-79**						
	Absent			x	x		0	0	3	0	2.1	**9**

Calculation results						
Plot 1	**Regenerating stems <5cm DBH**	**Stem size class**	**No. of large trees**	**Litter cover**	**Coarse woody debris**	**High threat weed cover**
Benchmark	Present	4	3	35	40	-
Observed mean (x̄)	0	2	0	3	0	2.1
Weighted function score (WFSi)	0	8.9	0	0.2	0	-
Weighting (wi)	0.15	0.15	0.35	0.15	0.2	-
Overall current vegetation integrity score						
13.3						

Table 6: Current vegetation integrity scores for Vegetation Zone 4.

Vegetation Zone 4							
Plant Community Type:	PCT 1395 Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion.						
Area: 0.52 hectares	**Condition class:** Low – weed infested						
Composition condition score							
Plot 1	**Tree**	**Shrub**	**Grass and grass like**	**Forb**	**Fern**	**Other**	**Current composition condition score**
	2	0	0	2	0	0	**5.3**

Calculation results						
Plot 1	**Tree**	**Shrub**	**Grass and grass like**	**Forb**	**Fern**	**Other**
Benchmark	5	8	12	15	2	5
Observed mean ($\bar{x}$)	2	0	0	2	0	0
Unweighted composition score (UCSi)	40	0	0	3.2	0	0
Weighted composition score (WCSi)	4.3	0	0	1	0	0
Dynamic weighting (wi)	0.11	0.17	0.26	0.32	0.04	0.11

Structure condition score							
Plot 1	**Tree**	**Shrub**	**Grass and grass like**	**Forb**	**Fern**	**Other**	**Current structure condition score**
	30.1	0	0	0.4	0	0	**25.7**

Calculation results						
Plot 1	**Tree**	**Shrub**	**Grass and grass like**	**Forb**	**Fern**	**Other**
Benchmark	52	18	61	10	1	5
Observed mean ($\bar{x}$)	30.1	0	0	0.4	0	0
Unweighted structure score (USSi)	72.5	0	0	0.2	0	0
Weighted structure score (WSSi)	25.7	0	0	0	0	0
Dynamic weighting (wi)	0.35	0.12	0.41	0.07	0.01	0.03

Vegetation Zone 4												
Plant Community Type:	PCT 1395 Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion.											
Area: 0.52 hectares	**Condition class:** Low – weed infested											
Zone function data												
Plot 1	**Regenerating stems <5cm DBH**	**Stem classes**					**No. of large trees (>50cm DBHOB)**	**Hollow-bearing trees**	**Litter cover**	**Coarse woody debris**	**High threat weed cover**	**Current function condition score**
		5-9	**10-19**	**20-29**	**30-49**	**50-79**						
	Absent				x		3	0	46	8.7	70	**54.3**

Calculation results						
Plot 1	**Regenerating stems <5cm DBH**	**Stem size class**	**No. of large trees**	**Litter cover**	**Coarse woody debris**	**High threat weed cover**
Benchmark	Present	4	3	35	40	-
Observed mean (x̄)	0	1	3	46	8.7	70
Weighted function score (WFSi)	0	2.2	35	15	2.1	-
Weighting (wi)	0.15	0.15	0.35	0.15	0.2	-
Overall current vegetation integrity score						
19.4						

Table 7: Current vegetation integrity scores for Vegetation Zone 5.

Vegetation Zone 5	
Plant Community Type:	PCT 807 Derived grasslands on shale plains of the Cumberland Plain (<100m asl), a form of PCT 849 Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion.
Area: 0.07 hectares	**Condition class:** Low – moderate

Composition condition score							
Plot 1	**Tree**	**Shrub**	**Grass and grass like**	**Forb**	**Fern**	**Other**	**Current composition condition score**
	0	0	4	1	0	0	**7.2**

Calculation results						
Plot 1	**Tree**	**Shrub**	**Grass and grass like**	**Forb**	**Fern**	**Other**
Benchmark	5	8	12	15	2	5
Observed mean (x̄)	0	0	4	1	0	0
Unweighted composition score (UCSi)	0	0	27.6	0.6	0	0
Weighted composition score (WCSi)	0	0	7.1	0.2	0	0
Dynamic weighting (wi)	0.11	0.17	0.26	0.32	0.04	0.11

Structure condition score							
Plot 1	**Tree**	**Shrub**	**Grass and grass like**	**Forb**	**Fern**	**Other**	**Current structure condition score**
	0	0	35.2	0.1	0	0	**30**

Calculation results						
Plot 1	**Tree**	**Shrub**	**Grass and grass like**	**Forb**	**Fern**	**Other**
Benchmark	52	18	61	10	1	5
Observed mean (x̄)	0	0	35.2	0.1	0	0
Unweighted structure score (USSi)	0	0	72.3	0	0	0
Weighted structure score (WSSi)	0	0	30	0	0	0
Dynamic weighting (wi)	0.35	0.12	0.41	0.07	0.01	0.03

Vegetation Zone 5												
Plant Community Type:	PCT 807 Derived grasslands on shale plains of the Cumberland Plain (<100m asl), a form of PCT 849 Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion.											
Area: 0.07 hectares	**Condition class:** Low – moderate											
Zone function data												
Plot 1	**Regenerating stems <5cm DBH**	**Stem classes**					**No. of large trees (>50cm DBHOB)**	**Hollow-bearing trees**	**Litter cover**	**Coarse woody debris**	**High threat weed cover**	**Current function condition score**
		5-9	**10-19**	**20-29**	**30-49**	**50-79**						
	Absent						0	0	2	0	20.0	**0.1**

Calculation results						
Plot 1	**Regenerating stems <5cm DBH**	**Stem size class**	**No. of large trees**	**Litter cover**	**Coarse woody debris**	**High threat weed cover**
Benchmark	Present	4	3	35	40	-
Observed mean (x̄)	0	0	0	2	0	20.2
Weighted function score (WFSi)	0	0	0	0.1	0	-
Weighting (wi)	0.15	0.15	0.35	0.15	0.2	-
Overall current vegetation integrity score						
19.4						

Table 8: Predicted threatened species (Ecosystem credit species), their predicted occurrence and their sensitivity profile. Source: BAM calculator.

Predicted species	Status *BC Act 2016*	Status *EPBC Act 1999*	Sensitivity to gain	Habitat constraints	Geographic limitations in Cumberland IBRA subregion	Relevant vegetation zone / PCT				Confirmed predicted species within PCT	Reason
						VZ 1 PCT 849	VZ 2 PCT 1395	VZ 3 PCT 1395	VZ 4 PCT 1395		
Anthochaera phrygia Regent Honeyeater	CE	CE	High	The species is a dual credit species, mapped important areas are a species credit, these areas do not require survey and any impact from development could be potentially serious and irreversible. Ecosystem credit areas are unlikely to be potential serious and irreversible impacts. Outside of its core population, key eucalypt species include *Eucalyptus sideroxylon, Eucalyptus melliodora, Eucalyptus albens,* and *Eucalyptus robusta.* Nectar and fruit from *Amyema* mistletoes are also used and when nectar is scarce, lerp and honeydew can comprise a large proportion of the diet.	None	✓	✓	✓	✓	No	Site is not within an area of mapped important habitat. Critical foraging resources generally absent.
Artamus cyanopterus Dusky Woodswallow	V	-	Moderate	Data for this species is complicated by resident and migratory components of populations, with the greater tendency to migration in south of state. The species uses paddock trees for nesting.	None	✓	✓	✓	✓	Yes	Suitable habitat within vegetation zones on site.
Callocephalon fimbriatum Gang-gang Cockatoo (Foraging)	V	-	Moderate	None	None	✓	✓	✓	✓	Yes	Suitable habitat within vegetation zones on site.
Calyptorhynchus lathami Glossy Black-Cockatoo	V	-	High	Breeding habitat must include living or dead tree with hollows greater than 15cm diameter and greater than 5m above ground. Note that the species may need larger patches and more intact landscapes for breeding.	None		✓	✓	✓	No	Specialist foraging habitat (*Allocasuarina* species) absent. Specialist breeding habitat absent. Vegetation patches small and landscape interrupted.
Chthonicola sagittata Speckled Warbler	V	-	High	Paddock trees can be important for this species as they can link remnant foraging habitat.	None	✓	✓	✓	✓	Yes	Suitable habitat within vegetation zones on site.
Circus assimilis Spotted Harrier	V	-	Moderate	Whilst this species is a raptor (and therefore could be a dual credit species) identifying nests is difficult. Species is flexible enough to use other nests sites once breeding completed.	None	✓				Yes	Suitable habitat within PCT 849 vegetation zone on site.
Climacterus picumnus victoriae Brown Treecreeper	V	-	High	Must be within 100m of moderate to good condition vegetation of suitable type.	None	✓	✓	✓	✓	Yes	Suitable habitat within vegetation zones on site.
Daphoenositta chrysoptera Varied Sittella	V	-	Moderate	None	None	✓	✓	✓	✓	Yes	Suitable habitat within vegetation zones on site.

Predicted species	Status *BC Act 2016*	Status *EPBC Act 1999*	Sensitivity to gain	Habitat constraints	Geographic limitations in Cumberland IBRA subregion	Relevant vegetation zone / PCT				Confirmed predicted species within PCT	Reason
						VZ 1 PCT 849	VZ 2 PCT 1395	VZ 3 PCT 1395	VZ 4 PCT 1395		
Dasyurus maculatus Spotted-tailed Quoll	V	E	High	The species has been shown to use small patches and highly fragmented landscapes. Paddock trees can be used for denning in cleared landscape, as can other habitat (e.g. windrows). Ecology of the quoll is reasonably well documented but its response to management is less well known. Species regularly uses hollows for denning and is dependent on hollow-dependent prey in many parts of NSW. Males will disperse long distances, however females remain close to maternal home range and are unlikely to disperse more than 10km.	None	✓	✓	✓	✓	Yes	Suitable habitat within vegetation zones on site.
Falsistrellus tasmaniensis Eastern False Pipistrelle	V	-	High	Prefers moist habitats, with tall trees. Roost requirements poorly known, but known to use hollows, loose bark and buildings. Paddock trees should be flagged as potential roosts. Forages for flying insects above or just below the tree canopy.	None	✓	✓	✓	✓	Not predicted	Calls recorded on site identified to a "possible" level of certainty.
Glossopsitta pusilla Little Lorikeet	V	-	High	The species is highly mobile and the small hollows required for breeding are relatively common.	None	✓	✓	✓	✓	Yes	Suitable habitat within vegetation zones on site.
Grantiella picta Painted Honeyeater	V	V	Moderate	Mistletoes present at a density of greater than five mistletoes per hectare.	None	✓	✓	✓	✓	No	Specialist foraging habitat (mistletoes) absent.
Haliaeetus leucogaster White-bellied Sea-Eagle (Foraging)	V	-	High	Within 1km of a rivers, lakes, large dams or creeks, wetlands and coastlines. The species is highly selective in nesting locations - breeding habitat is live large old trees within 1km of a rivers, lakes, large dams or creeks, wetlands and coastlines.	None	✓	✓	✓	✓	Yes	Suitable potential breeding habitat within vegetation zones on site.
Hieraaetus morphnoides Little Eagle (Foraging)	V	-	Moderate	Nest trees constraint - breeding habitat is live (occasionally dead) large old trees within suitable vegetation. Paddock trees can provide important breeding habitat. Little eagles are less likely than urban-adapted raptors to readily cross urban or peri-urban spaces to hunt.	None	✓	✓	✓	✓	Yes	Suitable habitat within vegetation zones on site.

Predicted species	Status *BC Act 2016*	Status *EPBC Act 1999*	Sensitivity to gain	Habitat constraints	Geographic limitations in Cumberland IBRA subregion	Relevant vegetation zone / PCT				Confirmed predicted species within PCT	Reason
						VZ 1 PCT 849	VZ 2 PCT 1395	VZ 3 PCT 1395	VZ 4 PCT 1395		
Lathamus discolor Swift Parrot (Foraging)	E	CE	Moderate	Only present in non-breeding season March to September. The species is a dual credit species, with the species credit component mapped as an important area. These mapped areas do NOT require survey as it is presumed that the species is present. Any impact from development could potentially be serious and irreversible. Ecosystem credit areas are unlikely to have potential serious and irreversible impacts.	None	✓	✓	✓	✓	Yes	Suitable habitat within vegetation zones on site.
Lophoictinia isura Square-tailed Kite (Foraging)	V	-	Moderate	The species is allocated to dual credit because they tend to be sensitive to disturbance around nests.	None	✓	✓	✓	✓	Yes	Suitable habitat within vegetation zones on site.
Melanodryas cucullata cucullata Hooded Robin	V	-	Moderate	Paddock trees can be important for this species as they can link remnant foraging habitat.	None	✓	✓	✓	✓	Yes	Suitable habitat within vegetation zones on site.
Melithreptus gularis gularis Black-chinned Honeyeater	V	-	Moderate	None	None	✓	✓	✓	✓	Yes	Suitable habitat within vegetation zones on site.
Miniopterus australis Little Bentwing-bat (Foraging)	V	-	High	Breeding habitat constraint cave, tunnel, mine, culvert or other suitable structure. Is a dual credit species because foraging habitat is broad ranging but breeding habitat is highly specific.	None	✓	✓	✓	✓	Yes	Suitable habitat within vegetation zones on site.
Miniopterus schreibersii oceanensis Eastern Bentwing-bat (Foraging)	V	-	High	Breeding habitat constraint cave, tunnel, mine, culvert or other suitable structure. Is a dual credit species because foraging habitat is broad ranging but breeding habitat is highly specific.	None	✓	✓	✓	✓	Yes	Suitable habitat within vegetation zones on site.
Micronomus norfolkensis Eastern Coastal Free-tailed Bat	V	-	High	Requires tree hollows for roosting as well as breeding. Species allocated to ecosystem credit class because it will usually change breeding sites every few days, rendering it very difficult to confirm breeding sites. It has been known to occasionally aggregate in large breeding groups (including in buildings). The species has been found to use paddock trees, these may provide critical roosts in some areas.	None	✓	✓	✓	✓	Yes	Suitable habitat within vegetation zones on site.

Predicted species	Status *BC Act 2016*	Status *EPBC Act 1999*	Sensitivity to gain	Habitat constraints	Geographic limitations in Cumberland IBRA subregion	Relevant vegetation zone / PCT				Confirmed predicted species within PCT	Reason
						VZ 1 PCT 849	VZ 2 PCT 1395	VZ 3 PCT 1395	VZ 4 PCT 1395		
Neophema pulchella Turquoise Parrot	V	-	High	The species is allocated to full ecosystem credit species given that hollows are now on the credit profile, therefore likely to capture suitable breeding habitat for the species (highly mobile and breeding habitat unpredictable). Some experts suggested the species may be more common than originally thought and/or increasing in number.	None	✓	✓	✓	✓	Yes	Suitable habitat within vegetation zones on site.
Ninox connivens Barking Owl (Foraging)	V	-	High	Uses paddock trees to extend foraging area from intact woodland. Breeding habitat constraint: living or dead trees with hollows greater than 20 cm diameter and greater than 4m above the ground.	None	✓	✓	✓	✓	Yes	Suitable habitat within vegetation zones on site.
Ninox strenua Powerful Owl (Foraging)	V	-	High	The species can breed and forage in very small patches of vegetation, although this is hugely variable across their range. Breeding habitat constraint: living or dead trees with hollow greater than 20cm diameter.	None	✓	✓	✓	✓	Yes	Suitable habitat within vegetation zones on site.
Petroica boodang Scarlet Robin	V	-	Moderate	Paddock trees are used for roosting and foraging.	None	✓	✓	✓	✓	Yes	Suitable habitat within vegetation zones on site.
Petroica phoenicea Flame Robin	V	-	Moderate	Breeding and non-breeding habitat is very different, key should be protecting breeding habitat. The species will occupy smaller patches outside breeding season. Paddock trees are used for roosting and foraging.	None	✓	✓	✓	✓	Yes	Suitable habitat within vegetation zones on site.
Phascolarctos cinereus Koala (Foraging)	V	V	High	Important' habitat is defined by the density of koalas and quality of habitat determined by on-site survey.	None	✓	✓	✓	✓	Yes	Suitable forage trees dominated the vegetation zones on site.
Pteropus poliocephalus Grey-headed Flying-fox (Foraging)	V	V	High	This species is retained as dual credit because foraging habitat is broad ranging but breeding camps are localised.	None	✓	✓	✓	✓	Yes	Suitable habitat within vegetation zones on site.
Saccolaimus flaviventris Yellow-bellied Sheathtail-bat	V	-	High	Roost requirements poorly known, paddock trees should be flagged as potential roosts.	None	✓	✓	✓	✓	Yes	Suitable habitat within vegetation zones on site.

Predicted species	Status *BC Act 2016*	Status *EPBC Act 1999*	Sensitivity to gain	Habitat constraints	Geographic limitations in Cumberland IBRA subregion	Relevant vegetation zone / PCT				Confirmed predicted species within PCT	Reason
						VZ 1 PCT 849	VZ 2 PCT 1395	VZ 3 PCT 1395	VZ 4 PCT 1395		
Scoteanax rueppellii Greater Broad-nosed Bat	V	-	High	Found most commonly in tall moist forest. Usually roosts in hollows, but also found in buildings. Forages slowly and directly along creek and river corridors at an altitude of between 3 to 6 m. Open woodland habitat and dry open forest suits the direct flight of this species as it searches for beetles and other large, slow-flying insects; this species has been known to eat other bat species.	None	✓	✓	✓	✓	Not predicted	Calls recorded on site identified to a "possible" level of certainty.
Stagonopleura guttata Diamond Firetail	V	-	Moderate	None	None	✓	✓	✓	✓	Yes	Suitable habitat within vegetation zones on site.
Tyto novaehollandiae Masked Owl (Foraging)	V	-	High	This species will use areas that are quite small, especially as foraging habitat but also as roosting habitat and occasionally as breeding habitat. Has been recording nesting in paddock trees and caves in Tas, but there is no evidence to suggest that this occurs in NSW. Dead stags are especially popular for roosting/breeding habitat and are a limited resource due to natural attrition.	None	✓	✓	✓	✓	Yes	Suitable habitat within vegetation zones on site.
Varanus rosenbergi Rosenberg's Goanna	V	-	High	Broad-ranging species that is difficult to survey - very transient.	None		✓	✓	✓	No	Specialist sheltering habitat (rocky outcrops) or nesting habitat (terrestrial termite mounds) absent.

Table 9: A list of candidate species identified for the PCTs on site, and whether or not they are to be included or excluded for further consideration through survey (shown bold).

Candidate species	Status *BC Act 2016*	Status *EPBC Act 1999*	Sensitivity to gain	Habitat constraints	Geographic limitations in Cumberland IBRA subregion	Included or excluded from targeted surveys	Suitable survey periods	Reason for Exclusion
Acacia bynoeana Bynoe's Wattle	E	V	High	Occurs in heath or dry sclerophyll forest on sandy soils. Prefers open, sometimes disturbed sites and recent burnt patches. Associated with overstorey species *Corymbia gummifera, Eucalyptus haemastoma* and *E. parramattensis* subsp. *parramattensis*.	None identified in the BAM.	Excluded	Not applicable – excluded from further survey.	The site does not provide suitable habitat for this species.
Acacia pubescens Downy Wattle	V	V	High	Occurs on alluviums, shales and at the intergrade between shales and sandstones on the Cumberland Plain.	None identified in the BAM.	Excluded	Not applicable – excluded from further survey.	Only one specimen collected from the local area, collected in 1995 from Annangrove. Collection notes state that the habitat comprised "*Eucalyptus haemastoma - Callitris rhomboidea* woodland with *Acacia parramattensis* and grasses. Shale - sandstone interface on ridgetop plateau." The site does not provide suitable habitat for this species.
Anthochaera phrygia Regent Honeyeater (Breeding)	CE	CE	High	Inhabits dry open forest and woodland, particularly Box-Ironbark woodland, and riparian forests of River Sheoak.	None identified in the BAM. There are only four known key breeding regions remaining: north-east Victoria (Chiltern-Albury), and in NSW at Capertee Valley, near Warragamba Dam, and the Bundarra-Barraba region. In NSW the distribution is very patchy and mainly confined to the main breeding areas and surrounding fragmented woodlands	Excluded	Not applicable – excluded from further survey.	The development site is not within any of the areas mapped as important habitat for this species, and critical foraging resources (such as dense stands of winter-flowering trees) are absent
Burhinus grallarius Bush Stone-curlew	E	-	High	Inhabits open forests and woodlands with a sparse grassy ground layer. Requires fallen / standing dead timber, including logs	None identified in the BAM. Species is mainly found in western slopes and plains and the Riverina with smaller numbers on Central and North Coast.	Excluded	Not applicable – excluded from further survey.	Although the site provides potential habitat within the open woodland on site, it is not located near the western slopes and plains and Riverina.
Caladenia tessellata Thick Lip Spider Orchid	V	V	Moderate	Recorded from coastal heath vegetation. Generally found in grassy sclerophyll woodland on clay loam or sandy soils, though the population near Braidwood is in low woodland with stony soil.	None identified in the BAM. Known from the Sydney area (old records), Wyong, Ulladulla and Braidwood in NSW. Populations in Kiama and Queanbeyan are presumed extinct. It was also recorded in the Huskisson area in the 1930s.	Excluded	Not applicable – excluded from further survey.	The site does not provide suitable habitat for this species.
Callistemon linearifolius Netted Bottle Brush	V	-	High	Grows in dry sclerophyll forest on the coast and adjacent ranges.	None identified in the BAM. Recorded from the Georges River to Hawkesbury River in the Sydney area, and north to the Nelson Bay area; also recorded in 2000 at Coalcliff in the northern Illawarra. For the Sydney area, recent records are limited to the Hornsby Plateau area near the Hawkesbury River.	Excluded	Not applicable – excluded from further survey.	The site does not provide suitable habitat for this species.
Callocephalon fimbriatum Gang-gang Cockatoo (Breeding)	V	-	High	In summer, generally found in montane forests and woodlands; in winter, may occur at lower altitudes in drier more open eucalypt forests and woodlands, and often found in urban areas. Breeds in large and old hollow-bearing trees in forest.	None identified in the BAM.	Excluded	Not applicable – excluded from further survey.	No old growth forest or woodland attributes on site suitable for nesting or roosting of this species. No suitable hollows on site (at least 10cm in diameter and at least 9 metres above the ground in eucalypts).
Calyptorhynchus lathami Glossy Black-Cockatoo (Breeding)	V	-	High	Breeds in large hollow-bearing trees in forest and forages on Allocasuarina species.	None identified in the BAM.	Excluded	Not applicable – excluded from further survey.	This species requires large hollow-bearing eucalypt for nesting. No such attributes occur on site.
Cercartetus nanus Eastern Pygmy-possum	V	-	High	Mostly found in woodland and heath with dense cover of flowering plants such as Banksia, Eucalyptus and Callistemon.	None identified in the BAM.	Excluded	Not applicable – excluded from further survey.	The site does not provide suitable habitat for this species.

Candidate species	Status *BC Act 2016*	Status *EPBC Act 1999*	Sensitivity to gain	Habitat constraints	Geographic limitations in Cumberland IBRA subregion	Included or excluded from targeted surveys	Suitable survey periods	Reason for Exclusion
Chalinolobus dwyeri Large-eared Pied Bat	V	V	Very high	Requires cliffs. Site location to be within 2 kilometres of rocky areas containing caves, overhangs, escarpments, outcrops or crevices, or within 2 kilometres of old mines or tunnels.	None identified in the BAM.	Excluded	Not applicable – excluded from further survey.	The site does not provide suitable habitat for this species.
***Cynanchum elegans* White-flowered Wax Plant**	**E**	**E**	**High**	**Usually occurs on the edge of dry rainforest vegetation. Other associated vegetation types include littoral rainforest; Coastal Tea-tree *Leptospermum laevigatum* – Coastal Banksia *Banksia integrifolia* subsp. *integrifolia* coastal scrub; Forest Red Gum *Eucalyptus tereticornis* aligned open forest and woodland; Spotted Gum *Corymbia maculata* aligned open forest and woodland; and Bracelet Honeymyrtle *Melaleuca armillaris* scrub to open scrub.**	**None identified in the BAM.**	**Included**	**Survey at all times of the year.**	**-**
Dillwynia tenuifolia	V, EPop	-	V Spp: moderate EPop: High	In western Sydney, may be locally abundant particularly within scrubby/dry heath areas within Castlereagh Ironbark Forest and Shale Gravel Transition Forest on tertiary alluvium or laterised clays. May also be common in transitional areas where these communities adjoin Castlereagh Scribbly Gum Woodland. At Yengo, is reported to occur in disturbed escarpment woodland on Narrabeen sandstone.	None identified in the BAM. The core distribution is the Cumberland Plain from Windsor and Penrith east to Dean Park near Colebee. Although all records within The Hills LGA are part of the listed Endangered Population only known from two locations near the junction of Wisemans Ferry and Sackville Roads at South Maroota.	Excluded	Not applicable – excluded from further survey.	Occurs largely in western Sydney, of which the site is not a part.
Epacris purpurascens* var. *purpurascens	**V**	**-**	**Moderate**	**Found in a range of habitat types, most of which have a strong shale soil influence.**	**None identified in the BAM.**	**Included**	**Survey at all times of the year.**	**-**
Eucalyptus benthamii Camden White Gum	V	V	High	Requires a combination of deep alluvial sands and a flooding regime that permits seedling establishment. Recruitment of juveniles appears to be most successful on bare silt deposits in rivers and streams. Occurs in open forest. Associated species at the Bents Basin site include *Eucalyptus elata, Eucalyptus bauerina, Eucalyptus amplifolia, Eucalyptus deanei* and *Angophora subvelutina.*	None identified in the BAM. Occurs on the alluvial flats of the Nepean River and its tributaries. There are two major subpopulations: in the Kedumba Valley of the Blue Mountains National Park and at Bents Basin State Recreation Area. Several trees are scattered along the Nepean River around Camden and Cobbitty, with a further stand at Werriberri (Monkey) Creek in The Oaks. At least five trees occur on the Nattai River in Nattai National Park. Large areas of habitat were inundated by the formation of Warragamba Dam in 1933.	Excluded	Not applicable – excluded from further survey.	The site does not contains suitable alluvial soils, and is outside of its known distribution.
Grevillea juniperina* subsp. *juniperina	**V**	**-**	**High**	**Grows on reddish clay to sandy soils derived from Wianamatta Shale and Tertiary alluvium (often with shale influence), typically containing lateritic gravels. Recorded from Cumberland Plain Woodland, Castlereagh Ironbark Woodland, Castlereagh Scribbly Gum**	**None identified in the BAM. Endemic to Western Sydney, centred on an area bounded by Blacktown, Erskine Park, Londonderry and Windsor with outlier populations at Kemps Creek and Pitt Town.**	**Included**	**Survey at all times of the year.**	**-**

Candidate species	Status *BC Act 2016*	Status *EPBC Act 1999*	Sensitivity to gain	Habitat constraints	Geographic limitations in Cumberland IBRA subregion	Included or excluded from targeted surveys	Suitable survey periods	Reason for Exclusion
				Woodland and Shale/Gravel Transition Forest.				
Grevillea parviflora subsp. *parviflora* Small-flower Grevillea	V	V	High	Grows in sandy or light clay soils usually over thin shales, often with lateritic ironstone gravels and nodules. Sydney region occurrences are usually on Tertiary sands and alluvium, and soils derived from the Mittagong Formation. Soil landscapes include Lucas Heights or Berkshire Park. Despite the range of associated communities several understorey species which are common to several of the known sites of *Grevillea parviflora* subsp. *parviflora* can be identified and include *Allocasuarina littoralis*, *Daviesia ulicifolia*, *Kunzea ambigua*, *Banksia spinulosa*, *Leptospermum trinervium*, *Melaleuca nodosa*, *Pimelea linifolia*, *Themeda australis*, *Entolasia stricta* and *Eragrostis brownii*.	None identified in the BAM. Sporadically distributed throughout the Sydney Basin with sizeable populations around Picton, Appin and Bargo (and possibly further south to the Moss Vale area) and in the Hunter at in the Cessnock - Kurri Kurri area (particularly Werakata NP). Separate populations are also known from Putty to Wyong and Lake Macquarie on the Central Coast.	Excluded	Not applicable – excluded from further survey.	The site does not provide suitable habitat for this species, and other than the common grasses, none of the known associated understorey species occur.
Grevillea parviflora* subsp. *supplicans	**E**	**-**	**High**	**Strongly associated with clay-capped ridges on Lucas Heights and Faulconbridge soil landscapes.**	**None identified in the BAM. May be associated with the margins of Shale Sandstone Transition Forest.**	**Included**	**Survey at all times of the year.**	-
Gyrostemon thesioides	E	-	High	Grows on hillsides and riverbanks and may be restricted to fine sandy soils and is a fire opportunist, recruiting from soil-stored seedbank following fire. Adult plants are killed by fire.	None identified in the BAM. Only ever recorded at three sites near the Colo, Georges and Nepean Rivers.	Excluded	Not applicable – excluded from further survey.	The site does not provide suitable habitat for this species.
***Haliaeetus leucogaster* White-bellied Sea-Eagle (Breeding)**	**V**	**-**	**High**	**Most commonly seen foraging over water bodies or near coastal waters for fish and freshwater turtles; will occasionally forage over open country for carrion. Breeding habitat consists of mature tall open forest and woodland near foraging habitats. Trees typically large emergent eucalypts.**	**None identified in the BAM. Occurs at sites near the sea or sea-shore, or in the vicinity of freshwater swamps, lakes, reservoirs, billabongs and saltmarshes.**	**Included**	**Survey suitable from July to December.**	-
Hibbertia puberula	E	-	High	Occurs on sandy soils, often associated with sandstone mainly from coastal areas. It is restricted to the greater Sydney region.	None identified in the BAM. Extends from Wollemi National Park to Morton National Park. Favours heath on sandy soils, rarely in clay.	Excluded	Not applicable – excluded from further survey.	The site does not provide suitable habitat for this species.
Hibbertia spanantha Julian's Hibbertia	CE	CE	NA	Known only from 3 small populations in Turramurra, Macquarie Park and Beecroft. Light clay / sandstone transition soils with *Eucalyptus pilularis, Eucalyptus resinifera, Corymbia gummifera* and *Angophora costata*. Grassy understorey.	None identified in the BAM. Occurs in light clay soils on shale sandstone transition areas.	Excluded	Unknown.	The site does not occur within the areas of known populations.
Hibbertia superans	**E**	**-**	**High**	**Occurs on sandstone ridgetops, often near the shale/sandstone boundary. Appears to prefer open, disturbed areas such as tracks.**	**None identified in the BAM. From Baulkham Hills to South Maroota.**	**Included**	**Survey suitable from July to December.**	-

Candidate species	Status *BC Act 2016*	Status *EPBC Act 1999*	Sensitivity to gain	Habitat constraints	Geographic limitations in Cumberland IBRA subregion	Included or excluded from targeted surveys	Suitable survey periods	Reason for Exclusion
Hieraaetus morphnoides **Little Eagle (Breeding)**	**V**	**-**	**Moderate**	**Seen over woodland and forested lands and open country, extending into the arid zone; tends to avoid rainforest and heavy forest. Nest in mature living trees in open woodland or tree-lined watercourses; rarely in isolated trees.**	**None identified in the BAM. Found within open forest and woodlands with Acacia woodlands and riparian of interior NSW also used.**	**Included**	**Survey suitable from August to October.**	**-**
Lathamus discolor Swift Parrot (breeding)	E	CE	Moderate	Migrates to the mainland between March and October to areas with flowering eucalypts or abundant lerps. Lerp infested trees can include Grey Box and Blackbutt. Breeding occurs in Tasmania.	None identified in the BAM. Favoured feed trees include *Eucalyptus robusta, Eucalyptus sideroxylon, Eucalyptus albens, Corymbia maculata* and *Corymbia gummifera*.	Excluded	Not applicable – excluded from further survey.	This species breeds in Tasmania and migrates to the mainland during other times. Habitat values on site may only support foraging activities, and the site is not within an area identified and mapped by OEH as important habitat.
Leucopogon fletcheri **subsp. *fletcheri***	**E**	**-**	**High**	**Occurs in dry eucalypt woodland on flat to gently sloping terrain along ridges and spurs.**	**None identified in the BAM. Restricted to north-west Sydney between St Albans and Annangrove within the LGAs of Hawkesbury, The Hills, and Blue Mountains.**	**Included**	**Survey at all times of the year.**	**-**
Litoria aurea **Green and Golden Bell Frog**	**E**	**V**	**High**	**Inhabits marshes, dams and stream-sides, in semi-permanent / ephemeral wet areas. Within 1 kilometre of wet area, including swamps and waterbodies.**	**None identified in the BAM. Some sites in the Greater Sydney region occur in highly disturbed areas.**	**Included**	**Survey suitable from November to March.**	**-**
Lophoictinia isura **Square-tailed Kite (Breeding)**	**V**	**-**	**Moderate**	**Found in timbered habitats with a particular preference for timbered watercourses. Breeding occurs July to February with nest sites generally located along or near watercourses in a fork or on large horizontal limbs.**	**None identified in the BAM. scattered records of the species throughout the state indicate that the species is a regular resident in the north, north-east and along the major west-flowing river systems. It is a summer breeding migrant to the south-east, including the NSW south coast, arriving in September and leaving by March.**	**Included**	**Survey suitable from September to January.**	**-**
Marsdenia viridiflora subsp. *viridiflora*	EPop	-	High	Grows in vine thickets and open shale woodlands.	Population in the Bankstown, Blacktown, Camden, Campbelltown, Fairfield, Holroyd, Liverpool and Penrith local government areas	Excluded	Not applicable – excluded from further survey.	The Endangered Population is not listed for The Hills LGA.
Melaleuca deanei Deane's Paperbark	V	V	High	Grows mostly in ridgetop woodlands with only 5% of sites in heath on sandstone.	None identified in the BAM. Occurs in two distinct areas in northern and southern Sydney (Ku-ring-gai/Berowra and Holsworthy/Wedderburn respectively).	Excluded	Not applicable – excluded from further survey.	The site does not provide suitable habitat for this species.
Meridolum corneovirens **Cumberland Plain Land Snail**	**E**	**-**	**High**	**Primarily inhabits Cumberland Plain Woodland.**	**None identified in the BAM. Lives in small areas on the Cumberland Plain.**	**Included**	**Survey suitable from September to January.**	**-**
Miniopterus australis Little Bentwing-bat (Breeding)	V	-	Very high	Roosts in caves, tunnels, abandoned mines and forage beneath the canopy of densely vegetated habitats.	Occurs in moist forests and generally found in well-timbered areas. Only 5 maternity / nursery sites are known in Australia.	Excluded	Not applicable – excluded from further survey.	This species breeds within specific maternity caves. Only a few are known within to occur within NSW. The site is not located in, or near an area identified as containing maternity roosts.
Miniopterus orianae oceanensis Eastern Bentwing-bat (Breeding)	V	-	Very high	Roosts in caves, tunnels, buildings and man-made structures and forages above tree tops in forested areas.	None identified in the BAM. Population disperses within 300km of maternity caves.	Excluded	Not applicable – excluded from further survey.	This species breeds within specific maternity caves. Only a few are known within to occur within NSW. The site is not located in, or near an area identified as containing maternity roosts.

Candidate species	Status *BC Act 2016*	Status *EPBC Act 1999*	Sensitivity to gain	Habitat constraints	Geographic limitations in Cumberland IBRA subregion	Included or excluded from targeted surveys	Suitable survey periods	Reason for Exclusion
Myotis macropus **Southern Myotis**	**V**	**-**	**High**	**Forages over large bodies of water and roosts in hollows or under old wooden bridges usually close to foraging habitat but also known to roost up to 10 km from foraging habitat. Roosts in groups, close to water in caves, hollow-bearing trees buildings and man-made structures.**	**None identified in the BAM. Found along the coastal band of Australia and rarely found more than 100km inland.**	**Included**	**Survey suitable from November to March.**	**-**
Ninox connivens Barking Owl (Breeding)	V	-	High	Occurs in eucalypt woodland, open forest, swamp woodlands and timbered watercourses. Occasionally uses dense vegetation for roosting. Requires large hollows in old trees to breed.	None identified in the BAM. Core populations exist on the western slopes and plains.	Excluded	Not applicable – excluded from further survey.	No suitable breeding habitat on site.
Ninox strenua Powerful Owl (Breeding)	V	-	High	Usually roosts in dense vegetation and hunts for arboreal mammals across large home range. Nest in large tree hollows, at least 0.5m deep, with entries of at least 20cm in trees that are at least 150 years old.	None identified in the BAM. Mainly occurs on the coastal side of the Great Dividing Range.	Excluded	Not applicable – excluded from further survey.	This species requires large hollows in large trees, generally in dense protected gullies. No such habitat occurs on site.
Persoonia bargoensis Bargo Geebung	E	V	High	Occurs in woodland and forest in sandstone and well drained, gravel soils of the Wianamatta Shale and Hawkesbury sandstone. Favours the interface of Blacktown soil landscape.	None identified in the BAM. Restricted to a small area south west of Sydney on the western edge of the Woronora Plateau.	Excluded	Survey suitable from December to May.	The site is outside of the known distribution of this species.
Persoonia hirsuta Hairy Geebung	E	E	High	Occurs in sandy soils in dry sclerophyll open forest, woodland and heath on sandstone.	None identified in the BAM. Scattered distribution around Sydney known from Singleton to Bargo.	Excluded	Not applicable – excluded from further survey.	The site does not provide suitable habitat for this species.
Persoonia nutans **Nodding Geebung**	**E**	**E**	**High**	**Northern populations occur on aeolian and alluvial sediments with southern populations also occupying tertiary alluvium but can extend onto Shale Sandstone Transition communities.**	**None identified in the BAM. Restricted to the Cumberland Plain.**	**Included**	**Not applicable – excluded from further survey.**	**-**
Petaurus norfolcensis Squirrel Glider	V	-	High	Found in forest and woodland with diverse understorey that provides forage throughout the year. Requires abundant tree hollows.	None identified in the BAM. Inhabits old growth Box-Ironbark woodlands and Blackbutt forest with heath understorey in coastal areas.	Excluded	Not applicable – excluded from further survey.	The site does not provide suitable habitat for this species.
Phascolarctos cinereus Koala (Breeding)	V	V	High	Occurs where suitable food trees present, generally on rich open valleys.	None identified in the BAM. mainly occurs on the central and north coasts.	Excluded	Not applicable – excluded from further survey.	No sightings of this species within 5 kilometres of the site, with the surrounds generally being farmland rapidly changing to urban. The site provides marginally suitable foraging habitat in the *Eucalyptus tereticornis* and *Eucalyptus amplifolia* on site.
Pimelea curviflora var. *curviflora*	V	V	High	Mostly confined to northern Sydney; known from Duffys Forest / Terrey Hills area. Occurs on shaley/lateritic soils over sandstone and shale/sandstone transition soils on ridgetops and upper slopes in woodlands.	None identified in the BAM. Confined to the coastal area of the Sydney and Illawarra regions.	Excluded	Not applicable – excluded from further survey.	The site does not provide suitable habitat for this species.
Pimelea spicata **Spiked Rice-flower**	**E**	**E**	**High**	**Found in well-structured clay soils and is associated with Grey Box communities.**	**None identified in the BAM. occurs in two disjunct areas; the Cumberland Plain and the Illawarra.**	**Included**	**Survey at all times of the year.**	**-**

Candidate species	Status *BC Act 2016*	Status *EPBC Act 1999*	Sensitivity to gain	Habitat constraints	Geographic limitations in Cumberland IBRA subregion	Included or excluded from targeted surveys	Suitable survey periods	Reason for Exclusion
Pomaderris brunnea Brown Pomaderris	E	V	High	Grows in moist woodland or forest on clay and alluvial soils.	None identified in the BAM. Found in a very limited area around the Colo, Nepean and Hawkesbury Rivers, including the Bargo area and near Camden.	Excluded	Not applicable – excluded from further survey.	The site does not provide suitable habitat for this species.
***Pommerhelix duralensis* Dural Woodland Snail**	**E**	**E**	**High**	**Specialist of shale-influenced woodland along the margins of the Cumberland Plain. Lives under rocks and in bark; does not burrow or climb. Occurs in leaf litter, shed bark, rocks or logs, or within 50 metres of such features.**	**None identified in the BAM. Occurs in low densities along the western and northwest fringes on the Cumberland IBRA subregion on shale-sandstone transition landscapes.**	**Included**	**Survey at all times of the year.**	**-**
Pseudophryne australis Red-crowned Toadlet	V	-	Moderate	Restricted to heads of periodically wet drainage lines below sandstone ridges that often have shale caps. Needs rocks and dense vegetation or litter for shelter.	Margin of Cumberland Plain where sandstone outcrops intersect.	Excluded	Not applicable – excluded from further survey.	The site does not provide suitable habitat for this species.
Pteropus poliocephalus Grey-headed Flying-fox (Breeding)	V	V	High	Foraging habitat in flowering eucalypts, particularly winter-flowering species; camps in dense wet forest or rainforest gullies.	None identified in the BAM. found within 200 km of the eastern coast of Australia, from Rockhampton in Queensland to Adelaide in South Australia.	Excluded	Not applicable – excluded from further survey.	This species breeds in large maternity camps in gullies. No such habitat occurs on site.
Pterostylis saxicola Sydney Plains Greenhood	E	E	High	Found in small pockets of shallow soils in depressions on sandstone rock shelves above cliff lines.	None identified in the BAM. Restricted to western Sydney between Freemans Reach in the north and Picton in the south.	Excluded	Not applicable – excluded from further survey.	The site does not provide suitable habitat for this species.
***Pultenaea pedunculata* Matted Bush-pea**	**E**	**-**	**N/A**	**Occurs in a range of habitats, generally among woodland but has also been found along road batters and coastal cliffs.**	**None identified in the BAM. Represented by just three disjunct populations, in the Cumberland Plains in Sydney, the coast between Tathra and Bermagui, and the Windellama area south of Goulburn**	**Included**	**Survey suitable from September to November.**	**-**
Tetratheca glandulosa	V	-	High	Occurs in shale-sandstone transition habitat on shallow soils associated with Lucas Heights, Gymea, Lambert and Faulconbridge soil landscapes. Usually found on ridgetops to mid slopes in heath, scrub, woodland to open forest.	None identified in the BAM. Restricted to The Hills, Gosford, Hawkesbury, Hornsby, Ku-ring-gai, Pittwater, Ryde, Warringah, and Wyong LGAs.	Excluded	Not applicable – excluded from further survey.	The site does not provide suitable habitat for this species.
***Thesium australe* Austral Toadflax**	**V**	**V**	**Moderate**	**Occurs in grassland on coastal heaths or grassy woodland away from the coast. Often found in association with *Themeda triandra*.**	**None identified in the BAM. Found in very small populations scattered across eastern NSW, along the coast, and from the Northern to Southern Tablelands**	**Included**	**Survey suitable from September to February.**	**-**
Tyto novaehollandiae Masked Owl (Breeding)	V	-	High	Occurs in dry forest and woodlands up to 1100m ASL. Roosts and breeds in moist eucalypt forested gullies using large tree hollows.	None identified in the BAM. Most abundant along the coast but extends to the western plains.	Excluded	Not applicable – excluded from further survey.	This species breeds in moist eucalypt gullies. The site does not provide any such habitat.

Table 10: Candidate species included in the survey and the survey result. Blue cells indicate suitable survey periods, black triangles show times of site survey. Species found or assumed to be present for the purposes of the BOS shown in bold.

Candidate species	Status *BC Act 2016*	Status *EPBC Act 1999*	Species present?	Species presence determined	Survey timetable												Survey technique	Biodiversity risk	Biodiversity risk weighting	Relevant Vegetation Zone for species recorded or assumed present	Area suitable for species
					J	F	M	A	M	J	J	A	S	O	N	D					
Anthochaera phrygia Regent Honeyeater (Breeding)	CE	CE	No	Surveyed							▲		▲	▲			BAR audio recording Dawn and dusk surveys	Very High	3	-	-
Cynanchum elegans White-flowered Wax Plant	E	E	No	Surveyed						▲	▲		▲	▲			Targeted random meander Active searches	High	2	-	
Epacris purpurascens var. *purpurascens*	V	-	No	Surveyed						▲	▲		▲	▲			Targeted random meander Active searches	Moderate	1.5	-	
Grevillea juniperina subsp. *juniperina*	V	-	No	Surveyed							▲		▲	▲		▲	Targeted random meander Active searches	High	2	-	
Grevillea parviflora subsp. *supplicans*	E	-	No	Surveyed							▲	▲		▲		▲	Targeted random meander Active searches	High	2	-	
Haliaeetus leucogaster White-bellied Sea-Eagle (Breeding)	V	-	No	Surveyed							▲		▲	▲			BAR audio recording Targeted survey Opportunistic survey	High	2	-	
Hibbertia superans	E	-	No	Surveyed							▲	▲		▲		▲	Targeted random meander Active searches	High	2	-	
Hieraaetus morphnoides Little Eagle (Breeding)	V	-	No	Surveyed							▲		▲	▲			BAR audio recording Targeted survey Opportunistic survey	Moderate	1.5	-	
Leucopogon fletcheri subsp. *fletcheri*	E	-	No	Surveyed							▲		▲	▲		▲	Targeted random meander Active searches	High	2	-	
***Litoria aurea* Green and Golden Bell Frog**	**E**	**V**	**Yes**	**Assumed present**							▲						BAR audio recording Opportunistic survey	**High**	**2**	**VZ 2 - 1395_SSTF_good_FS_regen** **VZ 3 - 1395_SSTF_grs_meadow**	**0.17** **0.76**
Lophoictinia isura Square-tailed Kite (Breeding)	V	-	No	Surveyed							▲		▲	▲			BAR audio recording Targeted survey Opportunistic survey	Moderate	1.5	-	-
***Meridolum corneovirens* Cumberland Plain Land Snail**	**E**	**-**	**Yes**	**Surveyed**						▲	▲		▲	▲			Targeted habitat searches	**High**	**2**	**VZ 1 - 849_CPW_native_us** **VZ 2 - 1395_SSTF_good_FS_regen**	**0.30** **0.17**
***Myotis macropus* Southern Myotis**	**V**	**-**	**Yes**	**Assumed present**							▲						Ultrasonic audio recording (Anabat express)	**High**	**2**	**VZ 1 - 849_CPW_native_us** **VZ 4 - 1395_SSTF_weed_inf**	**0.30** **0.52**
Persoonia nutans Nodding Geebung	E	E	No	Surveyed		▲					▲	▲		▲		▲	Targeted random meander Active searches	High	2	-	-
Pimelea spicata Spiked Rice-flower	E	E	No	Surveyed		▲				▲	▲		▲	▲			Targeted random meander Active searches	High	2	-	-
Pommerhelix duralensis Dural Woodland Snail	E	E	No	Surveyed						▲	▲		▲	▲			Targeted habitat searches	High	2	-	-
Pultenaea pedunculata Matted Bush-pea	E	-	No	Surveyed									▲	▲			Targeted random meander Active searches	**N/A**	**1**	-	-
Thesium australe Austral Toadflax	V	V	No	Surveyed									▲	▲			Targeted random meander Active searches	Moderate	1.5	-	-

Table 11: Fauna species recorded during survey of the development site (2015 to 2018) and immediate surrounds (numbers 314-320, and 338-340 Annangrove Rd (from 2013-2018).
Threatened species in bold type, * = exotic species.

Fauna Group	Species	Type of Record
Invertebrates	***Meridolum corneovirens*** **Cumberland Plain Land Snail**	**2 live and 1 dead shell observed within gutter alongside entry track on site at 330 Annangrove Road.**
Amphibian	*Litoria fallax* Eastern Dwarf Tree Frog	Heard nearby
Amphibian	*Crinia signifera* Common Eastern Froglet	Heard on site
Reptile	*Physignathus lesueurii* Eastern Water Dragon	Observed nearby during previous surveys.
Reptile	*Eulamprus quoyii* Eastern Water Skink	Observed nearby during previous surveys.
Reptile	*Lampropholis delicata* Garden Skink	Observed
Reptile	*Saproscincus mustelina* Weasel Skink	Observed nearby during previous surveys.
Reptile	*Pseudechis porphyriacus* Red-Bellied Black Snake	Observed nearby during previous surveys.
Bird	*Phalacrocorax melanoleucos* Little Pied Cormorant	Observed nearby during previous surveys.
Bird	*Anas supercilliosa* Pacific Black Duck	Observed nearby
Bird	*Aythya australis* Hardhead	Observed nearby during previous surveys.
Bird	*Chenonetta jubata* Australian Wood Duck	Observed nearby
Bird	*Elanus axillaris* Black-shouldered Kite	Observed nearby during previous surveys.
Bird	*Fulica atra* Eurasian Coot	Observed nearby during previous surveys.
Bird	*Gallinula tenebrosa* Dusky Moorhen	Observed nearby during previous surveys.
Bird	*Porphyrio porphyrio* Purple Swamphen	Observed nearby
Bird	*Vanellus miles* Masked Lapwing	Observed
Bird	*Columba livia** Feral Pigeon	Observed nearby during previous surveys.
Bird	*Streptopelia chinensis** Spotted Dove	Observed
Bird	*Cacatua galerita* Sulphur-crested Cockatoo	Observed
Bird	*Calyptorhynchus funereus* Yellow-tailed Black-Cockatoo	Heard
Bird	*Alisterus scapularis* Australian King Parrot	Heard
Bird	*Glossopsitta concinna* Musk Lorikeet	Observed nearby during previous surveys.
Bird	***Glossopsitta pusilla*** **Little Lorikeet**	**Observed nearby during previous surveys at #314 Annangrove Road**
Bird	*Trichoglossus haematodus* Rainbow Lorikeet	Observed

Fauna Group	Species	Type of Record
Bird	*Cacomantis flabelliformis* Fan-tailed Cuckoo	Heard nearby
Bird	*Ninox novaeseelandiae* Southern Boobook	Heard
Bird	*Alcedo azurea* Azure Kingfisher	Observed nearby
Bird	*Dacelo novaeguineae* Laughing Kookaburra	Heard
Bird	*Hirundo neoxena* Welcome Swallow	Observed nearby during previous surveys.
Bird	*Coracina novaehollandiae* Black-faced Cuckoo-shrike	Observed nearby during previous surveys.
Bird	*Pycnonotus jocosus* * Red-whiskered Bulbul	Heard nearby during previous surveys.
Bird	*Rhipidura fuliginosa* Grey Fantail	Heard
Bird	*Rhipidura leucophrys* Willie Wagtail	Heard
Bird	*Colluricincla harmonica* Grey Shrike-thrush	Observed nearby during previous surveys.
Bird	*Eopsaltria australis* Eastern Yellow Robin	Heard
Bird	*Psophodes olivaceus* Eastern Whipbird	Heard
Bird	*Malurus lamberti* Variegated Fairy-wren	Observed nearby during previous surveys.
Bird	*Acanthiza chrysorrhoa* Yellow-rumped Thornbill	Observed nearby during previous surveys.
Bird	*Cormobates leucophaeus* White-throated Treecreeper	Observed nearby during previous surveys.
Bird	*Acanthorhynchus tenuirostris* Eastern Spinebill	Observed nearby during previous surveys.
Bird	*Anthochaera carunculata* Red Wattlebird	Heard
Bird	*Manorina melanocephala* Noisy Miner	Observed
Bird	*Manorina melanophrys* Bell Miner	Observed
Bird	*Meliphaga lewinii* Lewin's Honeyeater	Observed nearby during previous surveys.
Bird	*Lichenostomus penicillatus* White-plumed Honeyeater	Observed nearby
Bird	*Turdus merula** Eurasian Blackbird	Heard nearby
Bird	*Smicrornis brevirostris* Weebill	Observed nearby
Bird	*Pardalotus punctatus* Spotted Pardalote	Heard nearby during previous surveys.
Bird	*Pardalotus striatus* Striated Pardalote	Observed nearby during previous surveys.
Bird	*Neochmia temporalis* Red-browed Finch	Observed nearby during previous surveys.
Bird	*Taeniopygia guttata* Zebra Finch	Observed nearby
Bird	*Taeniopygia bichenovii* Double-barred Finch	Observed nearby during previous surveys.

Fauna Group	Species	Type of Record
Bird	*Acridotheres tristis** Common Myna	Observed
Bird	*Ptilonorhynchus violaceus* Satin Bowerbird	Bower observed within Second Ponds Creek riparian corridor
Bird	*Cracticus nigrogularis* Pied Butcherbird	Observed
Bird	*Gymnorhina tibicen* Australian Magpie	Observed
Bird	*Strepera graculina* Pied Currawong	Observed
Bird	*Corvus coronoides* Australian Raven	Heard
Mammal	*Trichosurus vulpecula* Common Brushtail Possum	Scat observed
Mammal	***Micronomus norfolkensis* Eastern Coastal Free-tailed Bat**	**Call recorded definite**
Mammal	*Micronomus* sp. 2 Freetail-bat	Call recorded possible
Mammal	*Nyctophilus timoriensis* (south-eastern form) Eastern Long-eared Bat	Call recorded possible
Mammal	***Miniopterus orianae oceanensis* Eastern Bent-wing Bat**	**Call recorded possible from nearby sites**
Mammal	***Miniopterus australis* Little Bentwing-bat**	**Call recorded probable from nearby sites**
Mammal	*Chalinolobus gouldii* Gould's Wattled Bat	Call recorded possible
Mammal	*Scotorepens orion* Eastern Broad-nosed Bat	**Call recorded possible** Calls of these 3 species cannot be reliably separated
Mammal	***Falsistrellus tasmaniensis* Eastern False Pipistrelle**	
Mammal	***Scoteanax rueppellii* Greater Broad-nosed Bat**	
Mammal	*Vespadelus pumilus* Eastern Forest Bat	Call recorded possible
Mammal	*Rattus rattus** Black Rat	Observed nearby
Mammal	*Oryctolagus cuniculus** Rabbit	Observed along with warrens, scats and scratched scalds
Mammal	*Canis familiaris** Dog	Observed nearby
Mammal	*Vulpes vulpes** European Red Fox	Scat nearby

Table 12: Measures to be implemented before, during and after construction to avoid and minimise the impacts of the project, including action, outcome, timing and responsibility.

MEASURES TO AVOID AND MINIMISE IMPACTS							
Area	**Management activity**	**Action**	**Outcome**	**Sequencing and Timing of Actions**			**Responsibility**
				Before Construction	**During Construction**	**After Construction**	
All Areas	Fencing	Erect exclusion fencing and gates.	Prevent accidental incursion into protected vegetation.	✓	✓		Contractor
	Erosion and sedimentation controls	Install erosion and sedimentation controls on the development site.	Prevent downslope sedimentation	✓	✓		Contractor
	Nest Boxes (if applicable)	Install nest boxes according to species requirements (e.g. clusters of bat boxes).	Provide replacement habitat for hollow-bearing trees to be felled	✓			Project Ecologist
Veg zone 1: 849_CPW_native_us and Veg zone 2: 1395_SSTF_good_FS_regen	Fencing	Erect protective fencing around areas of veg zone to be retained under Arborist supervision.	Trees and vegetation protected from construction activities.	✓	✓		Contractor
	Tree removal	General tree removal under arborist supervision.	Trees felled without damage to retained vegetation	✓	✓		Arborist Contractor
		Hollow tree removal under ecological supervision.	Trees felled without trauma to resident fauna.	✓	✓		Project Ecologist Contractor
	Primary weeding	Bush regeneration methods employed to control weeds on the development site and road verges.	Weeds controlled.	✓	✓		Bush Regenerator (in consultation with Council) Maintenance Staff
	Secondary weeding	Follow up weeding as required.	Weeds controlled.		✓	✓	Bush Regenerator (in consultation with Council) Maintenance Staff
	Maintenance	Watering and weeding as required per Landscape Plan.	Diverse and structurally intact vegetation reinstated.		✓	✓	Bush Regenerator (in consultation with Council) Maintenance Staff
Veg zone 3: 1395_SSTF_grs_meadow	Fencing	Erect protective fencing around areas of veg zone to be retained under Arborist supervision.	Trees and vegetation protected from construction activities.	✓	✓		Contractor
	Tree removal	General tree removal under arborist supervision.	Trees felled without damage to retained vegetation	✓	✓		Arborist Contractor
		Hollow tree removal under ecological supervision.	Trees felled without trauma to resident fauna.	✓	✓		Project Ecologist Contractor
	Planting	Enrichment plantings – particularly of understorey species and ground covers to provide diversity to composition.	Diverse and structurally intact vegetation reinstated.			✓	Landscape Architect Maintenance Staff
	Maintenance	Watering and weeding as required per Landscape Plan.	Diverse and structurally intact vegetation reinstated.			✓	Landscape Architect Maintenance Staff
	Primary weeding	Bush regeneration methods employed to control weeds in bushland with the veg zone. Erosion and sedimentation controls to be used until soil stabilisation.	Weeds controlled.	✓	✓		Bush Regenerator (in consultation with Council) Maintenance Staff
	Secondary weeding	Follow up weeding as required.	Weeds controlled.		✓	✓	Bush Regenerator (in consultation with Council) Maintenance Staff
	Maintenance	Watering and weeding as required per Landscape Plan.	Diverse and structurally intact vegetation reinstated.		✓	✓	Bush Regenerator (in consultation with Council) Maintenance Staff
Veg zone 4: 1395_SSTF_weed_inf	Fencing	Erect protective fencing around areas of veg zone to be retained under Arborist supervision.	Trees felled without damage to retained vegetation	✓	✓		Arborist Contractor
	Tree removal	General tree removal under arborist supervision.	Trees felled without trauma to resident fauna.	✓	✓		Project Ecologist Contractor
		Hollow tree removal under ecological supervision.	Acceptable bushfire hazard.		✓	✓	Landscape Architect Bushfire Consultant Maintenance Staff
	Primary weeding	Bush regeneration methods employed to control weeds in bushland with the veg zone. Erosion and sedimentation controls to be used until soil stabilisation.	Slope stabilised and vegetated with native plants.	✓	✓	✓	Landscape Architect Maintenance Staff
	Secondary weeding	Follow up weeding as required.	Slope stabilised and vegetated with native plants.		✓	✓	Bush Regenerator (in consultation with Council) Maintenance Staff
	Maintenance	Watering and weeding as required per Landscape Plan.	Diverse and structurally intact vegetation reinstated.		✓	✓	Bush Regenerator (in consultation with Council) Maintenance Staff

Table 13: Details of identified prescribed impacts and indirect impacts on the development site.

Feature	Type of impact	Present on site	Description of feature characteristics and location	Potential impact	Duration and extent of potential impact (short term/long term)	Threatened species or community using or dependent on feature	Predicted consequences of impacts
Karst, caves, crevices, cliffs or other geologically significant feature	Prescribed	No	-	-	-	-	-
Rocks	Prescribed	No	-	-	-	-	-
Human-made structure	Prescribed	Yes	An existing dwelling and associated outbuildings occur within number 328.	Removal of potential roosting habitats for microbats.	Short term. Loss of potential roost sites can be compensated by the installation of nest boxes.	*Micronomus norfolkensis* Eastern Coastal Free-tailed Bat (potential – recorded foraging, not established they were using these man-made habitats).	Temporary displacement of microbats from roosting habitats within man-made structures.
			An existing derelict dwelling occurs within number 330.	Removal of potential roosting habitats for microbats.	Short term. Loss of potential roost sites can be compensated by the installation of nest boxes.	*Micronomus norfolkensis* Eastern Coastal Free-tailed Bat (potential – recorded foraging, not established they were using these man-made habitats).	Temporary displacement of microbats from roosting habitats within man-made structures.
Non-native vegetation	Prescribed	Yes	Highly modified understorey dominated by high threat weeds, particularly at the rear of the lots adjoining the riparian bushland corridor.	Removal of exotic foraging habitat.	Long term – Although this area likely supports foraging habitat for a number of fauna species, much of it comprises serious transformer weeds such as Lantana and Green Cestrum. The retained parts will be cleared of weed and regenerated as native ground covers under an approved Vegetation Management Plan. Weedy areas within the footprint will be developed and parts then planted out and maintained in accordance with the Landscape Plan.	Weed infestations occur within Shale Sandstone Transition Forest.	Permanent and temporary removal and modification of suitable foraging habitats.
Hydrological process sustaining/interacting with rivers, streams or wetlands	Prescribed	Yes	The small man-made dam is to be removed and the drainage controlled within pipes, pits and outlets as shown in the stormwater plans. This collected water will be discharged into Second Ponds Creek.	Removal of potentially suitable habitats for amphibians.	Long term. The dam is to be removed and filled, and then revegetated with Shale Sandstone Transition Forest species, in accordance with an approved Vegetation Management Plan.	*Litoria aurea* Green and Golden Bell Frog (potential – not found on site or in nearby habitats during this or previous surveys).	Permanent removal of aquatic habitat, but no long term consequences are predicted due to the poor condition as habitat for amphibians - dominance of Typha, lack of open water, dry for an extended period of time due to drought.
Wind farm development	Prescribed	No	-	-	-	-	-
Connectivity and movement of habitat	Prescribed	Yes	Direct connectivity between woody vegetation on site with the riparian bushland at the rear.	Shrinking of area of woody vegetation on site will interfere with potential connectivity in directions other than towards Second Ponds Creek.	Long term – the loss of vegetation within the footprint is permanent.	See predicted species in Tables 7, 8, and 9.	Fauna movement may be reduced due to the smaller area of vegetation available. However, the major fauna corridor is provided by the riparian bushland, and this connectivity will not be disrupted.
Vehicle strikes	Prescribed	No	-	-	-	-	-
Mine subsidence	Prescribed	No	-	-	-	-	-
Inadvertent impacts on adjacent habitat or vegetation	Indirect	No	-	-	-	-	-

Feature	Type of impact	Present on site	Description of feature characteristics and location	Potential impact	Duration and extent of potential impact (short term/long term)	Threatened species or community using or dependent on feature	Predicted consequences of impacts
Reduced viability of adjacent habitat due to edge effects	Indirect	Yes	Along the southern rear boundary where the site abuts the Second Ponds Creek corridor.	Degradation from polluted runoff, increase in weeds transported from the site, accumulation of litter (either deliberate or incidental) generated from the development.	Long term potential impact from alteration of soil processes, shifting dominance from native to exotic species.	See predicted species in Tables 7, 8, and 9.	Potential consequences are the degradation of habitat for threatened species and endangered vegetation, and the degradation of its function as a movement corridor.
Reduced viability of adjacent habitat due to noise, dust or light spill	Indirect	Yes	Retained and rehabilitated bushland on site as well as adjacent bushland along the southern rear boundary where the site abuts the Second Ponds Creek corridor.	Fauna may be dissuaded from occupying roost sites (including hollows) or have their foraging behaviour disrupted by noise generated from the development or by light spill.	Potentially long term for the life of the development.	Microbats, possums, diurnal birds.	Loss of potential habitat for fauna species and the absence of their ecological services for the long term health of the vegetation.
Transport of weeds and pathogens from the site to adjacent vegetation	Indirect	Yes	Exotic weeds on site may be spread to adjacent vegetation by natural processes (i.e. wind, water etc).	Possible transport of exotic seed during clearing and via inappropriate weed removal techniques.	Short term with the potential to become long term – potential weed spread via natural responses (wind and water) may carry seed where it may impact on native vegetation over a long-term period.	May have potential to impact Shale Sandstone Transition Forest and riparian vegetation.	Potential for weeds to establish within nearby TECs, thus potentially impacting on the TECs distribution and genetic diversity.
Increased risk of starvation, exposure and loss of shade or shelter	Indirect	No	-	-	-	-	-
Loss of breeding habitats	Indirect	No	-	-	-	-	-
Trampling of threatened flora species	Indirect	No	-	-	-	-	-
Inhibition of nitrogen fixation and increased soil salinity	Indirect	No	-	-	-	-	-
Fertiliser drift	Indirect	No	-	-	-	-	-
Rubbish dumping	Indirect	No	-	-	-	-	-
Wood collection	Indirect	No	-	-	-	-	-
Bush rock removal and disturbance	Indirect	No	-	-	-	-	-
Increase in predatory species populations	Indirect	Yes	Foxes and Cats may be attracted to rubbish.	Increased predation on native fauna.	Potentially long term impact for the life of the development.	All species within the size range to be prey for the Fox and Cat.	Potential devastating consequences for rare species with low population numbers.
Increase in pest animal populations	Indirect	Yes	Pest birds and rodents may be attracted to rubbish.	Increased predation on native fauna (e.g. bird eggs), displacement of native species.	Potentially long term impact for the life of the development.	Small forest birds (e.g. Varied Sittella). *Meridolum corneovirens* Cumberland Plain Snail.	Small forest birds may be chased away from an existing territory, or prevented from using breeding habitat by competitor pest bird. Snails or bird eggs may be preyed upon by rodents. Ultimately will result in simplified faunal assemblage.
Increased risk of fire	Indirect	No	-	-	-	-	-
Disturbance to specialist breeding and foraging habitat (e.g. beach nesting for shorebirds)	Indirect	No	-	-	-	-	-

APPENDIX 4

DATA SHEETS

KEYSTONE ECOLOGICAL

BAM Site – Field Survey Form

Site sheet no: 1 of 2

Survey Name			Plot identifier	Recorders
Date: 17/9/18 GPS:	328-330 Annangrove Rd Rouse Hill		1- A	AM + EA
Zone 56 Datum	IBRA region: Sydney Basin	IBRA subregion: Cumberland	Photo#	Zone ID
Easting Northing	Dimensions	Mitchell landscape: Cumberland Plain	Orientation of midline point from 0m point: 110°	

Vegetation Class	Coastal Valley Grassy Woodlands	Confidence (H) M L
Plant Community Type (PCT)	849 - Grey box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion	Confidence (H) M L
EEC / CEEC	Cumberland Plain Woodland in the Sydney Basin Bioregion	Confidence (H) M L

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

BAM Attribute (400m² plot)		# of spp
Count of Native richness (composition)	Trees	5
	Shrubs	2
	Grasses etc	3
	Forbs	2
	Ferns	0
	Other	0
	Sum of cover (%)	
Sum of cover of native vascular plants by growth form group (Structure)	Trees	75.2
	Shrubs	30
	Grasses etc	0.4
	Forbs	0.2
	Ferns	0
	Other	0
High Threat Weed cover		57

Function (woody veg only)

BAM Attribute (20x50m plot) DBH		#Tree stems count Euc*	Non euc	Hollows+
Large trees for Euc* & Non Euc	80+cm	|| (2)		
	50-79cm	||||		
30 – 49cm		𝍸 𝍸 |||	|	
20 – 29cm		𝍸 𝍸 𝍸 ||		
10 – 19cm		𝍸 𝍸 𝍸 |	|	
5 – 9cm		𝍸 𝍸 𝍸 𝍸 𝍸 |||	|	
<5cm		|		

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

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

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

D = Dead tree/stag

Length of logs (m) (≥10cm diameter, >50cm in length)	2, 3, 1, 2, 0.5 = 8.5m	Natural regen>	Yes (No)
		Rocky outcrop?	Yes (No)

Counts must apply to each size when the **number of living tree stems** within the size class is ≤ 10.
Estimates can be used when the number of living tree stems within a class is ≥ 10. Estimates should draw from the number of series 10, 20, 30...100, 200,300.
For a **multi-stemmed tree**, only the largest living stem is included in the count/estimate.
For **hollows**, count only the presence of a stem containing hollow, not the count of hollows in that stem.

BAM Attribute (1x1m plots)	Litter cover (%)					Bare ground cover (%)					Cryptogram cover (%)					Rock cover (%)				
Subplot score (% in each)	100	99	100	70	100	0	1	0	30	0	-	-	-	-	-	-	-	-	-	-
Average of the 5 subplots	94					6.2														

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1m x 1m plots located on alternate sides and 5m from the plot midline at the locations 5, 15, 25, 35 and 45m along the midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10cm in diameter). Within these 1m x 1m plots assessors may also record the cover of rock, bare ground and cryptogram soil crusts. Collection of these data is optional – the data do not currently contribute to assessment scores. They hold potential value for future vegetation integrity assessment attributes and benchmarks, and for enhancing PCT description.

Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological type		Landform element		Landform pattern		Microrelief	
Lithology		Soil surface texture		Soil colour		Soil depth	
Slope		Aspect		Site drainage		Distance to nearest water and type	

Plot disturbance	Severity code	Age code	Observational evidence
Clearing (incl. logging)			
Cultivation (incl. pasture)			
Soil erosion			
Firewood collection			
Grazing			
Fire damage			
Storm damage			
Weediness	2	NR	High threat Weeds
Other	1	NR	Disturbed ground in spots

Severity: 0 = no evidence; 1 = light; 2 = moderate; 3 = severe

Age: R = recent (<3yrs); NR = not recent (3-10yrs); O = Old (>10yrs)

KEYSTONE ECOLOGICAL	Date: 17/9/18 Recorders: EA + AM	Survey Name 328-332 Annangrae Rd, Rouse Hill	Plot Identifier 1-A	Site sheet no. 2 of 2

#	(native only. Leave blank for weeds)		***Top 3 native species in each growth form group: Full species name mandatory.*** ***All other native and exotic species: Full species name where practicable. Circle top 3 species in each layer.***	N, E or HTW	Cover (%)	Abund (stem count)	Stratum	Sample collect
	GF Code	BAM GF code						
1	(S)	SG	Bursaria Spinosa	N	25	30		
2	(S)	SG	Acacia parramatensis	N	5	2		
3	(T)	TG	Eucalyptus crebra	N	5	3		
4	T	TG	Eucalyptus moluccana	N	25	10		
5	-	-	Olea europea*	HTW	40	40		
6	-	-	Eragrostis curvula*	HTW	10	200		
7	(T)	TG	Eucalyptus tereticornis	N	5	10		
8	-	-	ligustrum sinense*	HTW	1	10		
9	-	-	Asparagus asparagoides*	HTW	5	20		
10	T	TG	Cupaniopsis anacardioides	N	0.1	1		
11	T	TG	Acacia implexa	N	0.1	1		
12	V	GG	Gahnia sieberiana	N	0.1	1		
13	(G)	GG	Themeda triandra	N	0.2	1		
14	R	GG	lomandra multiflora	N	0.1	1		
15	F	FG	Dichondra repens	N	0.1	1		
16	-	-	Solanum pseudocapsicum*	E	5	20		
17	F	FG	Brunoniella australis	N	0.1	1		
18			Ligustrum lucidum*	HTW	1	1		
19								
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GF Codes: *First letter represents GF code; code in bracket (e.g. (SG)) represents the BAM code for the calculator. Circle if in Top 3 of layer.*

A: Cycad (OG); **C:** Chenopod (SG); **D:** Other Grass (GG); **E:** Ferns (EG); **F:** Forb (FG); **G:** Tussock Grass (GG); **H:** Hummock Grass (GG); **K:** Epiphyte (OG); **L:** Vine (OG); **M:** Mallee Tree (TG); **P:** Palm (OG); **Q:** Tree Fern (OG); **R:** Rush (GG): **S:** Shrub (SG); **T:** Tree (TG); **V:** Sedge (GG); **X:** Xanthorrhoea (OG); **Y:** Mallee Shrub (SG); **Z:** Heath Shrub (SG)

N, E, HTW: N: native; **E:** exotic; **HTW:** high threat weed.

Cover: 0.1, 0.2, 0.3...1, 2, 3,...10, 15, 20, 25,....100% (foliage cover); **Note:** 0.1% cover represents approximately 63cm x 63cm or a circle about 71cm diameter. 0.1% cover is the lowest allowed – this may be an over estimate of the actual cover. 0.5% cover represents an area of approximately 1.4m x 1.4m, and 1% cover = 2m x 2m, 5% = 4m x 5x, 25% = 10m x 10m.

Abundance: 1, 2, 3,....10, 20, 30,....100, 200,....1000, ... **grass abundance**: count fractional unit, i.e. runner = one plant. Abundance of 200 – 1000 has no effect in BAM calculator.

Stratum: T1: Upper (20m+); **T2:** Upper (15-20m); **T3**: Trees (10-15m); **S1**: Small trees (5-10m); **S2:** Shrubs (≤5m); **L1**: ground (≤1m); **L2:** Lower ground (≤0.5m)

KEYSTONE ECOLOGICAL

BAM Site – Field Survey Form

Site sheet no: 1 of 2

		Survey Name		Plot identifier	Recorders
Date: 17/9/18	GPS:	328-332 Annangrae Rd, Rouse Hill		2-B	EA + AM
Zone 56	Datum	IBRA region: Sydney Basin	IBRA subregion: Cumberland	Photo#	Zone ID
Easting	Northing	Dimensions	Mitchell landscape: Cumberland Plain	Orientation of midline point from 0m point: 250°	

		Confidence
Vegetation Class	Coastal Valley Grassy Woodlands	(H) M L
Plant Community Type (PCT)	1395 - Narrow-leaved Ironbark-broad leaved Ironbark-Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion	H (M) L
EEC / CEEC	Shale Sandstone Transition Forest in the Sydney basin bioregion	H (M) L

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

BAM Attribute (400m² plot)		# of spp
Count of Native richness (composition)	Trees	2
	Shrubs	1
	Grasses etc	3
	Forbs	1
	Ferns	0
	Other	0
Sum of cover of native vascular plants by growth form group (Structure)	**Sum of cover (%)**	
	Trees	79
	Shrubs	0.1
	Grasses etc	66
	Forbs	0.1
	Ferns	0
	Other	0
High Threat Weed cover		16

Function (woody veg only)

BAM Attribute (20x50m plot)		#Tree stems count		
DBH		Euc*	Non euc	Hollows+
Large trees for Euc* & Non Euc	80+cm	1		1 Potential
	50-79cm	IIII		
30 – 49cm		++++ ++++ I		
20 – 29cm		++++ III		
10 – 19cm		++++ ++++ ++++ ++++		
5 – 9cm		++++ II	60, 40, 30 = 130	
<5cm				

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

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

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

D = Dead tree/stag

Length of logs (m) (≥10cm diameter, >50cm in length)	3m	**Natural regen>**	(Yes) / No
		Rocky outcrop?	Yes / (No)

Counts must apply to each size when the **number of living tree stems** within the size class is ≤ 10.
Estimates can be used when the number of living tree stems within a class is ≥ 10. Estimates should draw from the number of series 10, 20, 30...100, 200,300.
For a **multi-stemmed tree**, only the largest living stem is included in the count/estimate.
For **hollows**, count only the presence of a stem containing hollow, not the count of hollows in that stem.

BAM Attribute (1x1m plots)	Litter cover (%)					Bare ground cover (%)					Cryptogram cover (%)					Rock cover (%)				
Subplot score (% in each)	40	20	80	5	35	60	80	20	95	65										
Average of the 5 subplots	36					64														

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1m x 1m plots located on alternate sides and 5m from the plot midline at the locations 5, 15, 25, 35 and 45m along the midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10cm in diameter). Within these 1m x 1m plots assessors may also record the cover of rock, bare ground and cryptogram soil crusts. Collection of these data is optional – the data do not currently contribute to assessment scores. They hold potential value for future vegetation integrity assessment attributes and benchmarks, and for enhancing PCT description.

Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological type		**Landform element**		**Landform pattern**		**Microrelief**	
Lithology		**Soil surface texture**		**Soil colour**		**Soil depth**	
Slope		**Aspect**		**Site drainage**		**Distance to nearest water and type**	

Plot disturbance	Severity code	Age code	Observational evidence
Clearing (incl. logging)			
Cultivation (incl. pasture)			
Soil erosion			
Firewood collection			
Grazing			
Fire damage			
Storm damage			
Weediness	1	NR	High threat Weeds
Other			

Severity: 0 = no evidence; 1 = light; 2 = moderate; 3 = severe

Age: R = recent (<3yrs); NR = not recent (3-10yrs); O = Old (>10yrs)

KEYSTONE ECOLOGICAL	Date: 17/9/18	Survey Name: 328-332 Annangrove Rd, Rouse Hill	Plot Identifier: 2-B	Site sheet no.: 2 of 2
	Recorders: EA+AM			

#	(native only. Leave blank for weeds) GF Code	BAM GF code	*Top 3 native species in each growth form group: Full species name mandatory. All other native and exotic species: Full species name where practicable. Circle top 3 species in each layer.*	N, E or HTW	Cover (%)	Abund (stem count)	Stratum	Sample collect
1	(T)	TG	Eucalyptus tereticornis	N	45	24		✓
2	(T)	TG	Acacia parramatensis	N	34	60		✓
3	-	-	Olea europea*	HTW	5	10		
4	-	-	Asparagus asparagoides*	HTW	10	60		
5		-	Ehrharta erecta*	HTW	1	5		
6	G	GG	Themeda triandra	N	5	2		
7	(G)	GG	Entolasia stricta	N	60	100+		✓
8	V	GG	Gahnia sieberiana	N	1	3		
9	-	-	Solanum pseudocapsicum*	E	0.1	3		
10	-	-	Passiflora mollisima*	E	0.1	1		
11	F	FG	Solanum prinophyllum	N	0.1	1		
12	(S)	SG	Bursaria spinosa	N	0.1	1		
13								
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GF Codes: *First letter represents GF code; code in bracket (e.g. (SG)) represents the BAM code for the calculator. Circle if in Top 3 of layer.*

A: Cycad (OG); **C:** Chenopod (SG); **D:** Other Grass (GG); **E:** Ferns (EG); **F:** Forb (FG); **G:** Tussock Grass (GG); **H:** Hummock Grass (GG); **K:** Epiphyte (OG); **L:** Vine (OG); **M:** Mallee Tree (TG); **P:** Palm (OG); **Q:** Tree Fern (OG); **R:** Rush (GG): **S:** Shrub (SG); **T:** Tree (TG); **V:** Sedge (GG); **X:** Xanthorrhoea (OG); **Y:** Mallee Shrub (SG); **Z:** Heath Shrub (SG)

N, E, HTW: N: native; **E:** exotic; **HTW:** high threat weed.

Cover: 0.1, 0.2, 0.3...1, 2, 3,...10, 15, 20, 25,....100% (foliage cover); **Note:** 0.1% cover represents approximately 63cm x 63cm or a circle about 71cm diameter. 0.1% cover is the lowest allowed – this may be an over estimate of the actual cover. 0.5% cover represents an area of approximately 1.4m x 1.4m, and 1% cover = 2m x 2m, 5% = 4m x 5x, 25% = 10m x 10m.

Abundance: 1, 2, 3,....10, 20, 30,....100, 200,....1000, ... **grass abundance**: count fractional unit, i.e. runner = one plant. Abundance of 200 – 1000 has no effect in BAM calculator.

Stratum: T1: Upper (20m+); **T2:** Upper (15-20m); **T3**: Trees (10-15m); **S1**: Small trees (5-10m); **S2:** Shrubs (≤5m); **L1**: ground (≤1m); **L2:** Lower ground (≤0.5m)

KEYSTONE ECOLOGICAL

BAM Site – Field Survey Form

Site sheet no:

		Survey Name		Plot identifier	Recorders
Date: 17/9/18	GPS:	328-332 Annangrove Rd, Rouse Hill		2 - C	EA + AM
Zone 56	Datum	IBRA region: Sydney Basin	IBRA subregion: Cumberland	Photo#	Zone ID
Easting	Northing	Dimensions	Mitchell landscape: Cumberland Plain	Orientation of midline point from 0m point:	

		Confidence
Vegetation Class	Coastal Valley Grassy Woodlands	(H) M L
Plant Community Type (PCT)	1395 - Narrow-leaved Ironbark - broad leaved Ironbark - Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion	H (M) L
EEC / CEEC	Shale Sandstone Transition Forest in the Sydney Basin Bioregion	H (M) L

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

BAM Attribute (400m² plot)		# of spp
Count of Native richness (composition)	Trees	3
	Shrubs	4
	Grasses etc	5
	Forbs	1
	Ferns	0
	Other	0
	Sum of cover (%)	
Sum of cover of native vascular plants by growth form group (Structure)	Trees	60
	Shrubs	0.4
	Grasses etc	42.1
	Forbs	0.1
	Ferns	0
	Other	0
High Threat Weed cover		15.4

Function (woody veg only)

BAM Attribute (20x50m plot)		#Tree stems count			
DBH		Euc*	Non euc	Hollows+	
Large trees for Euc* & Non Euc	80+cm				Record number of **living** eucalypt (Euc*) and **living** non-eucalypt (Non Euc) stems separately.
	50-79cm				*includes all species of *Eucalyptus, Corymbia, Angophora, Lophostemon* and *Syncarpia*.
30 – 49cm		II (2)			+ Record total number of trees with hollows by size class with hollows (including dead stems/trees).
20 – 29cm		𝍸 𝍸 𝍸			D = Dead tree/stag
10 – 19cm		𝍸 𝍸 𝍸 III			
5 – 9cm		III (3)			
<5cm					

Length of logs (m) (≥10cm diameter, >50cm in length)	0	Natural regen>	(Yes) / No
		Rocky outcrop?	Yes / (No)

Counts must apply to each size when the **number of living tree stems** within the size class is ≤ 10.
Estimates can be used when the number of living tree stems within a class is ≥ 10. Estimates should draw from the number of series 10, 20, 30...100, 200,300.
For a **multi-stemmed tree**, only the largest living stem is included in the count/estimate.
For **hollows**, count only the presence of a stem containing hollow, not the count of hollows in that stem.

BAM Attribute (1x1m plots)	Litter cover (%)					Bare ground cover (%)					Cryptogram cover (%)					Rock cover (%)				
Subplot score (% in each)	10	25	15	5	5	0	5	0	10	0										
Average of the 5 subplots	12					3														

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1m x 1m plots located on alternate sides and 5m from the plot midline at the locations 5, 15, 25, 35 and 45m along the midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10cm in diameter). Within these 1m x 1m plots assessors may also record the cover of rock, bare ground and cryptogram soil crusts. Collection of these data is optional – the data do not currently contribute to assessment scores. They hold potential value for future vegetation integrity assessment attributes and benchmarks, and for enhancing PCT description.

Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological type		Landform element		Landform pattern		Microrelief	
Lithology		Soil surface texture		Soil colour		Soil depth	
Slope		Aspect		Site drainage		Distance to nearest water and type	

Plot disturbance	Severity code	Age code	Observational evidence
Clearing (incl. logging)			
Cultivation (incl. pasture)			
Soil erosion			
Firewood collection			
Grazing			
Fire damage			
Storm damage			
Weediness			
Other			

Severity: 0 = no evidence; 1 = light; 2 = moderate; 3 = severe

Age: R = recent (<3yrs); NR = not recent (3-10yrs); O = Old (>10yrs)

KEYSTONE ECOLOGICAL	Date: 17/9/18 Recorders:	Survey Name 328-332 Annangrae Rd, Rouse Hill	Plot Identifier 2-C	Site sheet no. 2 of 2

#	(native only. Leave blank for weeds)		***Top 3 native species in each growth form group: Full species name mandatory.*** ***All other native and exotic species: Full species name where practicable. Circle top 3 species in each layer.***	N, E or HTW	Cover (%)	Abund (stem count)	Stratum	Sample collect
	GF Code	BAM GF code						
1	(T)	TG	Eucalyptus tereticornis	N	50	14		
2	T	TG	Angophora floribunda	N	5	2		
3	R	GG	Lomandra longifolia	N	1	4		
4	F	FG	Centella asiatica	N	0.1	2		
5	-	-	Cenchrus clandestinus*	HTW	5	?		
6	G	GG	Microlaena stipoides var. stipoides	N	10	?		
7	G	GG	Aristida vagans	N	1	?		
8	T	TG	Acacia parramatensis	N	5	6		
9	S	SG	Acacia floribunda	N	0.1	1		
10	-	-	Vicia sativa*	E	0.1	1		
11	S	SG	Ozothamnus diosmifolius	N	0.1	1		
12	-	-	Senecio madagascariensis*	HTW	0.2	3		
13	-	-	Olea europea*	HTW	0.2	2		
14	S	SG	Bursaria spinosa	N	0.2	3		
15	(S)	SG	Lissanthe strigosa	N	1	2		
16	K	GG	Juncus usitatus	N	0.1	5		
17	-	-	Sida rhombifolia	E	0.2	6		
18	-	-	Andropogon virginicus*	HTW	5	?		
19	-	-	Eragrostis curvula*	HTW	5	?		
20	(G)	GG	Imperata cylindrica	N	30	?		
21								
22								
23								
24								
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GF Codes: *First letter represents GF code; code in bracket (e.g. (SG)) represents the BAM code for the calculator. Circle if in Top 3 of layer.*

A: Cycad (OG); **C:** Chenopod (SG); **D:** Other Grass (GG); **E:** Ferns (EG); **F:** Forb (FG); **G:** Tussock Grass (GG); **H:** Hummock Grass (GG); **K:** Epiphyte (OG); **L:** Vine (OG); **M:** Mallee Tree (TG); **P:** Palm (OG); **Q:** Tree Fern (OG); **R:** Rush (GG): **S:** Shrub (SG); **T:** Tree (TG); **V:** Sedge (GG); **X:** Xanthorrhoea (OG); **Y:** Mallee Shrub (SG); **Z:** Heath Shrub (SG)

N, E, HTW: N: native; **E:** exotic; **HTW:** high threat weed.

Cover: 0.1, 0.2, 0.3...1, 2, 3,...10, 15, 20, 25,....100% (foliage cover); **Note:** 0.1% cover represents approximately 63cm x 63cm or a circle about 71cm diameter. 0.1% cover is the lowest allowed – this may be an over estimate of the actual cover. 0.5% cover represents an area of approximately 1.4m x 1.4m, and 1% cover = 2m x 2m, 5% = 4m x 5x, 25% = 10m x 10m.

Abundance: 1, 2, 3,....10, 20, 30,....100, 200,....1000, ... **grass abundance**: count fractional unit, i.e. runner = one plant. Abundance of 200 – 1000 has no effect in BAM calculator.

Stratum: T1: Upper (20m+); **T2:** Upper (15-20m); **T3**: Trees (10-15m); **S1**: Small trees (5-10m); **S2:** Shrubs (≤5m); **L1**: ground (≤1m); **L2:** Lower ground (≤0.5m)

KEYSTONE ecologics

BAM Site – Field Survey Form

Site sheet no: 1 of 2

Date: 21/10/18	GPS:	Survey Name: 328-332 Annangrae Rd, Rouse Hill		Plot identifier: 3-D	Recorders: EA + JC
Zone 56	Datum	IBRA region: Sydney Basin	IBRA subregion: Cumberland	Photo#	Zone ID
Easting	Northing	Dimensions	Mitchell landscape: Cumberland Plain	Orientation of midline point from 0m point:	

		Confidence
Vegetation Class	Coastal Valley Grassy Woodlands	H (M) L
Plant Community Type (PCT)	1395- Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion	H (M) L
EEC / CEEC	Shale Sandstone Transition Forest in the Sydney Basin Bioregion	H (M) L

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

BAM Attribute (400m² plot)		# of spp
Count of Native richness (composition)	Trees	2
	Shrubs	0
	Grasses etc	2
	Forbs	1
	Ferns	0
	Other	0
	Sum of cover (%)	
Sum of cover of native vascular plants by growth form group (Structure)	Trees	10.1
	Shrubs	0
	Grasses etc	90.1
	Forbs	0.1
	Ferns	0
	Other	0
High Threat Weed cover		2.1

Function (woody veg only)

BAM Attribute (20x50m plot)		#Tree stems count		
DBH		Euc*	Non euc	Hollows+
Large trees for Euc* & Non Euc	80+cm			
	50-79cm			
30 – 49cm		11 (2)		
20 – 29cm		11 (2)		
10 – 19cm				
5 – 9cm			11 (2)	
<5cm				

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

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

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

D = Dead tree/stag

Length of logs (m) (≥10cm diameter, >50cm in length)	0	Natural regen>	(Yes) / No
		Rocky outcrop?	Yes / (No)

Counts must apply to each size when the **number of living tree stems** within the size class is ≤ 10.
Estimates can be used when the number of living tree stems within a class is ≥ 10. Estimates should draw from the number of series 10, 20, 30...100, 200,300.
For a **multi-stemmed tree**, only the largest living stem is included in the count/estimate.
For **hollows**, count only the presence of a stem containing hollow, not the count of hollows in that stem.

BAM Attribute (1x1m plots)	Litter cover (%)	Bare ground cover (%)	Cryptogram cover (%)	Rock cover (%)
Subplot score (% in each)	5 0 0 5 5	1 0 0 0 0		
Average of the 5 subplots	3	0.2		

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1m x 1m plots located on alternate sides and 5m from the plot midline at the locations 5, 15, 25, 35 and 45m along the midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10cm in diameter). Within these 1m x 1m plots assessors may also record the cover of rock, bare ground and cryptogram soil crusts. Collection of these data is optional – the data do not currently contribute to assessment scores. They hold potential value for future vegetation integrity assessment attributes and benchmarks, and for enhancing PCT description.

Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological type		Landform element		Landform pattern		Microrelief	
Lithology		Soil surface texture		Soil colour		Soil depth	
Slope		Aspect		Site drainage		Distance to nearest water and type	

Plot disturbance	Severity code	Age code	Observational evidence
Clearing (incl. logging)			
Cultivation (incl. pasture)			
Soil erosion			
Firewood collection			
Grazing			
Fire damage			
Storm damage			
Weediness			
Other			

Severity: 0 = no evidence; 1 = light; 2 = moderate; 3 = severe

Age: R = recent (<3yrs); NR = not recent (3-10yrs); O = Old (>10yrs)

KEYSTONE ECOLOGICAL	Date: 21/10/18 Recorders: EA+JC	Survey Name 328-332 Annangrove Rd, Rose Hill	Plot Identifier 3-D	Site sheet no. 2 of 2

#	(native only. Leave blank for weeds)		***Top 3 native species in each growth form group: Full species name mandatory.*** ***All other native and exotic species: Full species name where practicable. Circle top 3 species in each layer.***	N, E or HTW	Cover (%)	Abund (stem count)	Stratum	Sample collect
	GF Code	BAM GF code						
1	(T)	TG	Eucalyptus tereticornis	N	10	3		
2	-	-	Olea europea*	HTW	0.1	2		
3	-	-	Cestrum parqui*	HTW	1	4		
4	(G)	GG	Microlaena stipoides	N	90	?		
5	F	FG	Solanum prinophyllum*	N	0.1	2		
6	-	-	Asparagus asparagoides*	HTW	1	10		
7	T	TG	Acacia parramatensis	N	0.1	1		
8	V	GG	Gahnia sieberiana	N	0.1	1		
9								
10								
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GF Codes: *First letter represents GF code; code in bracket (e.g. (SG)) represents the BAM code for the calculator. Circle if in Top 3 of layer.*

A: Cycad (OG); **C:** Chenopod (SG); **D:** Other Grass (GG); **E:** Ferns (EG); **F:** Forb (FG); **G:** Tussock Grass (GG); **H:** Hummock Grass (GG); **K:** Epiphyte (OG); **L:** Vine (OG); **M:** Mallee Tree (TG); **P:** Palm (OG); **Q:** Tree Fern (OG); **R:** Rush (GG): **S:** Shrub (SG); **T:** Tree (TG); **V:** Sedge (GG); **X:** Xanthorrhoea (OG); **Y:** Mallee Shrub (SG); **Z:** Heath Shrub (SG)

N, E, HTW: N: native; **E:** exotic; **HTW:** high threat weed.

Cover: 0.1, 0.2, 0.3...1, 2, 3,...10, 15, 20, 25,....100% (foliage cover); **Note:** 0.1% cover represents approximately 63cm x 63cm or a circle about 71cm diameter. 0.1% cover is the lowest allowed – this may be an over estimate of the actual cover. 0.5% cover represents an area of approximately 1.4m x 1.4m, and 1% cover = 2m x 2m, 5% = 4m x 5x, 25% = 10m x 10m.

Abundance: 1, 2, 3,....10, 20, 30,....100, 200,....1000, ... **grass abundance**: count fractional unit, i.e. runner = one plant. Abundance of 200 – 1000 has no effect in BAM calculator.

Stratum: T1: Upper (20m+); **T2:** Upper (15-20m); **T3**: Trees (10-15m); **S1**: Small trees (5-10m); **S2:** Shrubs (≤5m); **L1**: ground (≤1m); **L2:** Lower ground (≤0.5m)

KEYSTONE ECOLOGICAL

BAM Site – Field Survey Form

Site sheet no: 1 of 2

		Survey Name		Plot identifier	Recorders
Date: 21/10/18	GPS:	328-332 Annangrove Rd, Rouse Hill		4-E	EA + JC
Zone 56	Datum	IBRA region: Sydney Basin	IBRA subregion: Cumberland	Photo#	Zone ID
Easting	Northing	Dimensions	Mitchell landscape: Cumberland Plain	Orientation of midline point from 0m point:	

Vegetation Class	Coastal Valley Grassy Woodlands	Confidence H (M) L
Plant Community Type (PCT)	1395- Narrow-leaved Ironbark - Broad leaved Ironbark - Grey Gum open Forest of the edges of the Cumberland Plain, Sydney Basin Bioregion	Confidence H (M) L
EEC / CEEC	Shale Sandstone Transition Forest in the Sydney Basin Bioregion	Confidence H (M) L

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

BAM Attribute (400m² plot)		# of spp
Count of Native richness (composition)	Trees	2
	Shrubs	0
	Grasses etc	0
	Forbs	2
	Ferns	0
	Other	0
Sum of cover of native vascular plants by growth form group (Structure)	**Sum of cover (%)**	
	Trees	30.1
	Shrubs	0
	Grasses etc	0
	Forbs	0.4
	Ferns	0
	Other	0
High Threat Weed cover		70

Function (woody veg only)

BAM Attribute (20x50m plot)		#Tree stems count		
DBH		Euc*	Non euc	Hollows+
Large trees for Euc* & Non Euc	80+cm			
	50-79cm	III (3)		
30 – 49cm		IIII (4)		
20 – 29cm				
10 – 19cm				
5 – 9cm				
<5cm				
Length of logs (m) (≥10cm diameter, >50cm in length)		5, 1.2, 2.5 = 8.7m	Natural regen>	Yes / (No)
			Rocky outcrop?	Yes / (No)

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

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

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

D = Dead tree/stag

Counts must apply to each size when the **number of living tree stems** within the size class is ≤ 10.
Estimates can be used when the number of living tree stems within a class is ≥ 10. Estimates should draw from the number of series 10, 20, 30...100, 200,300.
For a **multi-stemmed tree**, only the largest living stem is included in the count/estimate.
For **hollows**, count only the presence of a stem containing hollow, not the count of hollows in that stem.

BAM Attribute (1x1m plots)	Litter cover (%)					Bare ground cover (%)					Cryptogram cover (%)					Rock cover (%)				
Subplot score (% in each)	40	50	60	50	30	10	20	10	50	50										
Average of the 5 subplots	=46 NB: Mulch cover					28														

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1m x 1m plots located on alternate sides and 5m from the plot midline at the locations 5, 15, 25, 35 and 45m along the midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10cm in diameter). Within these 1m x 1m plots assessors may also record the cover of rock, bare ground and cryptogram soil crusts. Collection of these data is optional – the data do not currently contribute to assessment scores. They hold potential value for future vegetation integrity assessment attributes and benchmarks, and for enhancing PCT description.

Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological type		Landform element		Landform pattern		Microrelief	
Lithology		Soil surface texture		Soil colour		Soil depth	
Slope		Aspect		Site drainage		Distance to nearest water and type	

Plot disturbance	Severity code	Age code	Observational evidence
Clearing (incl. logging)			
Cultivation (incl. pasture)			
Soil erosion			
Firewood collection			
Grazing			
Fire damage			
Storm damage			
Weediness	3	R	Very weedy
Other			

Severity: 0 = no evidence; 1 = light; 2 = moderate; 3 = severe

Age: R = recent (<3yrs); NR = not recent (3-10yrs); O = Old (>10yrs)

KEYSTONE ECOLOGICAL

Date: 21/10/18	Survey Name	Plot Identifier	Site sheet no.
Recorders: EA + JC	328-332 Annangrove Rd, Rouse Hill	4 - E	2 of 2

#	(native only. Leave blank for weeds) GF Code	BAM GF code	***Top 3 native species in each growth form group: Full species name mandatory.*** *All other native and exotic species: Full species name where practicable. Circle top 3 species in each layer.*	N, E or HTW	Cover (%)	Abund (stem count)	Stratum	Sample collect
1	(T)	TG	Eucalyptus tereticornis	N	30		canopy	
2	-	-	Cestrum parqui*	HTW	30	200	grand - regen	
3	F	FG	Einadia hastata	N	0.3	2	grand	
4	F	FG	Solanum pinnatifidum	N	0.1	1	grand	
5	T	TG	Acacia parramattensis	N	0.1	1	ground	
6	-	-	Lantana camara*	HTW	20			
7	-		Ligustrum sinense*					
8								
9								
10								
11								
12								
13								
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43								
44								
45								

Information inadvertently omitted from original sheet.

GF Codes: *First letter represents GF code; code in bracket (e.g. (SG)) represents the BAM code for the calculator. Circle if in Top 3 of layer.*

A: Cycad (OG); **C:** Chenopod (SG); **D:** Other Grass (GG); **E:** Ferns (EG); **F:** Forb (FG); **G:** Tussock Grass (GG); **H:** Hummock Grass (GG); **K:** Epiphyte (OG); **L:** Vine (OG); **M:** Mallee Tree (TG); **P:** Palm (OG); **Q:** Tree Fern (OG); **R:** Rush (GG): **S:** Shrub (SG); **T:** Tree (TG); **V:** Sedge (GG); **X:** Xanthorrhoea (OG); **Y:** Mallee Shrub (SG); **Z:** Heath Shrub (SG)

N, E, HTW: N: native; **E:** exotic; **HTW:** high threat weed.

Cover: 0.1, 0.2, 0.3...1, 2, 3,...10, 15, 20, 25,....100% (foliage cover); **Note:** 0.1% cover represents approximately 63cm x 63cm or a circle about 71cm diameter. 0.1% cover is the lowest allowed – this may be an over estimate of the actual cover. 0.5% cover represents an area of approximately 1.4m x 1.4m, and 1% cover = 2m x 2m, 5% = 4m x 5x, 25% = 10m x 10m.

Abundance: 1, 2, 3,....10, 20, 30,....100, 200,....1000, ... **grass abundance**: count fractional unit, i.e. runner = one plant. Abundance of 200 – 1000 has no effect in BAM calculator.

Stratum: T1: Upper (20m+); **T2:** Upper (15-20m); **T3**: Trees (10-15m); **S1**: Small trees (5-10m); **S2:** Shrubs (≤5m); **L1**: ground (≤1m); **L2:** Lower ground (≤0.5m)

KEYSTONE	Survey Name: Annangrove Rd	Site sheet no.: 172

Date: 12 July 2020	GPS	Survey Name		Plot identifier: Quad F	Recorders
Zone	Datum	IBRA region	IBRA subregion	Photo#	Zone ID
Easting	Northing	Dimensions: Attached to QV	Mitchell landscape:	Orientation of midline from 0m point:	
Vegetation Class					Confidence H M L
Plant Community Type (PCT)		PCT 807 (DNG) = lowland 849			Confidence (H) M L
EEC / CEEC		CEEC			Confidence H M L

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

BAM Attribute	(400m² plot)	# of spp
Count of Native richness (composition)	Trees	0
	Shrubs	0
	Grasses etc	4
	Forbs	1
	Ferns	0
	Other	0
Sum of cover of native vascular plants by growth form group (Structure)	Sum of cover (%)	
	Trees	0
	Shrubs	0
	Grasses etc	35.2
	Forbs	0.1
	Ferns	0
	Other	0
High Threat Weed cover		20.2

Function (woody veg only, Palms are not trees)

BAM Attribute (20x50m plot)		#Tree stems count		
DBH		Euc*	Non euc	Hollows+
Large trees for Euc* & Non Euc	80+cm	0	0	0
	50-79cm	0	0	0
30 – 49cm		0	0	0
20 – 29cm		0	0	0
10 – 19cm		0	0	0
5 – 9cm		0	0	0
<5cm		0	0	0

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

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

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

D = Dead tree/stag

Length of logs (m) (≥10cm diameter and >50cm in length)	0	Natural regen?	Yes / No
		Rocky outcrop?	Yes / No

Counts must apply to each size when the **number of living tree stems** within the size class is ≤ 10. Estimates can be used when the number of living tree stems within a class is ≥ 10. Estimates should draw from the number of series 10, 20, 30...100, 200,300.
For a **multi-stemmed tree**, only the largest living stem is included in the count/estimate.
For **hollows**, count only the presence of a stem containing hollow, not the count of hollows in that stem.

BAM Attribute (1x1m plots)	Litter cover (%)	Bare ground cover (%)	Cryptogram cover (%)	Rock cover (%)
Subplot score (% in each)	0 C5 0 C5 0	0 0 10 5 0		
Average of the 5 subplots	2%	3%		

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1m x 1m plots located on alternate sides and 5m from the plot midline at the locations 5, 15, 25, 35 and 45m along the midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10cm in diameter). Within these 1m x 1m plots assessors may also record the cover of rock, bare ground and cryptogram soil crusts. Collection of these data is optional – the data do not currently contribute to assessment scores. They hold potential value for future vegetation integrity assessment attributes and benchmarks, and for enhancing PCT description.

Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological type		Landform element		Landform pattern		Microrelief	
Lithology		Soil surface texture		Soil colour		Soil depth	
Slope		Aspect		Site drainage		Distance to nearest water and type	

Plot disturbance	Severity code	Age code	Observational evidence
Clearing (incl. logging)			
Cultivation (incl. pasture)			
Soil erosion			
Firewood collection			
Grazing			
Fire damage			
Storm damage			
Weediness			
Other			

Severity: 0 = no evidence; 1 = light; 2 = moderate; 3 = severe

Age: R = recent (<3yrs); NR = not recent (3-10yrs); O = Old (>10yrs)

KEYSTONE	Date 12. July. 20	Survey Name	Plot Identifier	Site sheet no.
	Recorders EA	Annangrove Rd	Quad F	2 of

#	(native only. Leave blank for weeds) GF Code	BAM GF code	*Top 3 native species in each growth form group: Full species name mandatory.* *All other native and exotic species: Full species name where practicable. Circle top 3 species in each layer.*	N, E or HTW	Cover (%)	Abund (stem count)	Stratum	Sample collect
1			Eragrostis curvula	HTN	15			
2	G	GG	Microl stip	N	30			
3	G	GG	Sporob Teretifolius	N	5			
4			Sida rhom	E	0.1			
5			Kikuyu	HTN	5			
6			Senecio madag	HTN	0.1			
7	F	FG	Dichondra repens	N	<0.1			
8	G	GG	Aristida vagans	N	<0.1			
9			Vicia sativa	E	0.1			
10			Plantago lance	E	0.1			
11			Paspalum dilat	HTN	0.1			
12			Solanum nigr	E	0.1			
13	G	GG	Themeda	N	0.1			
14								
15								
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45								

GF Codes: First letter represents GF code; code in bracket (e.g. (SG)) represents the BAM code for the calculator. Circle if in Top 3 of layer.

A: Cycad (OG); **C:** Chenopod (SG); **D:** Other Grass (GG); **E:** Ferns (EG); **F:** Forb (FG); **G:** Tussock Grass (GG); **H:** Hummock Grass (GG); **K:** Epiphyte (OG); **L:** Vine (OG); **M:** Mallee Tree (TG); **P:** Palm (OG); **Q:** Tree Fern (OG); **R:** Rush (GG): **S:** Shrub (SG); **T:** Tree (TG); **V:** Sedge (GG); **X:** Xanthorrhoea (OG); **Y:** Mallee Shrub (SG); **Z:** Heath Shrub (SG)

N, E, HTW: N: native; **E:** exotic; **HTW:** high threat weed.

Cover: 0.1, 0.2, 0.3...1, 2, 3,...10, 15, 20, 25,....100% (foliage cover); **Note:** 0.1% cover represents approximately 63cm x 63cm or a circle about 71cm diameter. 0.1% cover is the lowest allowed – this may be an over estimate of the actual cover. 0.5% cover represents an area of approximately 1.4m x 1.4m, and 1% cover = 2m x 2m, 5% = 4m x 5x, 25% = 10m x 10m.

Abundance: 1, 2, 3,....10, 20, 30,....100, 200,....1000, ... **grass abundance**: count fractional unit, i.e. runner = one plant. Abundance of 200 – 1000 has no effect in BAM calculator.

Stratum: T1: Upper (20m+); **T2:** Upper (15-20m); **T3**: Trees (10-15m); **S1**: Small trees (5-10m); **S2:** Shrubs (≤5m); **L1**: ground (≤1m); **L2:** Lower ground (≤0.5m)

APPENDIX 5

BAM CALCULATOR OUTPUTS

BAM Vegetation Zones Report

Proposal Details

Assessment Id
00021061/BAAS17045/20/00021062

Assessment name
BDAR ABAX-Rouse Hill-Annangrove Rd w Derived Native Grassland

BAM data last updated *
18/06/2020

Assessor Name
Elizabeth Ashby

Report Created
14/07/2020

BAM Data version *
29

Assessor Number
BAAS17045

Assessment Type
Part 4 Developments (General)

BAM Case Status
Open

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

Assessment Revision
0

Date Finalised
To be finalised

Vegetation Zones

#	Name	PCT	Condition	Area	Minimum number of plots	Management zones
1	849_CPW_native_us	849-Cumberland shale plains woodland	CPW_native_us	0.3	1	
2	1395_SSTF_good_FS_regen	1395-Cumberland shale - sandstone Ironbark forest	SSTF_good_FS_regen	0.17	1	

3	1395_SSTF_grs_meadow	1395-Cumberland shale - sandstone Ironbark forest	SSTF_grs_meadow	0.31	1	
4	1395_SSTF_weed_inf	1395-Cumberland shale - sandstone Ironbark forest	SSTF_weed_inf	0.51	1	
5	849_CPW_dng	849-Cumberland shale plains woodland	CPW_dng	0.07	1	

BAM Predicted Species Report

Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00021061/BAAS17045/20/00021062	BDAR ABAX-Rouse Hill-Annangrove Rd w Derived Native Grassland	18/06/2020
Assessor Name	**Report Created**	**BAM Data version ***
Elizabeth Ashby	14/07/2020	29
Assessor Number	**Assessment Type**	**BAM Case Status**
BAAS17045	Part 4 Developments (General)	Open
	Assessment Revision	**Date Finalised**
	0	To be finalised

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Threatened species reliably predicted to utilise the site. No surveys are required for these species. Ecosystem credits apply to these species.

Common Name	Scientific Name	Vegetation Types(s)
Barking Owl	Ninox connivens	849-Cumberland shale plains woodland
		1395-Cumberland shale - sandstone Ironbark forest
Black-chinned Honeyeater (eastern subspecies)	Melithreptus gularis gularis	849-Cumberland shale plains woodland
		1395-Cumberland shale - sandstone Ironbark forest
Brown Treecreeper (eastern subspecies)	Climacteris picumnus victoriae	849-Cumberland shale plains woodland
		1395-Cumberland shale - sandstone Ironbark forest
Diamond Firetail	Stagonopleura guttata	849-Cumberland shale plains woodland
		1395-Cumberland shale - sandstone Ironbark forest
Dusky Woodswallow	Artamus cyanopterus cyanopterus	849-Cumberland shale plains woodland
		1395-Cumberland shale - sandstone Ironbark forest
Eastern Coastal Free-tailed Bat	Micronomus norfolkensis	849-Cumberland shale plains woodland
		1395-Cumberland shale - sandstone Ironbark forest
Flame Robin	Petroica phoenicea	849-Cumberland shale plains woodland
		1395-Cumberland shale - sandstone Ironbark forest

Gang-gang Cockatoo	Callocephalon fimbriatum	849-Cumberland shale plains woodland
		1395-Cumberland shale - sandstone Ironbark forest
Grey-headed Flying-fox	Pteropus poliocephalus	849-Cumberland shale plains woodland
		1395-Cumberland shale - sandstone Ironbark forest
Hooded Robin (south-eastern form)	Melanodryas cucullata cucullata	849-Cumberland shale plains woodland
		1395-Cumberland shale - sandstone Ironbark forest
Koala	Phascolarctos cinereus	849-Cumberland shale plains woodland
		1395-Cumberland shale - sandstone Ironbark forest
Large Bent-winged Bat	Miniopterus orianae oceanensis	849-Cumberland shale plains woodland
		1395-Cumberland shale - sandstone Ironbark forest
Little Bent-winged Bat	Miniopterus australis	849-Cumberland shale plains woodland
		1395-Cumberland shale - sandstone Ironbark forest
Little Eagle	Hieraaetus morphnoides	849-Cumberland shale plains woodland
		1395-Cumberland shale - sandstone Ironbark forest
Little Lorikeet	Glossopsitta pusilla	849-Cumberland shale plains woodland
		1395-Cumberland shale - sandstone Ironbark forest
Masked Owl	Tyto novaehollandiae	849-Cumberland shale plains woodland
		1395-Cumberland shale - sandstone Ironbark forest
Powerful Owl	Ninox strenua	849-Cumberland shale plains woodland
		1395-Cumberland shale - sandstone Ironbark forest
Regent Honeyeater	Anthochaera phrygia	849-Cumberland shale plains woodland
		1395-Cumberland shale - sandstone Ironbark forest
Scarlet Robin	Petroica boodang	849-Cumberland shale plains woodland
		1395-Cumberland shale - sandstone Ironbark forest
Speckled Warbler	Chthonicola sagittata	849-Cumberland shale plains woodland
		1395-Cumberland shale - sandstone Ironbark forest
Spotted Harrier	Circus assimilis	849-Cumberland shale plains woodland
Spotted-tailed Quoll	Dasyurus maculatus	849-Cumberland shale plains woodland
		1395-Cumberland shale - sandstone Ironbark forest
Square-tailed Kite	Lophoictinia isura	849-Cumberland shale plains woodland
		1395-Cumberland shale - sandstone Ironbark forest
Swift Parrot	Lathamus discolor	849-Cumberland shale plains woodland
		1395-Cumberland shale - sandstone Ironbark forest
Turquoise Parrot	Neophema pulchella	849-Cumberland shale plains woodland
		1395-Cumberland shale - sandstone Ironbark forest

Varied Sittella	Daphoenositta chrysoptera	849-Cumberland shale plains woodland
		1395-Cumberland shale - sandstone Ironbark forest
White-bellied Sea-Eagle	Haliaeetus leucogaster	849-Cumberland shale plains woodland
		1395-Cumberland shale - sandstone Ironbark forest
Yellow-bellied Sheathtail-bat	Saccolaimus flaviventris	849-Cumberland shale plains woodland
		1395-Cumberland shale - sandstone Ironbark forest

Threatened species not within the area of these PCT's

Common Name	Scientific Name	Vegetation Types(s)
Glossy Black-Cockatoo	Calyptorhynchus lathami	1395-Cumberland shale - sandstone Ironbark forest
Painted Honeyeater	Grantiella picta	849-Cumberland shale plains woodland
		1395-Cumberland shale - sandstone Ironbark forest
Rosenberg's Goanna	Varanus rosenbergi	1395-Cumberland shale - sandstone Ironbark forest

BAM Candidate Species Report

Proposal Details

Assessment Id
00021061/BAAS17045/20/00021062

Proposal Name
BDAR ABAX-Rouse Hill-Annangrove Rd w Derived Native Grassland

BAM data last updated *
18/06/2020

Assessor Name
Elizabeth Ashby

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Assessor Number
BAAS17045

Assessment Type
Part 4 Developments (General)

BAM Case Status
Open

Assessment Revision
0

Date Finalised
To be finalised

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List of Species Requiring Survey

Name	Presence	Survey Months
Burhinus grallarius Bush Stone-curlew	No (surveyed)	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Cynanchum elegans White-flowered Wax Plant	No (surveyed)	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Epacris purpurascens var. purpurascens Epacris purpurascens var. purpurascens	No (surveyed)	Sep Oct
Grevillea juniperina subsp. juniperina Juniper-leaved Grevillea	No (surveyed)	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Pommerhelix duralensis Dural Land Snail	No (surveyed)	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec

Litoria aurea Green and Golden Bell Frog	Yes (assumed present)	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Meridolum corneovirens Cumberland Plain Land Snail	Yes (surveyed)	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Myotis macropus Southern Myotis	Yes (assumed present)	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Pimelea spicata Spiked Rice-flower	No (surveyed)	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec

List of Species Not On Site

Name
Acacia bynoeana Bynoe's Wattle
Acacia pubescens Downy Wattle
Caladenia tessellata Thick Lip Spider Orchid
Callistemon linearifolius Netted Bottle Brush
Calyptorhynchus lathami Glossy Black-Cockatoo
Cercartetus nanus Eastern Pygmy-possum
Eucalyptus benthamii Camden White Gum
Chalinolobus dwyeri Large-eared Pied Bat
Dillwynia tenuifolia Dillwynia tenuifolia
Grevillea parviflora subsp. parviflora Small-flower Grevillea
Grevillea parviflora subsp. supplicans Grevillea parviflora subsp. supplicans
Gyrostemon thesioides Gyrostemon thesioides
Hibbertia puberula Hibbertia puberula
Hibbertia superans Hibbertia superans
Callocephalon fimbriatum Gang-gang Cockatoo
Hieraaetus morphnoides Little Eagle

Hibbertia spanantha Julian's Hibbertia
Haliaeetus leucogaster White-bellied Sea-Eagle
Dillwynia tenuifolia - endangered population Dillwynia tenuifolia, Kemps Creek
Marsdenia viridiflora subsp. viridiflora - endangered population Marsdenia viridiflora R. Br. subsp. viridiflora population in the Bankstown, Blacktown, Camden, Campbelltown, Fairfield, Holroyd, Liverpool and Penrith local government areas
Lathamus discolor Swift Parrot
Leucopogon fletcheri subsp. fletcheri Leucopogon fletcheri subsp. fletcheri
Lophoictinia isura Square-tailed Kite
Melaleuca deanei Deane's Paperbark
Miniopterus australis Little Bent-winged Bat
Miniopterus orianae oceanensis Large Bent-winged Bat
Ninox connivens Barking Owl
Ninox strenua Powerful Owl
Persoonia bargoensis Bargo Geebung
Persoonia hirsuta Hairy Geebung
Persoonia nutans Nodding Geebung
Petaurus norfolcensis Squirrel Glider
Phascolarctos cinereus Koala
Pimelea curviflora var. curviflora Pimelea curviflora var. curviflora
Pomaderris brunnea Brown Pomaderris
Pseudophryne australis Red-crowned Toadlet
Pteropus poliocephalus Grey-headed Flying-fox
Pterostylis saxicola Sydney Plains Greenhood
Pultenaea pedunculata Matted Bush-pea
Tetratheca glandulosa Tetratheca glandulosa
Thesium australe Austral Toadflax
Tyto novaehollandiae Masked Owl
Anthochaera phrygia Regent Honeyeater

BAM Credit Summary Report

Proposal Details

Assessment Id
00021061/BAAS17045/20/00021062

Proposal Name
BDAR ABAX-Rouse Hill-Annangrove Rd w Derived Native Grassland

BAM data last updated *
18/06/2020

Assessor Name
Elizabeth Ashby

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14/07/2020

BAM Data version *
29

Assessor Number
BAAS17045

BAM Case Status
Open

Date Finalised
To be finalised

Assessment Revision
0

Assessment Type
Part 4 Developments (General)

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

Zone	Vegetation zone name	Vegetation integrity loss / gain	Area (ha)	Constant	Species sensitivity to gain class (for BRW)	Biodiversity risk weighting	Potential SAII	Ecosystem credits

Cumberland shale - sandstone Ironbark forest								
2	1395_SSTF_good_FS_regen	43.6	0.2	0.25	High Sensitivity to Potential Gain	2.50	TRUE	5
3	1395_SSTF_grs_meadow	13.3	0.3	0.25	High Sensitivity to Potential Gain	2.50	TRUE	0
4	1395_SSTF_weed_inf	13.8	0.5	0.25	High Sensitivity to Potential Gain	2.50	TRUE	0
							Subtotal	**5**
Cumberland shale plains woodland								
1	849_CPW_native_us	41.2	0.3	0.25	High Sensitivity to Potential Gain	2.50	TRUE	8
5	849_CPW_dng	2.3	0.1	0.25	High Sensitivity to Potential Gain	2.50	TRUE	0
							Subtotal	**8**
							Total	**13**

Species credits for threatened species

Vegetation zone name	Habitat condition (HC)	Area (ha) / individual (HL)	Constant	Biodiversity risk weighting	Potential SAII	Species credits
Litoria aurea / Green and Golden Bell Frog (Fauna)						
1395_SSTF_good_FS_regen	43.6	0.17	0.25	2	False	4
1395_SSTF_grs_meadow	13.3	0.31	0.25	2	False	2

					Subtotal	**6**
Meridolum corneovirens / Cumberland Plain Land Snail (Fauna)						
849_CPW_native_us	41.2	0.3	0.25	2	False	6
1395_SSTF_good_FS_regen	43.6	0.17	0.25	2	False	4
					Subtotal	**10**
Myotis macropus / Southern Myotis (Fauna)						
849_CPW_native_us	41.2	0.3	0.25	2	False	6
1395_SSTF_weed_inf	13.8	0.51	0.25	2	False	4
					Subtotal	**10**

BAM Biodiversity Credit Report (Like for like)

Proposal Details

Assessment Id
00021061/BAAS17045/20/00021062

Proposal Name
BDAR ABAX-Rouse Hill-Annangrove Rd w Derived Native Grassland

BAM data last updated *
18/06/2020

Assessor Name
Elizabeth Ashby

Assessor Number
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BAM Data version *
29

Proponent Names

Report Created
14/07/2020

BAM Case Status
Open

Assessment Revision
0

Assessment Type
Part 4 Developments (General)

Date Finalised
To be finalised

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Potential Serious and Irreversible Impacts

Name of threatened ecological community	Listing status	Name of Plant Community Type/ID
Cumberland Plain Woodland in the Sydney Basin Bioregion	Critically Endangered Ecological Community	849-Cumberland shale plains woodland
Shale Sandstone Transition Forest in the Sydney Basin Bioregion	Critically Endangered Ecological Community	1395-Cumberland shale - sandstone Ironbark forest

Nil

BAM Biodiversity Credit Report (Like for like)

Additional Information for Approval

PCTs With Customized Benchmarks

No Changes

Predicted Threatened Species Not On Site

Name
Calyptorhynchus lathami / Glossy Black-Cockatoo
Grantiella picta / Painted Honeyeater
Varanus rosenbergi / Rosenberg's Goanna

Ecosystem Credit Summary (Number and class of biodiversity credits to be retired)

Name of Plant Community Type/ID	Name of threatened ecological community	Area of impact	Number of credits to be retired
849-Cumberland shale plains woodland	Cumberland Plain Woodland in the Sydney Basin Bioregion	0.4	8.00
1395-Cumberland shale - sandstone Ironbark forest	Shale Sandstone Transition Forest in the Sydney Basin Bioregion	1.0	5.00

849-Cumberland shale plains woodland	**Like-for-like credit retirement options**			
	Name of offset trading group	Trading group	HBT	IBRA region

	Cumberland Plain Woodland in the Sydney Basin Bioregion This includes PCT's: 849, 850	-	Yes	Cumberland, Burragorang, Pittwater, Sydney Cataract, Wollemi and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
1395-Cumberland shale - sandstone Ironbark forest	**Like-for-like credit retirement options**			
	Name of offset trading group	Trading group	HBT	IBRA region
	Shale Sandstone Transition Forest in the Sydney Basin Bioregion This includes PCT's: 792, 1281, 1395	-	Yes	Cumberland, Burragorang, Pittwater, Sydney Cataract, Wollemi and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

Species Credit Summary

Species	Area	Credits
Litoria aurea / Green and Golden Bell Frog	0.5	6.00
Meridolum corneovirens / Cumberland Plain Land Snail	0.5	10.00
Myotis macropus / Southern Myotis	0.8	10.00

Litoria aurea/ Green and Golden Bell Frog	1395_SSTF_good_FS_ regen	**Like-for-like credit retirement options**	
		Spp	IBRA region

		Litoria aurea/Green and Golden Bell Frog	Any in NSW
	1395_SSTF_grs_meadow	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Litoria aurea/Green and Golden Bell Frog	Any in NSW
Meridolum corneovirens/ Cumberland Plain Land Snail	1395_SSTF_good_FS_regen	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Meridolum corneovirens/Cumberland Plain Land Snail	Any in NSW
	849_CPW_native_us	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Meridolum corneovirens/Cumberland Plain Land Snail	Any in NSW

Meridolum corneovirens/ Cumberland Plain Land Snail	849_CPW_native_us	
Myotis macropus/ Southern Myotis	1395_SSTF_weed_inf	**Like-for-like credit retirement options**
		Spp: IBRA region
		Myotis macropus/Southern Myotis: Any in NSW
	849_CPW_native_us	**Like-for-like credit retirement options**
		Spp: IBRA region
		Myotis macropus/Southern Myotis: Any in NSW

BAM Biodiversity Credit Report (Variations)

Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00021061/BAAS17045/20/00021062	BDAR ABAX-Rouse Hill-Annangrove Rd w Derived Native Grassland	18/06/2020
Assessor Name	Assessor Number	BAM Data version *
Elizabeth Ashby	BAAS17045	29
Proponent Name(s)	Report Created	BAM Case Status
	14/07/2020	Open
Assessment Revision	Assessment Type	Date Finalised
0	Part 4 Developments (General)	To be finalised

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Potential Serious and Irreversible Impacts

Name of threatened ecological community	Listing status	Name of Plant Community Type/ID
Cumberland Plain Woodland in the Sydney Basin Bioregion	Critically Endangered Ecological Community	849-Cumberland shale plains woodland
Shale Sandstone Transition Forest in the Sydney Basin Bioregion	Critically Endangered Ecological Community	1395-Cumberland shale - sandstone Ironbark forest

Nil

Additional Information for Approval

BAM Biodiversity Credit Report (Variations)

PCTs With Customized Benchmarks

No Changes

Predicted Threatened Species Not On Site

Name
Calyptorhynchus lathami / Glossy Black-Cockatoo
Grantiella picta / Painted Honeyeater
Varanus rosenbergi / Rosenberg's Goanna

Ecosystem Credit Summary (Number and class of biodiversity credits to be retired)

Name of Plant Community Type/ID	Name of threatened ecological community	Area of impact	Number of credits to be retired
849-Cumberland shale plains woodland	Cumberland Plain Woodland in the Sydney Basin Bioregion	0.4	8.00
1395-Cumberland shale - sandstone Ironbark forest	Shale Sandstone Transition Forest in the Sydney Basin Bioregion	1.0	5.00

849-Cumberland shale plains woodland	**Like-for-like credit retirement options**			
	Name of offset trading group	Trading group	HBT	IBRA region

	Cumberland Plain Woodland in the Sydney Basin Bioregion This includes PCT's: 849, 850	-	Yes	Cumberland,Burragorang, Pittwater, Sydney Cataract, Wollemi and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
1395-Cumberland shale - sandstone Ironbark forest	**Like-for-like credit retirement options**			
	Name of offset trading group	Trading group	HBT	IBRA region
	Shale Sandstone Transition Forest in the Sydney Basin Bioregion This includes PCT's: 792, 1281, 1395	-	Yes	Cumberland,Burragorang, Pittwater, Sydney Cataract, Wollemi and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

Species Credit Summary

Species	Area	Credits
Litoria aurea / Green and Golden Bell Frog	0.5	6.00
Meridolum corneovirens / Cumberland Plain Land Snail	0.5	10.00
Myotis macropus / Southern Myotis	0.8	10.00

Litoria aurea/ Green and Golden Bell Frog	1395_SSTF_good_FS_ regen	**Like-for-like options**	
		Spp	IBRA region

		Litoria aurea/Green and Golden Bell Frog	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Endangered	Cumberland, Burragorang, Pittwater, Sydney Cataract, Wollemi and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	1395_SSTF_grs_meadow	**Like-for-like options**		
		Spp	IBRA region	
		Litoria aurea/Green and Golden Bell Frog	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region

		Fauna	Endangered	Cumberland, Burragorang, Pittwater, Sydney Cataract, Wollemi and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
Meridolum corneovirens/ Cumberland Plain Land Snail	1395_SSTF_good_FS_regen	**Like-for-like options**		
		Spp	IBRA region	
		Meridolum corneovirens/Cumberland Plain Land Snail	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Endangered	Cumberland, Burragorang, Pittwater, Sydney Cataract, Wollemi and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	849_CPW_native_us	**Like-for-like options**		
		Spp	IBRA region	

		Meridolum corneovirens/Cumberland Plain Land Snail	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Endangered	Cumberland, Burragorang, Pittwater, Sydney Cataract, Wollemi and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
Myotis macropus/ Southern Myotis	1395_SSTF_weed_inf	**Like-for-like options**		
		Spp	IBRA region	
		Myotis macropus/Southern Myotis	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region

		Fauna	Vulnerable	Cumberland, Burragorang, Pittwater, Sydney Cataract, Wollemi and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	849_CPW_native_us	**Like-for-like options**		
		Spp	IBRA region	
		Myotis macropus/Southern Myotis	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Cumberland, Burragorang, Pittwater, Sydney Cataract, Wollemi and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.