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11 September 2023



Biodiversity Development Assessment Report for the proposed Augusta Street warehouse and distribution centre in Huntingwood

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Prepared for:
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Document Control

Version	Date	Author	Details
1	10 July 2023	Dr AnneMarie Clements, Dr Anne Baumann, Tony Rodd, Joelan Sawyer, Pauline Dever.	BDAR for area subject to the proposal.
2	11 September 2023	As above	BDAR for area subject to the revised proposal. The revision was in response to Test of Adequacy comments from DPE dated 2 August 2023.

Photograph on front cover: Looking east across the historically cleared farm land towards Prospect Highway, east of the site. Photograph by Tony Rodd taken on 29 April 2022.

Summary

This Biodiversity Development Assessment Report (BDAR) has been commissioned by The Trustee for Huntingwood Property Trust in accordance with the technical requirements of the Secretary's Environmental Assessment Requirements (SEARs), and in support of the State Significant Development Application (SSD - 36138263) for the proposed Augusta Street warehouse and distribution centre.

The approximately 26.64 ha site is located in Augusta Street, Huntingwood in the Blacktown City Local Government Area. This once productive farmland dating back to early colonial settlement is now reduced to a 260 m wide strip of land bounded by major highways to the north, south and east. The site is now zoned IN1 – General Industrial is crossed by Blacktown Creek in the east and a drainage line in the west.

This BDAR assesses the impacts and biodiversity offset requirements of the proposal.

Proposal description

The proposal consists of construction and operation of a warehouse and distribution centre development of approximately 134,565 m^2 gross floor area, including four warehouse buildings, ancillary office space, office facilities, indicative warehouse fitout works inclusive of warehouse racking, on-site car parking, and associated works including excavation, landscaping, and signage.

The proposed conservation works in accordance with the Huntingwood Precinct DCP, as well as additional conservation areas along the site boundaries, result in approximately 8.6 ha of conservation.

Reason why a BDAR has been prepared

A BDAR is required for the proposal as:

- Section 9 of the SEARs requires the preparation of a BDAR, as neither a waiver has been granted, nor is the site on biodiversity certified land.
- The amount of native vegetation required to be cleared for the proposal (0.46 ha) exceeds the BOS threshold of 0.25 ha for a <1 ha site (smallest lot size being 0.2 ha); and
- Impacts from the proposal occur on an area mapped on the Biodiversity Values Map.

Measures to avoid and minimise

To avoid and minimise impacts on the native vegetation and potential habitats, the proposal has been located in accordance with Huntingwood Precinct DCP, with:

- the Employment Lands mainly on the historically cleared former farming land;
- employment related carparking under the Electricity Easement; and
- conservation areas in the 'Riparian corridors' (Blacktown Creek in the east and the drainage swale in the west).

In addition, conservation areas are:

- between the car parking in the Electricity Easement and the M4 motorway; and
- in the set back from the Great Western Highway.

Plant Community Types (PCTs)

Nine BAM plots were surveyed (7 onsite and 2 offsite on adjoining land). The vegetation was sampled in October 2021, March 2022, January and June 2023.

The native vegetation in all parts of the site has been modified and disturbed by historic agricultural landuse, former dwellings with associated gardens, and industrial landuses in the west. The greater part of the site is dominated by non-native vegetation, consisting of weedy paddocks with occasional scattered groups of native trees. Only four local native tree species were recorded by the arborist (*Acacia* sp., *Eucalyptus moluccana, Eucalyptus tereticornis* and *Melaleuca linariifolia)* with the remaining being exotic or non-local native.

Of the 381 local native canopy trees recorded by the arborist onsite (178 *Eucalyptus moluccana* and 203 *E. tereticornis*) heath rating ranged from Dead, Very poor, Poor, Fair to Good. The percentage of trees in Good health was higher for *E. moluccana* (70%) than *E. tereticornis* (53%).

The drainage lines onsite, Blacktown Creek in the east and the swale in the west, are dominated by exotic weeds, although with emergent eucalypts surviving along the swale in the west. The riparian zone of Blacktown Creek is treeless and swampy. The creek water was concealed beneath a broad swathe of wetland plants, both exotic and native-cosmopolitan, and with adjoining belts of blackberries.

The best fit match for the native vegetation onsite was *PCT 3319 - Cumberland Shale Hills Woodland*, with two vegetation zones assigned as 2.03 ha *PCT 3319 – Degraded* and 0.34 ha *PCT 3319 – Less degraded.* The remaining area is non-native vegetation or hardstand.

Threatened ecological communities (TECs) and *EPBC Act* listed ecological communities (ECs).

The associated TECs for *PCT 3319 - Cumberland Shale Hills Woodland* are:

- *Cumberland Plain Woodland in the Sydney Basin Bioregion* (Part) - Critically Endangered Ecological Community under the *BC Act;* and
- *Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest* (Part) - Critically Endangered under the *EPBC Act.*

From comparisons with the Final Determination the PCT 3319 vegetation onsite met the criteria for *Cumberland Plain Woodland in the Sydney Basin Bioregion* under the *BC Act.* None of the vegetation onsite met the condition thresholds for the Commonwealth listed EC under the *EPBC Act.*

Threatened species

Of the threatened species generated by the BAM Calculator, there were:

- twenty six (26) Predicted species considered to possibly utilise the site; and
- nine (9) Candidate species considered to possibly utilise the site.

Following targeted surveys and expert opinions, no Candidate species were recorded nor considered likely to occur onsite.

Impacts including direct, indirect, prescribed, and serious and irreversible impacts (SAII)

The lodged proposal results in the clearing of 0.52 ha of native vegetation, namely:

- 0.45 ha of the 2.03 ha of *PCT 3319 – Degraded;* and
- 0.075 ha of the 0.34 ha of *PCT 3319 – Less degraded.*

The extent of clearing for the revised proposal has been reduced to 0.458 ha, namely:

- from 0.45 ha to 0.38 ha of the 2.03 ha of *PCT 3319 – Degraded*; but

remained relatively constant for:

- from 0.075 ha to 0.078 ha of the 0.34 ha of *PCT 3319 – Less degraded.*

Impacts to vegetation integrity after development (calculated for the submitted proposal) and similarly for the revised proposal

Vegetation zone	Management Zone	Area (ha)	VI Score	Change in VI Score	Total VI loss
PCT 3319_Degraded	cleared	0.45	0	-24	-4.7
	retained	1.58	24.8	0.8	
PCT 3319_Less degraded	cleared	0.07	0	-56.2	-11.5
	retained	0.27	56.3	0	

There are no prescribed impacts nor likely potential Serious and Irreversible Impacts (SAIIs) for the proposal.

Mitigation measures

The proposed mitigation and management measures include:

- Appointing an experienced Restoration Ecologist and Construction Manager to design, supervise and implement works in accordance with Conservation / Vegetation and Construction Management Plans. These plans should be a Condition of Consent;
- Restoration of riparian habitats in consultation with the Stormwater Engineers and Frog expert.

Final offset requirements

Impacts that require an offset - ecosystem credits (Calculated for the submitted proposal)

Vegetation zone	PCT name	TEC / EC	Impact Area (ha)	Number of Ecosystem credits required
PCT 3319 – degraded	*PCT 3319 Cumberland Shale Hills Woodland*	CPW	0.45 of 2.03 ha	6
PCT 3319 – less degraded	*PCT 3319 Cumberland Shale Hills Woodland*	CPW	0.07 of 0.34 ha	2

CPW = Cumberland Plain Woodland in the Sydney Basin Bioregion (*BC Act*)

Given that the number of credits is related to the area impacted, the estimated number of credits under the revised proposal is estimated to be the following.

Vegetation zone	PCT name	TEC / EC	Impact Area (ha)	Number of Ecosystem credits required
PCT 3319 – degraded	*PCT 3319 Cumberland Shale Hills Woodland*	CPW	0.38 of 2.03 ha	5 (6 x 0.38 / 0.45)
PCT 3319 – less degraded	*PCT 3319 Cumberland Shale Hills Woodland*	CPW	0.08 of 0.34 ha	2 (2 x 0.8/0.7)

Impacts that require an offset – species credits

Common name	Scientific name	Loss of habitat (ha) or individuals	Number of species credits required
N/A	N/A	0	0

Recommendations

A site specific Conservation / Vegetation Management Plan (CMP / VMP) should be developed in conjunction with the Construction Management Plan as a condition of consent. Working with the construction team and their machinery forms an essential component of the CMP / VMP.

Currently, the natural regeneration of the native canopy onsite is suppressed. Encouraging natural germination from seed showers in the Conservation Areas forms part of the CMP / VMP. This will involve utilising the onsite earthworks equipment for the removal of the dense weedy understorey and building rubble currently covering the soil surface, as well as for earthworks required by the engineers and ecologists.

From overlaying the locations of the existing native canopy trees on the proposed Masterplan and Landscape Plan, some refinements of the locations and shapes of the Bioretention Basins and the proposed upgrade to the drainage channel in the western swale are recommended, depending on the health of the trees. This should be done in consultation with the engineers, the arborist, the Construction Manager and the Environmental Manager.

It is recommended that in preference to purchase of Biodiversity Credits any residual impacts should be offset by conservation works on the adjoining and nearby land, in consultation with Council and the landholders, in accordance with Clause 7.13 (4) of the *Biodiversity Conservation Act 2016*, namely:

> *The consent authority may reduce or increase the number of biodiversity credits that would otherwise be required to be retired if the consent authority determines that the reduction or increase is justified having regard to the environmental, social and economic impacts of the proposed development. The consent authority must give reasons for a decision to reduce or increase the number of biodiversity credits.*

Note, Clause 7.13 applies to *Development other than State significant development or infrastructure.*

In consultation with Council there are further opportunities for local conservation gain, including:

- Bush regeneration downstream along Blacktown Creek including in Timbertop Reserve (zoned C2 – Environmental Conservation) which is mapped as an Important Habitat Area for the Swift Parrot;
- Planting of local native trees in the RE1 - Public Recreation zoned land north of the Great Western Highway; and
- Planting of local native trees in the residential land north of the Great Western Highway for minimisation of heat island effects for the local residents.

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2. Advice from Government Authorities:
   - email from NRAR on 3 July 2022; and
   - email from BAM Support Team on 13 May 2022.
3. Photographic record.
4. Location data and BAM input data summary.
5. Reports generated by the online BAM calculator.
6. Likelihood tables for Predicted species and Candidate species.
7. Huntingwood frog survey outcomes and habitat suitability for microbats with recommendations for habitat restoration for threatened fauna (Grant Webster and Jayden Walsh 2022).
8. Targeted survey for the Cumberland Plain Land Snail (*Meridolum corneovirens* (Pfeiffer, 1851)) at Augusta Street, Huntingwood (Dr Stephanie A Clark 2022)
9. Comparison of the recorded data with the Final Determination and Listing Advice.
10. Applying the *Guidance to assist a decision-maker to determine a serious and irreversible impact* for the proposed Augusta Street warehouse and distribution centre in Huntingwood.

Declarations

i. Certification under clause 6.15 *Biodiversity Conservation Act 2016*

I certify that this report has been prepared based on the requirements of, and information provided under, the Biodiversity Assessment Method and clause 6.15 Biodiversity certification assessment report of the Biodiversity Conservation Act 2016 (BC Act).

Signature:



Date: 10 July 2023, confirmed 11 September 2023

Dr AnneMarie Clements

BAM Assessor Accreditation no: BAAS17088

This BDAR has been prepared to meet the requirements of BAM 2020.

iii. Conflict of interest

I declare that I have considered the circumstances and there is no actual, perceived or potential conflict of interest.

This declaration has been made in the interests of full disclosure to the decision-maker. Full disclosure has also been provided to the client.

Signature:



Date: 10 July 2023, confirmed 11 September 2023

Dr AnneMarie Clements

BAM Assessor Accreditation no: BAAS17088

iii. Details and experience of author/s and contributors

Name	Position	Tasks performed include	Relevant qualifications
Dr AnneMarie Clements	Ecologist	- report preparation - field survey, including BAM Plots - supervising survey - checking figures - review of data, - cross checking specimens - cross-checking photo records and data recorded - BAM-C analysis	MSc, PhD, Ecology Specialists Certified Environmental Practitioner under the EIANZ: CEnvP Registration Number E200001.
Dr Anne Baumann	Ecologist	- reviewing existing data - report preparation - document review - checking figures - checking data	PhD, BScAg, Cert IV Conservation and Land Management. Dip. Arboriculture
Tony Rodd	Botanist	- field survey, including BAM Plots - detail observations - report preparation - data review - double checking mapping - targeted threatened flora surveys	BSc, Specialist botanist with many years of experience
Joelan Sawyer	Ecologist	- report preparation - figure preparation, GIS - field survey, including BAM Plots - BAM-C data entry and analysis with AC - targeted threatened flora surveys	BSc
Pauline Dever	Ecologist	- data entry - research - figure preparation - field survey - report preparation	B Environment, Dip. Conservation and Land Management.

Glossary and Definitions

BAM	Biodiversity Assessment Method
BAM-C	Biodiversity Assessment Method Calculator
BC Act	Biodiversity Conservation Act 2016 (NSW)
BC Regulation	Biodiversity Conservation Regulation 2017 (NSW)
BDAR	Biodiversity Development Assessment Report
BOS	Biodiversity Offsets Scheme
CEEC	critically endangered ecological community
DBH	diameter at breast height over bark
DPIE	Department of Planning Industry and Environment
EC	ecological community listed under the EPBC Act
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999 (Commonwealth)
EP&A Act	Environmental Planning and Assessment Act 1979 (NSW)
EEC	endangered ecological community
HTW	high threat weed
IBRA	Interim Biogeographic Regionalisation for Australia
LLS Act	Local Land Services Act 2013 (NSW)
MNES	matters of national environmental significance
NPW Act	National Parks and Wildlife Act 1974 (NSW)
NSW	New South Wales
PCT	plant community type
SAII	Serious and Irreversible Impact
SEARs	Secretary's Environmental Assessment Requirements
TBDC	Threatened Biodiversity Data Collection
TEC	threatened ecological community

Definitions:

Clearing of native vegetation is defined in the *BC Act* as:

> ***native vegetation*** *and* ***clearing*** *native vegetation have the same meanings as in Part 5A of the Local Land Services Act 2013.*
> *Note—Under that Part of that Act, the clearing of dead or non-native plants on certain vulnerable land is taken to be the clearing of native vegetation.*

Local Land Services Act 2013 defines 'native vegetation' and 'clearing' of native vegetation as follows:

> ***60B Meaning of "native vegetation"***
>
> *(1) For the purposes of this Part, native vegetation means any of the following types of plants native to New South Wales—*
>
> *(a) trees (including any sapling or shrub or any scrub),*

(b) understorey plants,

(c) groundcover (being any type of herbaceous vegetation),

(d) plants occurring in a wetland.

(2) A plant is native to New South Wales if it was established in New South Wales before European settlement. The regulations may authorise conclusive presumptions to be made of the species of plants native to New South Wales by adopting any relevant classification in an official database of plants that is publicly accessible.

(3) For the purposes of this Part, native vegetation extends to a plant that is dead or that is not native to New South Wales if—

(a) the plant is situated on land that is shown on the native vegetation regulatory map as category 2-vulnerable regulated land, and

(b) it would be native vegetation for the purposes of this Part if it were native to New South Wales.

(4) For the purposes of this Part, native vegetation does not extend to marine vegetation (being mangroves, seagrasses or any other species of plant that at any time in its life cycle must inhabit water other than fresh water). A declaration under section 14.7 of the Biodiversity Conservation Act 2016 *that specified vegetation is or is not marine vegetation also has effect for the purposes of this Part.*

60C Meaning of "clearing" native vegetation

For the purposes of this Part, clearing native vegetation means any one or more of the following—

(a) cutting down, felling, uprooting, thinning or otherwise removing native vegetation,

(b) killing, destroying, poisoning, ringbarking or burning native vegetation.

Part A Preamble and background to the proposal

A1.0 Introduction

This Biodiversity Development Assessment Report (BDAR) has been commissioned by The Trustee for Huntingwood Property Trust in accordance with the technical requirements of the Secretary's Environmental Assessment Requirements (SEARs), and in support of the State Significant Development Application (SSDA) (SSD - 36138263) for the proposed Augusta Street warehouse and distribution centre on the 26.642 ha site in Augusta Street, Huntingwood in the Blacktown City Local Government Area (LGA) (location on Figures 1a-1 to 1d-2, revised proposal on Figures 1e, 1f).

Revision to the submitted proposal have occurred in response to Test of Adequacy comments from DPE dated 2 August 2023. The result of revision is a minor reduction in area of native vegetation being cleared (0.458 ha) compared with that for the submitted proposal (0.525 ha).

The SEARs issued on 2 August 2022 specify:

> ***9. Biodiversity***
> *Assess any biodiversity impacts associated with the development in accordance with the Biodiversity Conservation Act 2016 and the Biodiversity Assessment Method 2020, including the preparation of a Biodiversity Development Assessment Report (BDAR), unless a waiver is granted, or the site is on biodiversity certified land.*

Neither a waiver has been granted, nor is the site on biodiversity certified land.

This report has been prepared in accordance with the Biodiversity Assessment Methodology (BAM) (DPIE 2020) under the supervision of an accredited BAM assessor (CVs of the authors involved in Appendix 1). The assessor's details are:

Assessor name: Dr AnneMarie Clements
BAM Assessor number: 0129
NSW BAM Accreditation: BAAS17088
Ecology Specialists Certified Environmental Practitioner under the Environmental Institute of Australia and New Zealand CEnvP Program: CEnvP Registration Number E200001.

A2.0 The Proposal

The proposed SSDA seeks approval to redevelop the site to accommodate a warehouse and distribution centre use inclusive of the following:

- Site establishment works, including tree removal, minor excavation / bulk earthworks;
- Construction and operation of four (4) new warehouse buildings comprising a multi-level warehouse building on the eastern portion of the site and three single storey warehouse buildings on the western portion of the site. The warehouse buildings will include ancillary office space and indicative warehouse fit out works including warehouse racking;
- The warehouse and distribution tenancies are proposed to be operated 24 hours per day, 7 days per week;
- Other associated works including landscaping, at-grade car parking and general site improvements;

- Business and building identification signage including wayfinding signage;
- Vehicle access provided via Augusta Street and a new proposed access from the Great Western Highway;
- Lot consolidation of properties.

The proposed conservation works in accordance with Huntingwood Precinct DCP, as well as additional areas along the site boundaries, result in approximately 8.6 ha of conservation (Figures 1f and 2d).

A3.0 Biodiversity related legislation

A3.1 Blacktown Council plans and mapping

A3.1.1 Blacktown Local Environment Plan (LEP) 2015

Zoning - The approximately 260 m wide site is zoned IN1 – General Industrial and bounded by the major highways to the north, south and east, zoned SP2 – Infrastructure (Figures 1a-2, 1b-2, 2a). The biodiversity objectives associated with the zonings on adjoining land are the following:

Land use and location	**Zoning**	**Biodiversity related objectives**
The site	IN1– General Industrial	• *To enable other land uses that provide facilities or services to meet the day to day needs of workers in the area.* • *To minimise adverse impacts on the natural environment.* *Permitted without consent* *Nil*
Major highways to the north, south and east	SP2 – Infrastructure	No biodiversity related objective. Objectives include: • *To prevent development that is not compatible with or that may detract from the provision of infrastructure.* Permitted without consent **Environmental protection works**; Flood mitigation works
North of Great western Highway		
Mown strip with some trees adjoining the highway	RE1 – Public Recreation	• *To protect and enhance the natural environment for recreational purposes.* *Permitted without consent* ***Environmental protection works**; Roads*
Residential further to the north	R2 – Low Density Residential;	• *To enable other land uses that provide facilities or services to meet the day to day needs of residents.* (Assumed tree planting is permitted under this objective to minimise heat island effects) *Permitted without consent* *Home occupations*
Within Timbertop Reserve		
Blacktown Creek	W1 - Natural	• *To protect the ecological and scenic values of*

Land use and location	Zoning	Biodiversity related objectives
	Waterways	*natural waterways.* • *To prevent development that would have an adverse effect on the natural values of waterways in this zone.* • *To provide for sustainable fishing industries and recreational fishing.* • *To enable works associated with the rehabilitation of land towards its natural state.* *Permitted without consent* ***Environmental protection works***
Mainly to the east of the creek	RE1 and C2 – Environmental Conservation	Objective of C2 zoning • *To protect, manage and restore areas of high ecological, scientific, cultural or aesthetic values.* • *To prevent development that could destroy, damage or otherwise have an adverse effect on those values.* • *To provide for passive recreational activities that are compatible with the land's environmental constraints.* *Permitted without consent* ***Environmental protection works***
South of the Western Motorway (M4)		
Raging Waters Sydney (formerly Wet n Wild Sydney)	Not on zoning map	N/A
Skyline Drive-in	Not on zoning map	N/A
Prospect Nature Reserve further south	Not on zoning map	N/A

Lot size – There is no Lot Size mapped for the site (Figure 2b). The smallest lot is 2,004 m^2 (0.2 ha) (Lot 163 DP8716) (Figure 1a-2).

Terrestrial Biodiversity – There is no Terrestrial Biodiversity mapped on the site. The nearest mapping to the site is in Timbertop Reserve to the north of the Great Western Highway (Figure 2c). Clause 7.2 of the LEP applies to Timbertop Reserve, with the objectives of:

7.2 Terrestrial biodiversity

(1) The objective of this clause is to maintain terrestrial biodiversity by—

(a) protecting native fauna and flora, and

(b) protecting the ecological processes necessary for their continued existence, and

(c) encouraging the conservation and recovery of native fauna and flora and their habitats.

A3.1.2 Blacktown Development Control Plan 2015

The proposal has been designed to address the controls within the Blacktown Development Control Plan. Adopted in 2015, the Blacktown DCP details the various standards, policies and guidelines related to construction and development for Blacktown City.

Part A is the Introduction and General Guidelines. It includes definition of terms, including:

> ***Adjoining land*** *means land which abuts an Application site or is separated from it only by a pathway, driveway or similar thoroughfare.*

Section 3.5 points out "*What types of impacts are of concern*", namely:

> *(a) The views to and the view from the land*
> *(b) Overshadowing*
> *(c) Privacy*
> *(d) Noise, odour or any other potential polluting emission*
> *(e) The visual quality of the development in relation to the streetscape (*
> *f) The scale or bulk of the proposed development*
> *(g) The siting of the proposed development in relation to site boundaries*
> *(h) The proposed hours of use for the development*
> *(i) Light spillage or reflection*
> *(j) Means of access to or provision of parking on the proposed development site*
> *(k) The amount of traffic likely to be generated by the proposed development*
> *(l) Drainage*
> *(m) The social and economic impacts of the proposal.*

Section 4 relates to *Environmental protection*, pointing out:

> *Council, as well as developers, has a responsibility to ensure that development is undertaken in a manner which will enhance the existing environment or at least minimise any likely adverse environmental impacts.*

This section includes:

- *areas requiring filling;*
- *Tree preservation with Legal provisions for the preservation of trees are in force under Blacktown LEP 2015 (refer Clauses 5.9 and 5.9AA)*
- *Heritage*
- *Pollution control*
- *Noise reduction*

Under tree preservation:

> *A prescribed tree for the purpose of Clause 5.9 of Blacktown LEP 2015 is:*
> *(a) A perennial plant with a self-supporting stem which:*
> - *Has a height of more than 3 metres; and/or*
> - *Has a trunk diameter of more than 200mm or more measured 1.0 metre above ground level.*

[Note: Clause 5.9 of Blacktown LEP 2015 - Current version for 26 April 2023 to date (accessed 27 June 2023] is no longer related to Tree Preservation].

Appendix 1 of the DCP lists the "*Recommended tree species. Council encourages the use of Australian native species*". None of the listed trees in the table entitled *Australian native tree species – evergreen trees* are native to western Sydney, but are from environments such as rainforest, scrub near sea, along watercourses, with the possible exception of *Glochidion ferdinandi,* a widespread tree in coastal districts (further details on PlantNET, the online website of the Royal Botanic Gardens Sydney).

Section 5 deals with Roads, including:

- Arterial roads, such as the Great Western Highway;
- Pedestrian pathways linking destinations such as open space, schools, shops and bus stops;
- Land adjoining arterial and sub-arterial roads zoned SP2 Infrastructure (Classified Road) and SP2 (Local Road).

Section 6 deals with Car parking.

Section 7 deals with Services such as water, sewerage, electricity, telephony, gas and postal services.

Section 8 is Special consideration including solar access, Crime prevention through environmental design, retaining walls and ground reshaping.

Section 9 relates to Development on flood prone land, based on the NSW Government's Flood Prone Land Policy, and Section 10 to Local overland flooding – major drainage and local runoff.

Part E of the DCP is *Development in the Industrial Zones*.
In Section 4.2 Landscaping, it states:

> *Objectives in respect to landscaping in the industrial and B5 zones are as follows:*
>
> *(a) To encourage a high standard of environmental quality of individual developments, whilst enhancing the general steetscape and amenity of the area by providing high standard landscaping*
>
> *(b) To minimise loss of vegetation during the land development process by incorporating as many existing trees as possible within landscaped setbacks*
>
> *(c) To ensure that vegetation removed as part of the land development process is replaced by suitable indigenous species.*
>
> *Landscaping proposals should generally be in accordance with the following requirements:*
>
> *(a) Every effort should be made to preserve existing trees and any associated native understorey in accordance with the provisions of Clause 5.9 of Blacktown LEP 2015 (Preservation of Trees or Vegetation)*
>
> *(b) All setback areas are to be landscaped and maintained incorporating as many existing trees as possible. Undeveloped areas are to be stabilised to prevent soil erosion. Landscaping may be required around the perimeter of undeveloped areas*
>
> *(c) Car parking areas are to be suitably treated with landscaping to soften the appearance of the areas and to provide shade for parked cars. At a minimum standard one tree should be planted every 10 metres and be at a minimum height of 1m at the time of planting. Trees should be planted to achieve 50% shading of the carpark at ten year maturity. Appendix 1 provides a list of the tree species recommended by Council, with native species favoured. Undeveloped areas are to be stabilised to prevent soil erosion*
>
> *(d) All landscaped areas are to be separated from vehicular areas by means of a kerb, dwarf wall or other effective physical barrier, however full fencing of landscaped areas is not encouraged*
>
> *(e) Earth mounding (where on-site detention of drainage is not required) may be used within the setback area. Embankments that are not finished with rockeries or walls should not be steeper than 1:4 gradient in order to enable vegetation to be grown and maintained*

> *(f) All irrigation systems shall be automatic and designed to meet specific site requirements. Minimisation of water consumption should also be a consideration in the design of irrigation systems. Reliance on irrigation systems for the survival of chosen plant species is not encouraged.*
>
> *All landscaping is to be completed to Council's satisfaction prior to occupation of the development. Details of the works, including proposed plant species, are to be provided in the landscaping plans submitted with the DA.*

A3.1.3 The Huntingwood Precinct Development Control Plan

The Huntingwood Precinct Development Control Plan (DCP) applies to the site (Blacktown City Council dated August 2011 as amended May 2020). This plan is informed by Chapter 2 Western Sydney Employment Area of the State Environmental Planning Policy (Industry and Employment) 2021.

In the Huntingwood Precinct DCP it is stated that:

> *The aim of the WSEA SEPP is to protect and enhance the Western Sydney Employment Area (WSEA) for employment purposes, with reference to the following particular aims:* including [**emphasis** added for biodiversity related aims]:
>
> - *To promote economic development and the creation of employment in the WSEA by providing for development including major warehousing, distribution, freight transport, industrial, high technology and research facilities.*
> - *To rezone land for employment or* ***environmental conservation purposes****.*
> - ***To conserve and rehabilitate areas that have a high biodiversity or heritage or cultural value, in particular areas of remnant vegetation.***

In the Huntingwood Precinct DCP, Figure 4: Huntingwood Precinct Development Framework specifies the following land use locations (Conservation Area, Employment Lands, Electricity Easement and Riparian Corridors) (see Figure 2d in this BDAR). The development frameworks specified for the site include Employment Lands with Conservation Areas along ‘riparian corridors’.

A3.2 Relevant State Biodiversity Legislation

A3.2.1 *NSW Environment Planning and Assessment Act 1979*

The development is a Part 4 Development.

A3.2.2 *Biodiversity Conservation Act 2016*

A Biodiversity Development Assessment Report (BDAR) under the *Biodiversity Conservation Act 2016* is required, if:

- the proposal triggers the Biodiversity Offsets Scheme (BOS) threshold; or
- the proposal is likely to significantly affect threatened species based on the test of significance in section 7.3 of the NSW *Biodiversity Conservation Act 2016.*

The *Biodiversity Conservation Regulation 2017* sets out threshold levels for when the Biodiversity Offsets Scheme will be triggered. The threshold has two elements:

- whether the amount of native vegetation being cleared exceeds an area threshold; and
- whether the impacts occur on an area mapped on the Biodiversity Values

Map.

The definition of native vegetation and clearing are provided in the Glossary and Definitions at the front of this report.

As no lot size for the site has been mapped under the Blacktown LEP, the actual Lot size is used to determine the clearing threshold under the BOS. The smallest lot size on the site is 0.2 ha.

From Clause 7.2 of the *Biodiversity Conservation Regulation 2017*, the trigger for native vegetation clearing for a minimum lot size of <1 ha is 0.25 ha, namely:

Minimum lot size associated with the property	**Threshold for clearing, above which the BAM and offsets scheme apply**
Less than 1 ha	0.25 ha or more

The site contains four separate patches mapped on the Biodiversity Values Map, with a total area onsite of approximately 2.83 ha (1.24 + 0.99 + 0.54 + 0.06) (Figure 2e). [Note: the patch to the east is 0.32 ha, of which 0.06 ha is onsite].

Impacts from the proposal are likely to occur on an area mapped on the Biodiversity Values Map, and hence triggering the BOS.

The Biodiversity Offset Scheme (BOS) is also triggered by the proposal if the amount of native vegetation being cleared exceeds the area threshold of 0.25 ha.

Hence, a BDAR is required for the proposal as the proposal triggers the BOS.

A3.2.3 Local Land Services Act 2013

This Act applies to rural areas of the State and not to the site.

A3.3.3 Rural Fires Act 1997

The site is mapped on the Bush Fire Prone Lands Map (Figure 2f), as:

- Vegetation buffer to Vegetation Category 1 land on Timbertop Reserve north of the Great Western Highway.

A3.3.4 NSW *Water Management Act 2000* (*WM Act*)

There are controls for waterfront land under the *WM Act,* detailed in the *Guidelines for controlled activities on waterfront land - Riparian Corridors* (2018) prepared by the water regulator, NRAR. It is stated in the *Guidelines*:

> *The NRAR seeks to ensure effective, efficient, transparent and accountable compliance and enforcement measures through the natural resources management legislation and, in doing so, maintain public confidence in the enforcement of natural resources management legislation. …*
>
> *Controlled activities carried out in, on, or under waterfront land are regulated by the Water Management Act 2000 (WM Act). The NRAR administers the WM Act and is required to assess the impact of any proposed controlled activity to ensure that no more than minimal harm will be done to waterfront land as a consequence of carrying out the controlled activity. ...*
>
> *The riparian corridor consists of:*

- *the channel which comprises the bed and banks of the watercourse (to the highest bank) and*
- *the vegetated riparian zone (VRZ) adjoining the channel.*

The NRAR recommends a VRZ width based on watercourse order as classified under the Strahler System of ordering watercourses and using Hydroline Spatial Data which is published on the department's website . The width of the VRZ should be measured from the top of the highest bank on both sides of the watercourse ...

The site is crossed by Blacktown Creek, a south to north flowing mapped 1st Order watercourse with a recommended 10 m wide Vegetation Riparian Zone (NRAR 2018, email from NRAR dated October 2021, see Figure 1a-1, 1b-1). The creek is downstream of the controlled stormwater discharge basins from the Western Motorway (visible on LiDAR, Figure 1d-1) and detention systems on the Raging Waters Sydney (formerly known as Wet n Wild) site to the south of the Western Motorway (M4).

In the west, there is a drainage swale from controlled stormwater discharge basins from the Western Motorway flowing to the north under the Great Western Highway. It is not a mapped watercourse (see Figure 1b-1, 1b-2, email from NRAR on 3 July 2022 in Appendix 2).

Controls for 1st Order watercourses

Table 1 of the *Guidelines*, provides recommended riparian corridor widths and VRZs. For a 1st Order watercourse, the width of the VRZ is 10 m each side of the watercourse and the total riparian corridor width is 20 m + channel width.

The Riparian Corridor Matrix provided in Table 2 of the *Guidelines* enables applicants to identify certain works and activities that can occur on waterfront land and in riparian corridors under the *WM Act*.

Under the Matrix, for a 1st Order stream, any road crossings are permitted as part of a controlled activity approval (see updated version of Table 2 below from NRAR – emailed on 18 August 2022).

Stream order	Vegetated Riparian Zone (VRZ)	RC off-setting for non RC uses	Cycleways and paths	Detention basins		Stormwater outlet structures and essential services	Stream realignment	Road crossings		
				Only within 50% outer VRZ	Online			Any	Culvert	Bridge
1st	10m	•	•	•	•	•	•	•		
2nd	20m	•	•	•	•	•		•		
3rd	30m	•	•	•		•			•	•
4th +	40m	•	•	•		•			•	•

However, it is also pointed out in the *Guidelines* that:

> *.. **Applicants are still required to comply with other relevant government legislation, such as threatened species,** flood planning levels and fisheries guidelines.* [Emphasis added].

A3.3.5 *Biosecurity Act 2015*

The *Biosecurity Act 2015* replaced the *Noxious Weeds Act 1993.* Existing local control authorities continue to have functions in relation to weed control.
A list of Priority weeds for the Greater Sydney region is given on NSW WeedWise website (*https://weeds.dpi.nsw.gov.au/WeedBiosecurities?AreaId=21*) and includes these species recorded onsite:

Species	Duty	Presence
Anredera cordifolia	Prohibition on certain dealings	ACA Plots 4, 5, 8, 9
Asparagus aethiopicus	Prohibition on certain dealings	ACA Plots 4, 5, 8, 9, Spot A
Asparagus asparagoides	Prohibition on certain dealings	ACA Plots 2, 4, 5, 7, 9, Spots A,C,E, EP Q1,2,7
Asparagus plumosus	Prohibition on certain dealings	EP Plots 1, 2, Spots F, H
Cestrum parqui	Regional Recommended Measure	EP Plots 6,7
Cortaderia species	Regional Recommended Measure	*Cortaderia selloana* ACA Plot 8
Lantana camara	Prohibition on certain dealings	ACA Plots 2, 3, 5, 7, 8, 9, Spots C, E, J, L, M EP Q1,2
Olea europaea subsp. *cuspidata*	Regional Recommended Measure	ACA Plots 1,2,3,4, 8, 9, Spots A, C, D, J, L, M EP Plots 1,2,7
Opuntia monacantha	Prohibition on certain dealings	*Opuntia monacantha* ACA Plot 8
Rubus fruticosus	Prohibition on certain dealings	*Rubus anglocandicans* ACA Plot 6, Spots D, F, G, M EP Plots 6, 7
Senecio madagascariensis	Prohibition on certain dealings	ACA Plots 2,4,7,9, Spots A, B, C, D, G, I EP Plots 1,2, 3,4,5

Note: EP = Ecoplanning (2020), ACA = Anne Clements & Associates survey used in the BDAR.

A3.3 State Environmental Planning Policies (SEPPs)

A3.3.1 State Environmental Planning Policy (Biodiversity and Conservation) 2021

Chapter 2 (Vegetation in non-rural areas) aims to protect the biodiversity values and preserve the amenity of trees and other vegetation in non-rural areas of the State. This SEPP applies to the Blacktown LGA and land Zoned IN1 General Industrial.

Chapter 3 - Koala Habitat Protection 2020

Koala SEPP 2020 does not apply to the site as it only applies to land zoned RU1, RU2 and RU3 in specified LGAs of which Blacktown is not listed.

Chapter 4 - Koala Habitat Protection 2021
This chapter does not apply to Blacktown LGA.

Part B Stage 1 Biodiversity Assessment

B1.0 Site location

The site is located approximately 34 km west of the Sydney CBD and approximately 1 km north of Prospect Nature Reserve and approximately 3.3 km south of the Blacktown commercial centre in the Blacktown Local Government Area (LGA). The site is in Cumberland IBRA subregion of the Sydney Basin Bioregion (Figures 1a-1 to 1c-2).

The site is an approximately 260 m wide strip of land bounded by:

- two major east-west roads: Great Western Highway in the north and the Western Motorway (M4) in the south;
- north-south Prospect Highway in the east; and
- Flushcombe Road to the west.

The 26.642 ha site comprises multiple parcels of land varying in size, from:

- 2,004 m^2 (0.2 ha) on Lot 163 DP8716; to
- 43,360 m^2 (4.3 ha) on Lot 51 DP1144623.

The elevation of the site ranges from approximately 85 m AHD on the top of the hill west of Blacktown Creek and approximately 90 m AHD on the eastern boundary, to less than 70 m AHD along Blacktown Creek close to the northern boundary (Figures 1b-2, 1d-2).

B1.1 The Proposal and the subject land

Details of the proposal are provided in Section A2.0.

Subject land is defined in the BAM as:

> *land subject to a development, activity, clearing, biodiversity certification or a biodiversity stewardship proposal.*

The subject land is the entirety of the 26.642 ha site (Figure 1a-2).

B1.2 Documents relied on

Reports relevant to the proposal

Canopy Consulting (2023) *Industrial Estate Huntingwood – Tree Species Map.* Dated September 2023.

Clark SA (2022) *Targeted survey for the Cumberland Plain Land Snail* (Meridolum corneovirens *(Pfeiffer, 1851)) at Augusta Street, Huntingwood.* Prepared for Anne Clements & Associates Pty Limited. Dated 24 October 2022.

Habit8 Landscape Architects & Urbanism (2023) *Landscape Concept Plan. Huntingwood Logistics Estate, Augusta St, Huntingwood East, NSW.* Dated July 2023. Client: The Trustee for Huntingwood Property Trust.

JBS&G Australia Pty Ltd (2023a) *Detailed Site Investigation Huntingwood East Augusta Street, Blacktown NSW.* Prepared for The Trustee for Huntingwood Property Trust. Report 62742/144011 (Rev 0). Dated 22 June 2023.

JBS&G Australia Pty Ltd (2023b) *Remediation Action Plan Huntingwood East Augusta Street, Blacktown NSW*. Prepared for The Trustee for Huntingwood Property Trust. Report 62742/146178 (Rev 0). Dated 22 June 2023.

Pells Sullivan Meynink (PSM) (2023) *Augusta St, Huntingwood East* Results of Geotechnical Investigation. Client: Letter to The Trustee for Huntingwood Property Trust. Dated 29 June 2022.

Webster G and Walsh J (2022) Huntingwood frog survey outcomes and habitat suitability for microbats with recommendations for habitat restoration for threatened fauna. Prepared for Anne Clements & Associates Pty Limited. Dated 24 August 2022.

Previous onsite survey

Ecoplanning (2020) *Biodiversity Development Assessment Report, Augusta Street, Huntingwood, State Significant Development Application.* Prepared for EMKC Australia C/O Air Trunk – Final dated 6 August 2020.

Literature considered

Benson DH and Howell J (1990) *Taken for Granted: the bushland of Sydney and its suburbs.* Kangaroo Press Pty Ltd. Kenthurst NSW.

Benson D and McDougall L (1996) Ecology of Sydney plant species Part 4: Docotyledon family Fabaceae. *Cunninghamia.* Vol 4(4) 553-752.

Department of Planning, Industry and Environment (DPIE) (2020) *Biodiversity Assessment Method*. Dated October 2020.

Division of National Mapping (1986) *Climate. Atlas of Australian Resources. Third Series. Volume 4.* Division of National Mapping, Canberra.

Hazelton P and Clements A (2011) Historic and Environmental Significance of Ecological Communities in NSW, Australia. *International Journal of Heritage and Sustainable Development.* 1(1), 72-83. ISSN: 1647-4112.

Mitchell PB (2002) *Descriptions for NSW (Mitchell) Landscapes.* Published by Department of Planning, Industry and Environment.

Natural Resources Access Regulator (NRAR) (2018) *Guidelines for controlled activities on waterfront land—Riparian corridors. NSW* Department of Industry | INT19/15607|.Dated May 2018.

NSW Government (2022) *Biodiversity Values Map and Threshold Report.* Dated 31 May 2022.

Maps

Central Mapping Authority of New South Wales (1982) 1:25 000 topographic map Springwood 9030-IV-S 2nd Edition.

Online Maps and data include from:

Biodiversity Values Map and Threshold Tool

Bureau of Meteorology

Elvis - Elevation and Depth - Foundation Spatial Data

Historical, Aerial and Satellite Imagery - Spatial Services

NearMap aerial photographs
NSW FloraOnline - PlantNET
DP&E Website including BioNET
Blacktown City Council's website
Seed Portal – NSW Government

B2.0 Methods related to environmental setting

B2.1 Site context methods

B2.1.1 Landscape features methods

Landscape features were assessed using:

- topographic maps, and aerial photographs from the Seed Portal – NSW Government website;
- Nearmap aerial photographs on subscription;
- the Sydney 1 Metre DEM LiDAR dated May 2011 from Spatial Services, ELVIS;
- Geology and soil mapping from the Seed Portal – NSW Government website;
- Geotechnical assessment; and
- Field inspections, onsite surveys and photographic records.

B2.2 Native vegetation, TECs and vegetation integrity methods

A review of existing vegetation mapping and previous reports / surveys has been undertaken.

B2.2.1 Review of existing vegetation mapping

Office of Environment and Heritage (OEH) (2016) mapped most of the site as cleared (Figure 4a), except for:

PCT	Description	Patches located
PCT 849	Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion	In the NW fronting Great Western Highway and extending along drainage swale
		Along the southern boundary near the M4 Motorway
		Offsite in Timbertop Reserve.
PCT 850	Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin Bioregion	Extending offsite to the north-east
PCT 0	Urban Exotic/Native	Two patches offsite along M4 Motorway

The area mapped as PCT 849 and PCT 850 are the same as that mapped on the BV map (Figure 2e).

NSW State Vegetation Type Map (DPE 2022) mapping is similar to that of OEH (2016) with the same polygons for PCT 849, 850 as PCT 3320 (Figure 4b).

Mapped by OEH (2016)		Mapped by DPE (2022)	
PCT	Grey Box - Forest Red Gum	PCT	Cumberland Shale Plains Woodland

Mapped by OEH (2016)		Mapped by DPE (2022)	
849	grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion	3320	
PCT 850	Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin Bioregion		

B2.2.2 Review of previous surveys

Ecoplanning (2020) carried out a BDAR for a previous development application on part of the site. The area was surveyed on 8 April 2020 with data recorded in 7 BAM Plots 1 to 7 using the Biodiversity Assessment Method (BAM) (OEH 2017).

A total of 100 (36 native, 61 exotic and 3 non-local native) flora species were recorded in the 7 BAM Plots (data from Appendix B of Ecoplanning 2020 included in Table 1 and sampling locations are shown on Figure 6a of this BDAR).

For Ecoplanning's Plot 7, two "native tree" species are entered into the calculator but neither are native to the specified *PCT 849 Grey Box – Forest Red Gum grassy woodland of the Cumberland Plain, Sydney Bioregion (mixed native and exotic).* These "native trees" were:

- *Eucalyptus robusta* - the most widespread and abundant tree species of the Endangered Ecological Community *Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions;* and
- *Grevillea robusta* - a widely cultivated species, native to the NSW North Coast IBRA Bioregion, with its accepted southern limit in the wild being near Coffs Harbour.

From advice from the BOS helpdesk team (Appendix 2):

an assessor should consider if:

- *the planted native vegetation accounts for a minor component of the existing remnant native vegetation; and*
- *A PCT can be assigned for the purposes of a standard BAM assessment.*

Both *Eucalyptus robusta* and *Grevillea robusta* are likely to have been planted as part of a garden and should not have been considered a native tree species for the purposes of the BAM assessment. The subsequent natural colonisation of *Grevillea robusta* (observed onsite during the ACA surveys and recorded by the arborist as height classes of <5 m, 5-10 m) should also not be considered a native tree species for the purposes of the BDAR.

A total of seven microchiropteran bat species were detected from calls within and near the subject land, including three species listed as vulnerable under the *Biodiversity Conservation Act 2016* (Little Bent-winged Bat, Large Bent-winged Bat, Eastern Coastal Free-tailed Bat).

In the BDAR it was assumed by Ecoplanning that the site provided habitat for the frog *Litoria aurea* (Green and Golden Bell Frog) and *Myotis macropus* (Southern Myotis) and credits were assigned to these two species. No expert report nor site specific survey had been undertaken for either of the species.

Clements *et al.* (2021) carried out a biodiversity survey as part of the due diligence, focusing on potential biodiversity constraints on land identified in the DCP as Employment Lands and the potential biodiversity opportunities on the Conservation Areas.

A total of 102 (34 native, 68 exotic and non-local natives) species recorded on 26 October 2021 by Dr AnneMarie Clements and Tony Rodd from one BAM Plot ACA-1 and patches A to K on the site, with the species reflecting its past history as productive farm land (see sampling locations over current and 1956 aerial photographs, Figures 1930-1956, 6a).

The most widespread species recorded onsite were the exotic pasture grasses *Paspalum dilatatum* (Paspalum), *Cenchrus clandestinus* (Kikuyu Grass) and *Lolium perenne* (Perennial Ryegrass).

Associated with the former house site were garden plantings, including *Grevillea robusta,* which is growing outside its accepted natural range, (this species is native to the NSW North Coast IBRA Bioregion). *Grevillea robusta* has colonised parts of both the Employment Land and Conservation Areas.

The native species onsite were sparse, with:

- native trees restricted to the drainage swale in the west, patches adjoining the M4 Motorway in the south and isolated remnant eucalypt woodland patches in the paddocks and around industrial operations along Flushcombe Road;
- patches of *Bursaria spinosa* along a former fence line;
- A native legume *Daviesia genistifolia* which despite probably more than 150 years of agricultural land use, appeared to have germinated from the soil seed bank of the former market garden area (recorded at Spot D on Figure 6a). *Daviesia genistifolia* has a hard-coated seed which is long-lived in the soil seed bank (Benson and McDougall 1996); and
- native grasses from wind-blown seed, including in the cracks of the bituminised road (recorded at Spot B on Figure 6a).

Along Blacktown Creek (Spot H on Figure 6a):

- The wetter patches have been colonised by *Typha domingensis* (Narrow-leaved Cumbungi), described on PlantNET as a robust emergent aquatic perennial that grows in swamps, channels and drains;
- The damp ground beside the creek has been colonised by the exotic *Juncus acutus* (Sharp Rush), described on PlantNET as a serious weed because of its abundant seed production and viciously sharp tips, which makes control difficult; and
- The less inundated land supports dense stands of the exotic weed *Rubus anglocandicans* (Blackberry) which extends in abundance to parts of the adjacent hill slopes.

B2.2.3 Onsite survey methods

The vegetation was sampled in nine BAM plots on 26 October 2021, 10, 30 March 2022, 20 January 2023 and 14 June 2023 by Dr AnneMarie Clements, Tony Rodd, Joelan Sawyer and Pauline Dever using the BAM techniques (details in DPIE 2020) (sampling locations on Figure 6a).

In addition to the BAM techniques:

- to calculate the percentage covers of species present in the 0.04 ha floristic quadrat of the BAM plots, the covers recorded in four 10 m x 10 m contiguous subquadrats were averaged and the average rounded to a value acceptable in BAM (Table 1);
- To describe vegetation structure in the sampled vegetation, the numbers of individuals and maximum heights for species $\geq$ 2 m tall were recorded in the floristic quadrats (Table 2); and
- Supplementary data were recorded in Patches A–M, with species present and height of canopy trees as part of the due diligence survey in 2021.

All sampling locations were photographed with additional general photographs also taken (Appendix 3). GPS coordinates were recorded at regular intervals along the transects using a hand-held Garmin GPS map 78 at the time of survey. The GPS coordinates (given in Appendix 4), in conjunction with ground features, were used to plot the sampling locations.

Nomenclature is consistent with Harden (1990-1993, 2002), Harden and Murray (2000) and subsequent taxonomic changes as published in *Telopea*, the Sydney Royal Botanic Gardens' journal of systematic botany, and in other Australian taxonomic literature. The Royal Botanic Gardens' PlantNET website (plantnet.rbgsyd.nsw.gov.au) incorporating Flora Online is the major source for updated taxonomy.

Vegetation integrity is a quantitative measure of the composition, structure and function of the vegetation; as well as the presence of high threat weeds and hollow bearing trees. This is obtained from the BAM plot data (see input data for the BAM Calculator in Appendix 4).

B2.3 Threatened species survey methods

Ecosystem credit species and Species credit species were generated from the on-line BAM Calculator. In the BAM (DPIE 2020), the difference between Ecosystem credit species and Species credit species are described:

In Section 5.1.1 *Species that can be predicted by habitat surrogates (ecosystem credit species)*

> ***Ecosystem credit species*** *are threatened species whose occurrence can generally be predicted by vegetation surrogates and/or landscape features, or that have a low probability of detection using targeted surveys. The TBDC identifies the threatened species assessed for ecosystem credits.* ***A targeted survey is not required to identify or confirm the presence of ecosystem credit species.***

In Section 5.1.2 *Species that cannot be predicted by habitat surrogates (species credit species)*

> ***Species credit species*** *are threatened species for which vegetation surrogates and/or landscape features cannot reliably predict the likelihood of their occurrence or components of their habitat. These species are identified in the TBDC* [Threatened Biodiversity Data Collection]. *A targeted survey or an expert report is required to confirm the presence of these species on the subject land. Alternatively, for a development, activity, clearing or biodiversity certification proposal only, the proponent may elect to assume the species is present.*

An assessment of habitat suitability for threatened species known or predicted to occur on the site has been conducted through the use of the BAM Credit Calculator and supported by Threatened species profile information provided in BioNet and the Threatened Biodiversity Data Collection (TBDC), and recorded habitat features onsite.

B2.3.1 Review of existing information

The existing vegetation mapping and the BioNet records of threatened species were used to inform which species and their likely habitats may be present on the site.

Previous surveys and searches for threatened flora species and habitat assessment have been conducted on the site by Ecoplanning (2020), as well as numerous surveys nearby by our group, Anne Clements & Associates, and faunal specialists (see experts' report in Appendices 7, 8).

B2.3.2 Habitat constraints assessment

For the surveys on the site:

- the sites were carefully walked over targeting threatened species and their habitats;
- opportunistic sightings of any fauna species seen or heard on or within the immediate surrounds were noted;
- identifying and recording the locations of notable fauna habitat such as important nesting, roosting or foraging microhabitats;
- assessing the connectivity and quality of the vegetation onsite and nearby;
- evaluating potential threatened species habitats such as tree-hollows, caves, rock outcrops, soaks, abundance of flowering plants, etc.

B3.0 Site context

B3.1 Assessment area

B3.1.1 Landscape features

Native vegetation cover and connectivity have been assessed in accordance with Sections 3.2 and 3.1.3 of the Biodiversity Assessment Method (BAM) (DPIE 2020).

The extent of native vegetation cover is calculated within the assessment area (which includes the 2.03 ha on the subject land and a 1500 m buffer surrounding the outside edge of the boundary of the subject land) using the Nearmap aerial photographs and the most recent vegetation mapping (DP&E 2022) (Figures 1a-2, 1a-3).

	Area	**Before the proposal**		**After the proposal (proposed clearing, not including proposed conservation works)**	
		Approximate area of canopy vegetation	**% canopy vegetation cover**	**Approximate area of canopy vegetation**	**% canopy vegetation cover**
On site	26.6 ha	2.37 ha (2.03 + 0.34)	9% (Class 0-10%)	1.85 ha (1.58 + 0.27)	7% (Class 0-10%)

	Area	Before the proposal		After the proposal (proposed clearing, not including proposed conservation works)	
		Approximate area of canopy vegetation	**% canopy vegetation cover**	**Approximate area of canopy vegetation**	**% canopy vegetation cover**
Within 1.5 km buffer	961 ha	197 ha	20.5% (Class >10-30%)	196.5 ha	20.4% (Class >10-30%)

The landscape features are summarised as follows:

Landscape features	For the proposal
Percent native vegetation cover in the assessment area	Before the proposal (Figure 1a-3) Onsite, cover class 0-10% Within 1.5 km buffer, cover class >10-30% After the proposal (Figure 7b) Onsite, Cover class 0-10% Within 1.5 km buffer, cover class >10-30%
IBRA bioregion and subregions	The site is in the Cumberland subregion of the Sydney Basin Bioregion (Figure 1c-1).
Rivers and streams	The site is crossed by Blacktown Creek, a south to north flowing mapped 1st Order watercourse (Figures 1b-1, 1b-2).
Wetlands within, adjacent to and downstream of the site	Prospect Dam is located approximately 1 km south of the site (Figures 1a-1, 1b-1).
Connectivity of different areas of habitat	Connectivity (less than 100 m separation) (Figure 1a-1): - north to south along Blacktown Creek (onsite, north of Great Western Highway in Timbertop Reserve, south of M4 Motorway); - north to south along drainage swale to vegetation south of the M4 Motorway; and - east to west in the narrow strip adjoining the M4 Motorway.
Karst, caves, crevices, cliffs, rocks and other geological features of significance and for vegetation clearing proposals, soil hazard features	Karst, caves, crevices, cliffs are not features of soil landscapes on Wianamata Shale geology. The soil hazards associated with Blacktown soil landscape are moderately reactive highly plastic subsoil, low soil fertility and poor soil drainage (Figures 3a, 3b).
Areas of outstanding biodiversity value occurring on the subject land and assessment area	There are no areas of outstanding Biodiversity Value occurring on the subject land.
Any additional landscape features identified in any SEARs for the proposal	Secretary's Environmental Assessment Requirements (SEARs) have been issued for the proposal. No additional landscape features have been identified in the SEARs.
NSW (Mitchell) landscape on which the subject land occurs	The soil is on Cumberland Plain Mitchell Landscape (Figure 1c-2).

Note: NSW (Mitchell) landscape mapping is primarily a 1:250 000 scale geomorphic map.

B3.2 Geology, soil landscaping

The soils onsite are clays derived from the Bringelly Shale Formation of the Wianamatta Group (Figures 3a, 3b).

These clay soils were widely used for agriculture to feed the early colony of Sydney (Benson and Howell 1990, Hazelton and Clements 2011).

The site on the soil landscape of the Penrith 1:100 000 map is mapped as Blacktown (Figure 3b), which is described in Bannerman and Hazelton (1990) as:

	Blacktown
Landscape	• Gently undulating rises on the Wianamatta Group shales; • Local relief to 30 m; • Slopes <5%; • Broad rounded crests and ridges with gently inclined slopes.
Soils	• Shallow to moderately deep (<100 cm) hardsetting mottled texture contrast soils, red and brown podzolic soils on crests grading to yellow podzolic soils on lower slopes and in drainage lines.
Limitations	• Moderately reactive highly plastic subsoil; • Low soil fertility; • poor soil drainage.

B3.2.1 Geotechnical findings

Pells Sullivan Meynink (PSM) carried out field investigation (PSM letter dated 29 June 2023) on:

- 17, 18, 21, 25 February 2022 with 12 boreholes drilled (BH01 to BH12);
- 23 May 2022 with an addition five boreholes drilled (BH13 to BH17).

The inferred geotechnical units encountered at the test locations were the following:

- shallow topsoil – clay to silty clay trace / with gravel;
- 0.1 to 0.3 m existing fill – clay to clay with gravel. Some debris from demolition eg tiles, bricks and glass bottles observed at localised areas;
- 0 to 1.8 m natural soil - – clay to clay trace gravel;
- 1.2 to 3.5 m Bedrock A – shale;
- 5.7 to 7.6 Bedrock B – shale.

The soil chemistry from the laboratory testing were the following:

- pH in the range of 5.0 to 8.2;
- electrical conductivity ranged from 43 to 685 microSiemens/cm;
- concentration of chlorides ranged from <50 to 830 mg/kg;
- …

At 17 bore holes:

- salinity varied from non-saline to moderately saline;
- sodicity ranged from non-sodic to highly sodic. Sodicity provides a measure of the likely dispersion on wetting and to shrink/swell properties of a soil.

B3.2.2 Contamination report

Contamination on the 26.6 ha site was investigated by JBS&G Australia Pty Ltd (2023a) and a Remediation Action Plan prepared by JBS&G Australia Pty Ltd (2023b) in relation to future commercial/industrial land use, including the identification of site management/remediation requirements to support development of the site.

It was found that there was stockpiled material onsite including:

> *clays and sands with building rubble including PVC pipe, plastic sheeting, bricks, tile fragments, concrete fragments, plasterboard, timber, slagand ash, and fragments of ACM.*
>
> *Fill material was predominately in the western and eastern portion of the site, in the vicinity of former buildings …*

B3.2.3 Observations in the swale to the west

Stockpiles were observed onsite. During the biodiversity survey, building rubble was recorded in the drainage swale to the west, including:

- Plot 8 with ground-hollows and low mounds, some containing rubble that appeared to originate from demolition of a brick house; and
- Plot 9 with rubbish dumped throughout this area.

B3.3 Climate

The site is located in the rainshadow area to the west of Sydney's Central Business District within 700 to 800 mm rainfall isohytes (Division of National Mapping 1986).

Climate affects the survival of existing vegetation and proposed landscaping on the site. Since the 1990's, the climatic pattern is extended periods of low rainfall separated by periods of high rainfall events. This pattern has been observed at nearby meteorological stations, including Prospect Reservoir (station 67019, opened 1887, accessed 29 June 2023).

The extended periods of low rainfall are likely to cause drought-stress in future landscape plantings, and in periods of high rainfall, saturated soils and increased erosion risks.

B3.4 Flooding

The pre-development risk of 1:100 year flooding is shown on Figure 3c. There appears to be no existing flooding risk to the proposed development areas on the site.

B4.0 Native vegetation, threatened ecological communities and vegetation integrity

B4.1 Changes to land use and native vegetation extent

With urban expansion, the agricultural activities on the subject land have decreased and now have ceased. The land use changes have included (see historical aerial photographs in Figures 1930-1956 to 2002-2012), by:

- 1956, farming activities with dam offsite to the north of the site;
- 1965, the high voltage pylons installed in the south of the site;

- 1970, the Great Western Highway built along the northern boundary, agriculture decreasing east of Blacktown Creek onsite, but intensifying west of the creek;
- 1986, market gardens having ceased onsite; and
- 1991, the Western Motorway (M4) being built to the south of the site;
- 2012, Raging Waters (Wet n Wild) construction commenced to the south of the site and all remaining farm houses onsite have been demolished.

The landform onsite has been modified as a result of the past land uses (see landform on Figure 1d-1, 1d-2), including:

- in the east, two rectangular levelled sloping areas approximately 200 m long and approximately 50 m wide;
- a soil mound (probably from an excavated agricultural dam) potentially intruding into Blacktown Creek;
- an approximately 20 m x 20 m levelled area close to the drainage line in the southwest, with a grassed soil mound adjoining it upslope; and
- irregular mounds associated with the telephone tower on the former agricultural land.

B4.2 Biodiversity findings onsite

B4.2.1 Arborist's survey

Canopy Consulting (2023) assessed a total of 565 trees or groups of trees onsite (Note: trees under the Blacktown DCP are defined as at least 3 m in height, and/or a trunk diameter of at least 200 mm measured 1.0 m above ground level).

Of the 28 species identified by the arborist, there were only 4 local native species (*Acacia* sp., *Eucalyptus moluccana, Eucalyptus tereticornis, Melaleuca linariifolia*). The remaining 24 species recorded were either exotic (12 species) or non-local native (12 species) (planted and/or naturalised onsite).

The most frequently recorded trees were the local native canopy trees *Eucalyptus moluccana* (178 trees) and *E. tereticornis* (203 trees), followed by non-local native tree *Grevillea robusta* (39 trees) (distribution on site shown on Figure 6d-1, 6d-2).

From height class data, 76% (290) of the 381 (178+203) local native canopy trees are more than 10 m tall. The dense weedy understorey appears to have suppressed natural regeneration from eucalypt seed-showers, with less than 5 m height and 24% of these native trees in the 5-10 m height range with only 1.3% (5 trees) in the <5 m height range.

For *Grevillea robusta*, most (79%, 31 of 39 trees) appeared to have self-seeded from a small number of planted trees.

Species recorded, number of trees and height classes

Exotic/ non-local	Species	Number of trees recorded	Height class			
			<5 m	5-9 m	10-19 m	20-29 m
	Acacia sp.	3 (incl a group of 10)	2 (incl group)	1		
#	*Araucaria columnaris*	4		3	1	
#	*Archontophoenix cunninghamiana*	2			2	
#	*Callistemon citrinus*	1	1			

Exotic/ non-local	Species	Number of trees recorded	Height class			
			<5 m	5-9 m	10-19 m	20-29 m
#	*Callistemon viminalis*	1		1		
*	*Cotoneaster* sp.	1	1			
*	*Cupressus sempervirens*	2		2		
	Dead tree	51	1	11	30	9
*	*Erythrina crista-galli*	12		6	6	
*	*Erythrina* X *sykesii*	5	1	4		
#	*Eucalyptus camaldulensis* var. *obtusa*	2			1	1
#	*Eucalyptus microcorys*	1			1	
	Eucalyptus moluccana	178	4	43	79	52
#	*Eucalyptus robusta*	1			1	
	Eucalyptus tereticornis	203	1	43	124	35
#	*Ficus macrophylla*	1		1		
#	*Grevillea robusta*	39	7	24	8	
*	*Jacaranda mimosifolia*	2	1	1		
*	*Ligustrum lucidum*	16	4	12		
*	*Liquidambar styraciflua*	2		2		
#	*Livistona australis*	2		2		
#	*Lophostemon confertus*	2		2		
	Melaleuca linariifolia	3		2	1	
#	*Melia azedarach*	3	1	2		
*	*Olea europaea*	18	5	13		
*	*Pinus radiata*	2		1	1	
*	*Pistacia chinensis*	3	1	2		
*	*Prunus* sp.	1	1			
*	*Syagrus romanzoffiana*	2		2		
	Unknown species	2	2			
	Total	**565**				

Note: * = exotic, # = non-local native

Of the 381 local native canopy trees (178 *Eucalyptus moluccana* and 203 *E. tereticornis*) heath rating ranged from Dead, Very poor, Poor, Fair to Good. The percentage of trees in Good health was higher for *E. moluccana* (70%) than *E. tereticornis* (53%).

Overall, only 61% of the local native canopy species (231 of the 381 trees) were in Good health.

Native canopy tree species	Height	Number of trees	Dead	Very poor	Poor	Fair	Good	% good of total
Eucalyptus moluccana	<5 m	4				1	3	75%
	5-9	43				12	31	72%
	10-19	79				24	55	70%
	20-29	52			2	15	35	67%
	Total	**178**	**0**	**0**	**2**	**52**	**124**	**70%**
Eucalyptus tereticornis	<5 m	1				1		0%
	5-9	43		1	1	24	17	40%
	10-19	124	1	1	6	48	68	55%

	20-29	35	1	1	0	11	22	63%
	Total	**203**	**2**	**3**	**7**	**84**	**107**	**53%**
Overall native canopy trees	**Total**	**381**	**2**	**3**	**9**	**136**	**231**	**61%**

B4.2.2 Biodiversity Survey

From both the Ecoplanning (EP) (2020) and Anne Clements & Associates (ACA) surveys, the species composition was as follows:

- On the former farming land (sampled in EP Plots 3 to 5, ACA Plots 1, 3) predominantly exotic species, with the percentage of native species recorded being low;
- Along Blacktown Creek (sampled in EP Plots 6, ACA Plot 6), 35% and 50% respectively of the species recorded being native;
- associated with the swale in the west (sampled in ACA Plots 4, 5, 8, 9), between 29 to 43% of the total species recorded being native;
- in the northwestern corner (sampled in ACA Plot 7), 64% of the total species recorded being native.

Plot	**Located (mapped by DPE 2022, Figure 4b)**	**Number of species recorded**				
		Total	**Native**	**Exotic**	**Non-local native**	**% native to total**
Ecoplanning (2020)						
BAM Plots						
E-1	In the south in area mapped PCT 3320	38	18	20	0	47
E-2	In the south close to mapped PCT 3320	34	16	18	0	47
E-3	On former agricultural land	19	1	18	0	5
E-4	On former agricultural land	29	6	23	0	20
E-5	On former agricultural land	23	4	19	0	17
E-6	In the north along Blacktown Creek	20	7	13	0	35
E-7	Along the former fence line	51	9	39	3	18
Total		**100**	**36**	**61**	**3**	**36**
Anne Clements & Associates (ACA)						
BAM Plots						
ACA-1	Former agricultural land	25	7	18	0	28
ACA-2	NE corner mapped as PCT 3320	51	32	19	0	63
ACA-3	Former agricultural land	13	2	11	0	15
ACA-4	NW and east of swale mapped as PCT 3320	40	17	22	1	43
ACA-5	Swale mapped as PCT 3320	17	5	12	0	29
ACA-6	Along Blacktown Creek	4	2	2	0	50
ACA-7	NW corner mapped as PCT 3320	47	30	16	1	64

Plot	Located (mapped by DPE 2022, Figure 4b)	Number of species recorded				
		Total	Native	Exotic	Non-local native	% native to total
ACA-8	Swale mapped as PCT 3320	27	8	18	1	36
ACA-9	East of the swale mapped as PCT 3320	44	16	27	1	36
Total onsite	**Ecoplanning (2020) and ACA**	**196**	**90**	**100**	**6**	**46**
Patches						
ACA-A	Near old farm house	41	3	35	3	7
ACA-B	Near old farm house	10	4	6	0	40
ACA-C	Upslope of swale in west	9	8	1	0	89
ACA-D	Former agricultural land	21	8	12	1	38
ACA-E	Former agricultural land	21	5	16	0	24
ACA-F	Former agricultural land	2	0	2	0	0
ACA-G	Former agricultural land	11	1	10	0	9
ACA-H	Former agricultural land	12	4	8	0	33
ACA-I	Former agricultural land	12	2	10	0	17
ACA-J	NW mapped as PCT 3320	5	1	3	1	20
ACA-K	In south close to area mapped as PCT 3320	3	2	0	1	67
ACA-L	Former agricultural land	16	2	14	0	13
ACA-M	Former agricultural land with plantings including *Grevillea robusta* and *Melia azedarach*	13	1	10	2	8
Total for ACA patches		**147**	**68**	**74**	**5**	**46**

A targeted survey was undertaken for:

- Green and Golden Bell Frog and an expert opinion for the bat Southern Myotis by Grant Webster and Jayden Walsh (details in Appendix 7); and
- Cumberland Snail by Dr Stephanie Clark (details in Appendix 8).

None were recorded.

B4.2.3 Observations

Vegetation and fauna habitat on the site

Vegetation in all parts of the site has been greatly modified and disturbed, by historic agricultural use, by former house sites and their surrounding gardens, and by spreading of excavation waste (which in some parts forms large mounds), with:

- the greater part of the site is weedy paddocks with occasional scattered groups of trees;
- At the Flushcombe Road end, there were several lots occupied by businesses and residences;
- the drainage lines onsite, Blacktown Creek in the east and the swale in the west, are dominated by exotic weeds, although with emergent eucalypts surviving along the swale in the west;

- the riparian zone of Blacktown Creek is treeless and swampy and the creek water concealed beneath a broad swathe of wetland plants, both exotic and native-cosmopolitan, and with adjoining belts of blackberries; and
- the source of the water in the drainage lines along the swale in the west is from stormwater pond(s) south of the M4 Motorway and in Blacktown Creek from treated water from the Wet n Wild and untreated water from stormwater ponds south of the M4 Motorway.

BAM Plot 1

This plot sampled the degraded pasture on eroding clay soil, on the level ridgetop midway between the two creeklines. The plot was oriented north-south with its floristic quadrat close to the southern verge of the eastward continuation of Augusta Street. Trees and shrubs were absent from the whole plot, with exotic grasses accounting for close to 100 per cent of the vegetation cover. Most abundant was *Paspalum dilatatum*, followed (in descending order) by *Briza subaristata, Lolium perenne, Avena barbata, Cenchrus clandestinus* and *Eragrostis curvula.* Of broad-leaved weeds there was a moderate diversity but small cover; they included *Cirsium vulgare, Hypericum perforatum, Hypochaeris radicata, Plantago lanceolata, Sonchus oleracea* and *Vicia tetrasperma.*

Only 6 species of native plants were recorded, nearly all contributing very small cover. They included the grasses *Aristida ramosa, Dichelachne micrantha* and *Themeda triandra,* the latter mainly in a patch beside Augusta Street; the graminoids *Dianella longifolia* and *Lomandra filiformis;* and the small herb *Wahlenbergia gracilis.*

BAM Plot 2

This plot sampled a relatively intact patch of woodland in the far north-east, of which only a minor part was within the site's boundary as designated, but which is arguably the least disturbed remnant of native vegetation available in the vicinity. Its floristic composition can thus be assumed to reflect the pre-clearing composition on topographically similar parts of the site. The patch lies in a shallow gully falling to the north and containing a small ephemeral creek. The tree canopy in and around the plot's floristic quadrat was dominated by *Eucalyptus tereticornis* and E. moluccana, neither with trees more than about 15 m tall or 0.3 m diameter, indicative of regrowth of the woodland within the last 50 years or as little as 25 years. The understorey was dominated by the shrubs, mainly *Acacia fimbriata* (up to 7 m tall) with lesser numbers of *A. implexa* and *A. falcata*; also *Bursaria spinosa*, though sparse. Smaller native shrubs were absent, but native grasses and graminoids were surprisingly diverse: species recorded were (grasses) *Aristida ramosa, A. vagans, Dichelachne micrantha, Digitaria diffusa, D. parviflora, Microlaena stipoides* (c. 5% cover), *Paspalidium distans, Rytidosperma racemosum, Themeda triandra* and (graminoids) *Arthropodium milleflorum, Caesia parviflora, Cyperus gracilis, Dianella longifolia, Fimbristylis dichotoma, Lomandra filiformis, Tricoryne elatior.* Native dicots in the groundlayer included *Dichondra repens* (extensive mats in places), *Einadia hastata, Glycine clandestina, G. tabacina, Grona varians, Oxalis perennans, Phyllanthus virgatus, Senecio hispidulus and Wahlenbergia gracilis.*

Exotics were well represented though hardly to the exclusion of natives. The only one of tree size was *Olea europaea* subsp. *cuspidata,* with one 4 metres high, the rest juveniles. *Lantana camara* was widely scattered through the quadrat but lacking vigour. The main weedy grass was *Eragrostis curvula,* forming quite dense patches in some parts. In openings among the trees *Paspalum dilatatum w*as common, as well as *Paspalum notatum*, a far more recent invader in the Sydney region. *Asparagus asparagoides* was present in many parts, with lesser occurrences of *A. officinalis.*

Sida rhombifolia was abundant in some of the openings. Some of the more common annual and biennial weeds were recorded, such as *Bidens* spp. and *Sonchus oleraceus.*

BAM Plot 3

This plot sampled the area of pasture land with scattered groups of regenerating trees on the low ridge between Blacktown Creek and the site's north-east corner. The ridge crest there falls gently to the north. At the time of this survey there had been good rains earlier in the month and the grass was tall and thick. The grass cover consisted entirely of exotic species, dominated by *Cenchrus clandestinus* with *Paspalum dilatatum* and *Chloris gayana* as minor components. Broadleaved exotics were scattered sparsely through the grass, including *Sida rhombifolia, Foeniculum vulgare, Bidens pilosa* and *Cirsium vulgare.*

In the tree and shrub layers again only exotics were recorded in the floristic quadrat, except for two trees of *Eucalyptus moluccana* forming a small group ; one of the eucalypts was a mature tree approximately 25 m tall and 0.5 m DBH, with plants of the native mistletoe *Amyema pendula* on its branches. Sheltered by the eucalypts were the exotics *Olea europaea* subsp. *cuspidata,Lycium ferocissimum, Lantana camara* and *Araujia sericifera.*

An additional native shrub observed in the 'tail' of the plot was *Acacia falcata,* as several plants approximately 2 m tall in the tall grass.

BAM Plot 4

This plot sampled a patch of moderately dense degraded woodland on the northern boundary about 40 m east of unnamed western creek. It was positioned on a gentle slope to the west, adjoining the batter of the Great Western Highway. It was at the edge of the pasture land that extends westward onto the low ridgeline and appeared to consist of regenerating trees (both native and exotic), with some grassy openings among the trees.

The native canopy consisted of *Eucalyptus tereticornis* up to about 25 m tall and a smaller number of *E. moluccana*, to 20 m. Part of the 20 m x 20 m floristic quadrat had a dense subcanopy of the exotics *Olea europaea* subsp. *cuspidata, Ligustrum sinense* and *L. sinense*, blocking light to the soil. In the more open part there were several mature shrubs of *Bursaria spinosa* up to 4 m tall.

In the groundlayer there were significant occurrences of native species: the grasses *Aristida ramosa, Bothriochloa macra, Cynodon dactylon, Microlaena stipoides, Sporobolus creber* – all with small cover except *Microlaena* which was moderately profuse in parts – graminoids *Carex inversa, Cyperus gracilis, Lomandra filiformis*; and forbs *Asperula conferta, Dichondra repens, Geranium solanderi, Glycine clandestina, G. tabacina, Wahlenbergia gracilis.* Of the forbs *Dichondra repens* and *Glycine tabacina* were the only ones contributing significant cover, and only in the less shaded parts.

Exotics dominated the cover in both subcanopy (see above) and groundlayer. In the openings the grasses *Chloris gayana, Paspalum dilatatum, P. notatum, Sporobolus africanus;* forbs *Bidens pilosa, Conyza sumatrensis, Gomphocarpus fruticosus, Plantago lanceolata, Senecio madagascariensis, Sida rhombifolia, Tradescantia fluminensis, Verbena bonariensis.* Exotic climbers and scramblers were moderately abundant, including *Anredera cordifolia, Araujia sericifera*, *Asparagus aethiopicus, A. asparagoides* and *Lantana camara.* The shrub *Lycium ferocissimum* was also present in parts.

BAM Plot 5

This plot sampled the riparian zone of the sluggish drainage that flows from south to north across the west of the site. The creek was heavily shaded by trees, with tall eucalypts emergent above a dense subcanopy of exotics. *Eucalyptus moluccana* predominated, up to 25 m tall, with *E. tereticornis* uncommon and smaller (at least within the floristic quadrat). The dominant exotic tree in the subcanopy was *Erythrina crista-galli*, at up to 13 m tall; additional exotic small trees were *Ligustrum lucidum, L. sinense* and *Olea europaea* subsp. *cuspidata* – all of them abundant. There was also a native palm *Livistona australis*, though only as a few young plants (doubtfully a local native in western Sydney and probably spread from cultivation). The native shrub *Bursaria spinosa* was present but rare in the plot, with a few weak specimens; it is intolerant of deep shade.

The only native groundlayer plant was the grass *Microlaena stipoides*, though sparse. Apart from the trees already mentioned, exotic climbers and scrambling shrubs were common, *Lantana camara* the most abundant but *Anredera cordifolia* and *Cardiospermum grandiflorum* both quite frequent. The shade tolerant exotic grass *Ehrharta erecta* and the exotic forb *Tradescantia fluminensis* were among the very few groundlayer plants recorded.

BAM Plot 6

This plot sampled the swampy bed and banks of Blacktown Creek in the treeless central depression. If lobes of the adjacent better drained paddock soil were excluded (not surveyed) the vegetation structure and floristics were very simple. Dominating most of the centre was the tall native aquatic *Typha domingensis*, with cover up to 90%. Towards the margins there were narrower belts of the aquatic sedge *Bolboschoenus caldwellii.* The exotic rush *Juncus acutus* was also prominent, forming rows of large spiny tussocks along the margins. The common blackberry *Rubus anglocandicans* grew in large patches along banks of the swamp, with some patches extending well into the swamp.

BAM Plot 7

This plot sampled a narrow strip of remnant woodland on the verge of Flushcombe Road outside the western fenceline. The road runs in a shallow cutting, at most about 1.5 m deep, with an earth batter rising to a level top that, judging from the soil profile, was part of the original land surface. The batter exposed decomposed shale and mottled subsoil characteristic of the Wianamatta Shale geology (see photograph in Appendix 3). The narrowness of the verge necessitated the use of a 100 m x 10 m plot configuration, with the 40 m x 10 m floristic quadrat at its north end. Inside the security fence was industrial premises (Red Lea Chickens vehicle workshop, not accessible at time of survey) with a large shed around which were some scattered remnant trees in slashed long grass. On the road verge there was denser tree cover of approximately 50% and an apparently unmanaged understorey with many natives persisting plus some taller woody weeds and exotic grasses, these dense in parts.

The only eucalypt recorded was *Eucalyptus moluccana* with cover of approximately 50%. The trees were up to about 27 m tall and 0.4 m DBH, in a still vigorous stage of growth; age was estimated at 30 to 40 years. Some trees supported the native mistletoe *Amyema* miquelii. The native shrub *Bursaria spinosa* was present as a single plant 2 m tall; the only other native shrub was *Dillwynia sieberi* with several young plants recorded. Of exotic shrubs only a few sparse plants of *Lantana camara* were present. Native groundlayer plants were quite diverse with 26 species recorded, incuding: grasses *Bothriochloa macra, Chloris ventricosa, Cynodon dactylon, Entolasia marginata, Eriochloa pseudoacrotricha, Microlaena stipoides,*

Rytidosperma racemosa, Paspalidium distans, Paspalum orbiculare, Rytidosperma racemosum, Sporobolus creber; the graminoid (sedge) *Cyperus gracilis;* forbs/subshrubs *Brunoniella australis, Calotis lappulacea, Dichondra repens, Einadia hastata, E. nutans, E. polygonoides, E. trigonos, Eremophila debilis, Euphorbia drummondii, Hardenbergia violacea, Oxalis perennans, Phyllanthus virgatus* and *Vittadinia cuneata.* Some of these groundlayer plants were found only on the denuded subsoil of the road cutting.

The exotic grasses *Eragrostis curvula, Paspalum dilatatum, Chloris gayana,* and *Ehrharta erecta* dominated the less shaded parts of the plot above the cutting: in particular *Eragrostis curvula* made up to 70% cover in some patches. The most abundant broad-leaved weeds were *Plantago lanceolata* and *Sida rhombifolia. Asparagus asparagoides* was widely scattered through the plot.

BAM Plot 8

This plot sampled a patch of vegetation, appearing densely wooded on aerial imagery, at the foot of the slope on the east side of the drainage swale with water flowing north from under Augusta Street to exit the site in a culvert beneath the Great Western Highway. The plot commenced within the angle of two old chainlink fences, probably on the west and south boundaries of Lot 219 DP457024, and extended north paralleling the western fence. The 20 m x 20 m floristic quadrat extended about 5 m across the fence into the next lot on the west.

The ground in this plot was greatly disturbed, with ground-hollows and low mounds, some containing rubble that appeared to originate from demolition of a brick house.

The plot was dominated by quite tall eucalypts, with several mature *Eucalyptus moluccana* up about 25 m tall and up to 0.8 m trunk diameter. Most trees of *E. teretifolia* appeared to be much younger and concentrated in the lower flat area on both sides of the fenceline. Beneath the canopy trees there was very little native understorey, with no native subcanopy trees or shrubs. Of native groundlayer plants only 5 species were recorded with the only ones with appreciable cover being the grass *Oplismenus aemulus* and the forb *Dichondra repens.*

Exotic plants dominated the understorey. The subcanopy layer was dominated by *Olea europaea* subsp. *cuspidata* and the privets *Ligustrum lucidum* and *L. sinense*, all 3–4 m tall. Conspicuous among these were several plants of the tree prickly pear cactus *Opuntia monacantha* up to 3 m tall. *Lantana* camara and *Senna pendula* were also quite abundant and there was one clump of the tall invasive grass *Cortaderia selloana.* The climber *Anredera cordifolia* was abundant along the fenceline and on some smaller trees. In the groundlayer the weed grasses *Cenchrus clandestinus, Chloris gayana* and *Ehrharta erecta* contributed most of the cover. There were a few common dicot weeds, the most abundant being *Bidens pilosa.*

BAM Plot 9

This plot sampled the degraded vegetation between Plot 4 and Plot 8 to the east of the swale. The canopy was disturbed with large grassy opening with only scattered understorey species present. Rubbish has been dumped throughout this area.

The native canopy consisted of *Eucalyptus tereticornis* and *E. moluccana* up to about 18 m tall with some eucalypt regeneration recorded. The understorey included sparse covers by the native species *Pittosporum undulatum* and *Bursaria spinosa*, and high covers of exotic species *Ligustrum sinense, Lantana camara, Ligustrum lucidum* and *Olea europaea* subsp. *cuspidata.*

Of the 12 native groundcover species recorded, the grasses, *Cynodon dactylon* dominating with up to 40% cover and low cover by *Microlaena stipoides* and *Rytidosperma racemosum,* the graminoids *Carex inversa, Juncus usitatus* and *Lomandra filiformis* subsp*. filiformis,* and forbs/subshrub *Dichondra repens, Einadia nutans* subsp*. linifolia, Euchiton sphaericus, Geranium solanderi, Plectranthus parviflorus* and *Glycine tabacina.*

The groundcover was dominated by exotic grasses, especially *Ehrharta erecta* with the scattered cover of *Paspalum dilatatum, Sporobolus africanus, Setaria parviflora* and *Eragrostis curvula.* The exotic shrub C*otoneaster glaucophyllus* and the exotic forbs including *Aster subulatus, Cirsium vulgare, Conyza sumatrensis, Hypochaeris radicata, Modiola caroliniana, Plantago lanceolata, Senecio pterophorus, Sida rhombifolia, Solanum americanum, Verbena bonariensis* and *Vicia tetrasperma* were also recorded. The High threat weeds recorded were *Anredera cordifolia, Asparagus aethiopicus, Asparagus asparagoides, Bidens pilosa, Senecio madagascariensis* and *Senna pendula* var. *glabrata.*

B4.3 Most likely Plant Community Types (PCTs) on the site

The online *Plot to PCT Assignment Tool* was used to determine the most likely PCTs for the vegetation recorded in Plots 1 to 9.

It is stated on the Department of Planning and Environment website (accessed 3 May 2023) that:

> *The tool provides a standardised repeatable method for identifying quantitative PCTs using the floristic survey methods required under the NSW Biodiversity Assessment Method (BAM).*
>
> ...
>
> *The Tool uses the species and cover-abundance score data in the uploaded data matrix to compare each site with the floristic assemblages of each of the 1,067 quantitative Approved PCTs of the coast and tablelands bioregions. These quantitative PCTs are each defined by a specific group of existing classified reference sites (also known as PCT member plots). The Tool applies an algorithm that generates a measure of the floristic difference between each uploaded site and the central value or 'centroid' of the reference sites that define each PCT. This measure is called the 'distance to centroid', a value that ranges between 0 and 1 and is based on the Bray-Curtis dissimilarity index.*
>
> *An uploaded site with floristic data very similar to a PCT's centroid definition will have a low distance to centroid value for that PCT, indicating a strong match. Weaker matching results have higher distance to centroid values (closer to 1), or higher dissimilarity. The Tool identifies and displays the 10 PCTs with the lowest distance values for each uploaded site, as these have the strongest match to the species assemblage of the site(s).*
>
> *Distance to centroid values of 0.695 or less … indicate the site meets the floristic match threshold for that PCT. This threshold value is an important metric for deciding on the best-fitting PCT.*

The Plot to PCT Assignment Tool User Guide provides explanation for a weak floristic PCT match (high distance to centroid). This can indicate high levels of disturbance, high weed occurrence, or low number and cover by native species (Section 7.2 *Understanding centroid match results* of the Plot to PCT Assignment Tool User Guide), namely :

> *One common driver of high distance to centroid values is sites that have lower native species richness than is typical for the PCT. Common examples are disturbed sites where some elements of the expected floristic assemblage are no longer present. ... Sites where only a partial floristic inventory has been completed can also result in weaker PCT matches*

From applying the online tool to the data recorded in the ACA Plots 1 to 9, the best four PCT floristic matches are the following (centroid values of 0.695 or less are shaded green in the table below). [It should be noted that there was a high percentage of exotic species recorded in the plots and for the Plot to PCT tool only native species are entered], namely:

Plot	PCT Match 1	Distance to centroid1	PCT Match 2	Distance to centroid2	PCT Match 3	Distance to centroid3	PCT Match 4	Distance to centroid4	PCT Match5	Distance to centroid5
1	3877	0.822	3320	0.842	3350	0.848	3406	0.849	3372	0.855
2	3320	0.605	3319	0.648	3329	0.698	3328	0.713	4025	0.714
3	4121	0.884	3512	0.920	3314	0.939	3489	0.939	3319	0.942
4	3336	0.631	3319	0.637	3320	0.684	3396	0.697	4023	0.706
5	4125	0.854	4025	0.863	3319	0.873	4142	0.877	4068	0.878
6	4065	0.867	4094	0.922	3966	0.947	3975	0.955	3976	0.956
7	3319	0.680	3485	0.688	3431	0.695	4023	0.705	3397	0.712
8	3319	0.836	4023	0.842	3264	0.861	3318	0.862	3316	0.863
9	4088	0.741	4023	0.764	3319	0.778	4089	0.783	3320	0.797

Only three plots (Plots 2, 4, 7) have the floristic threshold met (centroid value of 0.695 or less) for the following 5 PCTs (PCT 3319, 3320, 3336, 3431, 3485):

Plot	PCTs where floristic threshold was met (from strongest to weakest based on the distance to centroid value)
1	none
2	3320, 3319
3	none
4	3336, 3319
5	none
6	none
7	3319, 3485, 3431
8	none
9	none

Of these five PCTs, only two PCTs occur in the Cumberland IBRA Subregion of the Sydney Basin Bioregion, namely, PCT 3319 and PCT 3320:

PCT	PCT name	IBRA Subregion
3319	Cumberland Shale Hills Woodland	**Cumberland**, Burragorang
3320	Cumberland Shale Plains Woodland	**Cumberland**, Wollemi, Yengo

PCT	PCT name	IBRA Subregion
3336	Hunter Range Basalt Peaks Red Gum-Velvet Wattle Forest	Yengo
3431	Central Hunter Ironbark Grassy Woodland	Liverpool Range; Ellerston; Upper Hunter; Hunter; Kerrabee
3485	Central Hunter Slaty Gum Grassy Forest	Hunter;Kerrabee

The descriptions of the two best matched PCTs 3319 and PCT 3320 are as follows :

Description from the online PCT profile (Vegetation Classification public application)
PCT 3319 Cumberland Shale Hills Woodland A tall to very tall sclerophyll woodland to open forest with a mid-stratum of soft-leaved shrubs and small trees with a grassy ground cover that is extensive on rises and upper slopes of hills south from Cecil Hills, in the south-western part of the Cumberland Plain to the west of Sydney. It is most extensive in Campbelltown, Camden and Wollondilly local government areas. The canopy commonly includes Eucalyptus moluccana and Eucalyptus tereticornis, with a sparse shrub to small tree layer which very frequently includes Bursaria spinosa and at least one species of Acacia, of which Acacia implexa is most frequent. The presence of Acacia implexa helps distinguish this PCT from PCT 3320, which has a similar assemblage and structure. The mid-dense ground layer typically includes forbs, grasses and twiners. Dichondra repens is almost always present and Microlaena stipoides, Desmodium varians, Brunoniella australis and Aristida ramosa are very frequent. This PCT typically occurs in a warm, moist climate between 90-300 metres asl. It has been heavily cleared and now occurs in small remnants with varying levels of disturbance within a rural landscape. The canopy in these remnants often comprises immature cohorts of trees that have regenerated after thinning or clearing. The distribution of this PCT overlaps with PCT 3320 between Cecil Hills and the Nepean River, in which area of overlap PCT 3319 typically occurs on higher elevation hills and ridges. This PCT grades into PCT 3318 on lower protected slopes in the more dissected hills around Cecil Hills and the Razorback Range, and into PCT 3321 near the interface with the sandstone plateaus on the edge of the Cumberland Plain. PCT 3318 includes shrubs, ferns and vines typical of sheltered habitats that are rare in this PCT. Ironbark eucalypts are very frequent and Eucalyptus punctata is common in the canopy of PCT 3321, and Eucalyptus moluccana and Eucalyptus tereticornis are both rare. **TEC list** Listed BC Act: Critically Endangered Ecological Community: Cumberland Plain Woodland in the Sydney Basin Bioregion (Part); Listed EPBC Act: Critically Endangered: Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest (Part).
PCT 3320 Cumberland Shale Plains Woodland A tall sclerophyll open forest to woodland with a sparse mid-stratum of soft-leaved shrubs and small trees with a grassy ground cover on the undulating shale plains of western Sydney. The canopy very frequently includes Eucalyptus tereticornis and Eucalyptus moluccana, with ironbarks (Eucalyptus crebra and Eucalyptus fibrosa) occasionally present however prominent in localised areas. The sparse shrub to small tree layer very frequently includes Bursaria spinosa and one or more species of Acacia, of which Acacia parramattensis, Acacia decurrens and Acacia falcata are the most frequent and abundant. Presence of these Acacia species helps to distinguish this PCT from PCT 3319 which typically includes Acacia implexa. The mid-dense ground layer typically includes grasses, forbs, twiners and a hardy fern. Microlaena stipoides is almost always present and Themeda triandra, Dichondra repens, Brunoniella australis, Cheilanthes sieberi subsp. sieberi, Desmodium varians, Aristida vagans and Glycine tabacina are very frequent. This is the most widespread PCT on the Cumberland Plain, occupying much of the plain between Bankstown and the Hawkesbury and Nepean rivers. It typically occurs in a warm, moist

Description from the online PCT profile (Vegetation Classification public application)
climate below 120 metres asl however can occur up to 200 metres asl on the undulating terrain between Douglas Park and Campbelltown to the east of the Nepean River. While widespread, this PCT primarily occurs in small, often disturbed patches within a rural or urban matrix. In the hilly country to the west of the Nepean River, this PCT is replaced by PCT 3319. On thinner shales above sandstone around the periphery of the Cumberland Plain, it grades into PCT 3321. Ironbarks are very frequent and Eucalyptus punctata is common in the canopy of PCT 3321, and Eucalyptus moluccana and Eucalyptus tereticornis are both rare. **TEC list** Listed BC Act: Endangered Ecological Community: Shale Gravel Transition Forest in the Sydney Basin Bioregion (Part); Listed BC Act: Critically Endangered Ecological Community: Cumberland Plain Woodland in the Sydney Basin Bioregion (Part); Listed EPBC Act: Critically Endangered: Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest (Part).

From the descriptions, PCT 3319 and PCT 3320 are similar. The data in Plots 2, 4 and 7 meet the floristic threshold for PCT 3319, but only Plot 2 meets the floristic theshold for PCT 3320. Hence it is assumed that the best match for the native vegetation on the site is *PCT 3319 Cumberland Shale Hills Woodland*.

B4.4 Threatened ecological communities (TECs)

There are listed TECs associated with the best match PCT 3319 namely:

PCT	Associated TEC
PCT 3319 - Cumberland Shale Hills Woodland	*Listed BC Act: Critically Endangered Ecological Community: Cumberland Plain Woodland in the Sydney Basin Bioregion (Part);* *Listed EPBC Act: Critically Endangered: Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest (Part).*

It was found from a comparison of the recorded data in Plots 4, 5, 7, 8, 9 with the Final Determination and Conservation Advice (Appendix 9), that:

Cumberland Plain Woodland in the Sydney Basin Bioregion under the *BC Act:*

- there were limited areas of semi-intact vegetation adjoining the site meeting the criteria for *Cumberland Plain Woodland in the Sydney Basin Bioregion,* being mainly offsite to the north-east adjoining Prospect Highway (sampled in Plot 2) and on the road verge of Flushcombe Road to the north-west (sampled in Plot 7).
- at least part of the approximately 2 ha of vegetation with regrowth native canopy trees in the western drainage swale meets the criteria for highly degraded *Cumberland Plain Woodland* (sampled in Plots 4, 5, 8, 9);
- part of the vegetation in the western drainage swale is growing on dumped building material, especially in Plots 8, 9;
- there was dense woody weed occurrence widespread in the western drainage swale; and
- following more than 150 years of intensive agriculture, none of the paddock meets the criteria for *Cumberland Plain Woodland*.

Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest under the *EPBC Act:*

- the condition thresholds were not met for vegetation onsite, nor for the road reserve (sampled in Plot 7); and
- the patch sampled in Plot 2, mainly offsite to the northeast adjoining the Prospect Highway, appears to satisfy the thresholds.

B4.5 Vegetation Zones

Two Vegetation Zones for PCT 3319 are mapped onsite. The remainder of the site is mapped as predominantly exotic or hardstand associated with the former agricultural use or more recently industrial use (Figure 7a).

Vegetation Zones	Area on site	Sampled in ACA Plots
PCT 3319 - Degraded	2.03	Plots 4, 5, 8, 9
PCT 3319 – Less degraded	0.34	Plots 2 (mainly offsite), Plot 7
Predominantly exotic or hardstand	24.27 ha	Plots 1, 3, 6
Total area	26.642 ha	

B4.6 Vegetation integrity (vegetation condition)

B4.6.1 Vegetation integrity of individual survey plots

Using the data recorded in the ACA Plots 1 to 9, the Vegetation Integrity Scores (VIS) for each of the plots are as follows:

Assumed PCT	Sampled in	Vegetation mapped as	Composition condition score	Structure condition score	Function condition score	Current vegetation integrity score
PCT 3319	Plot 1	exotic grassland	12.7	0	14.9	1.6
	Plot 2*	less degraded	80.4	40.8	45	52.9
	Plot 3	exotic grassland	2.3	15.4	24.3	9.5
	Plot 4	degraded	38.8	40.4	49.1	42.5
	Plot 5	degraded	6.5	3.3	59.7	10.8
	Plot 6	riparian corridor	1.5	42.1	0	4
	Plot 7**	less degraded	72	46.7	54.7	56.9
	Plot 8	degraded	10.8	8	11	9.9
	Plot 9	degraded	38.2	25.5	62	39.3

* includes area offsite to the east
** on the verge of Flushcombe Road outside the western fenceline

Despite the likelihood of the site's vegetation to have been PCT 3319 prior to colonisation, now, after 150 - 200 years of agricultural use:

- the mapped exotic grassland has a very low VIS of <10 (Plots 1, 3 with canopy trees);
- the vegetation adjoining Blacktown Creek has a VIS of 4 (Plot 6);

- The areas with native canopy associated with the swale in the west (Plots 4, 5. 8, 9) had variable VIS's ranging from low (approximately 10 in Plots 5, 8) to approximately 40 (Plot 4, 9);
- the roadside vegetation in the north-west (Plot 7) had canopy and had the highest VIS of 56.9; and
- the offsite vegetation in the east (Plot 2) had a native canopy and a VIS of 52.9.

B4.6.2 Vegetation integrity scores of vegetation zones

For the two Vegetation Zones, the calculated Vegetation Integrity Scores (VIS) are as follows:

Vegetation Zone	Sampled in	Composition condition score	Structure condition score	Function condition score	Current vegetation integrity score
PCT 3319 – degraded	Plots 4, 5, 8, 9	18.1	13.1	58.2	24
PCT 3319 – less degraded	Plots 2, 7	76.6	49.4	46.9	56.2

B4.7 Management Zones

For each of the two Vegetation Zones '*PCT 3319 – degraded*' and '*PCT 3319 – less degraded*', there are two Management Zones for the submitted proposal (to be cleared or to be retained) (Figures 7b-1, 7b-2)

Vegetation Zone	Area (ha)	Management Zones (submitted proposal)	
		To be cleared	To be retained
PCT 3319- degraded	2.03	0.45	1.58
PCT 3319- less degraded	0.34	0.07	0.27
Predominantly non-native	24.27 ha	-	-
Total	**26.64 ha**	**0.52**	**1.85**

For the revised proposal, there is a minor decrease in the area of native vegetation proposed to be cleared, namely:

Vegetation Zone	Area (ha)	Management Zones (revised proposal)	
		To be cleared	To be retained
PCT 3319- degraded	2.03	0.38	1.65
PCT 3319- less degraded	0.34	0.08	0.26
Predominantly non-native	24.27 ha	-	-
Total	**26.64 ha**	**0.46**	**1.91**

B5.0 Habitat suitability for threatened species

Potential habitat was systematically assessed onsite as follows:

<table>
<tr><th>Habitat component</th><th>Site values recorded</th></tr>
<tr><td>Coarse woody debris</td><td>Small logs and debris material were identified in only four of the BAM Plots in the site. Course woody debris is an important component of the structure of forests and woodlands and provides refuge habitat for ground-dwelling fauna.

The extent of fallen log length recorded in the 0.1 ha BAM Plots 1 to 9 varied, with:
• highest recorded in Plot 9 (27 m); and
• 0 m lengths recorded in Plot 1, 2, 6, 7, 8.
[Logs are woody material greater than 10 cm in diameter].

<table>
<tr><th></th><th>Length of fallen logs</th></tr>
<tr><td>Onsite</td><td></td></tr>
<tr><td>Plot 1</td><td>0 m</td></tr>
<tr><td>Plot 3</td><td>6 m</td></tr>
<tr><td>Plot 4</td><td>5 m</td></tr>
<tr><td>Plot 5</td><td>91 m</td></tr>
<tr><td>Plot 6</td><td>0 m</td></tr>
<tr><td>Plot 8</td><td>0 m</td></tr>
<tr><td>Plot 9</td><td>27 m</td></tr>
<tr><td>Offsite</td><td></td></tr>
<tr><td>Plot 2</td><td>0 m</td></tr>
<tr><td>Plot 7</td><td>0 m</td></tr>
</table>
</td></tr>
<tr><td>Rock outcrops and bush rock</td><td>Absent.</td></tr>
<tr><td>Caves, crevices and overhangs</td><td>Absent.</td></tr>
<tr><td>Culverts, bridges, mine shafts, or abandoned structures</td><td>Culvert under M4 draining road runoff from basins south of motorway. Collapsed culvert under Augusta Street. Culverts searched in February and March 2022 (details in Appendix 7).</td></tr>
<tr><td>Nectar/lerp-bearing Trees</td><td>Nectar-bearing trees recorded on the site included Acacia parramattensis, Eucalyptus moluccana, Eucalyptus tereticornis, Grevillea robusta and Ligustrum spp.</td></tr>
<tr><td>Nectar-bearing shrubs</td><td>Acacia spp. and Bursaria spinosa were recorded within the site.</td></tr>
<tr><td>Koala Feed Trees</td><td>The Koala use trees for the Central Coast Koala Management Area (Schedule 2 of Koala SEPP 2021) recorded onsite were the local native canopy trees Eucalyptus moluccana, Eucalyptus tereticornis and a non-local planted Eucalyptus robusta</td></tr>
<tr><td>Large stick nests</td><td>No large stick nests observed onsite.</td></tr>
<tr><td>Sap and gum sources</td><td>Native sap and gum source trees recorded onsite including Acacia spp., Eucalyptus spp.</td></tr>
<tr><td>She-oak fruit (Glossy Black Cockatoo feed)</td><td>No Allocasuarina spp. nor Casuarina spp. present onsite.</td></tr>
<tr><td>Seed-bearing trees and shrubs</td><td>Seed-bearing Acacia spp. recorded onsite.</td></tr>
<tr><td>Soft-fruit-bearing trees</td><td>Soft-fruit-bearing trees recorded onsite include Pittosporum undulatum and exotic species Ligustrum spp. and Olea europaea subsp. cuspidata.</td></tr>
<tr><td>Dense shrubbery and leaf litter</td><td>Shrubbery and leaf litter recorded on the site. The extent of litter cover recorded varied from 0% in Plots 3, 6 to over 40% in Plots</td></tr>
</table>

<table>
<tr><th>Habitat component</th><th>Site values recorded</th></tr>
<tr><td></td><td>2, 4, 5, 7, 9.

<table><tr><th></th><th>Litter cover</th></tr><tr><td>Onsite</td><td></td></tr><tr><td>Plot 1</td><td>37.6%</td></tr><tr><td>Plot 3</td><td>0%</td></tr><tr><td>Plot 4</td><td>51%</td></tr><tr><td>Plot 5</td><td>53%</td></tr><tr><td>Plot 6</td><td>0%</td></tr><tr><td>Plot 8</td><td>10%</td></tr><tr><td>Plot 9</td><td>42%</td></tr><tr><td>Offsite</td><td></td></tr><tr><td>Plot 2</td><td>44%</td></tr><tr><td>Plot 7</td><td>47</td></tr></table></td></tr>
<tr><td>Tree hollows</td><td>Tree hollows may provide nesting habitat for native birds, possums and microbats. Only one hollow bearing tree was recorded onsite in BAM Plot 3.</td></tr>
<tr><td>Decorticating bark</td><td>Half-bark Eucalypts may provide decorticating bark habitat within the site. This may be an important resource for arboreal fauna that feed on insects which shelter in decorticating bark. Microbat species also roost in this habitat. The eucalypt recorded with decorticating bark include:
- Eucalyptus tereticornis (bark smooth, white or grey, shedding in large plates or flakes).</td></tr>
<tr><td>Wetlands, soaks and streams</td><td>Wetlands, soaks and streams may offer important habitat for birds and frogs. Onsite Blacktown Creek and drainage swale. Frogs recorded in Blacktown Creek during the February / March 2022 survey (details in Appendix 7)</td></tr>
<tr><td>Open water bodies</td><td>Absent</td></tr>
<tr><td>Estuarine, beach, mudflats, and rocky foreshores</td><td>Absent</td></tr>
</table>

B5.1 Identification of threatened species for assessments

The likelihood of the Ecosystem credit species and Candidate species credit species generated from the on-line BAM Calculator (using the uploaded BioNET data) were assessed using the species profile information, habitat onsite and recorded data (see BAM Calculator reports in Appendix 5 and Likelihood tables in Appendix 6).

B5.1.1 Predicted species (ecosystem credit species)

Predicted species are threatened species reliably predicted to utilise PCT 3319 ecosystem. No surveys are required for these species. Ecosystem credits apply to these species.

In terms of the ecosystem credits species (Predicted Species), 29 threatened fauna species were generated by the BAM calculator with 26 considered as possible to utilise the site. Three (3) species are excluded from further assessment for the following reasons (further details in the Likelihood table in Appendix 6), namely:

Common Name	Scientific Name	Reason for exclusion
Black-necked Stork	*Ephippiorhynchus asiaticus*	The site is not floodplain wetlands, sandplain wetland nor estuary.
Eastern Osprey	*Pandion cristatus*	No open water onsite.
Glossy Black-Cockatoo	*Calyptorhynchus lathami*	No *Allocasuarina littoralis* nor *A. torulosa* recorded onsite.

B5.1.2 Presence of Candidate species credit species

Of the 29 Candidate species credit species generated by the BAM Calculator, seven candidate species were considered possible. Twenty (20) species were excluded from further assessment (further details in the Likelihood table in Appendix 6):

The nine species considered possible were searched for onsite and / or expert opinion sought, with:

Threatened species	Findings
Flora species	Searches carried out on 20 January 2023, 10, 30 March, April, 14 June, 26 October 2021 as part of the biodiversity surveys.
Acacia pubescens	No individuals were recorded.
Grevillea juniperina subsp. juniperina	No individuals were recorded.
Marsdenia viridiflora R. Br. subsp. *viridiflora* population in the Bankstown, Blacktown, Camden, Campbelltown, Fairfield, Holroyd, Liverpool and Penrith local government areas.	No individuals were recorded.
Pimelea spicata	No individuals were recorded.
Pultenaea parviflora	No individuals were recorded.
Fauna	
Green and Golden Bell Frog (*Litoria aurea*)	Nocturnal aural-visual spotlighting as well as diurnal habitat searches on four separate nights over February and March 2022 for 2-3 hours per night by Jayden Walsh, exceeding the survey effort required according to the NSW Guidelines. In the targeted survey, there was a lack of suitable habitat, in the form of open and pooling water. It is unlikely that this species would utilise the site (Appendix 7).
Cumberland Plain Land Snail (*Meridolum corneovirens*)	Search on 9 August 2022 by Dr Stephanie Clark. No evidence of *Meridolum corneovirens* was found, what little potential suitable habitat present is heavily weed infested and no other species of snails or slugs were found (Appendix 8).
Southern Myotis (*Myotis macropus*)	In the expert opinion (Appendix 7) there is reduced habitat suitability for Southern Myotis due to the lack of open water (i.e., foraging space). However, given the Bionet records in close proximity and suitability of the culverts for roosting, occurrence of, and utilisation of the site by Southern Myotis is moderately likely. None were recorded in the survey by Ecoplanning (2020).
Koala (*Phascolarctos cinereus*)	The Koala use trees (*Eucalyptus moluccana, Eucalyptus tereticornis* and a non-local planted *Eucalyptus robusta)* recorded onsite, but no Koala records nearby nor Koala recorded onsite.

B5.2 Area or count, and location of suitable habitat for a species credit species (species polygon)

There was potential habitat onsite for 26 of the 29 predicted threatened species including winter flowering eucalypts for Swift Parrot and Grey-headed Flying-fox.

There were no threatened candidate species (species credit species) recorded onsite, hence no species polygons.

B6.0 Identifying prescribed impacts

The likely features relevant to prescribed impacts onsite are the following: None of these prescribed impact features are likely to be exacerbated by the proposal. The site is currently highly degraded. Connectivity with surrounding vegetation is currently fragmented and further limited by the surrounding 6-lane highways.

Feature	Present	Description of feature characteristics and location	Threatened entities that use, are likely to use, or are part of the habitat feature.
Karst, caves, crevices, cliffs, rocks or other geological features of significance	☐Yes / **x No**	N/A	N/A
Human-made structures	**x Yes** / No☐ but limited	Drainage culverts under the M4 Motorway and the Great Western Highway.	Culverts were searched and no evidence of microbat use found. Higher likelihood for threatened species following conservation works.
Non-native vegetation	**x Yes /** ☐No	Exotic understorey species, especially *Ligustrum* spp.	N/A
Habitat connectivity	**x Yes /** ☐No	The former farming site is highly degraded or absent of native vegetation. Connectivity with surrounding vegetation is currently fragmented and further limited by the surrounding highways.	There is some potential for ecosystem species to fly between vegetated areas within the site and offsite vegetation. Connectivity is limited due to 6-lane highways surrounding the site on 3 sides. Higher likelihood for threatened species to utilise the site as part of a connected flight corridor following conservation works.
Waterbodies, water quality and hydrological processes	**x Yes /** ☐No	Drainage lines onsite, Blacktown Creek in the east and the swale in the west, are dominated by exotic weeds, although	Currently no threatened species utilising the waterbodies onsite but higher likelihood for threatened species

Feature	Present	Description of feature characteristics and location	Threatened entities that use, are likely to use, or are part of the habitat feature.
		with emergent eucalypts surviving along the swale in the west; The riparian zone of Blacktown Creek is treeless and swampy and the creek water concealed beneath a broad swathe of wetland plants, both exotic and native-cosmopolitan, and with adjoining belts of blackberries; and The source of the water in the drainage lines along the swale in the west is from stormwater pond(s) south of the M4 Motorway and in Blacktown Creek from treated water from the Wet n Wild and untreated water from stormwater ponds south of the M4 Motorway.	following conservation works.
Wind turbine strikes (wind farm development only)	☐Yes / **X No**	N/A	N/A
Vehicle strikes	**X Yes** / ☐No	Existing high risk for Vehicle strike due to 6-lane highways surrounding the site on 3 sides. The proposal increases traffic movements onsite.	Currently potential for ecosystem species onsite to be affected by vehicle strike.

Part C Stage 2: Impact assessment

C7.0 Avoid and minimise impacts

The design of the proposal is in response to the Huntingwood Precinct DCP which is informed by Chapter 2 Western Sydney Employment Area of the State Environmental Planning Policy (Industry and Employment) 2021 (I & E SEPP). The aim of Chapter 2 of the I & E SEPP includes:

- *to rezone land for employment or environmental conservation purposes;* and
- *to conserve and rehabilitate areas that have a high biodiversity or heritage or cultural value, in particular areas of remnant vegetation.*

In the Huntingwood Precinct DCP, the framework specifies the land use locations (Figure 2d) of:

- Employment Lands;
- Electricity Easements;
- Riparian Corridors; and
- Conservation Areas.

All of these landuses have been clearly identified on the site.

C7.1 Avoid and minimise direct and indirect impacts

C7.1.1 Project location

To avoid and minimise impacts on the native vegetation and potential habitats, the proposal has been located in accordance with Huntingwood Precinct DCP (Figures 1f and 2d) with :

- Employment Lands on the historically cleared former farming land;
- employment related carparking under the Electricity Easement;
- conservation areas in the 'Riparian corridors' (Blacktown Creek in the east and the drainage swale in the west).

In addition, conservation areas are:

- between the car parking in the Electricity Easement and the M4 motorway; and
- in the set back from the Great Western Highway.

C7.1.2 Project design

The project has been designed to achieve a conservation gain in the landscaping strategy (Figure 1f), with:

Strategy (see Figure 1f)	**Approximate area**
Area for conservation	
Conservation setback from roads	1.5 ha
Conservation associated with drainage lines (excl. area under Electricity Easement)	2.3 ha
Conservation (under Electricity Easement)	3.5 ha
Conservation Planting (Bioretention basins)	1.2 ha
Total area for conservation	**8.6 ha**
Additional Landscape Area (not included in Area for conservation)	

Strategy (see Figure 1f)	Approximate area
(these areas provide some potential habitat, especially arboreal and avifauna)	
Entry feature plantings	0.2 ha
Carpark and Office Planting	0.6 ha
Total Additional Landscape Area	**0.8 ha**
Total area in the Landscape Strategy	**9.4 ha**

C7.2 Avoid and minimise prescribed impacts

Onsite, the only features relevant to prescribed impacts onsite are limited habitat connectivity for avifauna and potential vehicle strike, both of which are currently impacting the site. None of the identified prescribed impact features are likely to be exacerbated by the proposal. The site is currently highly degraded. Connectivity with surrounding vegetation is currently fragmented and further limited by the surrounding 6-lane highways.

The project has been designed to maintain and enhance existing connectivity through conserving, enhancing and re-establishing native vegetation onsite within the proposed conservation areas.

C7.3 Other measures considered

No other measures for avoidance and minimisation were considered.

C7.4 Summary of measures to avoid and minimise impacts

The measures used to avoid and minimise direct, indirect and prescribed impacts are as follows (see details of other environmentally sustainable developments in Hazelton and Clements 2009, Clements *et al.* 2010):

Action	Outcome	Timing	Responsibility
Appoint an experienced Restoration Ecologist and Construction Manager to design, supervise and implement works.	Qualified persons to prepare a site specific Conservation / Vegetation Management Plan developed in conjunction with the Construction Management Plan for efficient operations onsite.	Prior to commencement of works onsite.	The project manager and/or land owner.
Prepare induction / tool box program and its implementation for conservation awareness.	All onsite workers to be aware of the conservation significance of the assets onsite.	Prior to, during and post construction works.	Restoration ecologist and Construction Manager.
Identify the conservation assets including soils, biomass, local native seed.	Minimise “waste” going to land fill. Maximise chance of restoring the native ecosystems onsite.	Prior to commencement of works onsite.	Restoration ecologist and Construction Manager.
Ensure efficient re-	Maximising use of	During	Restoration ecologist

Action	Outcome	Timing	Responsibility
use of conservation assets onsite.	biological active soil and plant material in the conservation areas for conserving and enhancing habitats onsite.	construction works.	and Construction Manager.
Ensuring sufficient local native tubestock are available for the project.	Conserving and enhancing local native habitats onsite.	Prior to and during construction works.	Restoration ecologist
Implementing conservation actions and associated monitoring and corrective actions.	A successful ecologically sustainable development.	Prior to, during and post construction works.	The entire team.

C8.0 Impact Assessment

C8.1 Residual direct impacts

After steps have been taken to avoid and minimise impacts, the residual direct impacts include:

Summary of residual direct impacts

Direct impact	BC Status	EPBC Status	SAII Entity	Project phase / timing of impact	Extent
Removal of potential habitat associated with PCT3319 (TEC = *Cumberland Plain Woodland in the Sydney Bioregion*)	Critically endangered	N/A	YES	During construction	0.52 ha (submitted) 0.46 ha (revised)

C8.1.1 Change in vegetation integrity score

The change in vegetation integrity for residual direct impacts on native vegetation are as follows.

The “future” vegetation integrity score was calculated. (Note: The recorded cover by High Threat Weeds (HTW) was high in the native vegetation. The future cover by HTW for the retained native vegetation was entered as 5% in the BAM Calculator. This proposed reduction in HTW cover is assumed following the conservation works).

Impacts to vegetation integrity (entered into the online Calculator for the submitted proposal)

Vegetation zone	Management Zone	Area (ha)	Before Development			
			Composition	Structure	Function	VI Score
PCT 3319_Degraded	cleared	0.45	18.1	13.1	58.2	24
	retained	1.58	18.1	13.1	58.2	24
PCT 3319_Less	cleared	0.07	76.6	49.4	46.9	56.2

Vegetation zone	Management Zone	Area (ha)	Before Development			
			Composition	Structure	Function	VI Score
degraded	retained	0.27	76.6	49.4	46.9	56.2

Impacts to vegetation integrity (entered into the online Calculator for the submitted proposal)

Vegetation zone	Management Zone	Area (ha)	Before Development			
			Composition	Structure	Function	VI Score
PCT 3319_Degraded	cleared	0.45	18.1	13.1	58.2	24
	retained	1.58	18.1	13.1	58.2	24
PCT 3319_Less degraded	cleared	0.07	76.6	49.4	46.9	56.2
	retained	0.27	76.6	49.4	46.9	56.2

Vegetation zone	Management Zone	Area (ha)	After Development					
			Composition	Structure	Function	VI Score	Change in VI Score	Total VI loss
PCT 3319_ Degraded	cleared	0.45	0	0	0	0	-24	-4.7
	retained	1.58	18.1	13.1	64.3	24.8	0.8	
PCT 3319_ Less degraded	cleared	0.07	0	0	0	0	-56.2	-11.5
	retained	0.27	76.6	49.5	46.9	56.3	0	

There is a minor reduction in the extent clearing under the revised proposal, namely:

Vegetation zone	Extent of clearing under the submitted proposal	Extent of clearing under the submitted proposal
PCT 3319_Degraded	0.45 ha	0.38 ha
PCT 3319_Less degraded	0.075 ha	0.079 ha

C8.2 Indirect impacts

The residual indirect impacts are those likely to occur on native vegetation, threatened entities and their habitat beyond the development footprint.

The site is currently weed infested. As part of the proposal the risk of weed and pathogen transfer is minimised with procedures for minimising these risks to be included in the CMP / VMP.

There are drainage lines onsite, Blacktown Creek in the east and the swale in the west. Both drainage lines are dominated by exotic weeds, with emergent eucalypts along the swale in the west.

The proposed conservation works associated with the creekline includes water quality structures to treat the existing water entering the site and flowing from the site under the Great Western Highway, including to Blacktown Creek in Timbertop Reserve. The sources of the water in both drainage lines are from stormwater collection pond(s) from runoff from the M4 Motorway. In addition, Blacktown Creek receives treated water from the Raging Waters Sydney site to the south (formerly known as Wet ‘n’ Wild).

Increased light spillage from the industrial development poses a risk to native nocturnal fauna in the Conservation Areas and offsite to Council reserves including Timbertop Reserve to the north of the Great Western Highway. There are major light issues currently from the surrounding 6 lane highways. The Timbertop Reserve is likely to be a dark space, however unlikely to be affected by the proposal due to the Great Western Highway. Best practice lighting should be considered to minimise any risk.

Summary of residual indirect impacts

Indirect impact	Impacted entities	Extent	Frequency	Duration	Project phase / timing of impact	Likelihood and consequences
Transfer of weed and pathogens	Potential habitat of threatened fauna species	Within the conservation and landscape area	Depends on pedestrian usage of conservation areas and roadsides.	The life of the project	The life of the project	Possible decrease in occurance of native species habitat
Water quality	Potential habitat including for Green and Golden Bell Frog and Southern Myotis	Drainage lines	At times of rainfall events sufficient for stormwater flow to the site.	The life of the project	The life of the project	Possible decrease in occurance of native species habitat
Increased light spillage to Conservation Areas	Bats and noctural fauna	Depends on light intensity and direction.	Depends on usage.	Evening when lights are turned on	Post construction.	Depends on lighting design

C8.3 Prescribed impacts

Onsite, the features relevant to prescribed impacts are:

- reduced habitat connectivity, currently limited to fly-overs by avifauna and bats; and
- potential vehicle strike.

Both of these features are currently impacting the habitat onsite.

The site is currently highly degraded. Connectivity with surrounding vegetation is currently fragmented and further limited by the surrounding 6-lane highways.

None of the identified prescribed impact features are likely to be exacerbated by the proposal.

The project has been designed to maintain and enhance existing connectivity through conserving, enhancing and re-establishing native vegetation onsite within the proposed conservation areas.

C8.4 Mitigating residual impacts – management measures and implementation

The following table outlines details of the proposed mitigation and management measures.

Note: A site specific Conservation / Vegetation Management Plan (CMP / VMP) should be developed in conjunction with the Construction Management Plan as a condition of consent.

Summary of proposed mitigation and management measures for residual impacts

Mitigation measure	Method technique	Timing	Frequency	Responsibility	Likely efficacy (including risk of failure)	MNES (where relevant)
Appoint an experienced Restoration Ecologist and Construction Manager to design, supervise and implement works in accordance with a Vegetation Management Plan (VMP).	In conjunction with the Construction Management Plan as part of the conditions of consent. Note: The VMP involves restoration of riparian habitats which requires inputs from the Stormwater Engineers in conjunction with the Frog expert.	Prior to works onsite	Once	The project manager and/or land owner.	Risk of failure unlikely	N/A
Conservation awareness of all persons onsite and the awareness of the No-Go Areas.	Prepare and implement induction / tool box program	Prior to and during works onsite.	Induction prior to entry to the site. Weekly toolbox talks	Restoration Ecologist and Construction Manager	Risk of failure unlikely, provided that there is adherence No-Go Areas.	N/A
Clearly identify No-Go areas onsite and on plan	Clearly identified with orange mesh fence or similar as required by the Restoration Ecologist and / or Construction Manager.	As required during construction	As required	Restoration Ecologist and Construction Manager	Risk of failure unlikely, provided that there is adherence No-Go Areas.	N/A

Mitigation measure	Method technique	Timing	Frequency	Responsibility	Likely efficacy (including risk of failure)	MNES (where relevant)
Ensure efficient re-use of conservation assets onsite from areas being cleared.	Industry best practice for ecologically sustainable developments.	During construction	During construction	Restoration Ecologist and Construction Manager	Risk of failure unlikely, provided adequate supervision	N/A
Ensure hygeine protocols in place	Implementation of standard hygeine protocols, such as clean vehicles, clean shoes, and healthy nursery stock.	During construction	Daily	Restoration Ecologist and Construction Manager	Risk of failure unlikely, provided adequate supervision and compliance with hygiene protocols by all persons onsite.	N/A
Pre-clearance fauna survey and relocation of native fauna to areas of retained vegetation.	Use of experienced wildlife spotter / catcher.	Prior to commencement of any clearing / earthworks.	As advised by the wildlife expert	Restoration Ecologist	Risk of failure unlikely provided adequate advice and supervision.	N/A
Implement monitoring and corrective actions.	Monitoring reports as specified in the Conservation and Construction Management Plans	Prior to, during and post construction works.	Month 1; Month 3; Month 6; and then 12 monthly.	Restoration Ecologist and Construction Manager	Risk of failure unlikely provided adequate advice and supervision	N/A

C9.0 Serious and irreversible impacts

C9.1 Assessment for Serious and irreversible impacts

From applying the *Guidance to assist a decision-maker to determine a serious and irreversible impact* the proposal, with its Conservation Areas, is unlikely to result in a Serious and Irreversible impact (see details in Appendix 10).

The proposal is unlikely to contribute significantly to the risk of extinction of the *Cumberland Plain Woodland* Ecological Community in NSW.

C10.0 Impact Summary

C10.1 Determine an offset requirement for impacts

C10.1.1 Impacts on native vegetation and TECs or Ecs (ecosystem credits)

From Section 9.2.1 of the BAM (DPIE 2020) an offset is not needed for impacts on native vegetation if the vegetation integrity score is below:

a. 15, where the PCT is representative of an EEC or a CEEC
b. 17, where the PCT is associated with threatened species habitat (as represented by ecosystem credits)
or represents a vulnerable ecological community; or
c. 20, where the PCT does not represent a TEC and is not associated with threatened species habitat.

For the vegetation zone identified onsite, the current Vegetation Integrity Score (VIS) was as follows:

Vegetation Zone	TEC	Impact area (ha) (revised)	Entity at risk of an SAII?	Current Vegetation integrity score	Offset required?
PCT 3319 – degraded	CPW	0.38 of 2.03	No	24	yes
PCT 3319 – less degraded	CPW	0.078 of 0.34	No	56.2	yes

CPW = Cumberland Plain Woodland in the Sydney Basin Bioregion

For the submitted proposal, an offset is required for *PCT 3319 Cumberland Shale Hills Woodland* with the number of ecosystem credits required as follows:

Vegetation zone	TEC	Impact area (ha)	Current VI score	Future VI score	Change in VI score	Biodiversity risk weighting	Number of ecosystem credits required for revised
PCT 3319 – degraded	CPW	0.45	24	0	-24	2	6
PCT 3319 – less degraded	CPW	0.07	56.2	0	-56.2	2	2
						Total	**8**

For the revised proposal, given that the number of credits is related to the area impacted, the estimated number of credits under the revised proposal is estimated to be the following.

Vegetation zone	**PCT name**	**TEC / EC**	**Impact Area (ha) for the revised proposal**	**Number of Ecosystem credits required**
PCT 3319 – degraded	*PCT 3319 Cumberland Shale Hills Woodland*	CPW	0.38 of 2.03 ha	5 (6 x 0.38/0.45)
PCT 3319 – less degraded	*PCT 3319 Cumberland Shale Hills Woodland*	CPW	0.08 of 0.34 ha	2 (2 x 0.8/0.7)
			Total	**7**

C10.1.2 Impacts on threatened species and their habitat (species credits)

No candidate species were identified.

Impacts that require an offset – species credits are as follows.

BC Act status	**EPBC Act status**	**Loss of habitat** (ha) or individuals	**Biodiversity risk weighting**	**Number of species credits required**
Common name: N/A				
N/A	N/A	N/A	N/A	0
			Total credits	0

C11.0 Biodiversity credit report

C11.1 Ecosystem credits

From the BAM Calculator reports, the Ecosystem credit class and matching credit profiles are as follows:

Ecosystem credits	**Attributes shared with matching credits**					
	PCT vegetation class	**PCT vegetation formation**	**Assoc. TEC**	**Offset trading group**	**Hollow bearing trees present?**	**IBRA subregion (in which proposal is located)**
8 (7 for revised)	Coastal Valley Grassy Woodlands	Grassy Woodlands	CPW	Cumberland Plain - Woodland in the Sydney Basin Bioregion This includes PCT's:	no	Cumberland

Ecosystem credits	Attributes shared with matching credits					
	PCT vegetation class	PCT vegetation formation	Assoc. TEC	Offset trading group	Hollow bearing trees present?	IBRA subregion (in which proposal is located)
				3319, 3320		

CPW = Cumberland Plain Woodland in the Sydney Basin Bioregion

C11.2 Species credits

From the BAM Calculator reports, the Species credit class and matching credit profile is as follows:

Species credit	Attributes shared with matching credits				
	Name of threatened species	Kingdom	BC Act status	EPBC Act status	IBRA region
0	N/A	N/A	N/A	N/A	N/A

C12.0 Recommendations

A site specific Conservation / Vegetation Management Plan (CMP / VMP) should be developed in conjunction with the Construction Management Plan as a condition of consent. Working with the construction team and their machinery forms an essential component of the planning and implementation of the CMP / VMP.

Currently, the natural regeneration of the native canopy onsite is suppressed. Encouraging natural germination from seed showers in the Conservation Areas forms part of the CMP / VMP. This will involve utilising the onsite earthworks equipment for the removal of the dense weedy understorey and building rubble currently covering the soil surface, as well as for earthworks required by the engineers and ecologists.

From overlaying the locations of the existing native canopy trees on the revised Masterplan and Landscape Plan (Figures 6e-1, 6e-2), some refinements of the locations and shapes of the Bioretention Basins are recommended, depending on the health of these trees. (Note: many of these existing trees are not rated as being in Good health by the arborist). Similarly, the location of the proposed upgrade to the drainage channel in the western swale may also require some refinements at time of construction to minimise impacts on the existing native trees. This should be done in consultation with the engineers, the arborist, the Construction Manager and the Environmental Manager.

It is recommended that in preference to purchase of Biodiversity Credits any residual impacts should be offset by conservation works on the adjoining and nearby land, in consultation with Council and the landholders, in accordance with Clause 7.13 (4) of the *Biodiversity Conservation Act 2016*, namely:

> *The consent authority may reduce or increase the number of biodiversity credits that would otherwise be required to be retired if the consent authority determines that the reduction or increase is justified having regard to the environmental, social and economic impacts of the proposed development. The consent authority must give reasons for a decision to reduce or increase the number of biodiversity credits.*

Note: Clause 7.13 applies to *Development other than State significant development or infrastructure.*

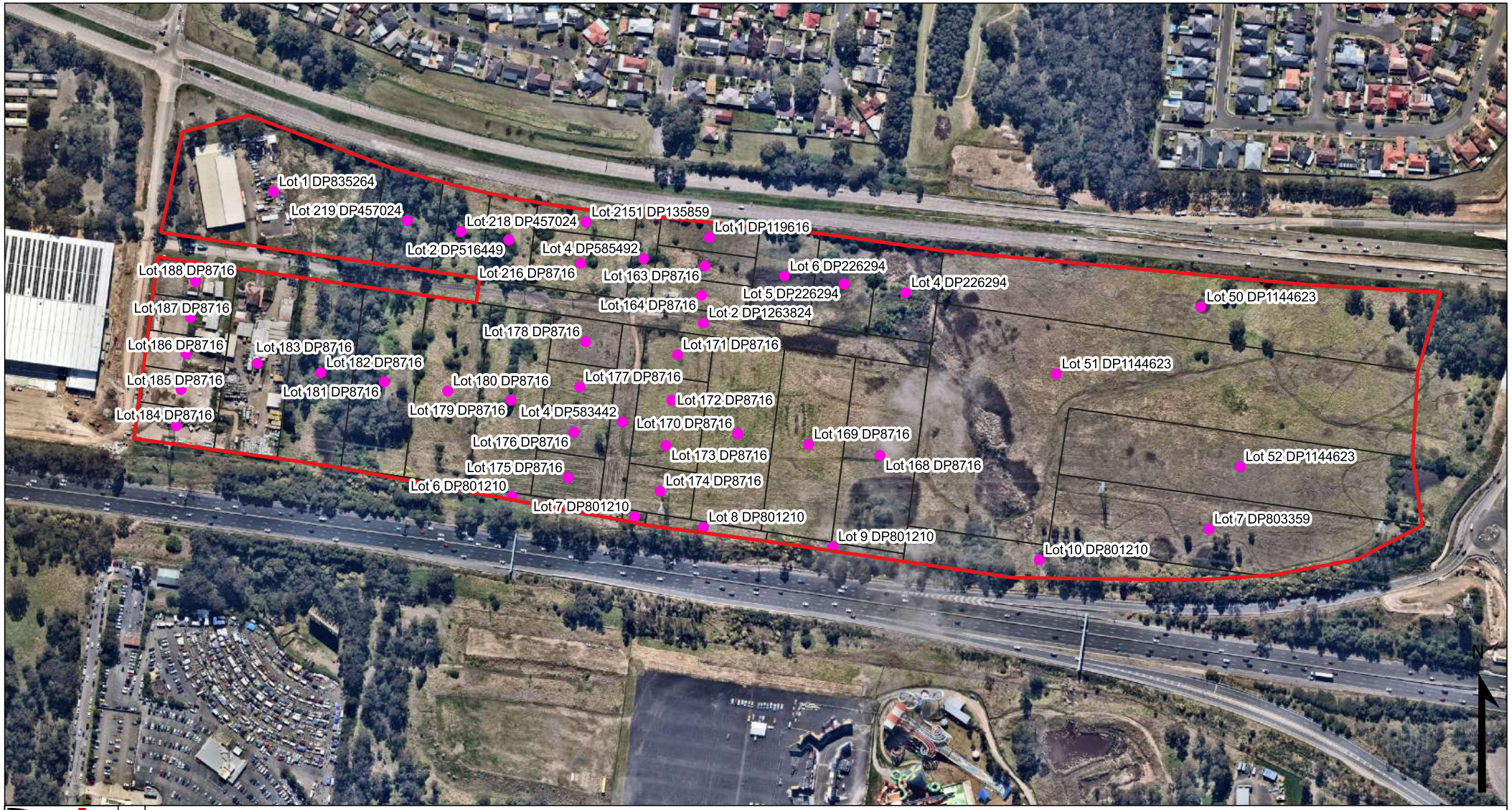
In consultation with Council there are opportunities, including:

- Bush regeneration downstream along Blacktown Creek including in Timbertop Reserve (zoned C2 – Environmental Conservation) which is mapped as an Important Habitat Area for the Swift Parrot (Figure 5e);
- Planting of local native trees in the RE1 - Public Recreation zoned land (Figure 2a) north of the Great Western Highway; and
- Planting of local native trees in the residential land north of the Great Western Highway for minimisation of heat island effects for the local residents.

Figures



Figure 1a-1.
Site boundary and mapped watercourses overlaid on the Nearmap aerial photograph dated 21 August 2022



ANNE CLEMENTS & ASSOCIATES PTY. LIMITED
Environmental and Botanical Consultants

Date created: 05-10-2022

Site boundary

Lot

0 75 150 m

Geocentric Datum of Australia 1994

Figure 1a-2.
Site and lot boundaries overlaid on the Nearmap aerial photograph dated 21 August 2022 - close up

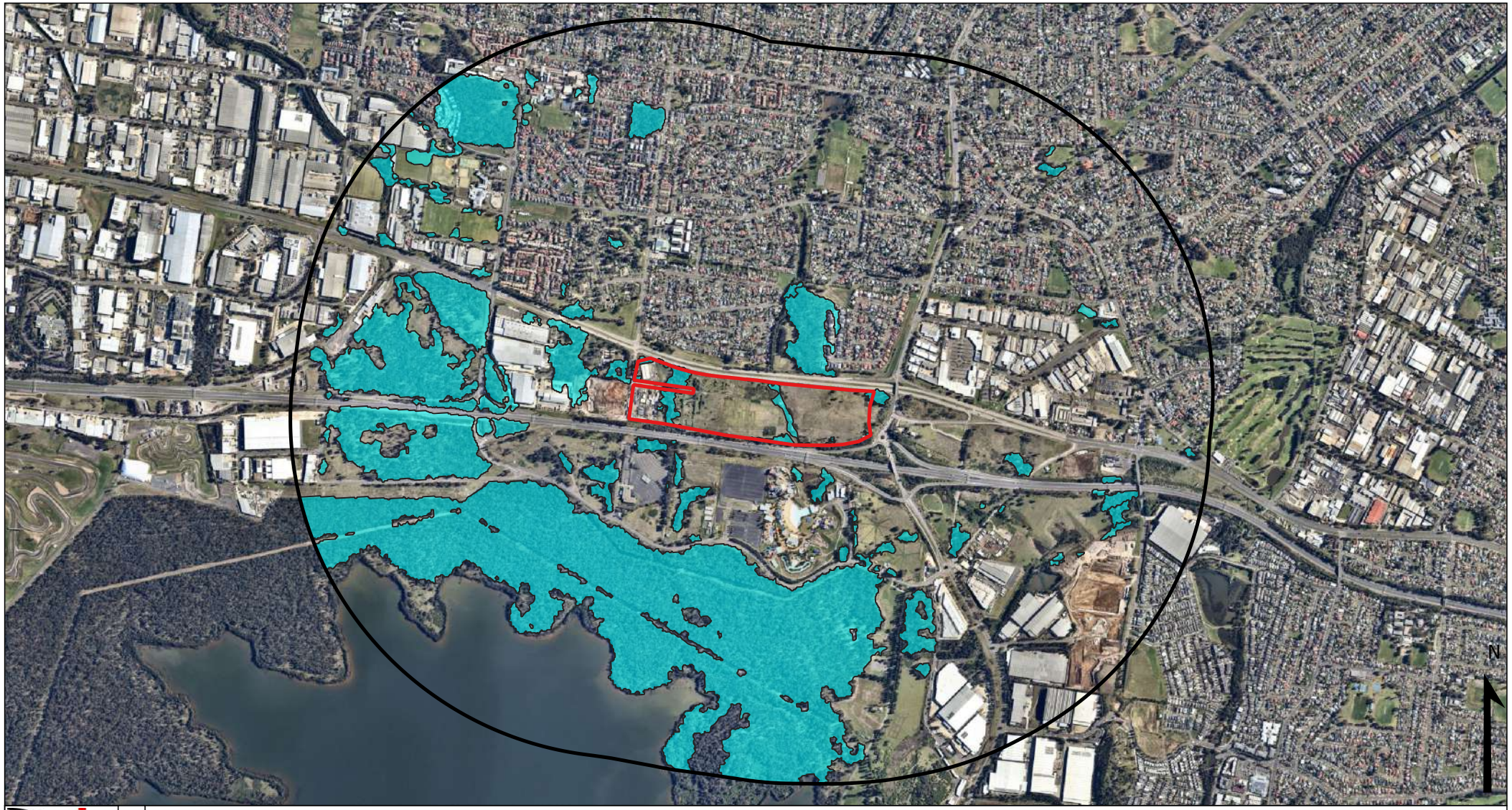
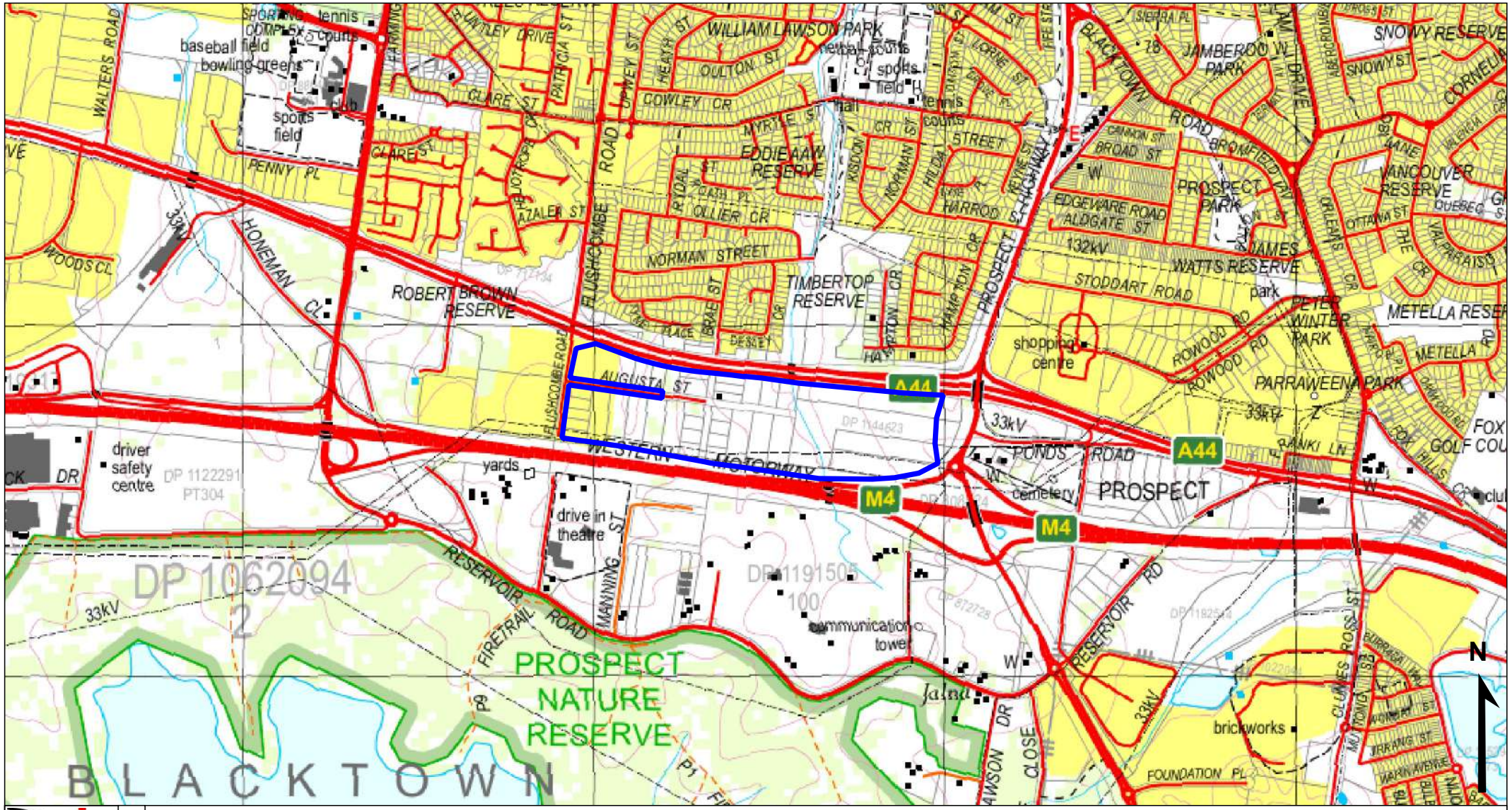


Figure 1a-3.
Native vegetation within 1.5 km buffer

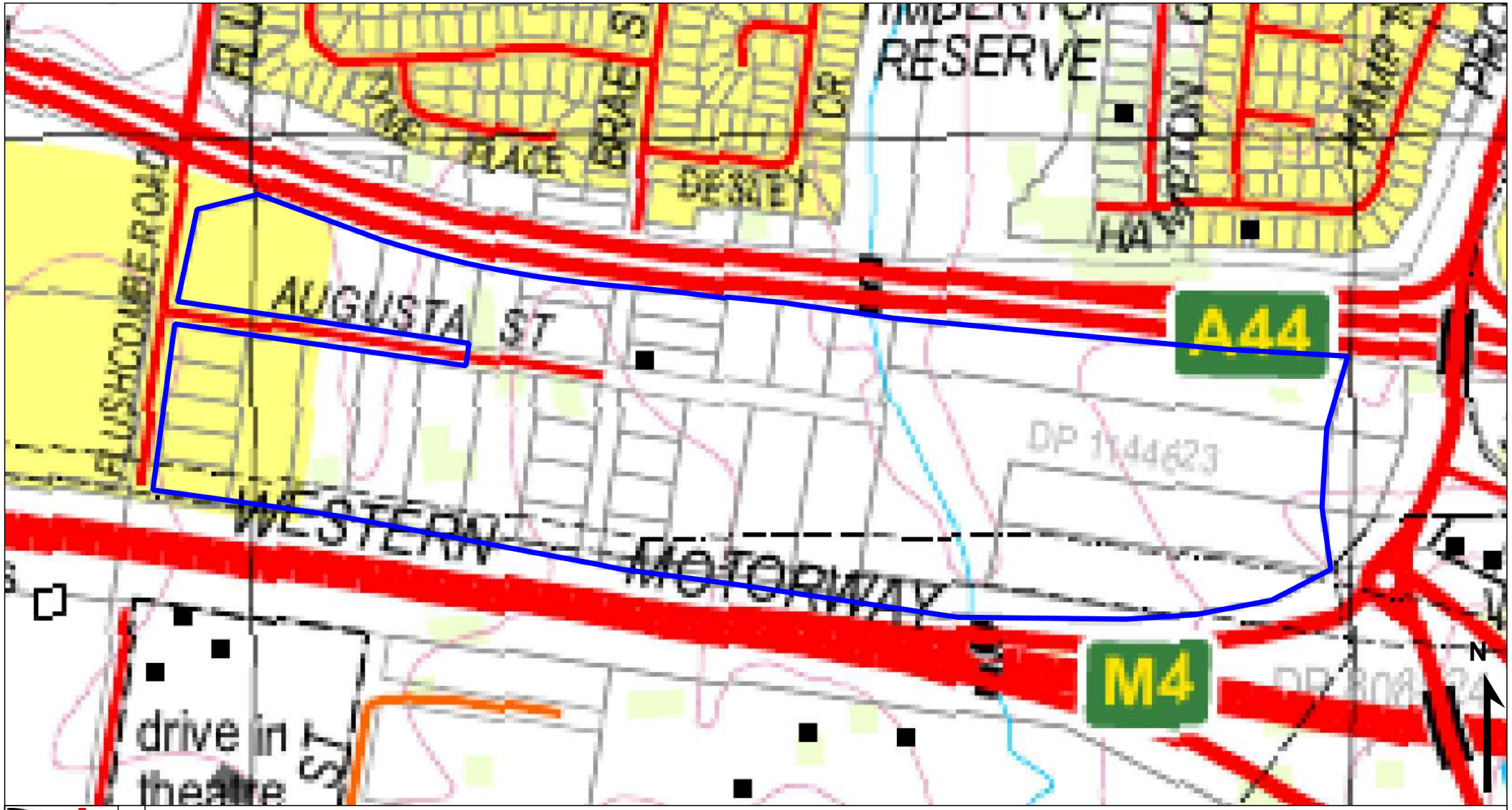


Site boundary

ANNE CLEMENTS & ASSOCIATES PTY. LIMITED
Environmental and Botanical Consultants

Date created: 17-03-2022

Figure 1b-1.
Site boundary overlaid on the E-topo Prospect topographic map sheet 9030-2N



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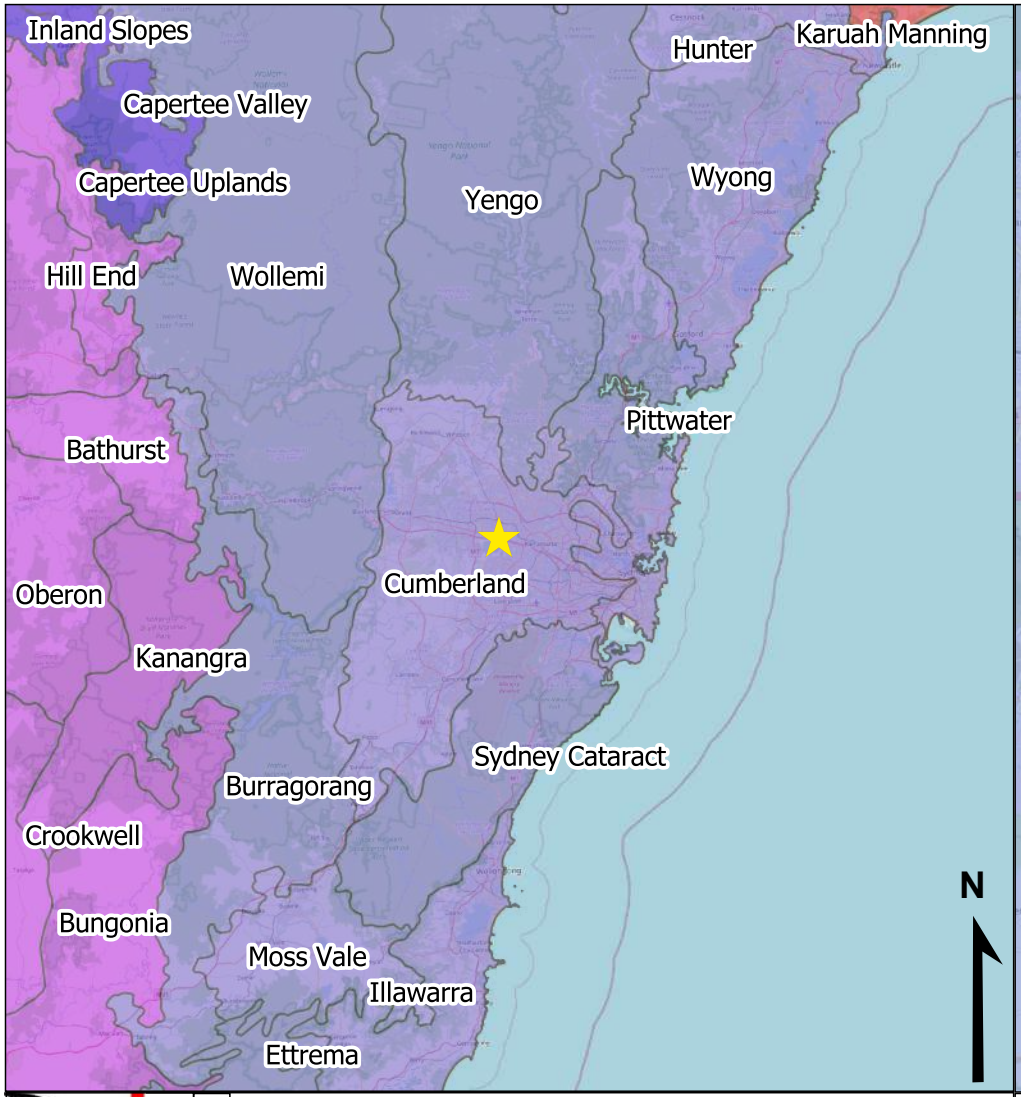
Date created: 17-03-2022

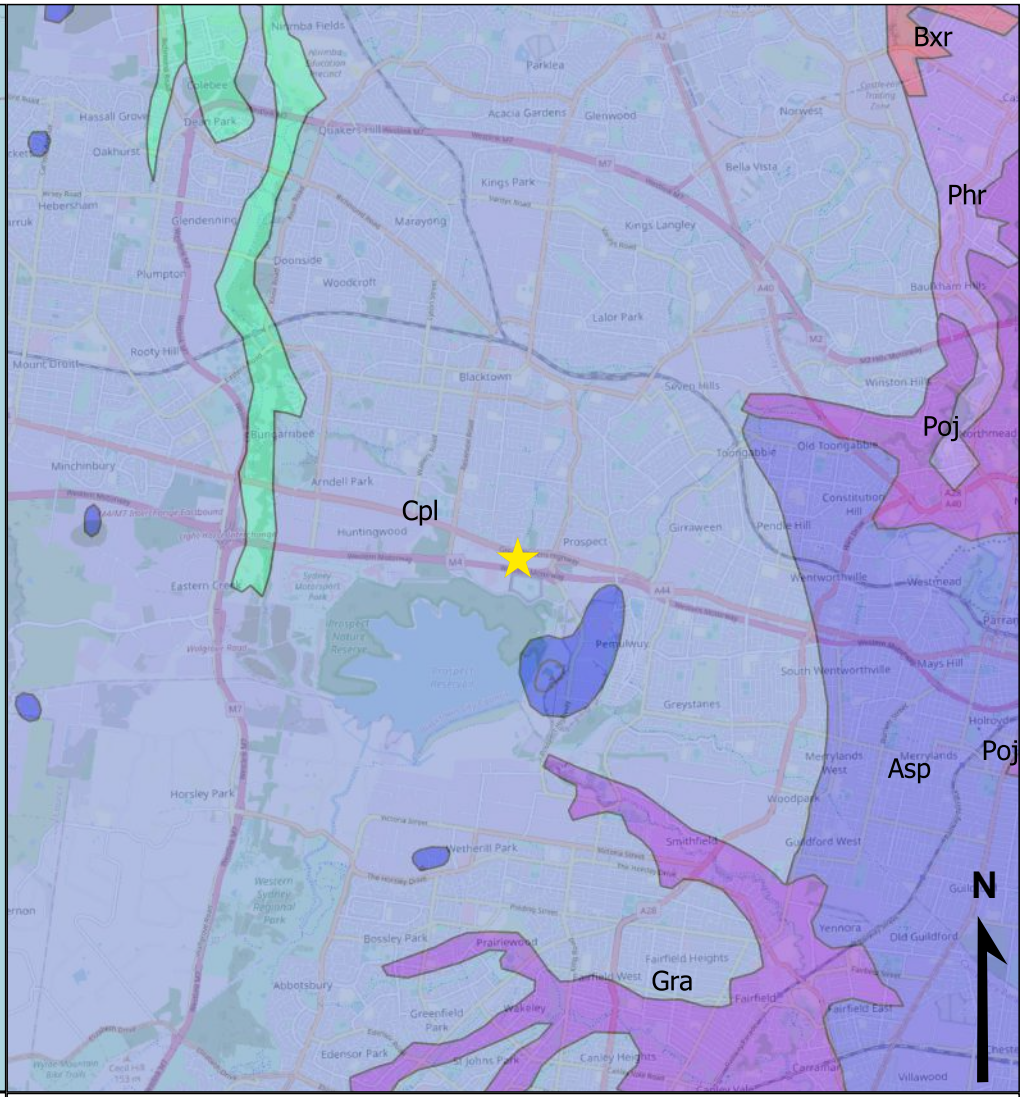
Site boundary

0 100 200 m

Geocentric Datum of Australia 1994

Figure 1b-2.
Site boundary overlaid on the E-topo Prospect topographic map sheet 9030-2N - close up





ANNE CLEMENTS & ASSOCIATES PTY. LIMITED
Environmental and Botanical Consultants

Date created: 17-03-2022

Site Location
NSW North Coast
NSW South Western Slopes
South Eastern Highlands
Sydney Basin

0 20 40 km
Geocentric Datum of Australia

Figure 1c-1.
Site location overlaid on the IBRA subregions map - version 7

Site Location
Asp Ashfield Plains
Bxr Blaxlands Ridge
Cpl Cumberland Plain
Gra Georges River Alluvial Plain
Hac Hawkesbury - Nepean Channels and Floodpl
Phr Pennant Hills Ridges
Poj Port Jackson Basin
Dia Sydney Basin Diatremes

0 2.5 5 km
Geocentric Datum of Australia

Figure 1c-2.
Site location overlaid on the NSW Mitchell Landscapes - version 3.1



Figure 1d-1.
Site boundary overlaid on the Penrith 1 Metre DEM LiDAR dated February 2011 and April 2013 (Spatial Services, ELVIS)

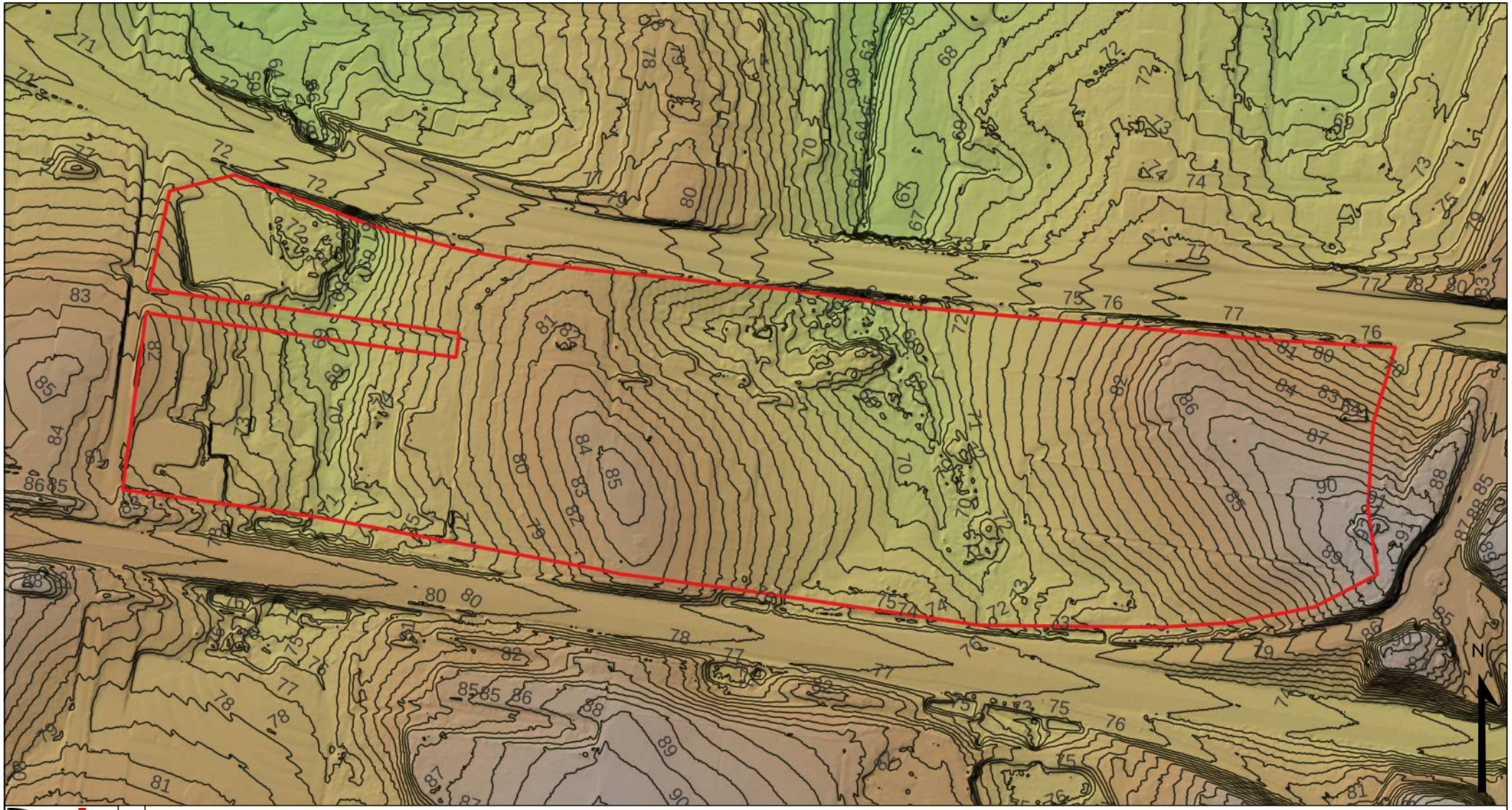
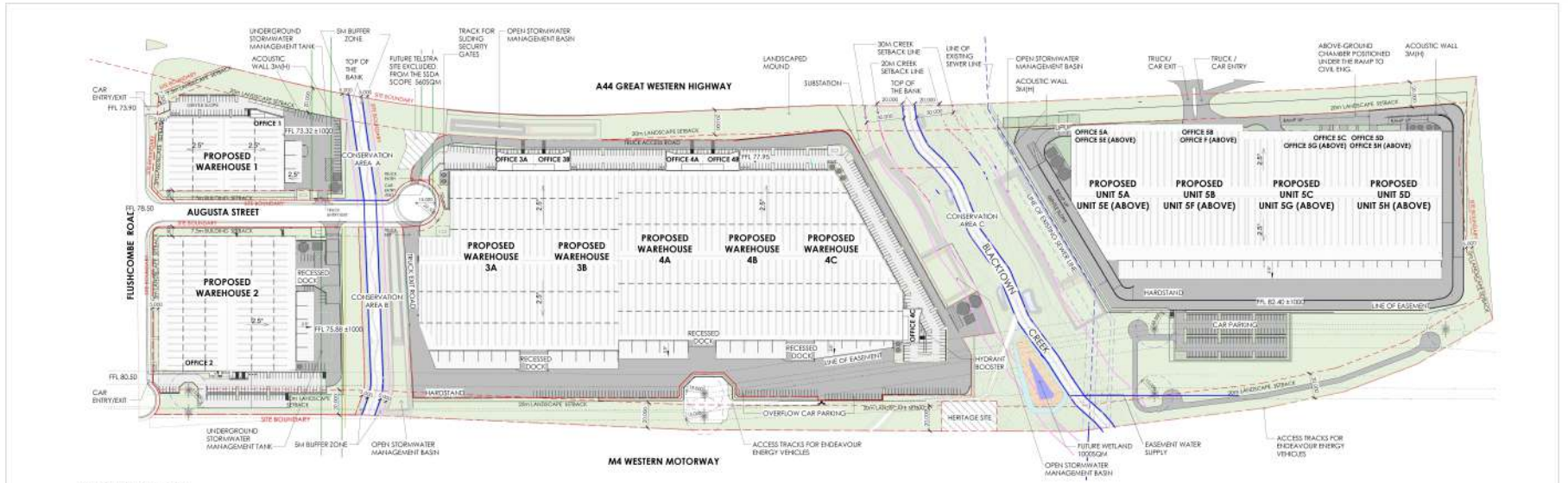


Figure 1d-2.
Site boundary overlaid on the Penrith 1 Metre DEM
LiDAR dated June 2019 (Spatial Services, ELVIS) - close up



1 MASTERPLAN
1 : 1500

NOTE 1:
METHOD OF MEASUREMENT OF **GFA (GROSS FLOOR AREA)** IS AS FOLLOW:
- MEASURED FROM INTERNAL FACE OF EXTERNAL WALLS.
- INCLUDED MEZZANINES AND ANY HABITABLE ROOMS IN THE BASEMENTS
- VERTICAL CIRCULATION SUCH AS LIFTS AND STAIRS:
  EXCLUDED - IF SHARED BETWEEN TENANCIES
  INCLUDED - IF EXCLUSIVE FOR ONE TENANT
- EXCLUDED BASEMENTS UNLESS THEY ARE HABITABLE ROOM
- EXCLUDE GARBAGE AREAS, SPACES USED EXCLUSIVELY FOR SERVICE SUCH AS DUCTING, PLANT ROOMS, LIFT MOTOR ROOMS AND CAR PARKING
- TERRACES AND BALCONIES:
  EXCLUDED - IF OUTER WALL IS LESS THEN 1.4m HIGH
  INCLUDED - IF OUTER WALL IS MORE THEN 1.4m HIGH
- EXCLUDED VOIDS AT ANY LEVEL THEY OCCUR

NOTE2:
PARKING CALCULATION (BASED ON GFA):
- INDUSTRIAL/ WAREHOUSE: BUILDING 7,500SQM OR LESS– 1 SPACE PER 100SQM GFA.
- BUILDING GREATER THAN 7,500SQM GFA– 1 SPACE PER 200SQM GFA ONLY FOR THE AREA IN EXCESS OF 7,500SQM WHERE THERE IS SPECIFIC END USER WHICH WOULD NOT DEMAND A HIGHER RATE AND WHERE EMPLOYEE PARKING IS ADEQUATELY CATERED FOR.
- COMMERCIAL: 1 SPACE PER 40SQM GFA.
NUMBER OF DISABLED CAR PARKS AT LEAST 1% OR PART THEREOF OF THOSE SPACES.

NOTE3:
MOTORCYCLE PARKING CALCULATION (BASED ON CAR PARKING NUMBER):
EACH 50 CAR PARKS, ONE MOTORCYCLE PARK

BUILDING 1

DEVELOPMENT SUMMARY (BLDG1) - GFA

Name	Area
OFFICE 1	399 m²
OFFICE 1 LOBBY	75 m²
WAREHOUSE 1	5461 m²
Grand total	5935 m²
AWNING 15M (BLDG 1)	511 m²
HEAVY DUTY PAVEMENT (BLDG 1)	3074 m²
LIGHT DUTY PAVEMENT (BLDG 1)	1352 m²

PROVIDED PARKING SCHEDULE (BLDG1)

Family	Type	Count
PK-CP1	5400 x 2500 - 90 deg	43
PK-CP3	5400 x 2500 - (Accessible)	2
PK-CP2	5400 x 2500 - (Backup)	25
PK-CP7	5400 x 2500 - EV CAR	3
Grand total		73
TOTAL CAR PARK REQUIRED		67

PROVIDED MOTORCYCLE PARKING (BLDG1)

Family	Type	Count
PK-CP8	2500 x 1200 (MOTORCYCLE)	2
Grand total		2

BUILDING 2

DEVELOPMENT SUMMARY (BLDG2) - GFA

Name	Area
OFFICE 2	363 m²
WAREHOUSE 2	11668 m²
Grand total	12031 m²
AWNING 10M (BLDG 2)	834 m²
HEAVY DUTY PAVEMENT (BLDG 2)	4035 m²
LIGHT DUTY PAVEMENT (BLDG 2)	2789 m²

PROVIDED PARKING SCHEDULE (BLDG2)

Family	Type	Count
PK-CP1	5400 x 2500 - 90 deg	83
PK-CP3	5400 x 2500 - (Accessible)	3
PK-CP2	5400 x 2500 - (Backup)	17
PK-CP7	5400 x 2500 - EV CAR	3
Grand total		106
TOTAL CAR PARK REQUIRED		104

PROVIDED MOTORCYCLE PARKING (BLDG2)

Family	Type	Count
PK-CP8	2500 x 1200 (MOTORCYCLE)	3
Grand total		3

BUILDING 3 | BUILDING 4

DEVELOPMENT SUMMARY (BLDG3&4) - GFA

Name	Area
OFFICE 3A	441 m²
OFFICE 3A LOBBY	42 m²
OFFICE 3B	439 m²
OFFICE 3B LOBBY	42 m²
OFFICE 4A	441 m²
OFFICE 4A LOBBY	42 m²
OFFICE 4B	441 m²
OFFICE 4B LOBBY	42 m²
OFFICE 4C	413 m²
OFFICE 4C LOBBY	66 m²
WAREHOUSE 3A	11703 m²
WAREHOUSE 3B	9733 m²
WAREHOUSE 4A	9093 m²
WAREHOUSE 4B	9088 m²
WAREHOUSE 4C	9838 m²
Grand total	51866 m²
AWNING 5M (BLDG 4)	56 m²
AWNING 15M (BLDG 3)	1834 m²
AWNING 15M (BLDG 4)	2183 m²
HEAVY DUTY PAVEMENT (BLDG 3&4)	23244 m²
LIGHT DUTY PAVEMENT (BLDG 3&4)	8114 m²

PROVIDED PARKING SCHEDULE (BLDG3&4)

Family	Type	Count
PK-CP1	5400 x 2500 - 90 deg	211
PK-CP3	5400 x 2500 - (Accessible)	10
PK-CP2	5400 x 2500 - (Backup)	113
PK-CP7	5400 x 2500 - EV CAR	12
Grand total		346
TOTAL CAR PARK REQUIRED		336

PROVIDED MOTORCYCLE PARKING (BLDG3&4)

Family	Type	Count
PK-CP8	2500 x 1200 (MOTORCYCLE)	7
Grand total		7

BUILDING 5

DEVELOPMENT SUMMARY (BLDG5) - GFA

Name	Area
OFFICE 5A	499 m²
OFFICE 5B	401 m²
OFFICE 5C	393 m²
OFFICE 5D	387 m²
OFFICE 5E	476 m²
OFFICE 5F	385 m²
OFFICE 5G	377 m²
OFFICE 5H	372 m²
UNIT 5A	9452 m²
UNIT 5B	7492 m²
UNIT 5C	6936 m²
UNIT 5D	7349 m²
UNIT 5E	9450 m²
UNIT 5F	7454 m²
UNIT 5G	6929 m²
UNIT 5H	6381 m²
Grand total	64738 m²
AWNING 15M (BLDG5)	3847 m²
HEAVY DUTY PAVEMENT (BLDG 5)	24063 m²
LIGHT DUTY PAVEMENT (BLDG 5)	26845 m²

PROVIDED PARKING SCHEDULE (BLDG5)

Family	Type	Count
PK-CP1	5400 x 2500 - 90 deg	282
PK-CP2	5400 x 2500 - (Backup)	120
PK-CP3	5400 x 2500 - (Disable)	12
PK-CP7	5400 x 2500 - EV CAR	14
PK-CP5	5900 x 2500 - 0 deg (PARALLEL PARKING)	16
Grand total		444
TOTAL CAR PARK REQUIRED (EXCLUDING BACKUP)		282

PROVIDED MOTORCYCLE PARKING (BLDG5)

Family	Type	Count
PK-CP8	2500 x 1200 (MOTORCYCLE)	12
Grand total		12

NOTE: THE LOCATION OF PROPERTY ALIGNMENTS IS DETERMINED FROM SURVEY INFORMATION PROVIDED BY SURVEYOR.

Augusta St Warehouse and Distribution Centre
Augusta St, Blacktown within Blacktown

FOR APPROVAL

REVISION	DESCRIPTION	DATE
A	FOR SSDA SUBMISSION	23.06.23
B	TEST OF ADEQUACY UPDATES	11.08.23
C	TEST OF ADEQUACY UPDATES	18.08.23
D	TEST OF ADEQUACY UPDATES	21.08.23

ARCHITECT: PACE ARCHITECTS
BUILDER / PROJECT MANAGER:
CLIENT: LOGOS

purpose: FOR APPROVAL
H- MASTERPLAN

scale: As Indicated A1
project no: 220207
date: 21.08.23
dwn: BH
dwg no: 220207 - DA-001
issue: D

Figure 1e.
Masterplan (PACE Architects, Dwg No. 220207 - DA - 001, Issue D. Dated 21.08.23)

LANDSCAPE STRATEGY

KEY

- Entry Feature Planting 1,943.22 sqm
- Conservation (Setback) 14,664.62 sqm
- Carpark and Office Planting 3,616.13 sqm
- Conservation 23,411.38 sqm
- Conservation (Under Electrical Easement) 38,810.03 sqm
- Conservation Planting (Bioretention Basins) 11,872.90 sqm

NOTE:

1. Refer to Plant Schedules for species lists.
2. All Conservation Areas are subject to VMP.

PROPOSED CONSERVATION OUTCOME ONSITE:

STRATEGY	APPROXIMATE AREA
AREA FOR CONSERVATION	
Conservation setback from roads	1.5 ha
Conservation associated with drainage lines (excl area under Electricity Easement)	2.3 ha
Conservation (under Electricity Easement)	3.5 ha
Conservation Planting (bioretention basins)	1.2 ha
TOTAL	8.6 ha
Area not included in area calculated for conservation (these area provide some potential habitat, especially arboreal and avifauna	
Entry Feature Planting	0.2 ha
Carpark and Office Planting	0.6 ha
TOTAL	0.8 ha
TOTAL LANDSCAPE AREA	9.4 ha



PROJECT	DRAWING TITLE	PROJECT NO.	PURPOSE	SCALE	REVISION	DATE	DRAWN	CHECKED	PAGE	CLIENT
HUNTINGWOOD LOGISTICS ESTATE AUGUSTA ST, HUNTINGWOOD EAST, NSW	LANDSCAPE STRATEGY	H8-22032	CLIENT REVIEW	NTS	I	06.09.2023	DG	DV	L07	LOGOS

0 10 50 100 150m

SCALE 1:3000 AT A3

HABIT8

Figure 1f.
Landscape Strategy (Habit8 - Project No. H8-22032. Rev. I. Dated 06.09.2023)





ANNE CLEMENTS & ASSOCIATES PTY. LIMITED
Environmental and Botanical Consultants

Date created: 20-06-2023

Site boundary

0 150 300 m

Geocentric Datum of Australia 1994

Figure 1930-1956.
Site boundary overlaid on the 1930 and 1956 historic aerial photographs (Spatial Services)





ANNE CLEMENTS & ASSOCIATES PTY. LIMITED
Environmental and Botanical Consultants

Date created: 20-06-2023

Site boundary

0 150 300 m

Geocentric Datum of Australia 1994

Figure 1965 - 1970.
Site boundary overlaid on the 1965 and 1970 historic aerial photographs (Spatial Services)





ANNE CLEMENTS & ASSOCIATES PTY. LIMITED
Environmental and Botanical Consultants

Date created: 20-06-2023

Site boundary

0 150 300 m

Geocentric Datum of Australia 1994

Figure 1978 - 1986.
Site boundary overlaid on the 1978 and 1986 historic aerial photographs (Spatial Services)





ANNE CLEMENTS & ASSOCIATES PTY. LIMITED
Environmental and Botanical Consultants

Date created: 20-06-2023

Site boundary

0 150 300 m

Geocentric Datum of Australia 1994

Figure 2002 - 2012.
Site boundary overlaid on the 2002 and 2012 historic aerial photographs (Spatial Services)



ANNE CLEMENTS & ASSOCIATES PTY. LIMITED
Environmental and Botanical Consultants

Date created: 11-09-2023

	Site boundary	R4	High Density Residential
W1	Natural Waterways	R2	Low Density Residential
SP2	Infrastructure	IN2	Light Industrial
SP1	Special Activities	IN1	General Industrial
RU4	Primary Production Small Lots	B5	Business Development
RE2	Private Recreation	B1	Neighbourhood Centre
RE1	Public Recreation		

0 250 500 m

Geocentric Datum of Australia 1994

Figure 2a.
Site boundary overlaid on the
Blacktown Local Environmental Plan 2015 - Land Zoning Map.



ANNE CLEMENTS & ASSOCIATES PTY. LIMITED
Environmental and Botanical Consultants

Date created: 10-07-2023

- Site boundary
- AB2 - 40 ha
- G - 450 m2
- U - 1000 m2
- V - 2000 m2

Figure 2b.
Site boundary overlaid on the Blacktown Local Environmental Plan 2015 - Minimum Lot Size Map



Figure 2c.
Site boundary overlaid on the Blacktown Local Environmental Plan 2015- Terrestrial Biodiversity Map

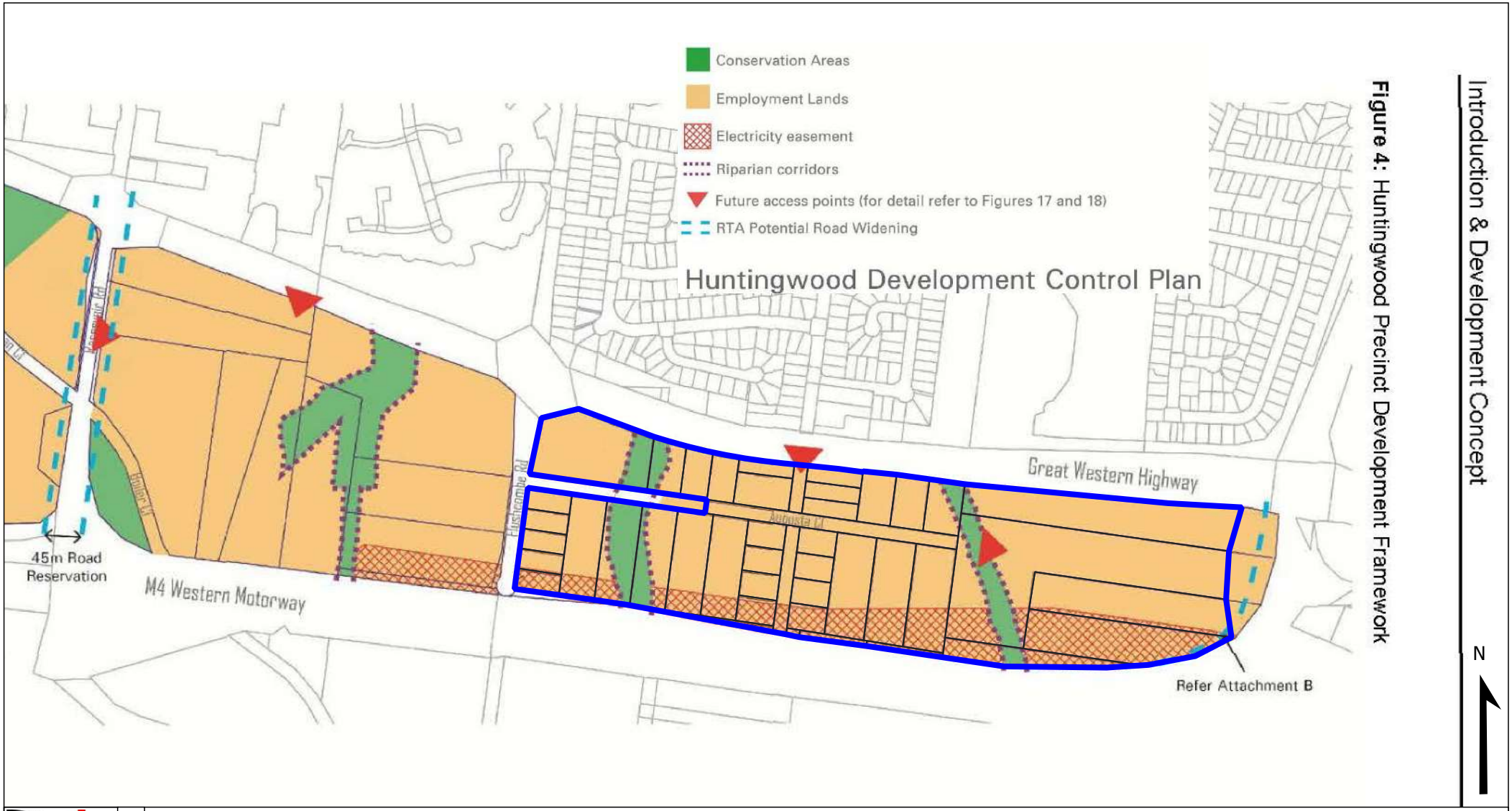


Figure 2d.
Site boundary overlaid on Huntingwood Precinct Development Framework (from Figure 4, page 7 of the Huntingwood Precinct DCP)

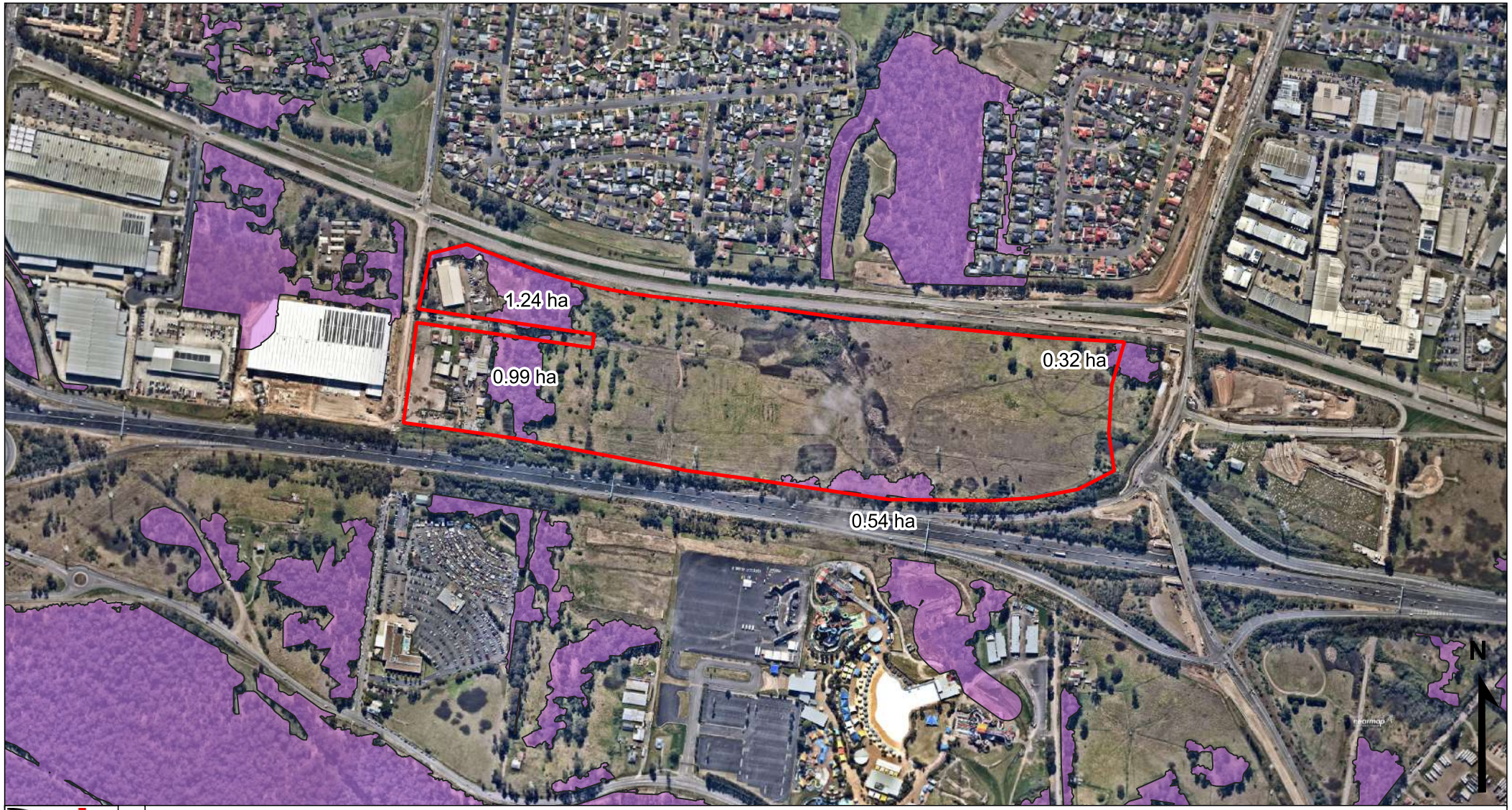


Figure 2e.
Site boundary overlaid on the Biodiversity Values Map - version 13

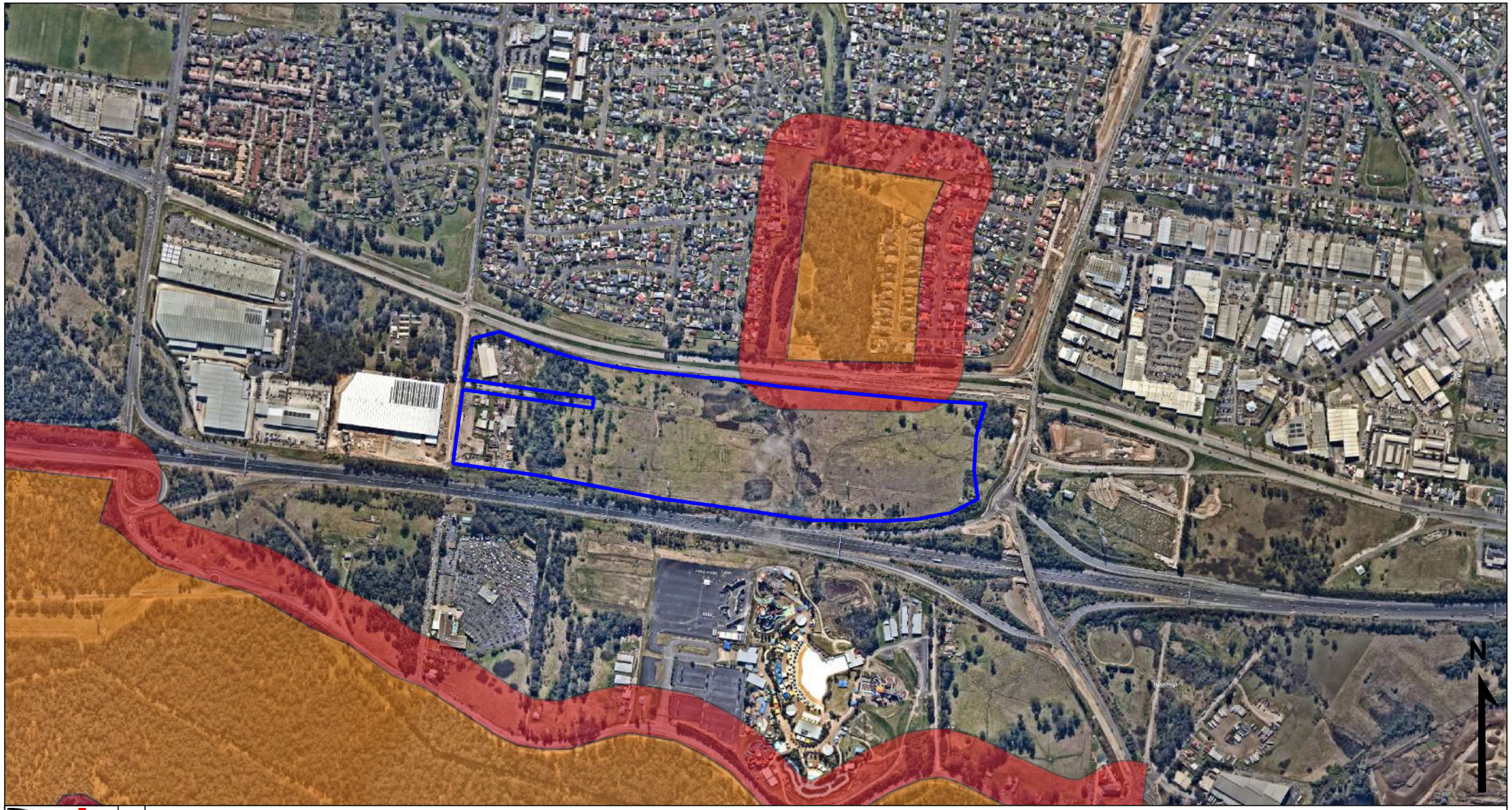
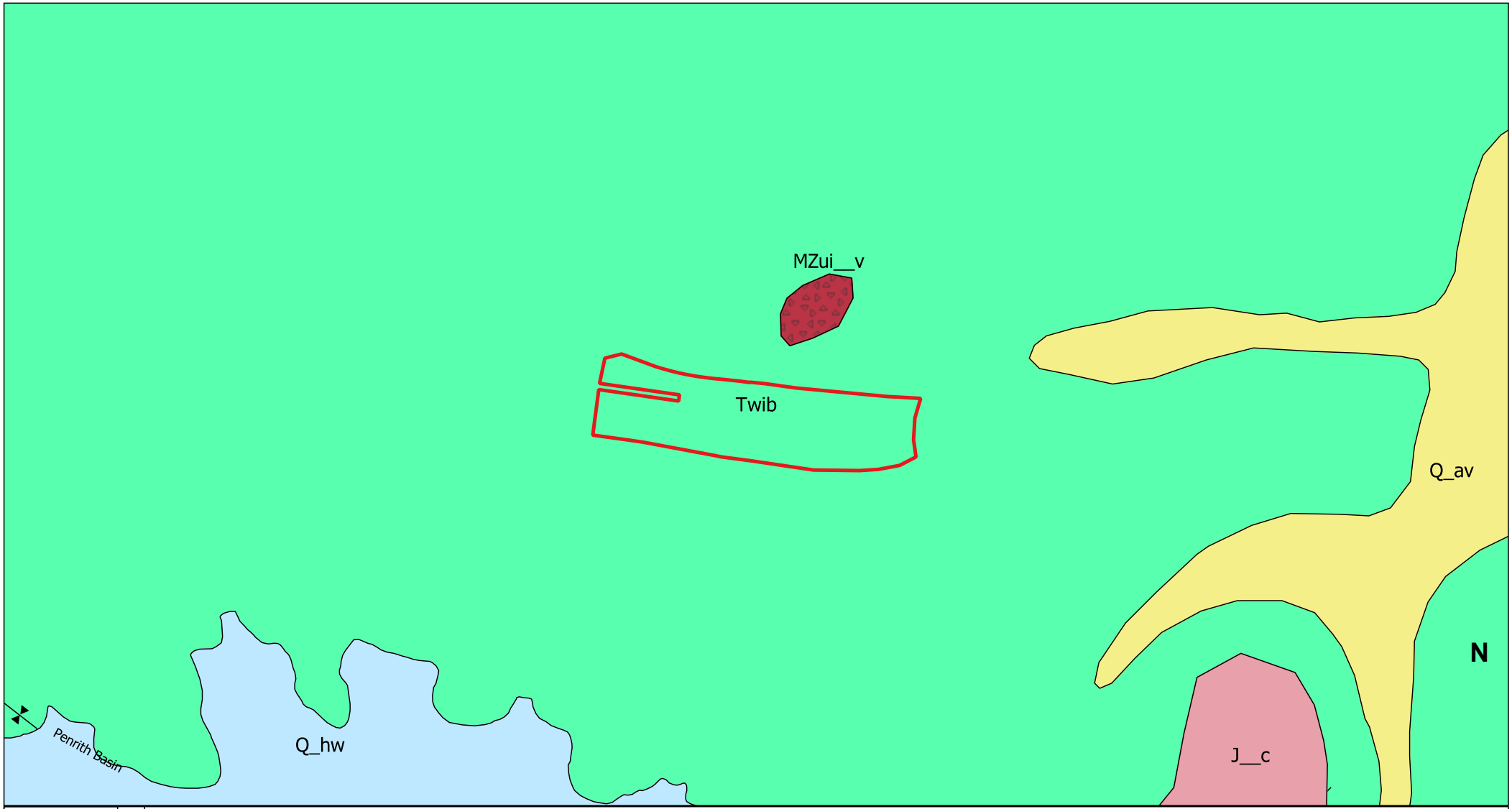


Figure 2f.
Site boundary overlaid on the Bushfire Prone Land map (NSW RFS 2020)



ANNE CLEMENTS & ASSOCIATES PTY. LIMITED
Environmental and Botanical Consultants

Date created: 17-03-2022

Site boundary

Geological boundary position accurate

Cenozoic sedimentary province

- Q_av Alluvial valley deposits
- Q_hw Anthropogenic stored water, pondage, reservoirs, canals

Permian-Mesozoic ignous province

- J__c Prospect Picrite
- MZui__v Ungrouped Mesozoic igneous units - breccia
- Undifferentiated breccia

Permian-Triassic basins

- Twib Bringelly Shale
- Syncline, position accurate

0 250 500 m

Geocentric Datum of Australia 1994

Figure 3a.
Site boundary overlaid on NSW Seamless Geology - version 2

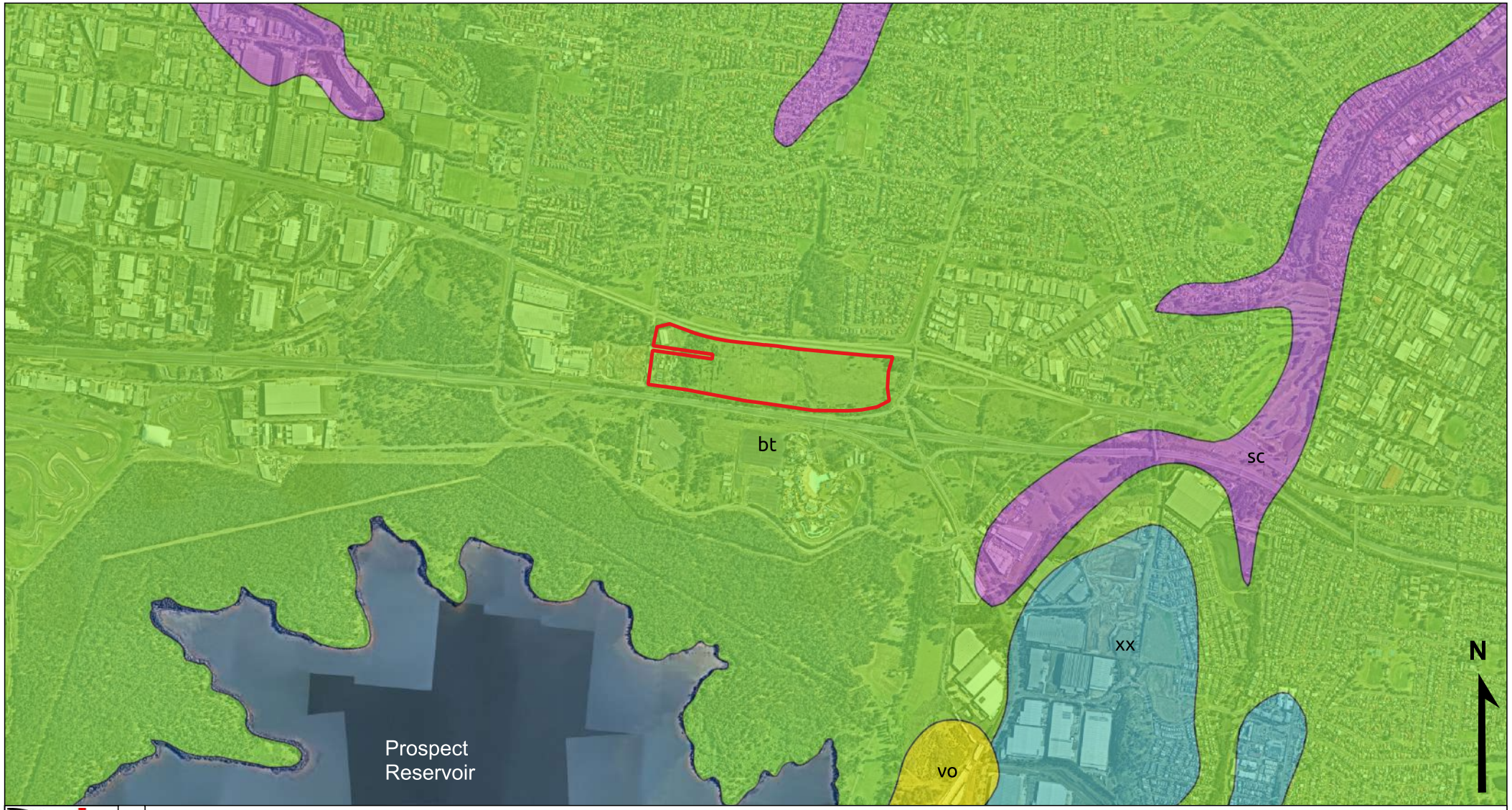


Figure 3b.
Site boundary overlaid on Soil Landscapes of Central and Eastern NSW - version 2.1

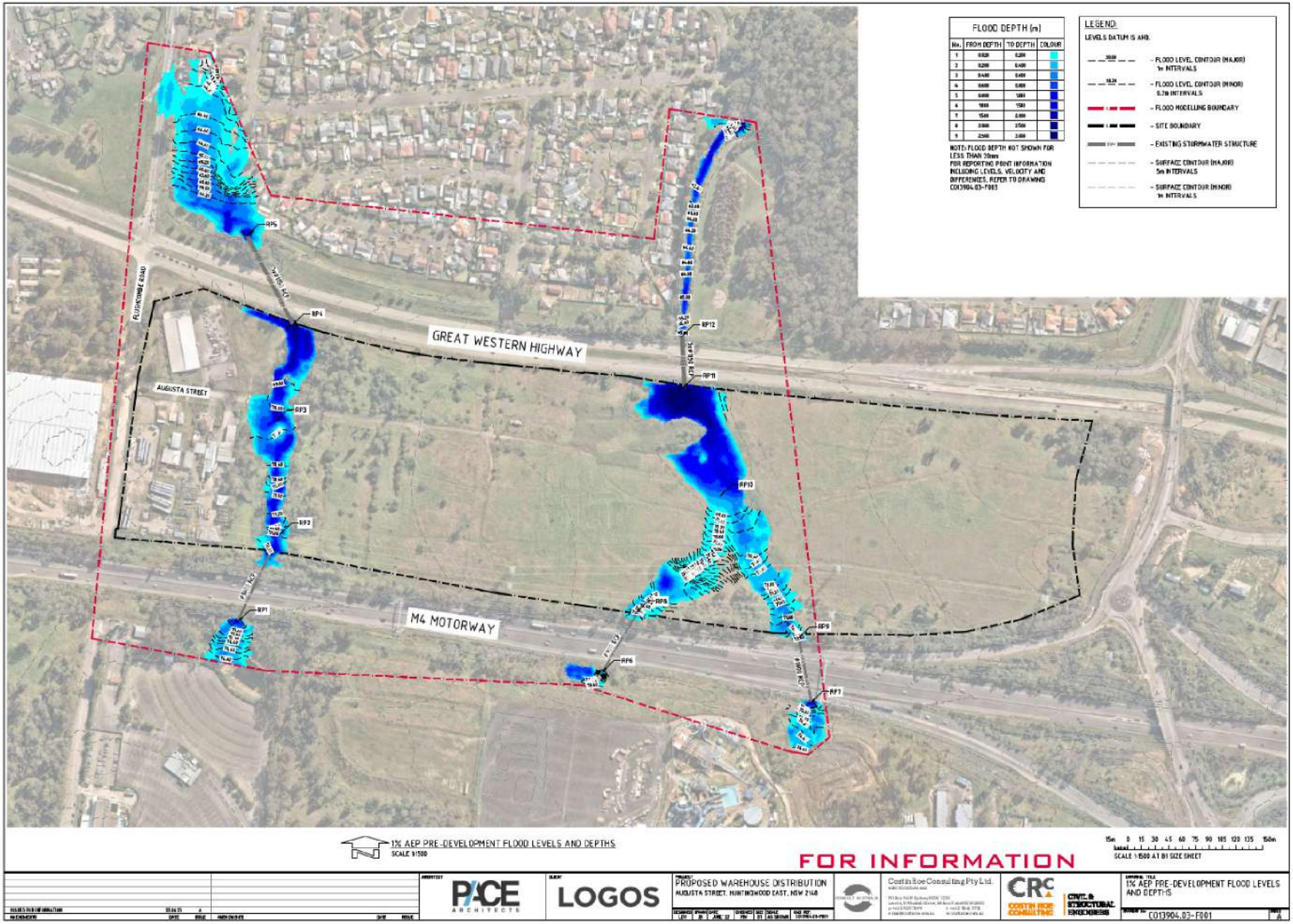
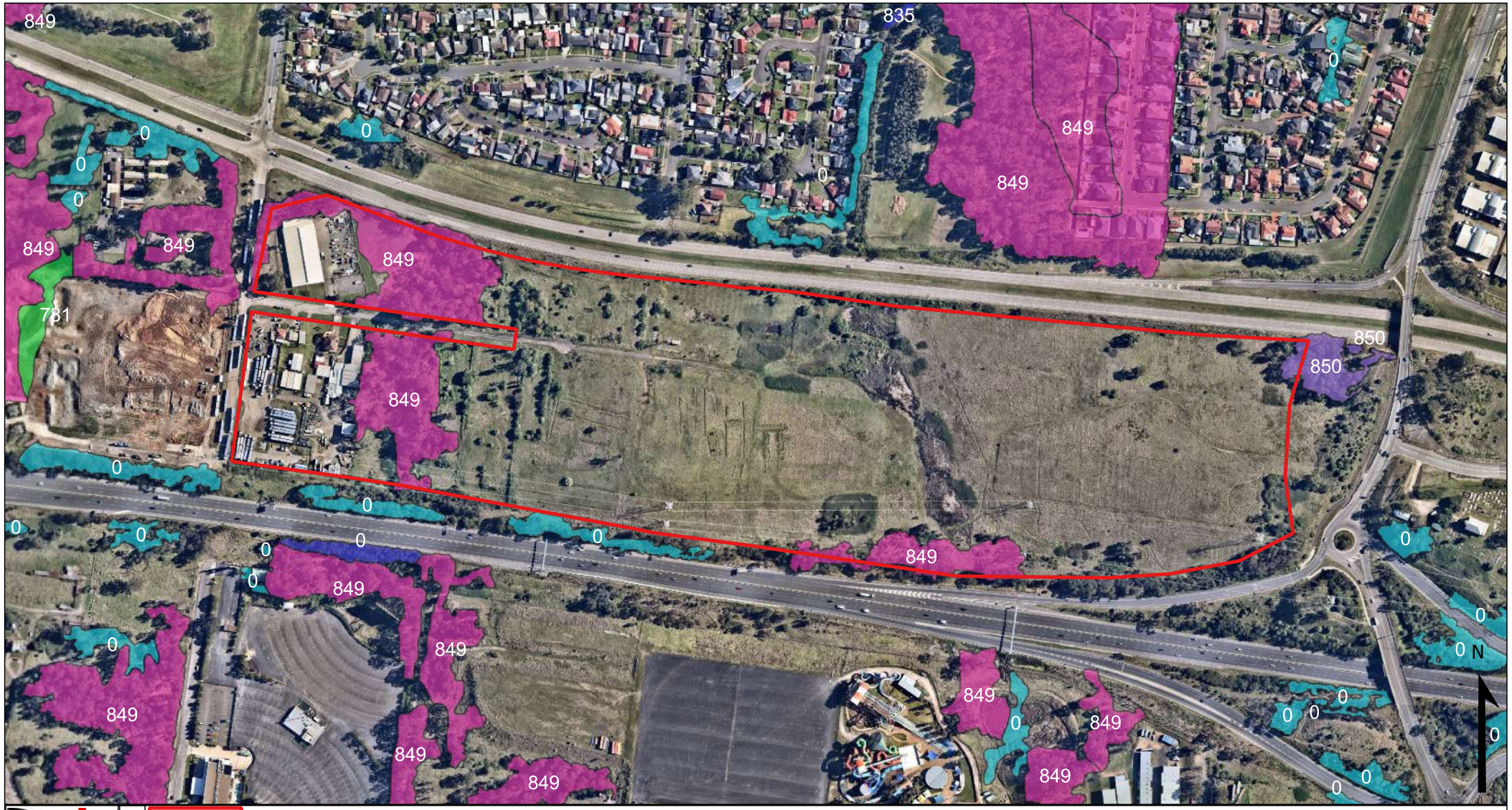


Figure 3c.
1% AEP pre-development flood levels and depth (Costin Roe Consulting Pty Ltd, Drawing No. C013904.03-F001. Issue A. Dated 23.06.23)



ANNE CLEMENTS & ASSOCIATES PTY. LIMITED
Environmental and Botanical Consultants

Date created: 13-09-2022

	Site boundary
PCT - 835	S_FoW06: Cumberland Riverflat Forest
PCT - 781	S_FrW03: Coastal Freshwater Wetland
PCT - 850	S_GW02: Cumberland Shale Hills Woodland
PCT - 849	S_GW03: Cumberland Shale Plains Woodland
PCT - 0	Urban_E/N: Urban Exotic/Native
PCT - 0	Weed_Ex: Weeds and Exotics

0 100 200 m

Geocentric Datum of Australia 1994

Figure 4a.
The Native Vegetation of the Sydney Metropolitan Area - Version 3.1 (OEH 2016) VIS_ID 4489



ANNE CLEMENTS & ASSOCIATES PTY. LIMITED
Environmental and Botanical Consultants

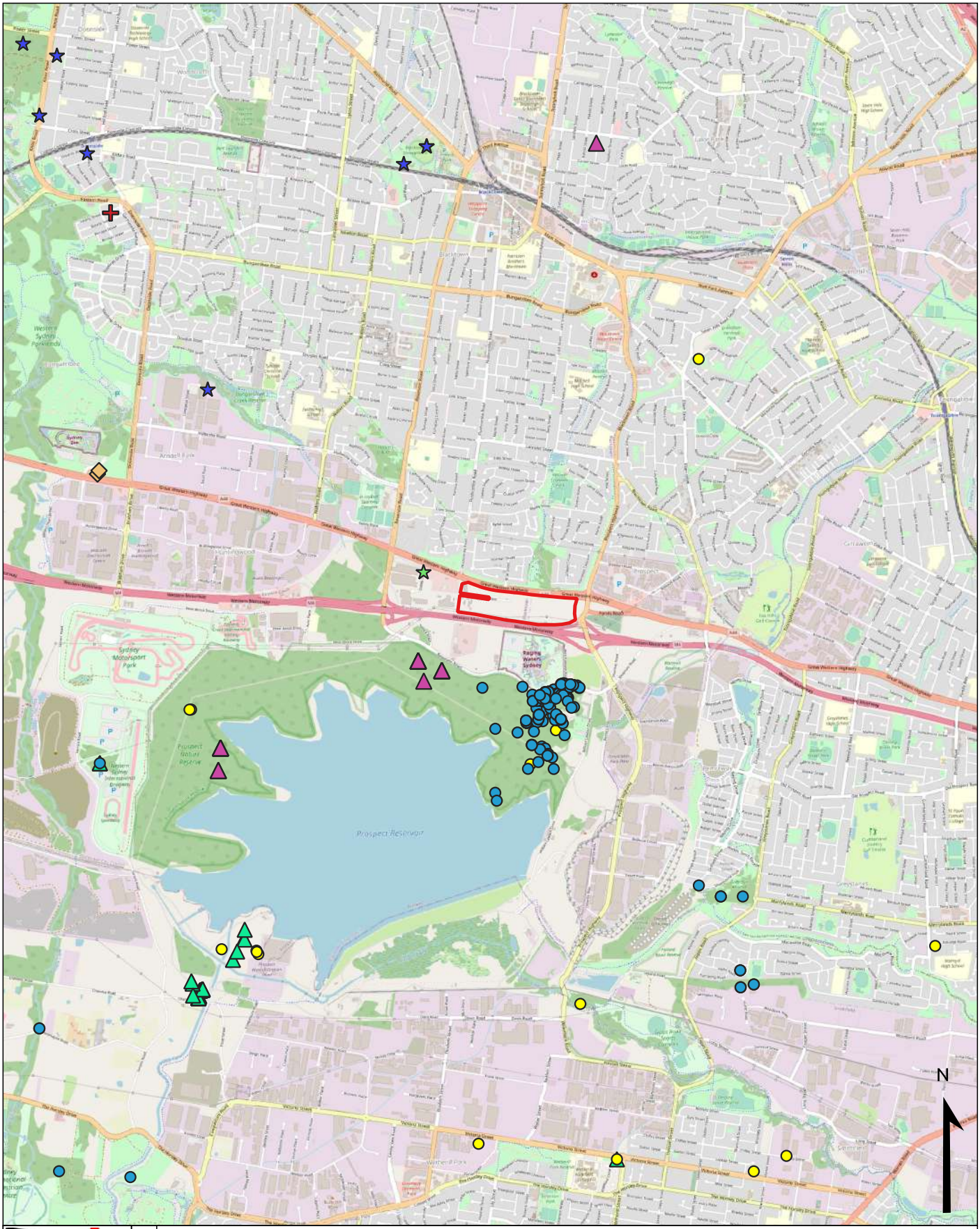
Date created: 13-09-2022

Site boundary
PCT - 4024 Cumberland Blue Box Riverflat Forest
PCT - 3320 Cumberland Shale Plains Woodland
PCT - 3972 Sydney Creekflat Wetland

0 100 200 m

Geocentric Datum of Australia 1994

Figure 4b.
NSW State Vegetation Type Map (DPE 2022)



ANNE CLEMENTS & ASSOCIATES PTY. LIMITED
Environmental and Botanical Consultants

Date created: 03-07-2023

- Site boundary
- Acacia pubescens
- Grevillea juniperina subsp. juniperina
- Marsdenia viridiflora subsp. viridiflora
- Pilularia novae-hollandiae
- Pimelea curviflora var. curviflora
- Pimelea spicata
- Pterostylis saxicola
- Pultenaea parviflora

0 1 2 km

Geocentric Datum of Australia 1994

Figure 5a.
Site boundary and BioNet records of threatened Flora species overlaid on the Google Street Map imagery

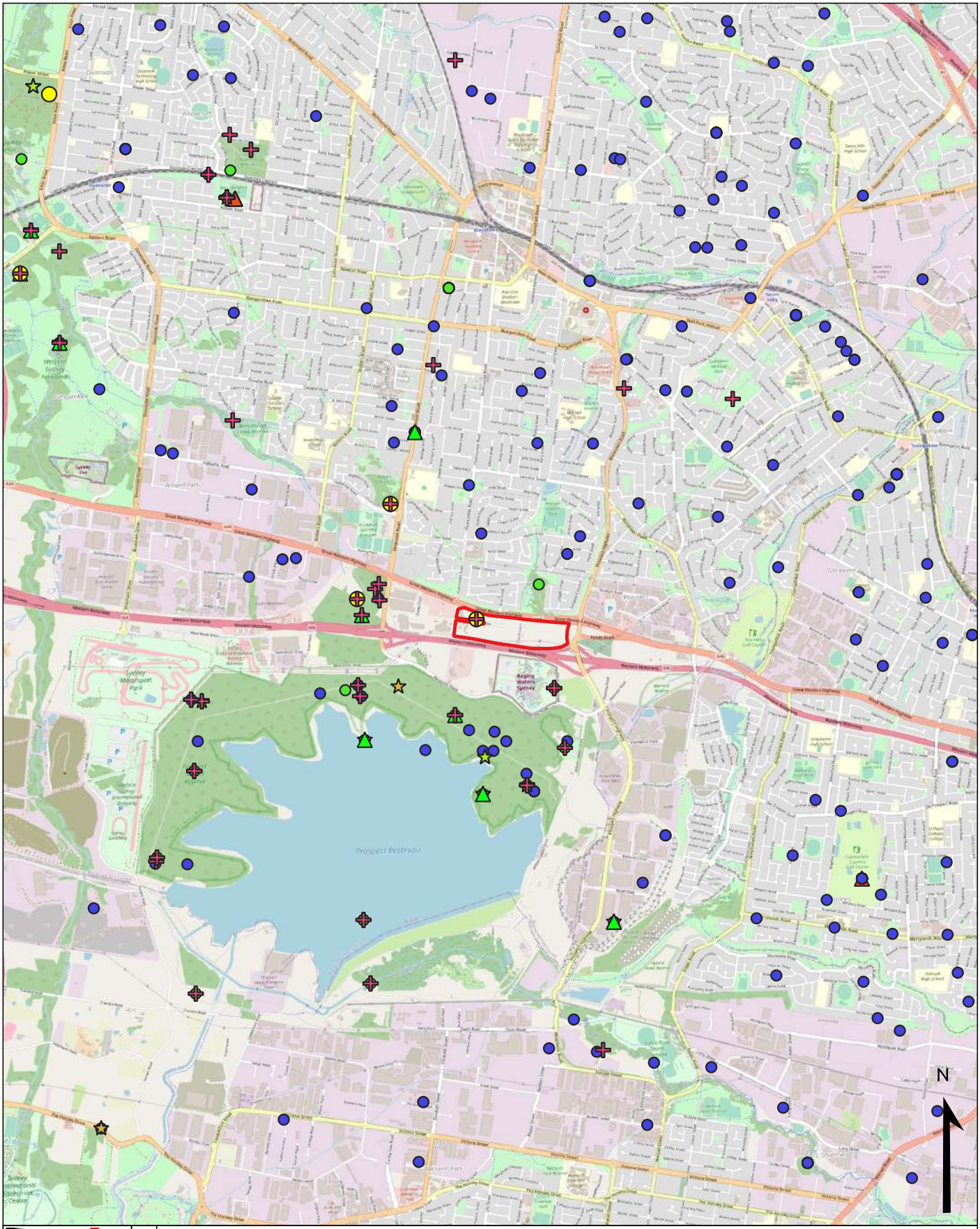


Figure 5b.
Site boundary and BioNet records of threatened mammal species overlaid on the Google Street Map imagery

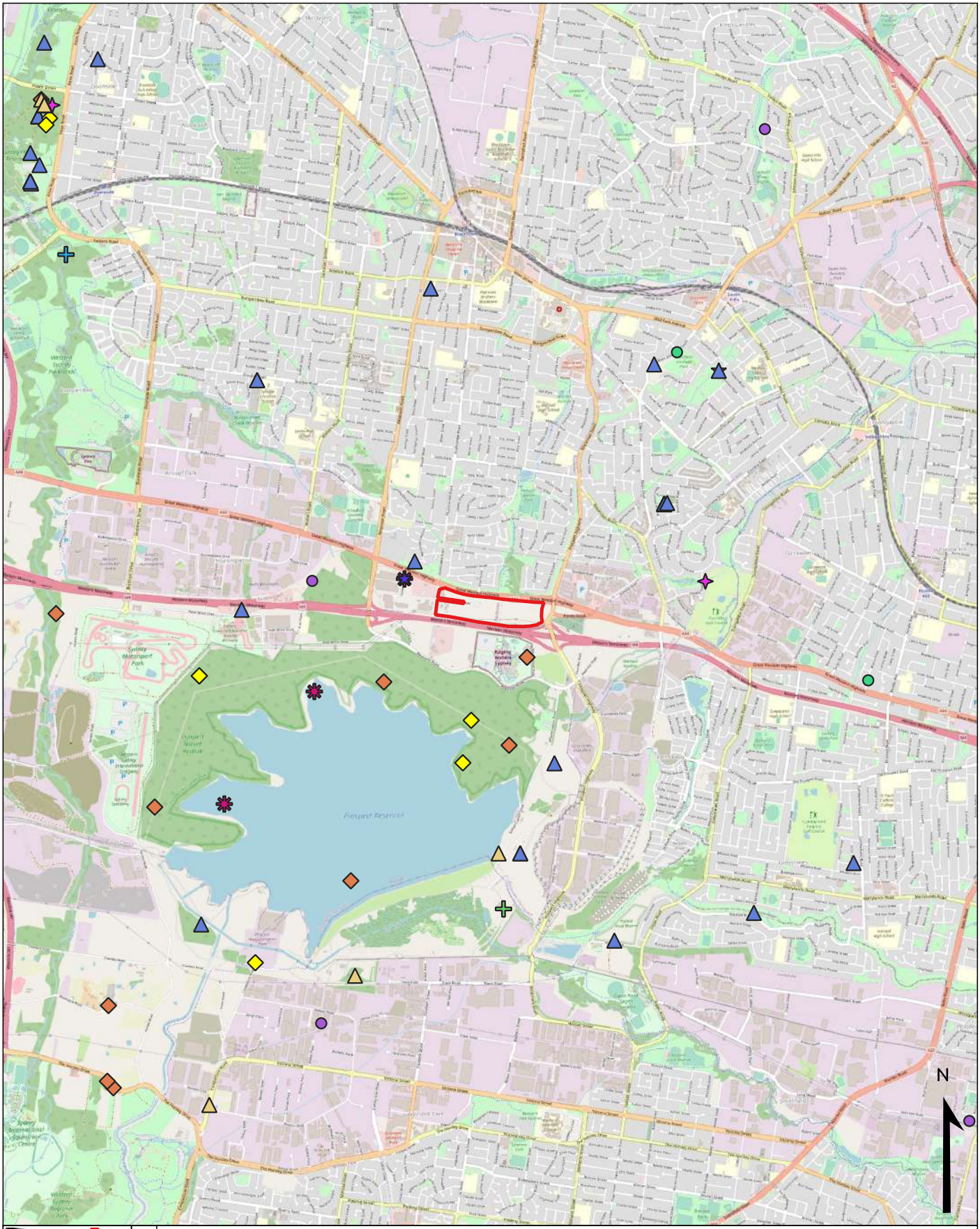
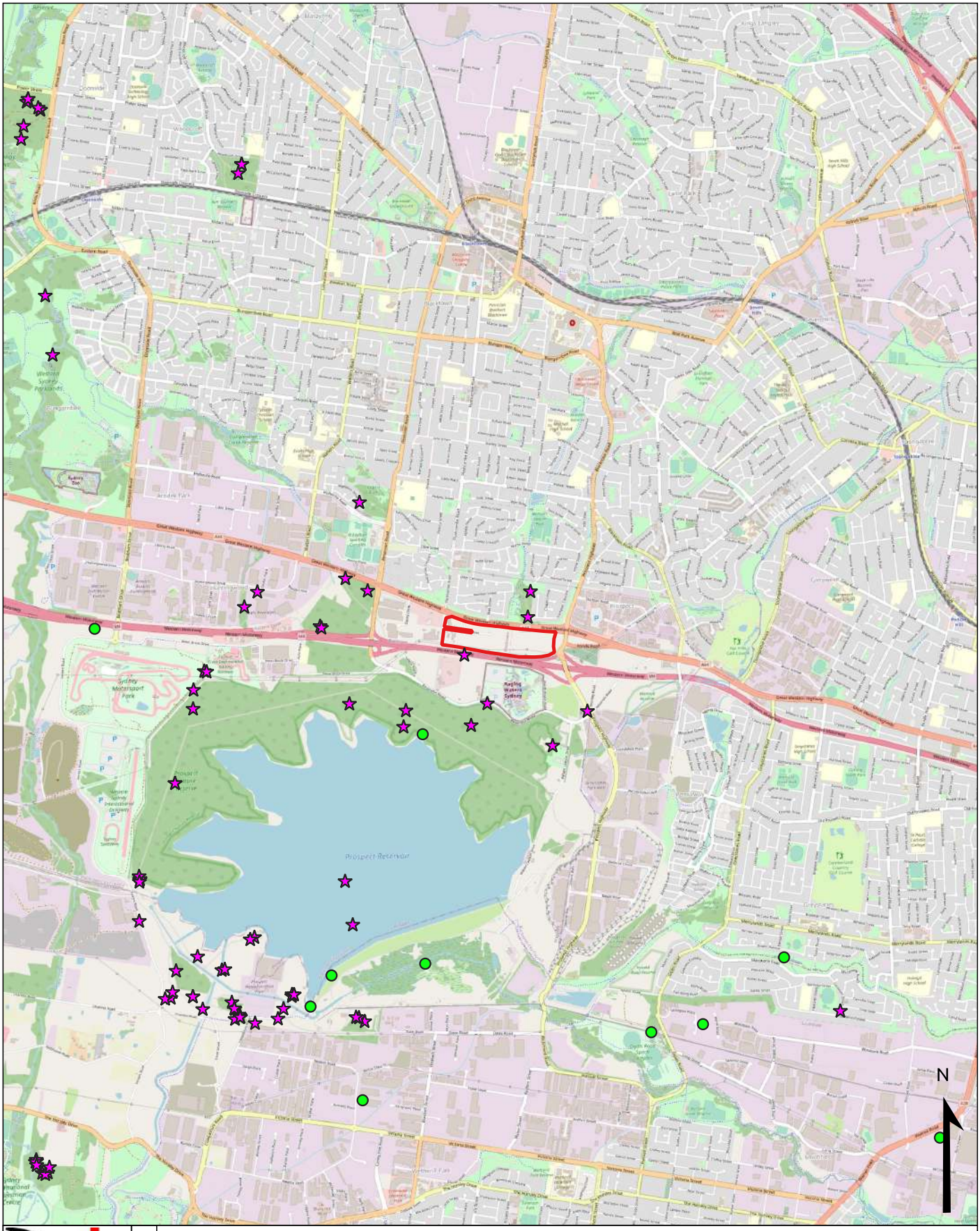


Figure 5c.
Site boundary and BioNet records of threatened bird species overlaid on the Google Street Map imagery



ANNE CLEMENTS & ASSOCIATES PTY. LIMITED
Environmental and Botanical Consultants

Date created: 04-07-2023

Site boundary

Cumberland Plain Land Snail

Green and Golden Bell Frog

0 1 2 km

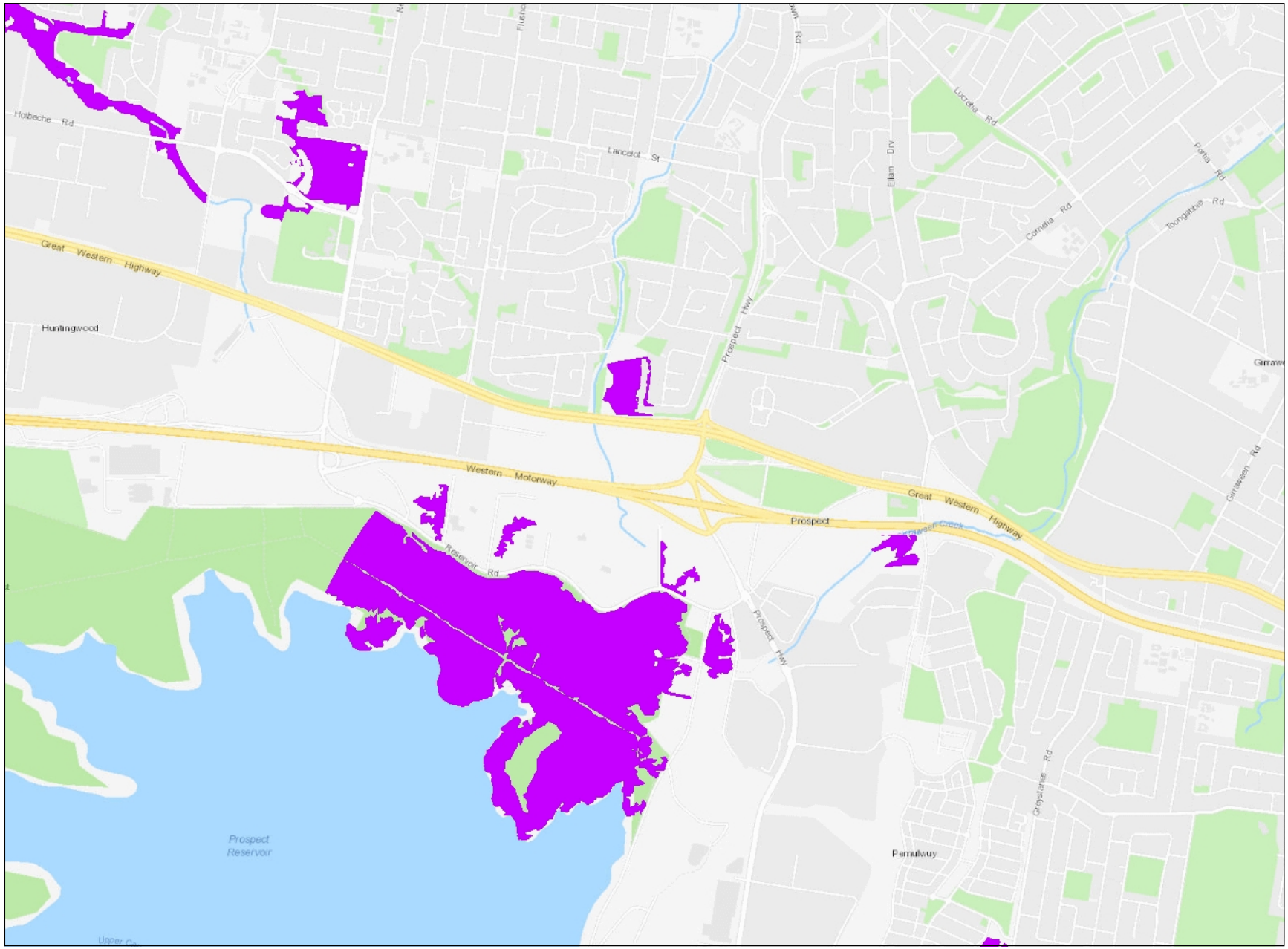
Geocentric Datum of Australia 1994

Figure 5d.
Site boundary and BioNet records of threatened amphibian and gastropod species overlaid on the Google Street Map imagery

Planning, Industry & Environment

Important Habitat map_Huntingwood

Map may contain errors and omissions. Neither the NSW Government nor any other data custodian will accept liability for any loss, damage, or cost incurred as a result of the use of, or reliance upon, the information in the map. Map copyright the State of NSW through the Department of Planning, Industry & Environment.



Legend

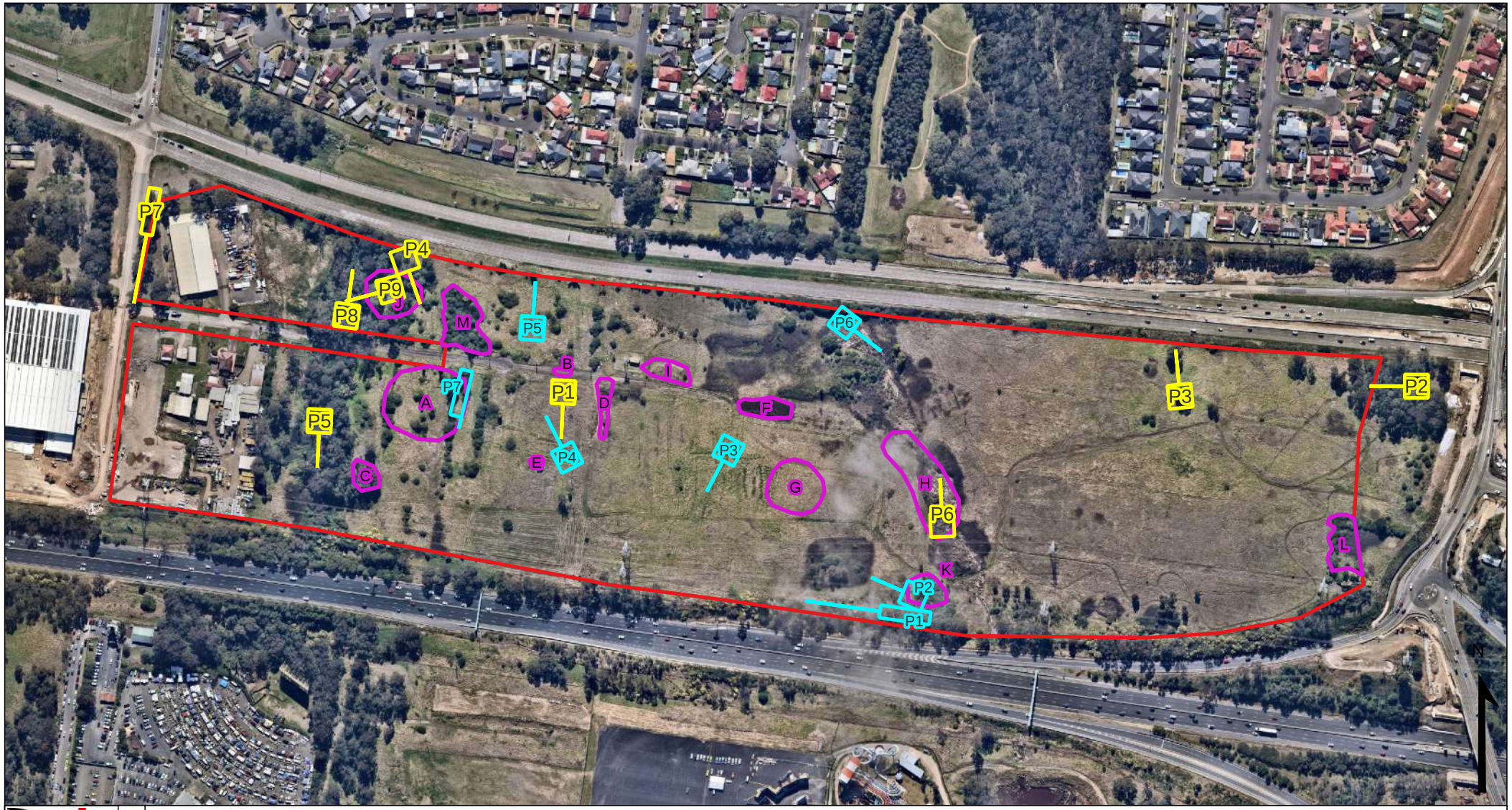
- Swift Parrot Important Areas
- Migratory Shorebird Important Areas
- Regent Honeyeater Important Areas
- Plains-wanderer Important Areas
- DPEBasemap

0 1.3 2.5 5.0

Kilometres

Map Created 3:16 PM 29/6/2023

Figure 5e.
Important habitat map



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Environmental and Botanical Consultants

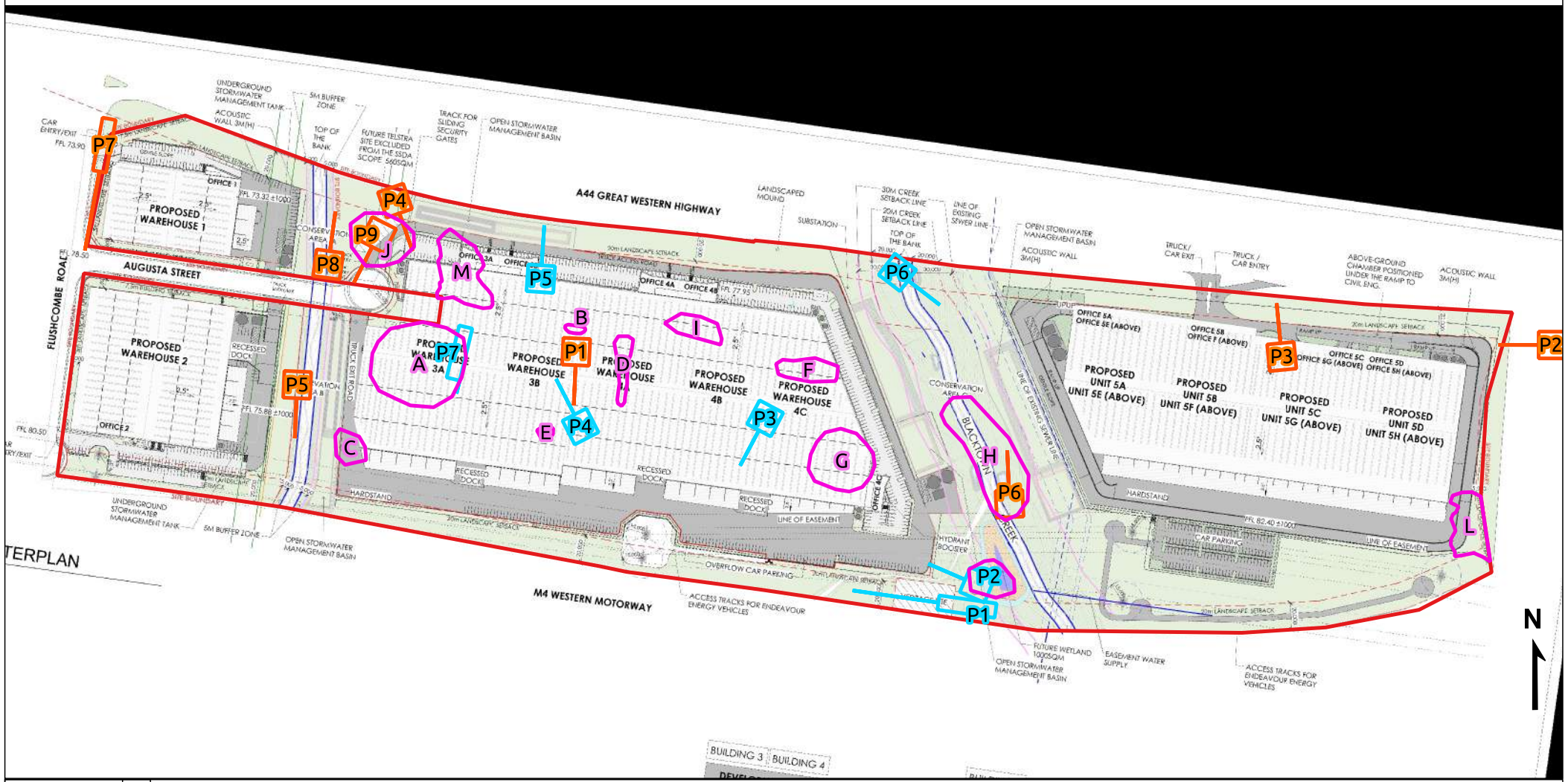
Date created: 29-06-2023

Site boundary
ACA BAM Plots
EP BAM Plots
ACA Patches

0 100 200 m

Geocentric Datum of Australia 1994

Figure 6a.
Sampling locations overlaid on the Nearmap aerial photograph dated 21 August 2022



ANNE CLEMENTS & ASSOCIATES PTY. LIMITED
Environmental and Botanical Consultants

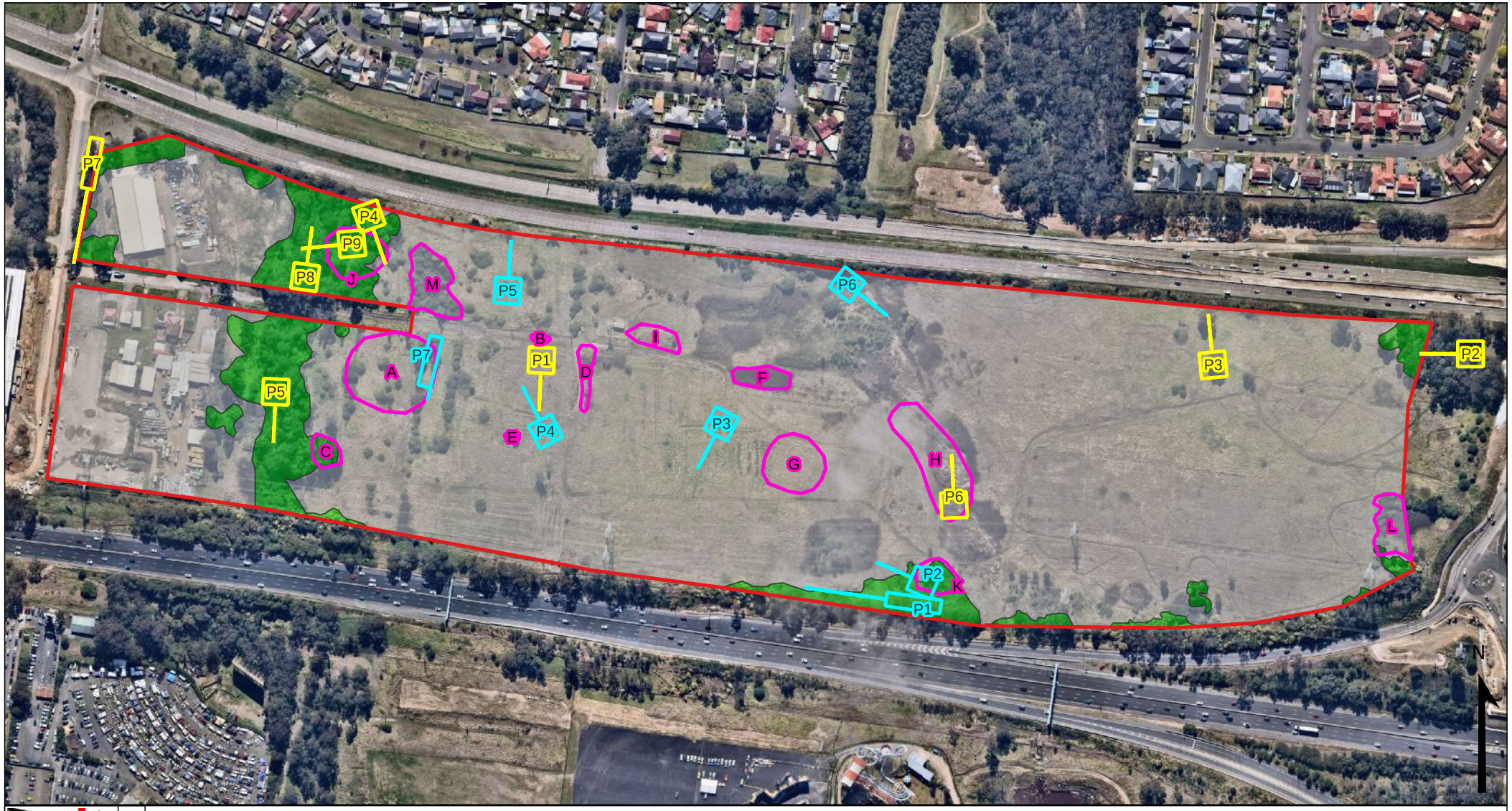
Date created: 08-09-2023

- ACA Patches
- ACA BAM Plots
- EP BAM Plots
- Site boundary

0 50 100 m

Geocentric Datum of Australia 1994

Figure 6b.
Sampling locations overlaid on the Masterplan (PACE Architects, Dwg No. 220207-DA-001, Issue D, dated 21.08.23)



ANNE CLEMENTS & ASSOCIATES PTY. LIMITED
Environmental and Botanical Consultants

Date created: 29-06-2023

Site boundary

Sampling

BAM Plots ACA

BAM Plots PE

Patches ACA

PCTS

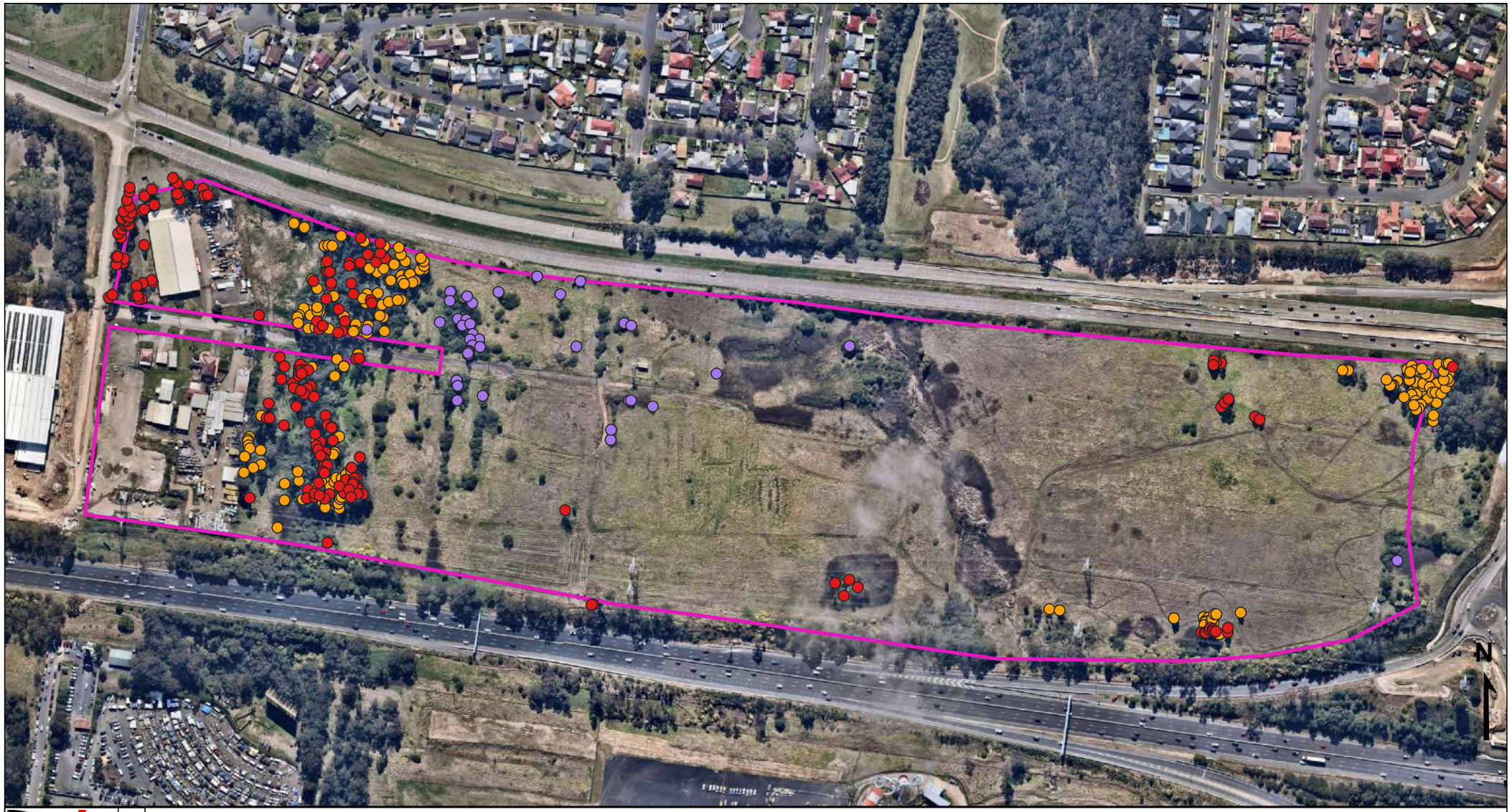
PCT 3319 - Degraded (2.37 ha)

Non-native vegetation or hardstand

0 100 200 m

Geocentric Datum of Australia 1994

Figure 6c.
BAM Plots overlaid on Vegetation Mapping



ANNE CLEMENTS & ASSOCIATES PTY. LIMITED
Environmental and Botanical Consultants

Date created: 08-09-2023

Figure 6d-1.
Canopy trees from Canopy Consulting with Grevillea robusta overlaid on the Nearmap aerial photograph dated 21 August 2022

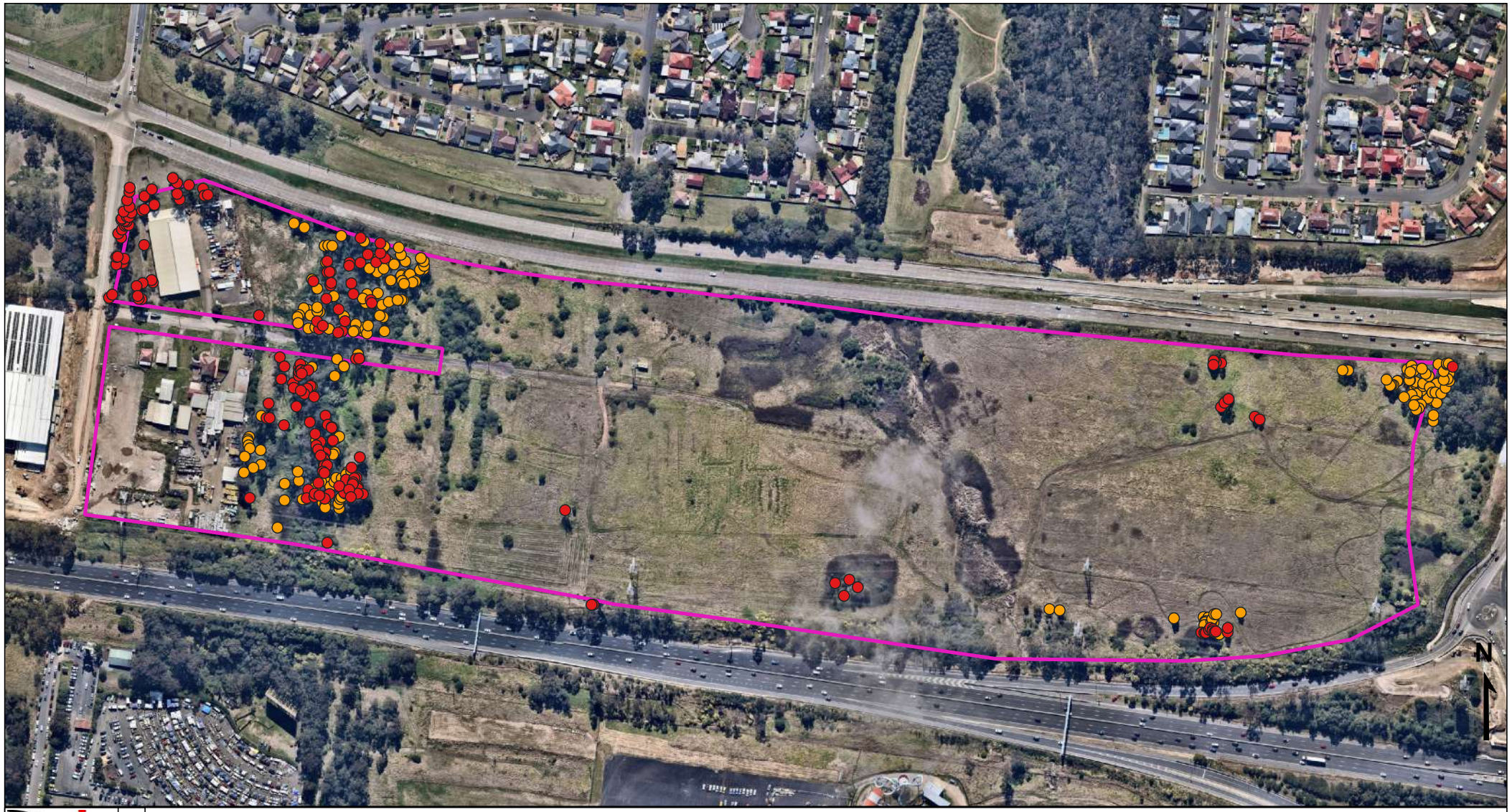
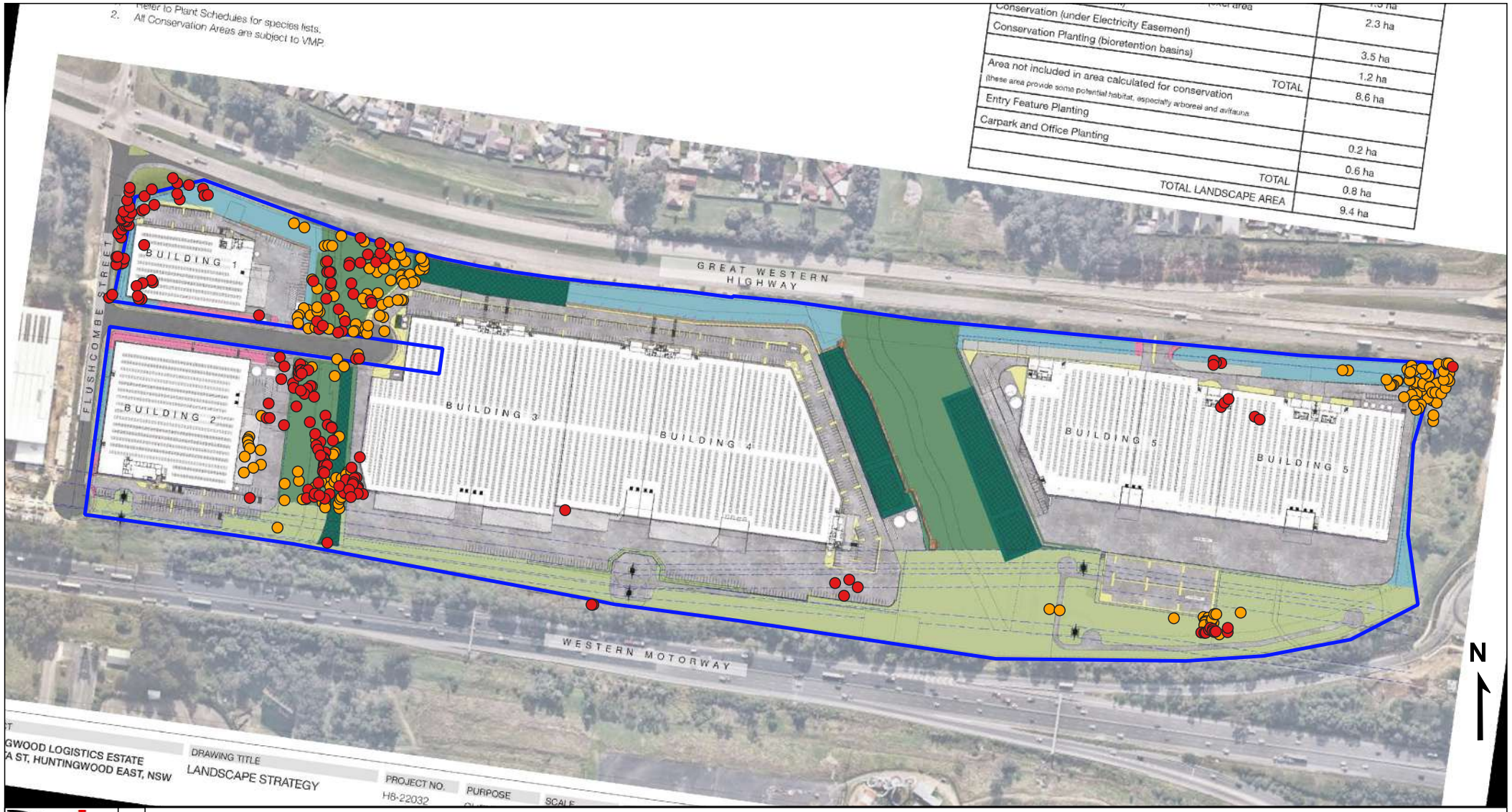


Figure 6d-2.
Native canopy trees from Canopy Consulting overlaid on the Nearmap aerial photograph dated 21 August 2022



ANNE CLEMENTS & ASSOCIATES PTY. LIMITED
Environmental and Botanical Consultants

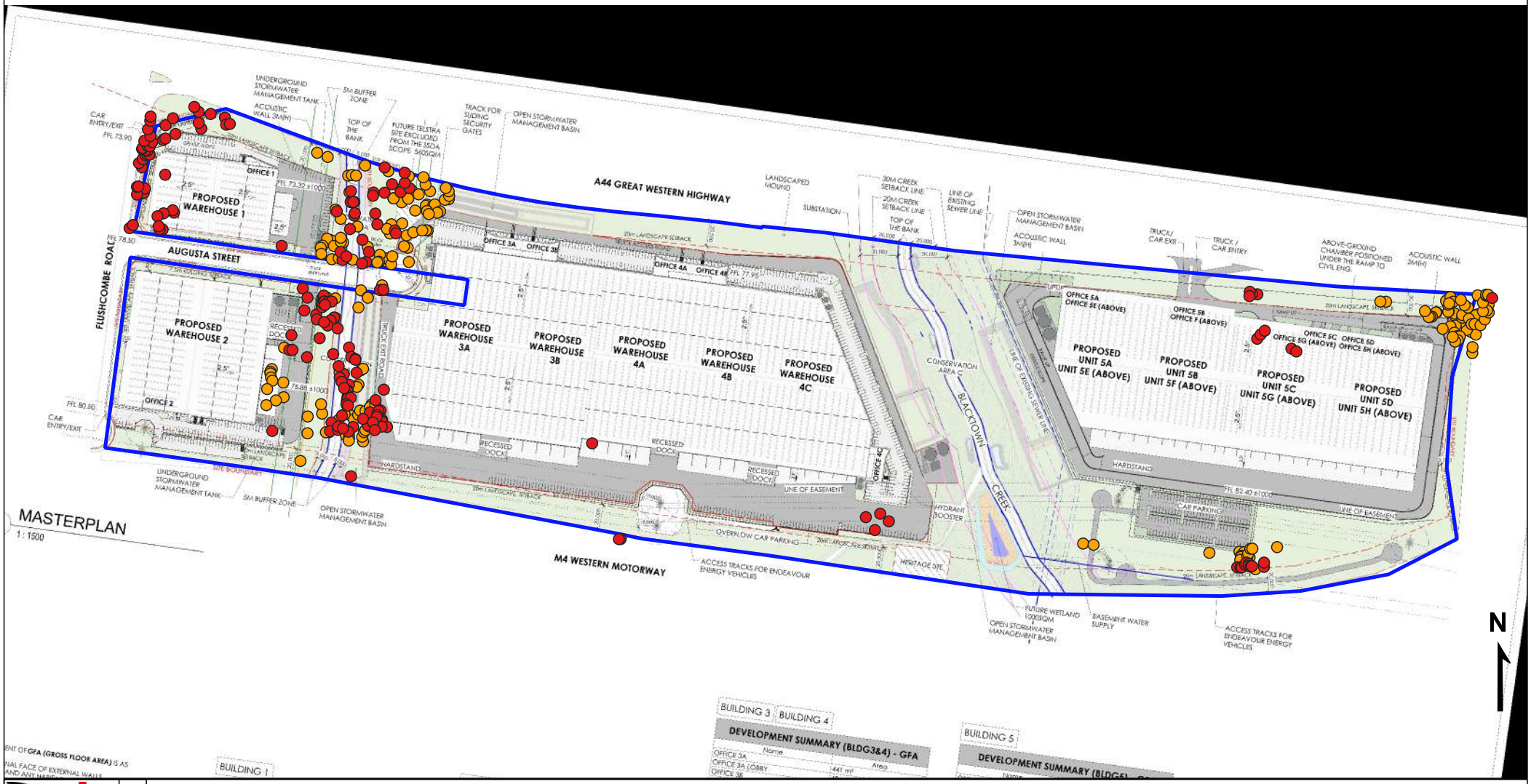
Date created: 08-09-2023

- Eucalyptus moluccana
- Eucalyptus tereticornis
- Site boundary

0 50 100 m

Geocentric Datum of Australia 1994

Figure 6e-1.
Native canopy trees overlaid on the Landscape Strategy



ANNE CLEMENTS & ASSOCIATES PTY. LIMITED
Environmental and Botanical Consultants

Date created: 08-09-2023

- Eucalyptus moluccana
- Eucalyptus tereticornis
- Site boundary

0 50 100 m

Geocentric Datum of Australia 1994

Figure 6e-2.
Native canopy trees overlaid on the Masterplan



ANNE CLEMENTS & ASSOCIATES PTY. LIMITED
Environmental and Botanical Consultants

Date created: 29-06-2023

Site boundary

Vegetation Zones

PCT 3319 - Degraded (2.03 ha)

PCT 3319 - Less degraded (0.34 ha)

Non-native vegetation or hardstand

0 100 200 m

Geocentric Datum of Australia 1994

Figure 7a.
Vegetation Zones overlaid on the Nearmap aerial photograph dated 21 August 2022

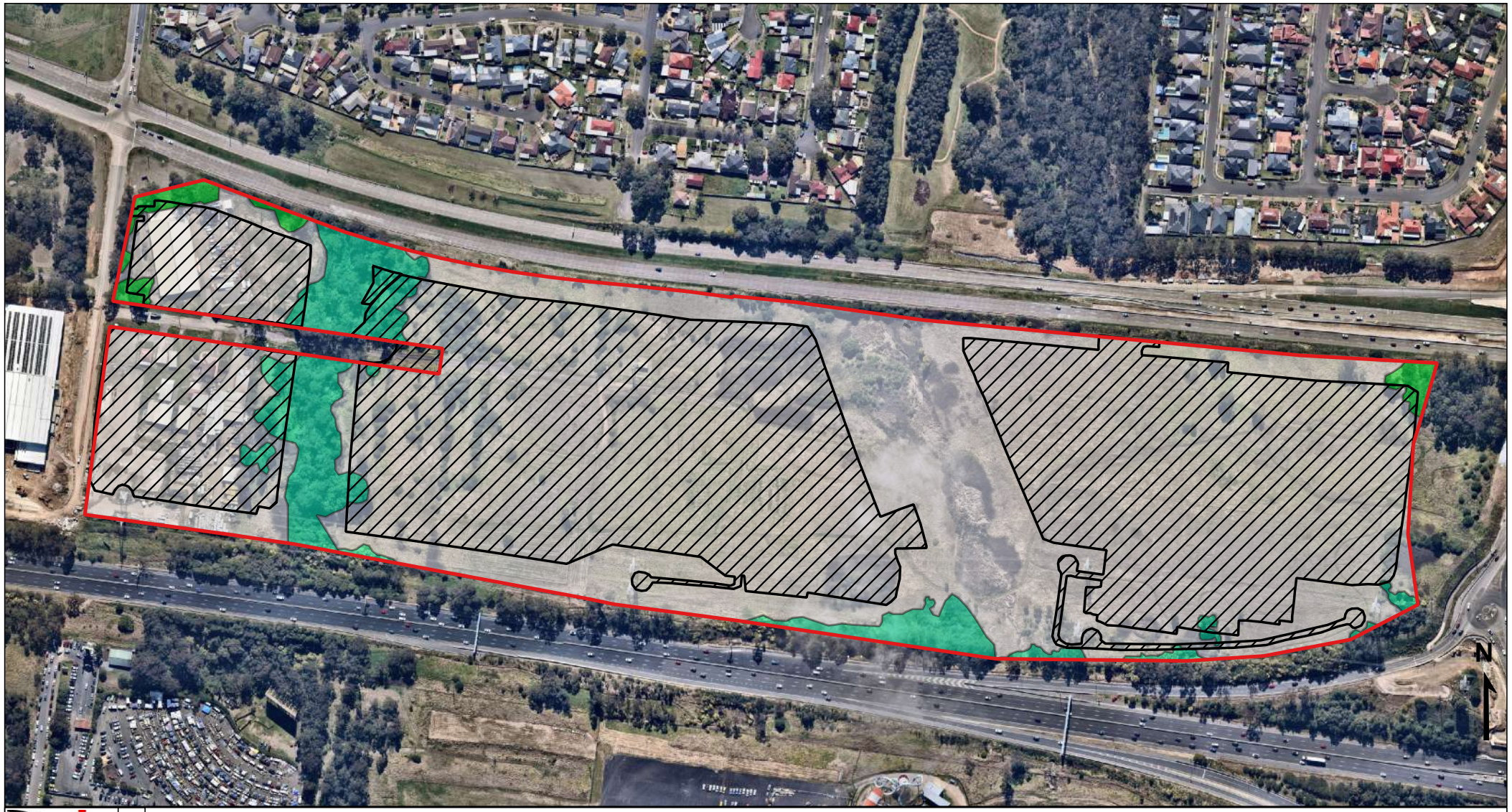


Figure 7b-1.
Management zones overlaid on vegetation zones for the submitted proposal

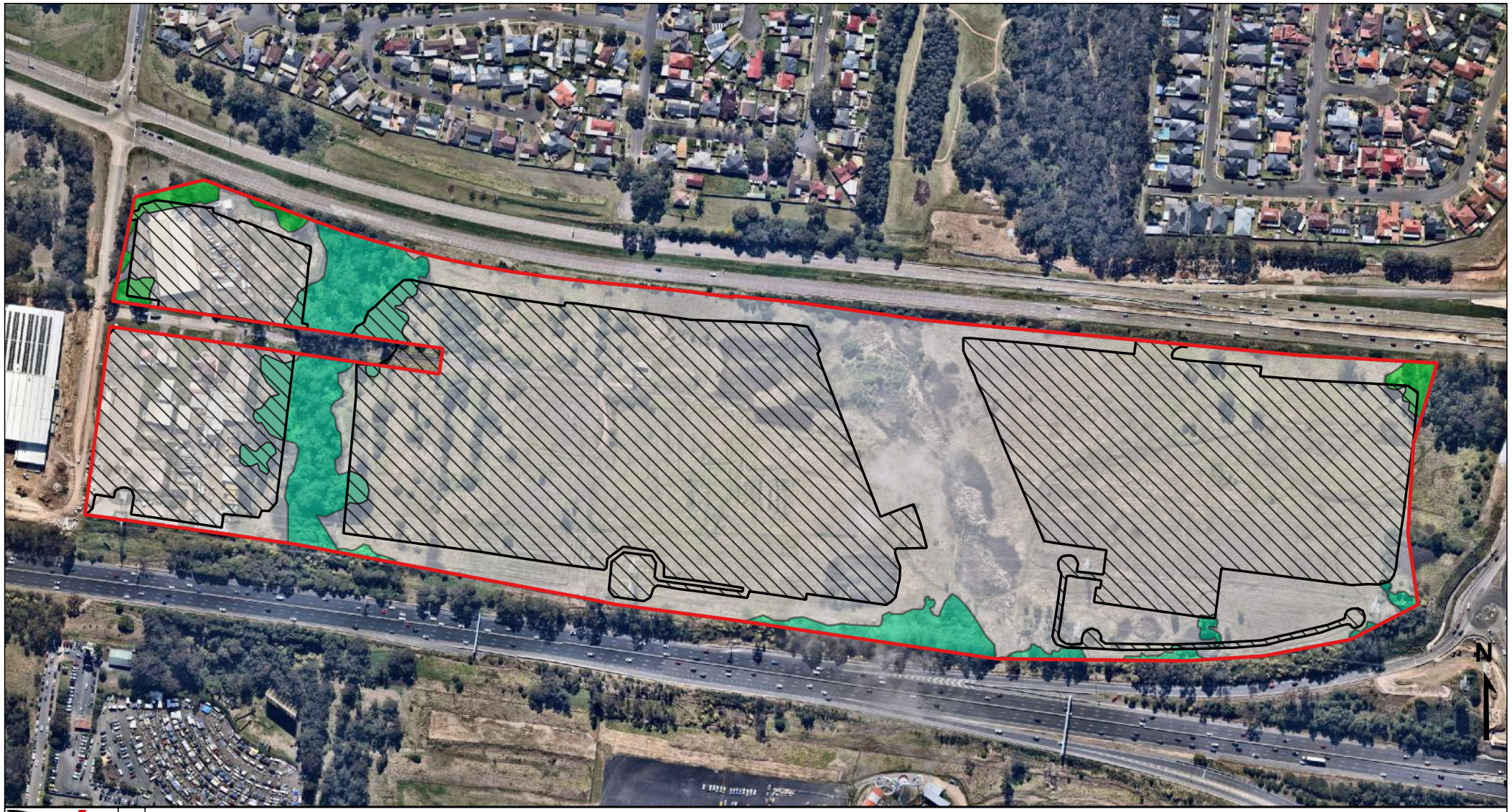


Figure 7b-2.
Management zones overlaid on vegetation zones for the revised proposal

Tables

Table 1. Cover of species recorded in 16 BAM Plots and species present in 13 patches A to M

Species	AC BAM Plots									AC Patches													EP BAM Plots						
	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	A	B	C	D	E	F	G	H	I	J	K	L	M	Q1	Q2	Q3	Q4	Q5	Q6	Q7
Tree (TG)																													
Acacia parramattensis																				X				2					
Eucalyptus moluccana		1	20	4	10		50	10	4					X									6						
Eucalyptus tereticornis		25		25	0.5			5	5					X					X				32	5					
Shrub (SG)																													
Acacia falcata		0.1																		X			0.5	0.2					
Acacia fimbriata		10																											
Acacia floribunda																							3						
Acacia implexa		0.3																											
Atriplex semibaccata											X		X																
Breynia oblongifolia																							0.1						
Bursaria spinosa subsp. *spinosa*		3		5	0.1		1		4				X										1	5					
Daviesia genistifolia													X																
Dillwynia sieberi		0.5					0.3																						
Eremophila debilis							0.7																						
Pittosporum undulatum									0.8																				0.1
Platysace lanceolata													X																
Grass & grasslike (GG)																													
Anthosachne scabra																													0.1
Aristida ramosa	0.1	1		1								X											0.1	0.1					
Aristida vagans		0.1										X																	
Bolboschoenus caldwellii						0.2																							
Bothriochloa decipiens var. *decipiens*											X		X										0.5	0.1					
Bothriochloa macra				0.1			0.5					X																	
Carex inversa				0.1					0.1														0.1	0.1		0.2	0.1		0.1
Chloris ventricosa							0.1																						
Cymbopogon refractus												X																	
Cynodon dactylon	0.3			0.1			0.1		25		X	X											0.1			2	1		1
Cyperus exaltatus																												0.3	
Cyperus gracilis		0.2		0.2			0.3					X																	
Dichelachne micrantha	0.1	0.1										X																	
Digitaria diffusa		0.1																											
Digitaria parviflora		0.1																											
Eleocharis plana																												0.5	
Entolasia marginata							0.5																						

Species	AC BAM Plots									AC Patches													EP BAM Plots						
	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	A	B	C	D	E	F	G	H	I	J	K	L	M	Q1	Q2	Q3	Q4	Q5	Q6	Q7
Eragrostis brownii													X			X													
Eragrostis leptostachya																								0.1					
Eriochloa pseudoacrotricha							0.1			X																0.1			
Fimbristylis dichotoma		0.5																											
Juncus usitatus									0.1								X										0.2	0.2	0.1
Lachnagrostis filiformis																	X											0.1	
Lomandra filiformis subsp. *filiformis*	0.3	2		0.1					0.1																				
Microlaena stipoides		5		15	0.5		4		0.3			X									X		8	20					0.5
Oplismenus aemulus								2																					
Paspalidium distans							0.3					X						X						0.1					
Paspalum orbiculare							0.1																						
Rytidosperma racemosum		0.1					0.1		0.3			X																	
Rytidosperma spp.																							0.1						
Sporobolus creber				0.1			0.3																						
Themeda triandra	0.3	0.1																											
Typha domingensis						90											X												
Typha orientalis																												25	
Forb (FG)																													
Alternanthera denticulata																												0.1	
Arthropodium milleflorum		0.1																											
Asperula conferta				0.1																						0.1			
Brunoniella australis		4					0.3																						0.1
Caesia parviflora		0.1																											
Calotis lappulacea							0.1																						
Commelina cyanea								0.1																					
Dianella longifolia	0.1	0.1										X	X	X									0.1						
Dichondra repens		2		2			5	1	0.2			X									X		0.3						1
Einadia hastata		0.1					0.1																						
Einadia nutans								0.3																					
Einadia nutans subsp. *linifolia*							0.1		0.1															0.2					
Einadia nutans subsp. *nutans*										X		X																	
Einadia polygonoides							0.3																						
Einadia trigonos								0.1																					
Einadia trigonos subsp. *trigonos*							0.1																						
Epilobium hirtigerum																	X												
Euchiton sphaericus									0.1																				0.1
Euphorbia drummondii							0.1																						

Species	AC BAM Plots									AC Patches														EP BAM Plots						
	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	A	B	C	D	E	F	G	H	I	J	K	L	M	Q1	Q2	Q3	Q4	Q5	Q6	Q7
Geranium solanderi				0.1					0.1																					
Grona varians		0.1																												
Opercularia diphylla												X																		
Oxalis exilis																							0.1	0.1	0.1	0.1	0.1			
Oxalis perennans		0.1					0.1							X																0.1
Phyllanthus virgatus		0.1					0.1																0.1	0.1						
Plectranthus parviflorus									0.1																					0.3
Portulaca oleracea							0.1																							0.1
Rumex brownii																		X												0.1
Senecio hispidulus		0.1																												
Tricoryne elatior		0.1																												
Vittadinia cuneata var. *cuneata*							0.1																							
Wahlenbergia gracilis	0.1	0.1		0.1							X		X											0.1						
Other (OG)																														
Amyema miquelii			2				2							X																
Glycine clandestina		0.1		0.1																			0.2							
Glycine tabacina		0.6		3			0.3		1	X													0.2	0.1		0.2			0.1
Hardenbergia violacea							1																							
Livistona australis					0.3																									
Unknown																														
Cyperaceae unknown genus																												0.3		
Cyperus sp.																								0.1						
Non-local native																														
Acacia baileyana							0.1																							
Eucalyptus robusta										X										X										0.1
Grevillea robusta				0.1					0.1	X			X						X			X								2
Melia azedarach								0.1														X								
Pandorea jasminoides										X																				
Plumbago zeylanica																														0.1
High threat weed																														
Anredera cordifolia				0.1	1			3	0.1																					
Asparagus aethiopicus				0.1	0.1			0.1	0.3	X																				
Asparagus asparagoides		0.2		0.1	0.1		0.1		0.4	X		X		X									0.1	0.1					0.3
Asparagus plumosus																							0.1	0.1						
Bidens pilosa		0.2	0.2	4			0.5		2	X				X							X	X	0.1	0.1		0.1	0.1			
Bidens subalternans		0.1																												3
Briza subaristata	15											X	X														0.5	0.5		

Species	AC BAM Plots									AC Patches													EP BAM Plots						
	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	A	B	C	D	E	F	G	H	I	J	K	L	M	Q1	Q2	Q3	Q4	Q5	Q6	Q7
Cardiospermum grandiflorum					0.5																								
Cenchrus clandestinus	1		85					2		X						X		X			X	X	0.2	10	80	15	30		25
Cestrum parqui															X		X											0.1	0.1
Chloris gayana		0.1	3	5			1	0.8			X	X									X		0.5	1					
Cyperus eragrostis																	X												0.1
Ehrharta erecta		0.1		0.1	5		4	5	3	X													0.1						
Eragrostis curvula	0.3	10					35		0.1	x	X	X	X					X			X		10	0.5		0.3			
Hyparrhenia hirta											X																		
Hypericum perforatum	1	0.1								X			X	X							X				0.1	0.3			2
Juncus acutus						5											X												15
Lantana camara		3	0.5		20		2	5	5			X		X					X		X	X	7	20					
Ligustrum lucidum				10	15			3	3	X											X	X							0.1
Ligustrum sinense				10	3			0.8	10	X				X			x		X			X					0.5	
Lonicera japonica										X												X							
Opuntia monacantha								0.8																					
Paspalum dilatatum	40	0.6	5	5			0.2		0.4		X			X							X		0.5	5	1	30	30		0.1
Rubus anglocandicans						5							X		X	X					X							10	0.5
Senecio madagascariensis		0.1		0.2			0.1		2	X	X	X	X			X		X					0.1	0.1	0.1	0.3	0.1		
Senna pendula var. *glabrata*				0.3				2	0.1	X												X							
Exotic																													
Agrostis stolonifera																	X												
Anagallis arvensis	0.1																												
Araucaria columnaris										X																			0.1
Araujia sericifera		0.1	0.1	0.3			0.1																				0.1	0.2	
Asparagus officinalis		0.1																											0.5
Aster subulatus									0.1	X															0.1			0.2	
Avena barbata	0.6															X		X											
Bromus catharticus										X				X													0.1		5
Campsis radicans										X																			
Cirsium vulgare	0.3		0.1					0.3	0.1					X		X		X					0.1	0.1		0.1	0.1	0.2	0.3
Conyza bonariensis																								0.1	0.1	0.2			0.1
Conyza sp.																													
Conyza sumatrensis	0.1			0.1					0.2	X											X					0.1	0.2		
Cortaderia selloana								1																					
Cotoneaster glaucophyllus									0.3																				
Cyanthillium cinereum var. *cinereum*																							0.1	0.1					1
Cyclospermum leptophyllum	0.1																												

Species	AC BAM Plots									AC Patches													EP BAM Plots						
	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	A	B	C	D	E	F	G	H	I	J	K	L	M	Q1	Q2	Q3	Q4	Q5	Q6	Q7
Cyperus brevifolius							0.1																						
Dactylis glomerata																													0.1
Epilobium hirsutum																												0.6	
Erythrina crista-galli					30																								
Erythrina x sykesii																													
Festuca elatior										X																			2
Foeniculum vulgare			0.1																									0.2	
Gomphocarpus fruticosus				0.1									X								X								0.1
Hibiscus rosa-sinensis (unidentified cultivar)										X																			
Hypochaeris microcephala var. *albiflora*													X																0.1
Hypochaeris radicata	0.3								0.1																				10
Lactuca serriola																									0.1				0.1
Lepidium bonariense																													
Linum trigynum	0.2						0.1				X		X																
Lolium perenne	10									X		X				X		X											
Lonicera sp.																													0
Lotus sp.	0.1																X												1
Lycium ferocissimum			0.5	0.3																									
Malva parviflora																									0.1				
Modiola caroliniana								0.1	0.1																				
Nerium oleander										X												X							
Nothoscordum gracile							0.1																		0.1		0.1		
Olea europaea subsp. *cuspidata*		0.8	2	15	4			5	3	X		X	X						X		X	X	0.5	2					15
Osteospermum ecklonis										X																			0.1
Osteospermum spinescens																													
Paspalum notatum		5		10								X	X			X							0.1			10			
Pavonia hastata																							0.1	0.1					
Phalaris aquatica												X				X	X												
Phalaris sp.																										0.1		0.1	
Plantago lanceolata	1			0.2			3		0.2			X						X			X		0.2		0.5	0.3	0.3		
Pyracantha sp.																		X											
Rosa banksiae Alboplena										X																			5
Rumex conglomeratus																												0.3	
Rumex crispus														X			X								0.1	0.1	0.1		
Schinus molle var. *areira*																													0.1
Senecio pterophorus									0.1	X																			

Species	AC BAM Plots									AC Patches													EP BAM Plots						
	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	A	B	C	D	E	F	G	H	I	J	K	L	M	Q1	Q2	Q3	Q4	Q5	Q6	Q7
Setaria parviflora		0.1					0.3		0.9														0.1	0.2		0.7		0.4	0.2
Sida rhombifolia		0.6	1	0.1	0.1		0.1		0.8	X			X	X									0.2	0.1	0.1	0.2	0.1		
Solanum americanum									0.1													X							
Solanum nigrum								0.1		X				X											0.1		0.2		
Solanum sisymbriifolium								0.3						X												0.1			
Sonchus oleraceus	1	0.1					0.1									X		X							0.1	0.1		0.1	
Sorghum halepense																													
Sporobolus africanus		0.1		0.3					0.1	X		X		X															
Stachys arvensis	0.3																												0.1
Syagrus romanzoffiana										X																			
Taraxacum officinale																							0.1				0.1		
Tradescantia fluminensis				1	0.1																	X							0.1
Tragopogon porrifolius										X				X															
Trifolium glomeratum										X																			
Trifolium sp.																										0.1	0.1		
Verbena bonariensis		0.1		0.1					0.6	X		X	X	X		X		X			X			0.1	0.2	0.2	0.2	0.2	
Verbena incompta																									0.1	0.2			
Verbena quadrangularis								0.3		X														0.1	0.1	0.1	0.1		
Verbena rigida var. *rigida*																							0.1						
Vicia sp.																									0.1	0.1	0.2		
Vicia tetrasperma	0.4								0.1	X				X															
Yucca elephantipes										X																			

Table 2. Maximum heights and numbers of individuals per 10 m x 10 m subquadrat, for species present ≥ 2 m.

Botanical name	Subquadrat 1		Subquadrat 2		Subquadrat 3		Subquadrat 4	
	Number	Height	Number	Height	Number	Height	Number	Height
Plot 1								
No trees								
Plot 2								
Acacia fimbriata			4	7m				
Bursaria spinosa			1	2m	1	2m	1	3m
Eucalyptus moluccana	1	9m						
Eucalyptus tereticornis	8	15m	8	15m	4	14 m	3	10m
**Olea europaea* subsp. *cuspidata*			1	4m				
Plot 3								
Eucalyptus moluccana			2	25m				
Plot 4								
Bursaria spinosa					3	4m		
Eucalyptus tereticornis	2	16m	1	17m	1	13m	2	25m
Eucalyptus moluccana					2	20m		
#*Grevillea robusta*					1	2m		
**Lantana camara*			2	2m				
**Ligustrum lucidum*	1	3m	2	4m	3	6m	8	5m
**Ligustrum sinense*	3	3m	3	4m	3	3m	2	3m
**Olea europaea* subsp. *cuspidata*					3	9m	1	7m
Plot 5								
Eucalyptus moluccana	1	12m	2	17m			2	25
Eucalyptus tereticornis					1	10m		
**Erythrina crista-galli*					6	13m	6	10m
**Ligustrum lucidum*			3	7m			1	3m
**Ligustrum sinense*			1	4m			4	4m
**Olea europaea* subsp. *cuspidata*	1	4m	5	7m				
Plot 6								
No trees								
Plot 7								
Eucalyptus moluccana	3	25 m	3	27 m	10	27 m	3	27 m
Bursaria spinosa			1	2 m				
Plot 8								
Eucalyptus moluccana	3	25 m	2	25 m	1	20 m	1	16 m
Eucalyptus tereticornis	5	23 m			1	22 m		
**Ligustrum lucidum*	3	4 m			2	5 m		
**Ligustrum sinense*					2	2 m		

Botanical name	Subquadrat 1		Subquadrat 2		Subquadrat 3		Subquadrat 4	
	Number	Height	Number	Height	Number	Height	Number	Height
**Opuntia monacantha*			2	3 m			2	2 m
Plot 9								
Bursaria spinosa	1	3 m	2	4 m			1	3 m
Eucalyptus moluccana			2	7 m			2	18 m
Eucalyptus tereticornis					1	18 m		
**Lantana camara*	1	2 m	2	2 m			1	2 m
**Ligustrum lucidum*					3	2 m	2	4 m
**Ligustrum sinense*	10	3 m	2	3 m	9	3 m	5	3 m
Pittosporum undulatum	3	2 m						
**Olea europaea* subsp. *cuspidata*	4	4 m			3	3 m		

= non-local native
* = exotic

Appendices

Appendix 1

Company profile and brief CVs of authors

ANNE CLEMENTS & ASSOCIATES PTY. LIMITED
(ABN 41 077 242 365, ACN 077-160-939)
Environmental and Botanical Consultants
Office 2, 3 Harbourview Crescent, Milsons Point 2060
PO Box 1623, North Sydney 2059
Phone: (02) 9955 9733
Email: mail@acabotanic.com

2 March 2022

Anne Clements & Associates is a group of botanists, ecologists and restoration ecologists who specialise in botanical conservation assessment, as well as developing and implementing optimal conservation strategies. The company has more than 30 years of experience in:

- flora surveys of a wide range of ecosystems;
- environment and botanical assessments;
- assessments of impacts;
- vegetation plans of management;
- the implementation of rehabilitation/conservation programs as part of sustainable development of sites; and
- environmental management of development sites.

The group provides a broad variety of skills and a high level of experience:

The company works closely with community groups, fauna consultants, town planners, geologists, engineers, lawyers, land developers and mining companies in planning and implementing optimal conservation strategies as part of sustainable development of sites.

Four of the company's environmental managed sites have won excellence awards for their quality and innovations, including "Excellence of Excellence" in 2000, Gold and Silver in NSW Rivercare 2000, Silver and Excellence in NSW Mineral Resources Excellence Awards and Excellence in the Earthmovers Awards, 2006 Environment Award for Australian Property Industry and 2007 International Green Apple Award.

Brief CV s of key personnel

Dr AnneMarie Clements
A restoration ecologist with M.Sc. (Macquarie Univ.) Thesis - *The vegetation of bushland in the northern Sydney area* and a Ph.D. (Univ. of Sydney) Thesis – *The vegetation of the sand masses of the mid-north coast of New South Wales*. She has more than 30 years experience.

Her major research interests include the re-establishment of native ecosystems, impacts of urban development on vegetation and soil, pattern analysis, effects of inundation and salinity on the plant communities, metal concentrations on plant growth and bioaccumulation. She has utilised her research in designing and implementing numerous rehabilitation / conservation programs as part of sustainable developments.

Anne is certified as a BAM Assessor (Accreditation Number: BAAS17088) under the *Biodiversity Conservation Act 2016*, a BioBank Assessor, and an Ecology Specialists

Certified Environmental Practitioner under the Environmental Institute of Australia and New Zealand CEnvP Program (CEnvP Registration Number E200001).

Dr Anne Baumann
Anne has 20 years of broad industry experience in a range of technical flora related roles including with the Office of Environment and Heritage. Her formative career was in biosecurity having spent 6 years in the Australian Quarantine Inspection Service. Anne has a Bachelor of Science in Agriculture from the University of Sydney and a PhD on the recruitment of the Broad-leaved Paperbark Tree on the mid north coast of NSW. She also has a Diploma in Arboriculture and a Certificate III in Conservation and Land Management . Her skills include writing Biodiversity Assessment Reports and vegetation management plans. She has strong GIS mapping skills and plant identification and curatorial skills and has completed an internship with the NSW Herbarium at the Royal Botanical Gardens, Sydney. She is experienced in flora survey and BioBanking field assessment techniques and has worked in a range of endangered ecological communities. Anne has also worked as a bushland regenerator and has implemented vegetation management plans including selecting and sourcing of stock, supervision of soil preparation, planting and monitoring.

Tony Rodd
Taxonomic botanist with B.Sc. (University of Sydney) with extensive experience in plant identification. Tony was the Horticultural Botanist at the Royal Botanic Gardens, Sydney for 13 years (1970-82). After leaving the Gardens, he continued as an occasional consultant, including preparation of interpretative material and collection of plants from the wild for the living collections at the Mount Annan and Mount Tomah Botanic Gardens.

He has also worked extensively with book publishers, most recently in the role of Chief Consultant for *Botanica* (Random House 1997) and *Flora* (Timber Press / ABC Gardening Australia 2003), and co-author of *Trees: a visual guide* (Weldon Owen 2008). He has a long-standing interest in the taxonomy of Australian palms and has had a major revision of the palm genus *Livistona* published in the journal *Telopea*. For more than 25 years, he has worked with Anne Clements & Associates on many flora surveys and rehabilitation projects.

Joelan Sawyer
Joelan holds a Bachelor of Science majoring in Biological Conservation and General Biology (Western Sydney University 2018). Joelan has conducted research on the effects of forest fragmentation by monitoring changes in stomatal densities in the vegetation at the edges and cores of vegetation communities. He has experience in vegetation surveys, plant identification, GIS mapping and data analysis. Joelan has a passion for biology particularly botanic and fresh water aquatic ecology. Joelan has experience in cultivating and propagating both native and exotic plant species as well as extensive experience in breeding freshwater fish species. He has used his skills as an ecologist in survey and environmental restoration for the past 4 years.

Dr Pamela Hazelton
Dr Pam Hazelton is a Certified Professional Soil Scientist (CPSS). She graduated from the University of Sydney with a Bachelor of Science degree; gained a Diploma of Education from the University of New England and a PhD from the University of NSW. She is an experienced pedologist of more than 30 years, and has produced over half of the Western Division (NSW) land system maps and also soil landscape maps in the south-eastern areas of New South Wales, Australia. She has published scientific papers on a variety of soil and education topics and is the editor of a widely used research text for the interpretation of soil test data.

Throughout her career she has lectured at a variety of universities including Hong Kong and France, worked in a government department and also worked as a consultant specialising in the association of soil types and their relationship with endangered ecological communities. Dr Hazelton's major research interests lie in the application of soil science to environmental engineering specifically in the areas of salinity, sodicity and acid sulfate soil in coastal and urban land use, At present she is the Program Head and coordinator of the Master of Environmental Engineering Management in the School of Civil and Environment, Faculty of Engineering, University of Technology, Sydney.

Dr Margaret Donald
Margaret holds a Ph.D from the Queensland University of Technology; Thesis: *Using Bayesian methods for the estimation of uncertainty in complex statistical models*. She has been a co-author of 14 published journal articles and currently has additional articles in press.

Margaret's previous positions include a Senior research statistician, responsible for the development and design of databases and acquisition of machine data for Polartechnics Pty.Ltd, biometrician for Sydney Water, post-doctoral research fellow at UNSW. Margaret is engaged by Anne Clements & Associates to undertake statistical analysis of field collected data and for advice regarding field experiments. Margaret has been recognised by her peers (the Statistical Society of Australia) as a highly competent statistician with the award of an Astat.

Pauline Dever
Pauline holds a Bachelor of Environment majoring in Earth and Environmental Science. She has a Diploma of Conservation and Land Management and has worked as a bushland regenerator. She has experience in weed control, plant identification, soil classification and GIS mapping.

Grant Webster
Grant is an experienced research biologist and conservation ecologist with a strong background in Australian flora and fauna. He is a specialist in herpetology and has an expert knowledge of Australian frogs. He is an enthusiastic researcher and has a good general knowledge of ecological communities, standard ecological practices and methodologies. Grant holds a B.Sc (Hons) in Biology and a M.Res in Science from Macquarie University. His Honours project investigated dynamic sexual dichromatism in frogs, documenting a previously unstudied aspect of frog communication. Since completing his Honours project in 2013, Grant has continued with the research on dynamic sexual dichromatism and recently was accepted to be published. Grant graduated from his Masters degree in 2017, with a project studying the geographic variation in the frogs *Pseudophryne bibronii* and *P dendyi.* He is currently completing his PhD in Ecology and conservation of the endangered Mahony's Toadlet (*Uperoleia mahonyi)*.

Grant has worked in ecology since 2005 on a range of projects and has been working as a contract ecologist since 2012. He has much experience with ecological practices including flora and fauna surveys. Grant is also an experienced wildlife photographer, including a stamp release for Australia Post.

Jayden Walsh
Jayden holds a Bachelor of Biodiversity and Conservation from Macquarie University. He has experience working on a range of projects surveying amphibian, avian and mammalian species on a contracted and casual basis. He has successfully found

new populations of the Cumberland Plain Land Snail, Red-backed Buttonquail, Dusky Woodswallow and other threatened species. He has worked as an environmental educator and volunteer tour guide, plus has held volunteer positions with NPWS and Office of Environment and Heritage. In 2017, Jayden ran as a Candidate in the Northern Beaches Council Election and is an ongoing member of the Friends of Narrabeen Lagoon Catchment Committee.

Appendix 2

Advice from Government Authorities

- email from NRAR on 3 July 2022

- email from BAM Support Team on 13 May 2022

A swale in west of the Huntingwood site

Inbox ×

Anne Clements <mail@acabotanic.com>
to Gina, Athlene, Greg.Oxley

Sun, 3 Jul 2022, 17:06

Hi Gina,
Hope you are well.

In the east of the site, there is Blacktown Creek, a 1st Order watercourse.

In the west, there is a swale (near the "UG" in AUGUSTA ROAD on the attached 1:25 000 topo). There is no blue line mapped in the area on the 1:25 000 topo.

Can you please clarify if this swale could be considered as containing a "watercourse" under the *Water Management Act 2000.*

Thanks,
Anne

Anne Clements & Associates Pty Limited

Environmental and Botanical Consultants

PO Box 1623 North Sydney NSW 2059

Ph: (02) 9955 9733 M: 0427553362

Email: mail@acabotanic.com

One attachment • Scanned by Gmail



PDF Figure 1b-2. Topo ...

Gina Potter <gina.potter@nrar.nsw.gov.au> 3 Jul 2022, 19:24
to Anne

Hi Anne,

No watercourse



regards,

Gina Potter | Water Regulation Officer
Water Regulation Officer

Licensing & Approval
W www.dpie.nsw.gov.au
Controlled Activities https://www.dpie.nsw.gov.au/water/licensing-and-trade/approvals/controlled-activity-approvals
4 Parramatta Square, 12 Darcy Street, Parramatta NSW 2150
Locked Bag 5022, PARRAMATTA NSW 2124.

NSW GOVERNMENT | Planning, Industry & Environment

Gmail **Anne Clements <acabotanic@gmail.com>**

Planted trees - Grevillea robusta and Eucalyptus robusta in the former house site

8 messages

Anne Clements <mail@acabotanic.com> 7 March 2022 at 13:08
To: OEH ROD BAM Support Mailbox <BAM.support@environment.nsw.gov.au>

Hi,
Can you please advise on the status of planted trees, in particular *Grevillea robusta* and *Eucalyptus robusta* in a former garden planting in western Sydney as being part of PCT 849 (*Cumberland Plain Woodland*)?

In the BAM (DPIE 2020) following the decision making key steps in Appendix D streamline assessment module - planted native vegetation.
The response to Appendix D1. 5, i) is Yes Go to D.2.
D.2 relates to use of planted native vegetation by threatened species.

QUESTIONS
For assigning a PCT
1. The planted trees *Grevillea robusta* and *Eucalyptus robusta* in the former garden are not local native trees, nor trees of PCT849 (Cumberland Plain Woodland).
SHOULD PCT 849 be assigned to this stand - CORRECT?

2. In terms of data to enter in the calculator
If PCT 849
Grevillea robusta and *Eucalyptus robusta*

- For calculating Composition score - Do we enter **TREES 2?**
- For calculating Structure Score - Do we enter **TREES 2.1% cover**?
- For calculating Function Score - Do we enter **stem classes 10-20, 20-30 and regeneration of *Grevillea robusta*?**

3. Can you please provide advice on:
a. planted trees near the former house
b. Stands of Privet and Lantana near the former house as fauna habitat
c. regeneration / naturalised stands of *Grevillea robusta.*

Looking forward to your response.

Regards,
Dr AnneMarie Clements
Assessor No. BAAS17088

Anne Clements & Associates Pty Limited

Environmental and Botanical Consultants

PO Box 1623 North Sydney NSW 2059

Ph: (02) 9955 9733 M: 0427553362

Email: mail@acabotanic.com

Anne Clements <mail@acabotanic.com> 4 May 2022 at 15:38
To: OEH ROD BAM Support Mailbox <BAM.support@environment.nsw.gov.au>

Gmail

Anne Clements <acabotanic@gmail.com>

BSM-4116

EES BOS Help Desk Mailbox <BOS.helpdesk@environment.nsw.gov.au> 13 May 2022 at 09:50
To: "mail@acabotanic.com" <mail@acabotanic.com>

Hi Anne,

The subject matter expert has provided the following response to your enquiry:

Question 1 – Assigning a PCT

The first item in the in Appendix D (Planted Native Vegetation) of BAM 2020 asks if the planted native vegetation occurs within an area that contains a mosaic of planted and remnant native vegetation.

In considering if a PCT can be assigned, an assessor should consider if:

- The planted native vegetation accounts for a minor component of the existing remnant native vegetation; and
- A PCT can be assigned for the purposes of a standard BAM assessment.

Q2. In terms of data to enter in the calculator

If the vegetation allows you to assign PCT 849 as the best-fit PCT in the same IBRA subregion as the proposal then the BAM must be applied. In this scenario, data should be entered into the calculator as you would for any standard BAM assessment. You will not progress any further in the decision-making key in Appendix D.

Alternatively, if a PCT cannot be assigned, then you must include justification for this in the BAR and proceed to Q2 in the decision-making key (Appendix D). If the decision-making key leads you to D.2, then you are only required to assess of planted native vegetation for threatened species habitat. In these circumstances, you don't need to use the BAM Calculator (See minimum requirements info below).

3. Can you please provide advice on:

a. planted trees near the former house

b. Stands of Privet and Lantana near the former house as fauna habitat

c. regeneration / naturalised stands of *Grevillea robusta.*

In applying Streamlined Assessment Module - Planted Native Vegetation, the minimum BAR requirements are:

- Inclusion of the decision key, documenting responses and justification for each decision in each step of the key. If you can establish that the planted vegetation meets D2 in the decision-making key in Appendix D, then regeneration from the same species of the original planted vegetation may also be included so long as it is justified in the BAR.
- Evidence of planting may include receipts of tubestock or seed purchase, plastic tree guards, tags, historical aerial photography, photos of planted vegetation relative to landscape (artificial bunds, contour beds, furrow lines, uniform patterning, ages). This may be needed for the trees planted near the former house if they are native vegetation. Please note that *Grevillea robusta* is on the draft Widely Cultivated Native Species list. If a species on the 'widely cultivated native species' list is found outside its accepted natural range, it is likely to have been planted and can be justified as a widely cultivated native species for the purposes of Q.6 without additional evidence provided (e.g. silky oak (Grevillea robusta) occurring outside the NSW North Coast IBRA Bioregion).
- Determination of which subsection of the D.1 decision-making key applies to the native vegetation to be cleared or impacted by the proposal.
- Describe the review of existing information and assessment of the suitability of the planted native vegetation for use by potentially occurring threatened species. The assessor needs to consider if the planted native vegetation provides habitat for threatened species. Rapid vegetation assessments and walking transects to identify any notable features or evidence of threatened species occupation would be necessary to underpin the assessment of the planted native vegetation as potential habitat for threatened species.
- Record any incidental sightings or evidence (e.g. scats, evidence of hollow use, diggings, adjacent records) of threatened species credit species (flora and fauna) found to be using, inhabiting or part of, the planted native vegetation.
- Provide methods for survey and field data including records of any incidental sightings or evidence of threatened species credit species as outlined above.

I hope this helps you with your assessment.

Kind regards,

The BOS Help Desk Team

Biodiversity and Conservation Division | Department of Planning and Environment
Mailbox: BOS.helpdesk@environment.nsw.gov.au

BOS Help Desk Hotline: 1800 931 717 (Tuesday to Thursday 9.30am to 4pm)



The Department of Planning and Environment acknowledges that it stands on Country which always was and always will be Aboriginal land. We acknowledge the traditional custodians of the land and we show our respect for elders past, present and emerging.

From: Angela Taylor <angela.taylor@environment.nsw.gov.au> **On Behalf Of** OEH ROD BAM Support Mailbox
Sent: Monday, 7 March 2022 3:44 PM
To: Anne Clements <mail@acabotanic.com>
Subject: BSM-4116

Hi Anne

[Quoted text hidden]
[Quoted text hidden]

Appendix 3

Photographic record

(26 October 2021, 10 and 30 March 2022, 20 January 2023 and 14 June 2023)

Photographic record of vegetation surveys from 26 October 2021,10 and 30 March 2022 and 20 January and 14 June 2023



BAM Plot 1 – 0 m on tape, looking south towards M4.



BAM Plot 1 – 10 m on tape looking south.



BAM Plot 1 – looking north towards Great Western Highway.



BAM Plot 1 – end of 50 m tape looking south.



near BAM Plot 1 - view to west.



near BAM Plot 1 – view to northwest across Plot 1.



BAM Plot 2 – 10 m looking west (into floristic quadrat).



BAM Plot 2 – from 50 m mark looking back east.



Near BAM Plot 2 – Looking north.



Near BAM Plot 2 – looking west: *Bursaria spinosa* and *Eucalyptus tereticornis.*



BAM Plot 3 – 0m on tape looking north (into the floristic quadrat), *Cenchrus clandestinus* in the groundlayer.



BAM Plot 3 – 20 m along the tape looking south (into the floristic quadrat), *Eucalyptus tereticornis* with *Amyema miquelii* and *Olea europaea subsp. cuspidata* at base.



BAM Plot 3 – 40 m along the tape looking south, *Acacia falcata* in foreground.



BAM Plot 4 – 0 m on the tape (looking into the floristic quadrat).



BAM Plot 4 – 20 m along the tape looking north west (into the floristic quadrat).



BAM Plot 4 – 20 m along the tape looking southeast.



near Spot M – looking towards BAM Plot 4.



beside BAM Plot 4 – looking over boundary fence to Great Western Highway batter.



BAM Plot 5 – looking north from start of tape.



BAM Plot 5 – looking north from start of tape: *Erythrina crista-galli* at left, *E. moluccana* at right.



BAM Plot 5 – looking forward from 10 mark on tape. Large tree is *E. moluccana*.



BAM Plot 5 – creek line.



BAM Plot 5 – looking forward from 20 mark on tape; small trees mostly *Ligustrum* spp.



BAM Plot 5 – Looking south to tall *E. moluccana.*



BAM Plot 6 – *Typha domingensis, Juncus acutus, Rubus anglocandicans*



BAM Plot 6 – *Typha domingensis, Juncus acutus, Rubus anglocandicans, Cynodon dactylon*



BAM Plot 7 – start of tape looking south, with a *Eucalypts moluccana* canopy and a grassy understorey.



BAM Plot 7 – start of tape looking east towards site and Great Western Highway.



BAM Plot 7 – 20 m on tape looking north back along floristic quadrat with Great Western Highway in background.



BAM Plot 7 – exposed soil profile on batter slope along Flushcombe Road.



BAM Plot 7 – looking north at the end of tape with dense cover of *Lantana camara* and *Olea europaea subsp. cuspidata*



BAM Plot 8 – looking north from start of tape. *Eucalyptus moluccana* at centre, *E. tereticornis* at left, *Ligustrum lucidum* foreground, clump of *Cortaderia selloana* centre-left.



BAM Plot 8 – looking west from start of tape, *E. tereticornis* behind fence, *Ligustrum lucidum* in foreground.



BAM Plot 8 – looking south from 20 m on tape. Dominant weeds are *Lantana camara, Cenchrus clandestinus, Ligustrum lucidum.*



BAM Plot 8 – looking north from 20 m on tape. *E. moluccana* in centre.



BAM Plot 8 – looking northwest from near 20 m on tape, 2 trees of *E. moluccana* at left, further trees *are E. tereticornis.* Large mound of fill behind, extending toward Great Western Highway.



BAM Plot 8 – looking northwest across old fence from near 20 m tape, *E. tereticornis* on far side.



BAM Plot 8 – *Opuntia monacantha* near start of tape.



BAM Plot 8 – looking southwest from near middle of plot, across old fence and creek line towards Augusta Street. *E. tereticornis* with dense weed cover, mainly *Lantana camara* and *Anredera cordifolia.*



BAM Plot 8 – mound of demolition rubble around 30–40 m from start of tape extending along inside old fence, with dense growth of *Ligustrum* spp.



BAM Plot 8 – looking north from near 50 m on tape, showing east edge of rubble mound.



BAM Plot 9 – looking south from start of tape with *Lantana camara* in foreground and *Olea europaea* subsp. *cuspidata* in centre background.



BAM Plot 9 – at the start of tape looking north towards BAM Plot 4 and the Great Western Highway, with dense growth of *Lantana camara.*



BAM Plot 9 – 20 m on tape looking south towards Augusta Street, with *E. tereticornis* in centre of

weedy understorey of *Ligustrum sinense, Lantana camara* and *Asparagus asparagoides.*



BAM Plot 9 – near the end of the 50 m tape with a dense stand of *Ligustrum sinense* in background and *Chloris gayana* in right foreground.



Spot L – *Olea europaea* subsp. c*uspidata*, *Rubus anglocandicans, Verbena bonariensis.*



Spot L – Looking southeast.



Spot M – *Olea europaea* subsp. c*uspidata, Lantana camara, Ligustrum lucidum, Melia azedarach, Grevillea robusta.*



Spot M – looking south.



Spot M – *Grevillea robusta* (left), *Melia azedarach* (centre) defoliated by caterpillars.

Appendix 4

Location data and BAM input data summary

Location data and BAM input data summary

Location values

Plot	Location							
	PCT	Zone Area	Patch size	Condition class	Zone	Eastings	Northings	Bearing
AC-1	3319	19.1	100	Exotic grassland	56	306297	6257780	180
AC-2	3319	0.1	100	Intact	56	307036	6257776	265
AC-3	3319	19.1	100	Exotic grassland	56	306825	6257757	355
AC-4	3319	2.26	100	Degraded	56	306158	6257892	160
AC-5	3319	2.26	100	Degraded	56	306089	6257755	180
AC-6	3319	0.73	100	Degraded	56	306620	6257667	175
AC-7	3319	2.26	100	Degraded	56	305949	6257944	190
AC-8	3319	2.26	100	Degraded	56	306119	6257851	200
AC-9	3319	2.26	100	Degraded	56	306162	6257864	265

Composition and structure values

Note: Growth form groups: Tree = TG, Shrub = SG, Groundcover and other (GG= Grass & grasslike, FG= Forb, EG= Fern, OG = Other)

Plot	Composition (number of trees, shrubs and groundcover species recorded in the plots)						Structure (summed percent cover for trees, shrubs and groundcover species recorded in the plots)					
	TG	SG	GG	FG	EG	OG	TG	SG	GG	FG	EG	OG
AC-1	0	0	5	2	0	0	0	0	1.1	0.2	0	0
AC-2	2	5	11	12	0	2	26	13.9	9.3	7	0	0.7
AC-3	1	0	0	0	0	1	20	0	0	0	0	2
AC-4	2	1	8	4	0	2	29	5	16.7	2.3	0	3.1
AC-5	2	1	1	0	0	1	10.5	0.1	0.5	0	0	0.3
AC-6	0	0	2	0	0	0	0	0	91	0	0	0
AC-7	1	3	11	12	0	3	50	2	6.4	6.5	0	3.3
AC-8	2	0	1	4	0	0	15	0	2	1.5	0	0
AC-9	2	2	6	5	0	1	9	4.8	25.9	0.6	0	1

Function values

Plot	Function										
	Litter cover	Length of fallen logs	Hollow bearing trees	Stem class DBH (cm)							Percent cover of High Threat Weeds
				<5	5-9	10-19	20-29	30-49	50-79	80+	
AC-1	37.6	0	0	0	0	0	0	0	0	0	57.3
AC-2	44	0	0	1	1	1	1	1	0	0	14.5
AC-3	0	6	1	0	0	1	1	1	0	1	93.7
AC-4	51	5	0	1	0	1	1	0	1	1	34.9
AC-5	53	91	0	0	1	1	1	1	1	1	44.7

Plot	Function										
	Litter cover	Length of fallen logs	Hollow bearing trees	Stem class DBH (cm)							Percent cover of High Threat Weeds
				<5	5-9	10-19	20-29	30-49	50-79	80+	
AC-6	0	0	0	0	0	0	0	0	0	0	10
AC-7	47	0	0	1	1	1	1	1	1	1	42.9
AC-8	10	0	0							0	22.5
AC-9	42	27	0	1	1					0	26.4

Appendix 5

Reports generated by the online BAM calculator

BAM Biodiversity Credit Report (Like for like)

Proposal Details

Assessment Id
00031758/BAAS17088/22/00031759

Proposal Name
Augusta_St_Complex_2_veg_zones

BAM data last updated *
22/06/2023

Assessor Name
Anne Clements

Assessor Number
BAAS17088

BAM Data version *
61

Proponent Names

Report Created
05/07/2023

BAM Case Status
Finalised

Assessment Revision
7

Assessment Type
Part 4 Developments (General)

Date Finalised
05/07/2023

BOS entry trigger
BOS Threshold: Area clearing threshold

* 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.

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	3319-Cumberland Shale Hills Woodland

Species
Nil

Additional Information for Approval

BAM Biodiversity Credit Report (Like for like)

PCT Outside Ibra Added

None added

PCTs With Customized Benchmarks

PCT
No Changes

Predicted Threatened Species Not On Site

Name
Calyptorhynchus lathami / Glossy Black-Cockatoo
Ephippiorhynchus asiaticus / Black-necked Stork
Pandion cristatus / Eastern Osprey

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	HBT Cr	No HBT Cr	Total credits to be retired
3319-Cumberland Shale Hills Woodland	Cumberland Plain Woodland in the Sydney Basin Bioregion	2.4	0	8	8

BAM Biodiversity Credit Report (Like for like)

3319-Cumberland Shale Hills Woodland	Like-for-like credit retirement options					
	Name of offset trading group	Trading group	Zone	HBT	Credits	IBRA region
	Cumberland Plain Woodland in the Sydney Basin Bioregion This includes PCT's: 3319, 3320	-	3319_degraded	No	6	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.
	Cumberland Plain Woodland in the Sydney Basin Bioregion This includes PCT's: 3319, 3320	-	3319_less_degraded	No	2	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

No Species Credit Data

Credit Retirement Options

Like-for-like credit retirement options

BAM Biodiversity Credit Report (Variations)

Proposal Details

Assessment Id

00031758/BAAS17088/22/00031759

Proposal Name

Augusta_St_Complex_2_veg_zones

BAM data last updated *

22/06/2023

Assessor Name

Anne Clements

Assessor Number

BAAS17088

BAM Data version *

61

Proponent Name(s)

Report Created

05/07/2023

BAM Case Status

Finalised

Assessment Revision

7

Assessment Type

Part 4 Developments (General)

Date Finalised

05/07/2023

BOS entry trigger

BOS Threshold: Area clearing threshold

* 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.

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	3319-Cumberland Shale Hills Woodland

Species
Nil

Additional Information for Approval

PCT Outside Ibra Added

None added

BAM Biodiversity Credit Report (Variations)

PCTs With Customized Benchmarks

PCT
No Changes

Predicted Threatened Species Not On Site

Name
Calyptorhynchus lathami / Glossy Black-Cockatoo
Ephippiorhynchus asiaticus / Black-necked Stork
Pandion cristatus / Eastern Osprey

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	HBT Cr	No HBT Cr	Total credits to be retired
3319-Cumberland Shale Hills Woodland	Cumberland Plain Woodland in the Sydney Basin Bioregion	2.4	0	8	8.00

3319-Cumberland Shale Hills Woodland

Like-for-like credit retirement options

Class	Trading group	Zone	HBT	Credits	IBRA region
Cumberland Plain Woodland in the Sydney Basin Bioregion This includes PCT's: 3319, 3320	-	3319_degraded	No	6	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.

	Cumberland Plain Woodland in the Sydney Basin Bioregion This includes PCT's: 3319, 3320	-	3319_less_degraded	No	2	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

No Species Credit Data

Credit Retirement Options

Like-for-like options

BAM Candidate Species Report

Proposal Details

Assessment Id 00031758/BAAS17088/22/00031759	Proposal Name Augusta_St_Complex_2_veg_zones	BAM data last updated * 22/06/2023
Assessor Name Anne Clements	Report Created 05/07/2023	BAM Data version * 61
Assessor Number BAAS17088	Assessment Type Part 4 Developments (General)	BAM Case Status Finalised
Assessment Revision 7	Date Finalised 05/07/2023	BOS entry trigger BOS Threshold: Area clearing threshold

* 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.

List of Species Requiring Survey

Name	Presence	Survey Months
Acacia pubescens Downy Wattle	No (surveyed)	☑ Jan ☐ Feb ☑ Mar ☑ Apr ☐ May ☑ Jun ☐ Jul ☐ Aug ☐ Sep ☑ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Grevillea juniperina subsp. juniperina Juniper-leaved Grevillea	No (surveyed)	☑ Jan ☐ Feb ☑ Mar ☑ Apr ☐ May ☑ Jun ☐ Jul ☐ Aug ☐ Sep ☑ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Litoria aurea Green and Golden Bell Frog	No (surveyed)	☐ Jan ☑ Feb ☑ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?

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	No (surveyed)	☑ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Meridolum corneovirens Cumberland Plain Land Snail	No (surveyed)	☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☑ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Myotis macropus Southern Myotis	No (expert report)	☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Phascolarctos cinereus Koala	No (surveyed)	☑ Jan ☐ Feb ☑ Mar ☑ Apr ☐ May ☑ Jun ☐ Jul ☐ Aug ☐ Sep ☑ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Pimelea spicata Spiked Rice-flower	No (surveyed)	☑ Jan ☐ Feb ☑ Mar ☑ Apr ☐ May ☑ Jun ☐ Jul ☐ Aug ☐ Sep ☑ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?

Pultenaea parviflora Pultenaea parviflora	No (surveyed)	☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☑ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?

Threatened species Manually Added

None added

Threatened species assessed as not on site

Refer to BAR for detailed justification

Common name	Scientific name	Justification in the BAM-C
Barking Owl	Ninox connivens	Habitat constraints
Bush Stone-curlew	Burhinus grallarius	Habitat constraints
Camden White Gum	Eucalyptus benthamii	Refer to BAR
Dillwynia tenuifolia	Dillwynia tenuifolia	Refer to BAR
Eastern Osprey	Pandion cristatus	Habitat constraints
Eastern Pygmy-possum	Cercartetus nanus	Refer to BAR
Gang-gang Cockatoo	Callocephalon fimbriatum	Habitat constraints
Glossy Black-Cockatoo	Calyptorhynchus lathami	Habitat constraints
Grey-headed Flying-fox	Pteropus poliocephalus	Habitat constraints
Large Bent-winged Bat	Miniopterus orianae oceanensis	Habitat constraints
Large-eared Pied Bat	Chalinolobus dwyeri	Habitat constraints
Little Bent-winged Bat	Miniopterus australis	Habitat constraints
Little Eagle	Hieraaetus morphnoides	Habitat constraints
Masked Owl	Tyto novaehollandiae	Habitat constraints
Powerful Owl	Ninox strenua	Habitat constraints
Regent Honeyeater	Anthochaera phrygia	Habitat constraints
Square-tailed Kite	Lophoictinia isura	Habitat constraints
Squirrel Glider	Petaurus norfolcensis	Refer to BAR

Swift Parrot	Lathamus discolor	Habitat constraints
White-bellied Sea-Eagle	Haliaeetus leucogaster	Habitat constraints

BAM Credit Summary Report

Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00031758/BAAS17088/22/00031759	Augusta_St_Complex_2_veg_zones	22/06/2023
Assessor Name	Report Created	BAM Data version *
Anne Clements	05/07/2023	61
Assessor Number	BAM Case Status	Date Finalised
BAAS17088	Finalised	05/07/2023
Assessment Revision	Assessment Type	BOS entry trigger
7	Part 4 Developments (General)	BOS Threshold: Area clearing threshold

* 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.

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

Zone	Vegetation zone name	TEC name	Current Vegetation integrity score	Change in Vegetation integrity (loss / gain)	Area (ha)	Sensitivity to loss (Justification)	Species sensitivity to gain class	BC Act Listing status	EPBC Act listing status	Biodiversity risk weighting	Potential SAII	Ecosystem credits

Cumberland Shale Hills Woodland												
1	3319_degraded	Cumberland Plain Woodland in the Sydney Basin Bioregion	24	4.7	2	Biodiversity Conservation Act listing status	High Sensitivity to Gain	Critically Endangered Ecological Community	Not Listed	2.50	True	6
2	3319_less_degraded	Cumberland Plain Woodland in the Sydney Basin Bioregion	56.2	11.5	0.34	Biodiversity Conservation Act listing status	High Sensitivity to Gain	Critically Endangered Ecological Community	Not Listed	2.50	True	2
											Subtotal	**8**
											Total	**8**

Species credits for threatened species

Vegetation zone name	Habitat condition (Vegetation Integrity)	Change in habitat condition	Area (ha)/Count (no. individuals)	Sensitivity to loss (Justification)	Sensitivity to gain (Justification)	BC Act Listing status	EPBC Act listing status	Potential SAII	Species credits

BAM Predicted Species Report

Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00031758/BAAS17088/22/00031759	Augusta_St_Complex_2_veg_zones	22/06/2023
Assessor Name	Report Created	BAM Data version *
Anne Clements	05/07/2023	61
Assessor Number	Assessment Type	BAM Case Status
BAAS17088	Part 4 Developments (General)	Finalised
Assessment Revision	BOS entry trigger	Date Finalised
7	BOS Threshold: Area clearing threshold	05/07/2023

* 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.

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	3319-Cumberland Shale Hills Woodland
Black Falcon	Falco subniger	3319-Cumberland Shale Hills Woodland
Black-chinned Honeyeater (eastern subspecies)	Melithreptus gularis gularis	3319-Cumberland Shale Hills Woodland
Brown Treecreeper (eastern subspecies)	Climacteris picumnus victoriae	3319-Cumberland Shale Hills Woodland
Diamond Firetail	Stagonopleura guttata	3319-Cumberland Shale Hills Woodland
Dusky Woodswallow	Artamus cyanopterus cyanopterus	3319-Cumberland Shale Hills Woodland
Eastern Coastal Free-tailed Bat	Micronomus norfolkensis	3319-Cumberland Shale Hills Woodland
Gang-gang Cockatoo	Callocephalon fimbriatum	3319-Cumberland Shale Hills Woodland
Grey-headed Flying-fox	Pteropus poliocephalus	3319-Cumberland Shale Hills Woodland
Large Bent-winged Bat	Miniopterus orianae oceanensis	3319-Cumberland Shale Hills Woodland

Little Bent-winged Bat	Miniopterus australis	3319-Cumberland Shale Hills Woodland
Little Eagle	Hieraaetus morphnoides	3319-Cumberland Shale Hills Woodland
Little Lorikeet	Glossopsitta pusilla	3319-Cumberland Shale Hills Woodland
Masked Owl	Tyto novaehollandiae	3319-Cumberland Shale Hills Woodland
Powerful Owl	Ninox strenua	3319-Cumberland Shale Hills Woodland
Regent Honeyeater	Anthochaera phrygia	3319-Cumberland Shale Hills Woodland
Scarlet Robin	Petroica boodang	3319-Cumberland Shale Hills Woodland
Speckled Warbler	Chthonicola sagittata	3319-Cumberland Shale Hills Woodland
Spotted Harrier	Circus assimilis	3319-Cumberland Shale Hills Woodland
Spotted-tailed Quoll	Dasyurus maculatus	3319-Cumberland Shale Hills Woodland
Square-tailed Kite	Lophoictinia isura	3319-Cumberland Shale Hills Woodland
Swift Parrot	Lathamus discolor	3319-Cumberland Shale Hills Woodland
Varied Sittella	Daphoenositta chrysoptera	3319-Cumberland Shale Hills Woodland
White-bellied Sea-Eagle	Haliaeetus leucogaster	3319-Cumberland Shale Hills Woodland
White-throated Needletail	Hirundapus caudacutus	3319-Cumberland Shale Hills Woodland
Yellow-bellied Sheathtail-bat	Saccolaimus flaviventris	3319-Cumberland Shale Hills Woodland

Threatened species Manually Added

None added

Threatened species assessed as not within the vegetation zone(s) for the PCT(s)

Common Name	Scientific Name	Plant Community Type(s)
Black-necked Stork	Ephippiorhynchus asiaticus	3319-Cumberland Shale Hills Woodland
Eastern Osprey	Pandion cristatus	3319-Cumberland Shale Hills Woodland
Glossy Black-Cockatoo	Calyptorhynchus lathami	3319-Cumberland Shale Hills Woodland

Threatened species assessed as not within the vegetation zone(s) for the PCT(s)

Refer to BAR for detailed justification

BAM Predicted Species Report

Common Name	Scientific Name	Justification in the BAM-C
Black-necked Stork	Ephippiorhynchus asiaticus	Habitat constraints
Eastern Osprey	Pandion cristatus	Refer to BAR
Glossy Black-Cockatoo	Calyptorhynchus lathami	Habitat constraints

BAM Vegetation Zones Report

Proposal Details

Assessment Id	Assessment name	BAM data last updated *
00031758/BAAS17088/22/00031759	Augusta_St_Complex_2_veg_zones	22/06/2023
Assessor Name	**Report Created**	**BAM Data version ***
Anne Clements	05/07/2023	61
Assessor Number	**Assessment Type**	**BAM Case Status**
BAAS17088	Part 4 Developments (General)	Finalised
Assessment Revision	**Date Finalised**	**BOS entry trigger**
7	05/07/2023	BOS Threshold: Area clearing threshold

* 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.

Vegetation Zones

#	Name	PCT	Condition	Area	Minimum number of plots	Management zones
1	3319_degraded	3319-Cumberland Shale Hills Woodland	degraded	2.03	2	Cleared (0.45 ha) retained (1.58 ha)

2	3319_less_degraded	3319-Cumberland Shale Hills Woodland	less_degraded	0.34	1	Cleared (0.07 ha) retained (0.27 ha)

Appendix 6

Likelihood tables for Predicted species and Candidate species

Likelihood of Predicted threatened species (Ecosystem credit species):

Species	BC Act listing status	EPBC Act listing status.	OEH species profile descriptions	Habitat constraints	Geographic limitations	Species retained for further assessment?	Likelihood / Reason for exclusion from further assessment
Anthochaera phrygia Regent Honeyeater (Foraging)	Critically Endangered	Critically Endangered	*a generalist forager, although it feeds mainly on the nectar ... Key eucalypt species include Mugga Ironbark, Yellow Box, White Box and Swamp Mahogany. Other tree species may be regionally important. For example the Lower Hunter Spotted Gum forests have recently been demonstrated to support regular breeding events. Flowering of associated species such as Thin-leaved Stringybark* Eucalyptus eugenioides *and other Stringybark species, and Broad-leaved Ironbark* E. fibrosa *can also contribute* i*mportant nectar flows at times. Nectar and fruit from the mistletoes* Amyema miquelii, A. pendula *and* A. cambagei *are also utilised. When nectar is scarce lerp and honeydew can comprise a large proportion of the diet. Insects make up about 15% of the total diet and are important components of the diet of nestlings.*	--	--	Yes	**Possible.**
Artamus cyanopterus cyanopterus Dusky Woodswallow	Vulnerable	Not Listed	*Primarily inhabit dry, open eucalypt forests and woodlands, including mallee associations, with an open or sparse understorey of eucalypt saplings, acacias and other shrubs, and ground-cover of grasses or sedges and fallen woody debris. It has also been recorded in shrublands, heathlands and very occasionally in moist forest or rainforest. Also found in farmland, usually at the edges of forest or woodland.*	--	--	Yes	**Possible**, grassy woodland onsite.
Callocephalon fimbriatum Gang-gang Cockatoo (Foraging)	Vulnerable	Endangered	In spring and summer, generally found in tall mountain forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests. In autumn and winter, the species often moves to lower altitudes in drier more open eucalypt forests and woodlands, particularly box-gum and box-	--	--	Yes	**Possible**, moves to drier more open eucalypt forests and woodlands at lower altitudes in autumn & winter.

Species	BC Act listing status	EPBC Act listing status.	OEH species profile descriptions	Habitat constraints	Geographic limitations	Species retained for further assessment?	Likelihood / Reason for exclusion from further assessment
			ironbark assemblages, or in dry forest in coastal areas and often found in urban areas.				
Calyptorhynchus lathami Glossy Black-Cockatoo (Foraging)	Vulnerable	Vulnerable	Inhabits open forest and woodlands of the coast and the Great Dividing Range where stands of sheoak occur. Black Sheoak (Allocasuarina littoralis) and Forest Sheoak (A. torulosa) are important foods. Inland populations feed on a wide range of sheoaks, including Drooping Sheoak, Allocasuaraina diminuta, and A. gymnathera. Belah is also utilised and may be a critical food source for some populations.	-Presence of Allocasuarina and casuarina species	--	No	**Not likely**, no *Allocasuarina littoralis* nor *A. torulosa* recorded onsite
Chthonicola sagittata Speckled Warbler	Vulnerable	Not Listed	The Speckled Warbler lives in a wide range of Eucalyptus dominated communities that have a grassy understorey, often on rocky ridges or in gullies.	--	--	Yes	**Possible,** eucalypt woodland onsite.
Circus assimilis Spotted Harrier	Vulnerable	Not Listed	*Occurs in grassy open woodland including Acacia and mallee remnants, inland riparian woodland, grassland and shrub steppe. It is found most commonly in native grassland, but also occurs in agricultural land, foraging over open habitats including edges of inland wetlands.*	--	--	Yes	**Possible,** eucalypt woodland onsite.
Climacteris picumnus victoriae Brown Treecreeper (eastern subspecies)	Vulnerable	Not Listed	*endemic to eastern Australia and occurs in eucalypt forests and woodlands of inland plains and slopes of the Great Dividing Range. It is less commonly found on coastal plains and ranges.* *...mainly inhabits woodlands dominated by stringybarks or other rough-barked eucalypts, usually with an open grassy understorey, sometimes with one or more shrub species;*	--	--	Yes	**Possible,** eucalypt woodland onsite.
Daphoenositta chrysoptera Varied Sittella	Vulnerable	Not Listed	*Inhabits eucalypt forests and woodlands, especially those containing rough-barked species and mature smooth-barked gums with dead branches, mallee and Acacia woodland.*	--	--	Yes	**Possible,** eucalypt woodland onsite.

Species	BC Act listing status	EPBC Act listing status.	OEH species profile descriptions	Habitat constraints	Geographic limitations	Species retained for further assessment?	Likelihood / Reason for exclusion from further assessment
Dasyurus maculatus Spotted-tailed Quoll	Vulnerable	Endangered	*Recorded across a range of habitat types, including rainforest, open forest, woodland, coastal heath and inland riparian forest, from the sub-alpine zone to the coastline.* *use hollow-bearing trees, fallen logs, other animal burrows, small caves and rock outcrops as den sites.* *hunt possums and gliders in tree hollows and prey on roosting birds.*	--	--	Yes	**Possible**, inhabits a range of habitats including woodlands.
Ephippiorhynchus asiaticus Black-necked Stork	Endangered	Not Listed	Floodplain wetlands (swamps, billabongs, watercourses and dams) of the major coastal rivers are the key habitat in NSW for the Black-necked Stork. Secondary habitat includes minor floodplains, coastal sandplain wetlands and estuaries.	Swamps Shallow, open freshwater or saline wetlands or shallow edges of deeper wetlands within 300m of these swamps.| Waterbodies Shallow lakes, lake margins and estuaries within 300m of these waterbodies	--	No	**Not likely**, the site is not floodplain wetlands, sandplain wetland nor estuary.
Falco subniger Black Falcon	Vulnerable	Not Listed	Widely but sparsely distributed.	--	--	Yes	**Possible.**
Glossopsitta pusilla	Vulnerable	Not Listed	Forages primarily in the canopy of open Eucalyptus forest and woodland, yet also finds food in	--	--	Yes	**Possible,** Eucalypt woodland onsite

Species	BC Act listing status	EPBC Act listing status.	OEH species profile descriptions	Habitat constraints	Geographic limitations	Species retained for further assessment?	Likelihood / Reason for exclusion from further assessment
Little Lorikeet			Angophora, Melaleuca and other tree species. Riparian habitats are particularly used, due to higher soil fertility and hence greater productivity. Isolated flowering trees in open country, e.g. paddocks, roadside remnants and urban trees also help sustain viable populations of the species. Feeds mostly on nectar and pollen, occasionally on native fruits such as mistletoe, and only rarely in orchards				
Haliaeetus leucogaster White-bellied Sea-Eagle (Foraging)	Vulnerable	Not Listed	Habitats are characterised by the presence of large areas of open water including larger rivers, swamps, lakes, and the sea. Occurs at sites near the sea or sea-shore, such as around bays and inlets, beaches, reefs, lagoons, estuaries and mangroves; and at, or in the vicinity of freshwater swamps, lakes, reservoirs, billabongs and saltmarsh. Terrestrial habitats include coastal dunes, tidal flats, grassland, heathland, woodland, and forest (including rainforest).	Waterbodies Within 1km of a rivers, lakes, large dams or creeks, wetlands and coastlines	--	Yes	**Possible**, the site is 0.5 km inland.
Hieraaetus morphnoides Little Eagle (Foraging)	Vulnerable	Not Listed	a medium-sized bird of prey … Occupies open eucalypt forest, woodland or open woodland. Sheoak or Acacia woodlands and riparian woodlands of interior NSW are also used.	--	--	Yes	**Possible,** woodland onsite.
Hirundapus caudacutus White-throated Needletail	Not Listed	Vulnerable	Migratory and usually seen in eastern Australia from October to April. Most often seen in eastern Australia before storms, low pressure troughs and approaching cold fronts and occasionally bushfire. These conditions are often used by insects to swarm (eg termites and ants) or tend to lift insects away from the surface which favours sighting of White-throated Needletails as they feed. More common in coastal areas, less so inland.	--	--	Yes	**Possible**.
Lathamus discolor Swift Parrot	Endangered	Critically Endangered	*On the mainland they occur in areas where eucalypts are flowering profusely or where there are abundant lerp (from sap-sucking bugs) infestations. Favoured*	--	--	Yes	**Possible**, winter flowering trees onsite. Important

Species	BC Act listing status	EPBC Act listing status.	OEH species profile descriptions	Habitat constraints	Geographic limitations	Species retained for further assessment?	Likelihood / Reason for exclusion from further assessment
(Foraging)			*feed trees include winter flowering species such as Swamp Mahogany Eucalyptus robusta, Spotted Gum Corymbia maculata, Red Bloodwood C. gummifera, Forest Red Gum E. tereticornis, Mugga Ironbark E. sideroxylon, and White Box E. albens. Commonly used lerp infested trees include Inland Grey Box E. microcarpa, Grey Box E. moluccana, Blackbutt E. pilularis, and Yellow Box E. melliodora.*				Habitat mapped to the north in Timbertop Reserve.
Lophoictinia isura Square-tailed Kite (Foraging)	Vulnerable	Not Listed	a reddish, medium-sized, long-winged raptor. Found in a variety of timbered habitats including dry woodlands and open forests. Shows a particular preference for timbered watercourses. … Is a specialist hunter of passerines, especially honeyeaters, and most particularly nestlings, and insects in the tree canopy, picking most prey items from the outer foliage.	--	--	Yes	**Possible**, woodland onsite.
Melithreptus gularis gularis Black-chinned Honeyeater (eastern subspecies)	Vulnerable	Not Listed	*It is rarely recorded east of the Great Dividing Range, although regularly observed from the Richmond and Clarence River areas. Occupies mostly upper levels of drier open forests or woodlands dominated by box and ironbark eucalypts, especially Mugga Ironbark (Eucalyptus sideroxylon), White Box (E. albens), Inland Grey Box (E. microcarpa), Yellow Box (E. melliodora), Blakely's Red Gum (E. blakelyi) and Forest Red Gum (E. tereticornis)*	--	--	Yes	**Possible**, woodland onsite.
Micronomus norfolkensis Eastern Coastal Free-tailed Bat	Vulnerable	Not Listed	Occur in dry sclerophyll forest, woodland, swamp forests and mangrove forests east of the Great Dividing Range.	--	--	Yes	**Possible**, previously recorded onsite (Ecoplanning 2020)
Miniopterus	Vulnerable	Not Listed	Moist eucalypt forest, rainforest, vine thicket, wet and	--	--	Yes	**Possible**,

Species	BC Act listing status	EPBC Act listing status.	OEH species profile descriptions	Habitat constraints	Geographic limitations	Species retained for further assessment?	Likelihood / Reason for exclusion from further assessment
australis Little Bent-winged Bat			dry sclerophyll forest, Melaleuca swamps, dense coastal forests and banksia scrub. Generally found in well-timbered areas. Little Bentwing-bats roost in caves, tunnels, tree hollows, abandoned mines, stormwater drains, culverts, bridges and sometimes buildings during the day, and at night forage for small insects beneath the canopy of densely vegetated habitats.				previously recorded onsite (Ecoplanning 2020)
Miniopterus orianae oceanensis Large Bent-winged Bat (Foraging)	Vulnerable	Not Listed	Hunt in forested areas, catching moths and other flying insects above the tree tops.	--	--	Yes	**Possible**, previously recorded onsite (Ecoplanning 2020)
Ninox connivens Barking Owl (Foraging)	Vulnerable	Not Listed	*Preferentially hunts small arboreal mammals such as Squirrel Gliders and Common Ringtail Possums, but when loss of tree hollows decreases these prey populations the owl becomes more reliant on birds, invertebrates and terrestrial mammals such as rodents and rabbits. Can catch bats and moths on the wing, but typically hunts by sallying from a tall perch. Requires very large permanent territories in most habitats due to sparse prey densities. Monogamous pairs hunt over as much as 6000 hectares, with 2000 hectares being more typical in NSW habitats.*	--	--	Yes	**Possible,** foraging habitat onsite.
Ninox strenua Powerful Owl (Foraging)	Vulnerable	Not Listed	*The Powerful Owl inhabits a range of vegetation types, from woodland and open sclerophyll forest to tall open wet forest and rainforest. The Powerful Owl requires large tracts of forest or woodland habitat but can occur in fragmented landscapes as well. The species breeds and hunts in open or closed sclerophyll forest or woodlands and occasionally hunts in open habitats.*	--	--	Yes	**Possible**, foraging habitat onsite.

Species	BC Act listing status	EPBC Act listing status.	OEH species profile descriptions	Habitat constraints	Geographic limitations	Species retained for further assessment?	Likelihood / Reason for exclusion from further assessment
Pandion cristatus Eastern Osprey (Foraging)	Vulnerable	Not Listed	*Favour coastal areas, especially the mouths of large rivers, lagoons and lakes. Feed on fish over clear, open water.*	--	--	No	**Unlikely**, no open water onsite.
Petroica boodang Scarlet Robin	Vulnerable	Not Listed	*occurs from the coast to the inland slopes... lives in dry eucalypt forests and woodlands. The understorey is usually open and grassy with few scattered shrubs... habitat usually contains abundant logs and fallen timber:*	--	--	Yes	**Possible** habitat onsite.
Pteropus poliocephalus Grey-headed Flying-fox (Foraging)	Vulnerable	Vulnerable	Occur in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops. Feed on the nectar and pollen of native trees, in particular Eucalyptus, Melaleuca and Banksia, and fruits of rainforest trees and vines.	--	--	Yes	**Possible**, floweirng eucalypts recorded onsite.
Saccolaimus flaviventris Yellow-bellied Sheathtail-bat	Vulnerable	Not Listed	When foraging for insects, flies high and fast over the forest canopy, but lower in more open country. Forages in most habitats across its very wide range, with and without trees; appears to defend an aerial territory.	--	--	Yes	**Possible**.
Stagonopleura guttata Diamond Firetail	Vulnerable	Not Listed	widely distributed in NSW, ...Not commonly found in coastal districts, though there are records from near Sydney,..Found in grassy eucalypt woodlands, including Box-Gum Woodlands and Snow Gum Eucalyptus pauciflora Woodlands.	--	--	Yes	**Possible**.
Tyto novaehollandiae Masked Owl (Foraging)	Vulnerable	Not Listed	Lives in dry eucalypt forests and woodlands from sea level to 1100 m. A forest owl, but often hunts along the edges of forests, including roadsides.	--	--	Yes	**Possible** foraging habitat onsite.

Likelihood of candidate threatened species (Species credit species):

Species	BC Act listing status	EPBC Act listing status	OEH habitat descriptions	Habitat constraints (from TBDC)	Geographic limitations	BioNet records within 10km grid	Likely habitat onsite
Acacia pubescens Downy Wattle	Vulnerable	Vulnerable	*Occurs on alluviums, shales and at the intergrade between shales and sandstones. The soils are characteristically gravely soils, often with ironstone….Occurs in open woodland and forest, in a variety of plant communities, including Cooks River/Castlereagh Ironbark Forest, Shale/Gravel Transition Forest and Cumberland Plain Woodland.*	--	--	21 (closest record within 1 km S of site, dated 6/12/1990)	**Possible,** occurs in Cumberland Plain Woodland.
Anthochaera phrygia Regent Honeyeater (Breeding)	Critically Endangered	Critically Endangered	*three known key breeding areas, two of them in NSW - Capertee Valley and Bundarra-Barraba regions. Distribution - mainly inhabits temperate woodlands and open forests of the inland slopes of south-east Australia. … also found in drier coastal woodlands and forests in some years.*	As per Important Habitat Map	--	13 (closest is 5 km to the NW, dated 20/12/2009)	**Unlikely**. Not a known breeding area.
Burhinus grallarius Bush Stone-curlew	Endangered	Not Listed	*inhabits open forests and woodlands with a sparse grassy groundlayer and fallen timber.*	Fallen/standing dead timber including logs	--	0	**Unlikely**, the site does not have a sparse grassy understorey. No BioNet records nearby.
Callocephalon fimbriatum Gang-gang Cockatoo (Breeding)	Vulnerable	Endangered	*Favours old growth forest and woodland attributes for nesting and roosting.*	Hollow bearing trees Eucalypt tree species with hollows at least 3 m above the ground and with hollow diameter of 7 cm or larger	--	0	**Unlikely**, the site is not in an old growth forest but on disturbed land with sparse occurance of hollows

Species	BC Act listing status	EPBC Act listing status	OEH habitat descriptions	Habitat constraints (from TBDC)	Geographic limitations	BioNet records within 10km grid	Likely habitat onsite
Calyptorhynchus lathami Glossy Black-Cockatoo (Breeding)	Vulnerable	Vulnerable	*Inhabits open forest and woodlands of the coast and the Great Dividing Range where stands of sheoak occur.*	Hollow bearing trees Living or dead tree with hollows greater than 15cm diameter and greater than 8m above ground	--	0	**Unlikely**, absence of important food resources onsite including *Allocasuarina littoralis* and *A. torulosa.* Sparse occurance of hollows
Cercartetus nanus Eastern Pygmy-possum	Vulnerable	Not Listed	*prefers habitat with a rich shrub understory. Feeds largely on nectar and pollen collected from banksias, eucalypts and bottlebrushes; soft fruits are eaten when flowers are unavailable.*	--	--	0	**Unlikely**, no banksias or bottlebrushes recorded onsite. No BioNet records in the area.
Chalinolobus dwyer – Large - eared pied bat	Vulnerable	Vulnerable	*Roosts in caves (near their entrances), crevices in cliffs, old mine workings and in the disused, bottle-shaped mud nests of the Fairy Martin (Petrochelidon ariel), frequenting low to mid-elevation dry open forest and woodland close to these features.*	Cliffs. Within two kilometres of rocky areas containing caves, overhangs, escarpments, outcrops, or crevices, or within two kilometres of old mines or tunnels.	--	1 (5.5 km to the NE, dated 20/10/2000)	**Unlikely,** no preferred habitat (cliffs, caves, overhangs..) onsite.
Dillwynia tenuifolia Dillwynia tenuifolia	Vulnerable	Not Listed	*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.….Eucalyptus fibrosa is usually the dominant canopy species. Eucalyptus globoidea, E. longifolia, E. parramattensis, E.*	--	--	0	**Unlikely,** absence of preferred habitat or dominant canopy species, *E. fibrosa*

Species	BC Act listing status	EPBC Act listing status	OEH habitat descriptions	Habitat constraints (from TBDC)	Geographic limitations	BioNet records within 10km grid	Likely habitat onsite
			sclerophylla and E. sideroxylon may also be present or codominant, with Melaleuca decora frequently forming a secondary canopy layer				
Eucalyptus benthamii – Camden White Gum	Critically Endangered	Vulnerable	*Requires a combination of deep alluvial sands and a flooding regime that permits seedling establishment...The recorded elevation range for the species is from 30m ASL at Bents Basin to 750m ASL in the Kedumba population...Occurs in open forest.*	--	--	0	**Unlikely,** no deep alluvial soils and required flooding regime
Grevillea juniperina subsp. juniperina - Juniper-leaved Grevillea	Vulnerable	Not Listed	*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 Woodland and Shale/Gravel Transition Forest.*	--	--	8 (closest record is 3 km to NW, dated 8/5/2018)	**Possible.**
Haliaeetus leucogaster White-bellied Sea-Eagle (Breeding)	Vulnerable	Not Listed	*Breeding habitat … close to foraging habitat. Feed mainly on fish and freshwater turtles. … Nests are large structures built from sticks and lined with leaves or grass.*	Living or dead mature trees within suitable vegetation within 1km of a rivers, lakes, large dams or creeks, wetlands and coastlines	--	0	**Unlikely**, no large stick nest onsite,

Species	BC Act listing status	EPBC Act listing status	OEH habitat descriptions	Habitat constraints (from TBDC)	Geographic limitations	BioNet records within 10km grid	Likely habitat onsite
Hieraaetus morphnoides Little Eagle (Breeding)	Vulnerable	Vulnerable	*It occurs as a single population throughout NSW. Nests in tall living trees within a remnant patch, where pairs build a large stick nest in winter.*	Other Nest trees - live (occasionally dead) large old trees within vegetation)		12 (closest record is 300 m south of site dated 14/9/2010)	**Unlikely**, no stick nets observed onsite.
Lathamus discolor Swift Parrot (Breeding)	Endangered	Critically Endangered	*breeds in Tasmania.*	As per Important Habitat Map	--	32 (closest record is 374 m to the NW dated 16/9/2001)	**No**, the site is not in Tasmania.
Litoria aurea Green and Golden Bell Frog	Endangered	Vulnerable	*Inhabits marshes, dams and stream-sides, particularly those containing bullrushes (Typha spp.) or spikerushes (Eleocharis spp.). Optimum habitat includes water-bodies that are unshaded, free of predatory fish such as Plague Minnow (Gambusia holbrooki), have a grassy area nearby and diurnal sheltering sites available.*	Within 1km of wet areas. Within 1km of swamp. Within 1km of waterbody.		10 (closest record 870 m S, dated 1/1/1967)	**Possible,** Blacktown Creek and drainage swale onsite.
Lophoictinia isura Square-tailed Kite (Breeding)	Vulnerable	Not Listed	*A raptor with preference for timbered watercourses.* *Nest sites generally located along or near watercourses, in a fork or on large horizontal limbs.*	Nest trees	--	0	**Unlikely,** No nest sites observed onsite. No Bionet records in the area.
Marsdenia viridiflora subsp. viridiflora - endangered population Marsdenia viridiflora R. Br.	Endangered population	Not Listed	*Recent records are from Prospect, Bankstown, Smithfield, Cabramatta Creek and St Marys.* *Grows in vine thickets and open shale woodland.*	--	Blacktown, Camden, Campbelltown, Canterbury-Bankstown, Cumberalnd,	36 (closest record is 3.5 km S of site, dated 27/1/1993)	**Possible,** degraded open shale woodland present onsite. Site located in the Blacktown LGA.

Species	BC Act listing status	EPBC Act listing status	OEH habitat descriptions	Habitat constraints (from TBDC)	Geographic limitations	BioNet records within 10km grid	Likely habitat onsite
subsp. viridiflora population in the Bankstown, Blacktown, Camden, Campbelltown, Fairfield, Holroyd, Liverpool and Penrith local government areas					Fairfield, Liverpool and Penrith local government areas (as amended from the Determination)		
Meridolum corneovirens Cumberland Plain Land Snail	Endangered	Not Listed	*Primarily inhabits Cumberland Plain Woodland..Lives under litter of bark, leaves and logs, or shelters in loose soil around grass clumps. Occasionally shelters under rubbish.*	--	--	85 (several records within 1 km of site, closest 65 m S of site dated 3/7/2018)	**Possible,** degraded Cumberland Plain Woodland present onsite.
Miniopterus australis - Little Bent-winged Bat (Breeding)	Vulnerable	Not Listed	*Only five nursery sites /maternity colonies are known in Australia.*	Cave, tunnel, mine, culvert or other structure known or suspected to be used for breeding including species records in BioNet with microhabitat code 'IC – in cave'; observation type code 'E nest-roost'; with numbers of individuals >500; or from the scientific literature.	--	5 (observed onsite by ultrasonic recording dated 8/4/2020)	**Unlikely,** no maternity colonies onsite
Miniopterus orianae oceanensis	Vulnerable	Not Listed	*Caves are the primary roosting habitat, but also use derelict mines, storm-water*	Cave, tunnel, mine, culvert or structure known or suspected	--	42 (observed onsite by ultrasonic	**Unlikely**, no roosting habitat onsite.

Species	BC Act listing status	EPBC Act listing status	OEH habitat descriptions	Habitat constraints (from TBDC)	Geographic limitations	BioNet records within 10km grid	Likely habitat onsite
Large Bent-winged Bat (Breeding)			*tunnels, buildings and other man-made structures.*	to be used for breeding including species records with microhabitat code "IC - in cave " observation type code "E nest-roost " with numbers of individuals >500		recording dated 8/4/2020)	
Myotis macropus Southern Myotis	Vulnerable	Not Listed	*Generally roost in groups of 10 - 15 close to water in caves, mine shafts, hollow-bearing trees, storm water channels, buildings, under bridges and in dense foliage.Forage over streams and pools catching insects and small fish by raking their feet across the water surface.*	Waterbodies with permanent pools/stretches 3m or wider, including rivers, large creeks, billabongs, lagoons, estuaries, dams and other waterbodies, on or within 200m of the site.	--	10 (closest record 1 km S of site, dated 17/2/1999)	**Possible,** water bodies onsite, however unlikely as no open waterbodies.
Ninox connivens Barking Owl (Breeding)	Vulnerable	Not Listed	*in hollows of large, old trees. Nest sites are used repeatedly over years by a pair, but they may switch sites if disturbed by predators (e.g. goannas).*	Hollow bearing trees Living or dead trees with hollows greater than 20 cm diameter and greater than 4m above the ground	--	2 (closest record 2.84 km NEE of site, dated 1/6/1996)	**Unlikely**, no nest sites recorded onsite, no hollows greater than 20 cm diameter recorded onsite.
Ninox strenua Powerful Owl (Breeding)	Vulnerable	Not Listed	*nest in large tree hollows (at least 0.5 m deep), at least 150 years old.*	Hollow bearing trees Living or dead trees with hollow greater than 20cm diameter	--	4 (closest record 1.27 km W of site, dated 18/4/2018)	**Unlikely**, no large diameter hollows observed onsite.
Pandion cristatus Eastern Osprey (Breeding)	Vulnerable	Not Listed	*Nests are made high up in dead trees or in dead crowns of live trees, usually within one kilometre of the sea.*	Presence of stick-nests in living and dead trees (>15m) or artificial structures within 100m of a floodplain for nesting)	--	0	**Unlikely,** no large stick nests observed.
Petaurus	Vulnerable	Not Listed	Inhabits mature or old growth	--	--	0	**Unlikely**, the site does

Species	BC Act listing status	EPBC Act listing status	OEH habitat descriptions	Habitat constraints (from TBDC)	Geographic limitations	BioNet records within 10km grid	Likely habitat onsite
norfolcensis Squirrel Glider			Box, Box-Ironbark woodlands and River Red Gum forest west of the Great Dividing Range and Blackbutt-Bloodwood forest with heath understorey in coastal areas.				not support Blackbutt-Bloodwood forest with heath understorey.
Phascolarctos cinereus Koala	Endangered	Endangered	*Inhabit eucalypt woodlands and forests. Feed on the foliage of more than 70 eucalypt species and 30 non-eucalypt species, but in any one area will select preferred browse species.*	Presence of koala use trees - refer to Survey Comments field in TBDC	--	0	**Possible,** The Koala use trees for the Central Coast Koala Management Area (Schedule 2 of Koala SEPP 2021) recorded onsite were the local native canopy trees *Eucalyptus moluccana, Eucalyptus tereticornis* and a non-local planted *Eucalyptus robusta*
Pimelea spicata Spiked Rice-flower	Endangered	Endangered	*In both the Cumberland Plain and Illawarra environments this species is found on well-structured clay soils. On the Cumberland Plain sites it is associated with Grey Box communities (particularly Cumberland Plain Woodland variants and Moist Shale Woodland) and in areas of ironbark. The co-occurring species in the Cumberland Plain sites are grey box (Eucalyptus moluccana), forest red gum (E. tereticornis) and narrow-leaved ironbark (E. crebra). Blackthorn (Bursaria spinosa) is often*	--	--	187 (multiple records within 1 km S of site)	**Possible,** degraded *Cumberland Plain Woodland* onsite and co-occuring species *Eucalyptus moluccana, E. tereticornis* and *Bursaria spinosa.*

Species	BC Act listing status	EPBC Act listing status	OEH habitat descriptions	Habitat constraints (from TBDC)	Geographic limitations	BioNet records within 10km grid	Likely habitat onsite
			present at sites (and may be important in protection from grazing) and kangaroo grass (Themeda australis) is usually present in the groundcover (also indicative of a less intense grazing history).				
Pteropus poliocephalus Grey-headed Flying-fox (Breeding)	Vulnerable	Vulnerable	*Roosting camps are generally located within 20 km of a regular food source and are commonly found in gullies, close to water, in vegetation with a dense canopy. Individual camps may have tens of thousands of animals and are used for mating, and for giving birth and rearing young.*	Breeding camps	--	318 (several records within 1 km of site)	**No**, no camp onsite.
Pultenaea parviflora Pultenaea parviflora	Endangered	Vulnerable	*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. Eucalyptus fibrosa is usually the dominant canopy species. Eucalyptus globoidea, E. longifolia, E. parramattensis, E. sclerophylla and E. sideroxylon may also be present or co-dominant, with*	--	--	26 (several records within 1 km S of site)	**Possible.**

Species	BC Act listing status	EPBC Act listing status	OEH habitat descriptions	Habitat constraints (from TBDC)	Geographic limitations	BioNet records within 10km grid	Likely habitat onsite
			Melaleuca decora frequently forming a secondary canopy layer.				
Tyto novaehollandiae Masked Owl (Breeding)	Vulnerable	Not Listed	Roosts and breeds in moist eucalypt forested gullies, using large tree hollows or sometimes caves for nesting.	Hollow bearing trees Living or dead trees with hollows greater than 20cm diameter	--	3 (closest record 365 m W of site, dated 18/4/2018)	**Unlikely**, no large diameter hollows or caves onsite. The site is not a moist gully.

Appendix 7

Huntingwood frog survey outcomes and habitat suitability for microbats with recommendations for habitat restoration for threatened fauna

Huntingwood Frog Survey Outcomes and Habitat Suitability for Microbats with Recommendations for Habitat Restoration for Threatened Fauna

Date: 24 August 2022



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Front cover image: Green and Golden Bell Frog. Photo by Grant Webster

1.0 Introduction

This report has been prepared to assess the presence of and habitat suitability for threatened fauna species in particular the Green and Golden Bell Frog (*Litoria aurea*) and the Southern Myotis (*Myotis macropus*) along Blacktown Creek on the Huntingwood site in Blacktown City Local Government Area. This report also provides advice on habitat restoration for threatened species with a likelihood of local occurrence.

The approximately 27 ha site is located west of the Prospect Highway between the Great Western Highway and the M4 Motorway and accessed via Augusta Street. The 1st Order watercourse Blacktown Creek flows through the site from south to north (**Figure 1**).

It is an approximately 270 m wide strip of former agricultural land, highly degraded and largely cleared of native vegetation. The riparian corridor associated with Blacktown Creek is heavily overgrown with native and exotic vegetation leaving little open water.

1.1 Previous surveys

Ecoplanning (2020) in their Biodiversity Development Assessment Report for a previous development application considered:

- Green and Golden Bell Frog as a candidate species for the subject site. The species was assumed to be present due to Blacktown Creek being considered to have characteristics of suitable habitat for Green and Golden Bell Frog. It's presence was not confirmed by targeted survey;
- Southern Myotis as a candidate species for the subject site and assumed present as the 18 targeted survey nights (two ultrasonic detectors over 9 nights from 8-17th April 2020) were outside the allowable survey period for the species.

Ecoplanning (2020) in their targeted microbat survey recorded a *total of seven microchiropteran bat species from calls within and near the site*, *including three species listed as vulnerable under the BC Act (Little Bent-winged Bat, Large Bent-winged Bat, Eastern Coastal Free-tailed Bat)*.

2.0 Survey effort and methology for the current survey

The approximately 300 m stretch of the Blacktown Creek riparian corridor was surveyed for the presence of Green and Golden Bell Frog and the site was assessed for habitat suitability for the Southern Myotis and other threatened microbat species. Other fauna species detected during the surveys were noted and opportunistic searches for threatened birds were also conducted.

Surveying consisted of nocturnal aural-visual spotlighting as well as diurnal habitat searches on four separate nights over February and March 2022 for 2-3 hours per night by Jayden Walsh, accompanied by Joelan Sawyer on one of these nights (see Appendix 2 for daily survey effort and Appendix 3 for associated climatic conditions).

Total survey effort (>480 mins/~300 m transect) exceeded that required for Green and Golden Bell Frogs according to the NSW Guidelines which recommend four surveys and at least 288 mins of survey time for a 300 m transect (NSW DPIE, 2020). The NSW guidelines also require surveys to be conducted between November and March (NSW DPIE, 2020) but do not state specific environmental conditions necessary for surveying.

The Green and Golden Bell Frog species profile (OEH, 2017) states *the species is active by day and usually breeds in summer when conditions are warm and wet.*

The targeted survey was undertaken at a suitable time with favourable conditions for species detection and breeding activity, including recent rainfall and warm temperatures and with one of the surveys following a flood.

3.0 Survey results

Common fauna species, generally typical of the region, were detected on the site (listed in Appendix 4), namely:

- 24 bird species (21 native and three exotic) including Australian Reed-Warbler, listed as “Marine” on the EPBC Act being recorded in dense reeds of the riparian corridor;
- two frog species, Common Eastern Froglet and Striped Marsh Frog;
- three reptiles, Eastern Brown Snake, Dark-flecked Sunskink and Pale-flecked Sunskink; and
- two mammals, Eastern Grey Kangaroo and European Rabbit.

The Green and Golden Bell Frog was not detected during the current targeted survey.

4.0 Habitat suitability and likelihood of occurrence of threatened species

4.1 Green and Golden Bell Frog

In the current targeted survey along Blacktown Creek riparian corridor, it was found that there was a lack of suitable habitat, in the form of open and pooling water. It is unlikely that this species would utilise the site for breeding.

Further, given the species was not detected over the course of the February-March 2022 surveys, it is unlikely that the species occurs on the site or that the site forms an important area for the species.

Green and Golden Bell Frogs are now very rare in Western Sydney and despite some relatively close records to the site, none of these records are more recent than the 1960s (**Figure 2**).

The closest more recent records from the broader area are from 1998-1999 in the Guildford-Holroyd region and are along a different creek system from Blacktown Creek (**Figure 3**). The most recent record in the broader area is from 2012 at Tregear about 12 km from the site and again along a separate creek system (**Figure 3**). According to the Draft Recovery Plan for this species a population persists at Holroyd Gardens (approximately 9km from the site)

but it is highly unlikely that frogs would be able to disperse from this population to the site given the dense urbanisation between these locations.

It is unlikely that Green and Golden Bell Frogs still persist in the immediate vicinity of the site (within about 5km of the site). However, if a population of the species does still occur undetected in the vicinity, perhaps in very low density, the site would at best currently provide only marginally suitable habitat. This degraded creek corridor is limited to potential foraging habitat and could possibly enable dispersal across the landscape by providing sheltering habitat amongst aquatic vegetation as well as access to water.

As part of a sustainable development, restoration of breeding habitat for Green and Golden Bell Frog is being proposed (details below).

4.2 Microbats

There are eight species of threatened microbats with records within 10 km of the site (**Table 1**). The Eastern Coastal Free-tailed Bat, Southern Myotis, Eastern False Pipistrelle, Greater Broad-nosed Bat, Little Bent-winged Bat and Large Bent-winged Bat are recorded particularly close to the site (within approximately 3 km). Ecoplanning (2020) recorded three of these microbat species within and near the subject site (Little Bent-winged Bat, Large Bent-winged Bat, Eastern Coastal Free-tailed Bat).

There are numerous nearby records of the Southern Myotis (**Figure 4**) particularly around Prospect Reservoir to the south of the site and along Eastern Creek to the north-west of the site.

Suitable roosting habitat for microbats exists on / adjacent to the site in the form of a culvert as well as dead / potential hollow bearing trees and possibly infrastructure (buildings etc) in the immediate vicinity (photos in Appendix 4). Along Blacktown Creek within the site, there is reduced habitat suitability for Southern Myotis due to the lack of open water (i.e., foraging space). However, given the records in close proximity and suitability of the culverts for roosting, occurance of, and utilisation of the site by Southern Myotis is moderately likely.

The site may also provide potential foraging/dispersal or roosting habitat for the Yellow-bellied Sheathtail-bat, and the Greater Broad-nosed Bat, it is also possible that these species could occur on or utilise the site. Due to the lack of suitable more extensive areas of forest or woodland on the site, occurrence of the Large-eared Pied Bat and Eastern False Pipistrelle is unlikely.

As part of a sustainable development, restoration of microbat habitat is being proposed in particular, foraging habitat for Southern Myotis (details below).

4.3 Other threatened fauna species

A total of 28 threatened fauna species have been recorded in the vicinity of the site (10 km radius) (**Table 2**).

In its current state, the site provides little opportunity for other threatened species with the exception of Grey-headed Flying-fox and some woodland bird species (e.g. Swift Parrot, Little Lorikeet and Dusky Woodswallow) which may forage among remnant trees and woodland patches on the site.

The Grey-headed Flying-fox and Dusky Woodswallow are likely to occur on and utilise site, while the Swift Parrot and Little Lorikeet are moderately likely to occupy the site when flowering eucalypts provide valuable food resources. All of these species are either migratory or nomadic in their behaviour and move between areas of suitable habitat within their range.

5.0 Habitat reconstruction / restoration

5.1 Existing habitat

The proposed industrial subdivision is on the former productive agricultural land, which included market gardens with houses and sheds. With urban expansion, the agricultural activities decreased over time and now have ceased on the site. Inferred by aerial photographs, the land use changes have been the following:

Year	Observed from aerial photographs
1956	Farming activities with dam offsite to the north of the site;
1965	The high voltage pylons installed in the south of the site;
1970	The Great Western Highway built along the northern boundary, agriculture decreasing east of Blacktown Creek onsite, but intensifying west of the creek;
1986	Market gardens having ceased onsite; and
1991	The Western Motorway (M4) being built to the south of the site.

The aerial photo from 1956 (**Figure 5**) shows roughly the same extent of native vegetation and cleared land on the site as the present day with some losses of native woodland remnants on neighbouring land since 1956.

In terms of breeding habitat for Green and Golden Bell Frog, there were visible sections of open and pooling water suitable for breeding along Blacktown Creek in 1956, which are no longer present.

Habitat value along Blacktown Creek is presently significantly reduced for most stream-dwelling fauna. Invasion of the exotic *Juncus acutus* (Sharp/Spiny Rush) has resulted in a loss of open water that receives direct sunlight and water bodies being no longer deep enough for Green and Golden Bell Frog tadpoles to complete development.

The large stand of *Juncus acutus*, however, currently supports a population of the ‘marine’ protected Australian Reed-Warbler (*Acrocephalus australis*) (EPBC Act). Proposed riparian corridor works need to minimise impact upon this species and other wetland birds potentially present such as Bitterns, Crakes and Rails.

5.2 Key fauna species for habitat reconstruction / restoration

There are a number of threatened fauna species that have been recorded within the vicinity of the site that are likely to benefit from habitat reconstruction / restoration on the site (see **Table 3**).

5.3 Reconstruction / restoration areas

5.3.1 Woodlands

The woodland conservation areas largely cover existing treed land in the west of the site. Mature eucalypt trees are to be retained where practicable in these areas to provide important foraging resources for microbats and birds as well as potential hollows and anchor points for nest boxes.

Restoration efforts within these conservation areas focus on progressively replacing weeds with local native vegetation.

5.3.2 Blacktown Creek riparian corridor

Background

This is the largest of the conservation areas for the site and covers the riparian zone of Blacktown Creek, closely following the creek corridor and extending at least 10 m beyond the top of bank. This will potentially benefit the Green and Golden Bell Frog, which was formerly very common and widely distributed across much of coastal NSW including the Cumberland Plain.

The species declined severely following the global spread of the amphibian chytrid fungus, among other existing pressures such as land clearing and habitat modification. Additionally, *Gambusia holbrooki* (Mosquito Fish) pose a significant threat to tadpole mortality. For an effective wetland habitat construction these factors need to be considered and accounted for.

Best practice management involves a matrix of ephemeral and permanent water sources, saline influence and earthen bund walls (Klop-toker et al, 2017; Beranek et al, 2020; Klop-toker et al, 2021).

This wetland/creek restoration proposal is consistent with habitat known to support extant Green and Golden Bell Frog populations and restored wetlands occupied by this species (Beranek et al 2020). For example, Klop-toker et al. (2021) found that ideal Green and Golden Bell Frog habitat *included a mosaic of permanent and ephemeral ponds, increased salinity in a subset of ponds, fencing to exclude predators and prevent* L. aurea *dispersal, and rock piles for shelter*.

Wetlands should also be constructed to have a short hydro-period where chytrid fungus zoospores are eliminated due to desiccation (Scheele et al. 2015); this will also prevent the establishment of large populations of Mosquito Fish. This is achievable at the site, by establishing ephemeral ponds and also by incorporating inflow/outflow drains into the

earthen bunds of the ponds that allow for the mechanical regulation of water level and filling/draining of all the proposed ponds in the riparian zone.

If run-off/discharge or detention basin ponds are proposed as part of the development, then these could potentially be formed into additional wetlands suitable for Green and Golden Bell Frogs and other fauna. These are to be planted with aquatic vegetation and landscaping of the surrounding area should utlise native vegetation species proposed for planting in the riparian corridor.

Water from these detention basins could potentially be used to help regulate water level during droughts in the permanent ponds proposed as part of the Blacktown Creek riparian corridor reconstruction / restoration. Further, water from detention basins could be used to periodically inundate the proposed ephemeral ponds in the riparian corridor during drier periods to provide additional available breeding habitat for frogs, and foraging habitat for wetland birds, when environmental conditions are otherwise not conducive to natural inundation of these ponds.

An off-line matrix of four or five ponds with direct connectivity to Blacktown Creek is proposed within the riparian corridor, below the top of bank (**Figure 6**). This will consist of at least two ephemeral and two permanent ponds with bund walls controlling water flow, allowing for the inundation of the ephemeral wetlands during flood events and the regulating of water level in the permanent ponds. A matrix of permanent and ephemeral ponds allows for frog populations to persist during droughts, where the permanent ponds form refugia, while during wetter periods ephemeral ponds are likely to be favoured for breeding.

At a minimum, both an ephemeral and a permanent pond should be >20 m long each, with the permanent pond >10 m wide and the ephemeral pond >5 m wide. The other two ponds may be smaller, both approximately 10 m long by 5 m wide. Depths will be dependent upon nature of water body, and should be 1.1–1.9 m deep for permanent ponds and 0.3–0.7 m deep for ephemeral ponds (Pyke & White, 1996; Beranek et al, 2020). All ponds should be slightly deeper at the end where water inflows from the creek (Pyke & White, 1996), with capacity to drain/overflow from the shallow end. Water inflow access and drainage/overflow channels, with associated mechanisms for regulating pond water level, need to be constructed within and on the bund walls in direct contact to the closest upstream and downstream flowing section of the creek respectively.

All ponds need to be surrounded on every bank with a constructed bund, being an elevated earthen wall that sits >0.6 m and >1.2 m above the respective maximum water levels of the ephemeral and permanent ponds (Beranek et al 2020), and at least 1 m higher than the maximum water level of the creek (i.e. during flood events). The bunds should be roughly 3.5 m wide and can be created from material excavated during pond construction, and compacted for stability (Beranek et al 2020). Bunding is necessary to prevent the predatory exotic Mosquito Fish (*Gambusia holbrooki*) from entering the ponds during floods (Chapman & Kramer, 1991; Kerezsy, 2015).

Within the appropriate bund walls, regulated water inflow and outflow access points need to be constructed to allow water to flow in from Blacktown Creek and be drained back into the creek as required. On the bund wall containing the outflow access, an additional above

ground, gently sloping, overflow “spillway” needs to be constructed in the event that extreme rainfall causes the pond water level to reach the top of the bund.

The access (i.e. inflow) points need to be well below the normal or average water level of the creek (i.e. close to the streambed) for the permanent ponds, and well above the normal water level but below the maximum/ “flood” level for ephemeral ponds. The inflow access then connects to the pond entry point, best located just above the bottom of the bund near where it joins the base of the pond, allowing the ponds to fill from the deepest point. The outflow point within the ponds must to be located at the pond base, where it joins the bottom of the bund, with the exit point into the creek located below the normal creek water level.

Valves to open and close the water access points need to be installed so pond water level can be regulated, with valve filters fitted at inflow (creek side) and outflow (pond side) points to prevent Mosquito Fish entering the ponds.

Once constructed, the bunds can be vegetated with local native groundcover species.

As water salinity has an important influence on the persistence of Green and Golden Bell Frog populations, a salinity of 2 ppt in the proposed large permanent pond at the northern end of the site and 4 ppt in the smaller proposed permanent pond is recommended. Salinity of the ephemeral ponds should be lower, ideally between 1 and 2 ppt. Salinity should never exceed 9 ppt in any of the ponds.

Pond salinity can be regulated either by:

1) physically adding rock salt (NaCl) into the pond (while concurrently measuring pond salinity) to reach the desired salt concentration (Stockwell et al 2014; Klop-toker et al, 2017); or

2) digging deep enough or boring a hole within the base of the pond to intersect the water table, allowing groundwater to enter the pond and increase salinity (Beranek et al 2020).

For the proposed ephemeral ponds, adding rock salt post inundation would be a practical way to regulate salinity level, especially as lower salt concentration is recommended for these ponds. Adding rock salt to the proposed permanent ponds could also be used to regulate or alter salt levels in these water bodies, however depending on the depth of the water table, boring to allow groundwater to mix with the pond water may be a better method of maintaining salinity in the long term (particularly as these ponds are intended to be permanent water sources).

Monitoring salt concentration could be achieved by taking measurements with a salinity meter or installing data loggers, the latter being more practical for the permanent water bodies. From the salinity report for the site (PSM letter, dated 22 March 2022) the concentrations of chlorides in soil samples varied from less than 50 mg/kg to 830 mg/kg, it is likely that the natural groundwater is slightly saline.

Table 4 provides a list of suitable aquatic and fringing vegetation for Green and Golden Bell Frogs that is recommended for planting within and around the proposed permanent and ephemeral ponds. Species such as *Phragmites australis* and *Typha* spp. should be mostly avoided in plantings given their tendency to quickly colonise water bodies and reducing the amount of open water (Pyke & White, 1996; Beranek et al 2020), however actively facilitating

Typha domingensis to naturally colonise some sections of Blacktown Creek as a replacement for existing *Juncus acutus*, that will be removed, is important to ensure the local population of Australian Reed-Warblers persists.

Trees should not be planted close enough to the proposed ponds that they would shade or overhang any of the pond area (Pyke & White, 1996). Rather, tree planting along the riparian corridor should occur along sections of Blacktown Creek away from the proposed ponds, and higher up the bank. Maintaining sections of unshaded, open water will benefit both Green and Golden Bell Frogs and Southern Myotis.

Other habitat features, such as logs and rock piles should be placed around the perimeter of the deeper ends of the ponds in order to provide overwintering and sheltering habitat for Green and Golden Bell Frogs (Pyke & White, 1996; Klop-toker et al 2021).

Rock piles along the pond perimeter should extend for 2–3 m and range from at least 1 m below and up to 5 m above the water level of the pond when full (Pyke & White, 1996).

In brief

As part of creek reconstruction / restoration works, open and pooling water ponds are designed to provide breeding habitat for the Green and Golden Bell Frog and to minimise the risks of:

- Amphibian Chitrid fungus by use of permanent and ephemeral ponds; and
- Predation of Green and Golden Bell Frog tadpoles by *Gambusia holbrooki* (Mosquito Fish) by encouraging the threatened fishing bat, Southern Myotis. This bat's diet includes *Gambusia holbrooki.*

Southern Myotis requires unimpeded flight paths over open water with a glide slope of approximately 3 m on approach to these open ponds. The restoration works incorporate flight paths along Blacktown Creek for both bats and birds.

The ponds will include at least:

- two permanent (at least 20m x 10m & 10m x 5m), depth 1.1-1.9m;
- two ephemeral (20m x 5m & 10m x 5m), depth 0.3-0.7m; and
- Rock piles/logs for shelter.

These ponds are being designed by the hydro engineer to meet the requirements of the Green and Golden Bell Frog as part of the water management for the proposal.

Tree plantings within this riparian zone are to be away from the constructed ponds so that they will not shade or overhang the ponds when mature.

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Appendix 1. Details of authors

Name	Position	Tasks performed include	Relevant qualifications
Grant Webster	Fauna Ecologist	- Report preparation, - Data analysis; - Research.	B.Sc (Hons) in Biology and a M.Res in Science. Grant graduated from his Masters degree in 2017, with a project studying the geographic variation in the frogs *Pseudophryne bibronii* and *P dendyi*. Grant is currently completing his PhD on the conservation and ecology of the threatened frog species, Mahony's Toadlet.
Jayden Walsh	Ecologist	- Field survey, - data collection - photography	Experienced naturalist with a B.Sc from Macquarie University

Appendix 2. Daily survey effort

07/02/22 – 7-9:45pm - JW
08/02/22 – 8-10pm - JW
14/02/22 – 8-10pm - JW
09/03/22 – 6:30-9:45pm – JW & JS

(JW = Jayden Walsh, JS = Joelan Sawyer)

Appendix 3. Survey date climatic conditions

Date / time	Rainfall (Prospect)	Rainfall (Horsley Park)	Temp at 3 pm (Horsley Park)	Wind at 3 pm (Horsley Park)
07/02/22 – 7-9:45pm	Dry	7.4 mm	21.2	15 km/hr SSE
08/02/22 – 8-10pm	Dry	5.6 mm	24.1	11km/hr ENE
14/02/22 – 8-10pm	Dry	19 mm from 11, 12, 13 Feb, none on 14 Feb	28.2	6 km/hr N
09/03/22 – 6:30-9:45pm	More than 500 mm recorded between 16 Feb and 8 March.	30 mm on 9 Mar More than 350 mm between 11 Feb and 8 March (226.2 + 129mm)	24.0	20 km/hr SSW

(Source: Bureau of Meteorology online climate data)

Appendix 4. Fauna species detected onsite

Common Name	Scientific Name	Observation Type
Birds		
Bell Miner	*Manorina melanophrys*	OW
Red-whiskered Bulbul*	*Pycnonotus jocosus*	OW
Black-shouldered Kite	*Elanus axillaris*	OW
Australian Raven	*Corvus coronoides*	OW
Australian Magpie	*Gymnorhina tibicen*	O
Australian Reed-Warbler^	*Acrocephalus australis*	OW
Grey Fantail	*Rhipidura albiscapa*	OW
Willie Wagtail	*Rhipidura leucophrys*	O
New Holland Honeyeater	*Phylidonyris novaehollandiae*	OW
Little Grassbird	*Megalurus gramineus*	W
Spotted Dove*	*Spilopelia chinensis*	OW
Laughing Kookaburra	*Dacelo novaeguineae*	OW
Red-rumped Parrot	*Psephotus haematonotus*	OW
Rainbow Lorikeet	*Trichoglossus moluccanus*	OW
Superb Fairywren	*Malurus cyaneus*	OW
Magpie Lark	*Grallina cyanoleuca*	OW
Common Myna*	*Acridotheres tristis*	O
Noisy Miner	*Manorina melanocephala*	OW
Red Wattlebird	*Anthochaera carunculata*	OW
Welcome Swallow	*Hirundo neoxena*	OW
Grey Butcherbird	*Cracticus torquatus*	OW
White-plumed Honeyeater	*Lichenostomus penicillatus*	OW
Frogs		
Common Eastern Froglet	*Crinia signifera*	OW
Striped Marsh Frog	*Limnodynastes peronii*	OW
Reptiles		
Eastern Brown Snake	*Pseudonaja textilis*	O
Dark-flecked Sunskink	*Lampropholis delicata*	O
Pale-flecked Sunskink	*Lampropholis guichenoti*	O
Mammals		
Eastern Grey Kangaroo	*Macropus giganteus*	O
European Rabbit*	*Oryctolagus cuniculus*	O

O = seen; W = heard; OW = seen and heard, ^ = listed on EPBC Act, * = exotic species

Appendix 5. Site photographs

Plate 1. Site access via Augusta Street.

Plate 2. Dead trees along Augusta Street

Plate 3. View east across cleared former agricultural land towards the riparian zone onsite

Plate 4. Culvert of Blacktown Creek with potential microbat roosting habitat

Plate 5. View of paddock grassland typical of the site

Appendix 5. Site photographs



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Plate 4. Culvert of Blacktown Creek with potential microbat roosting habitat



Plate 5. View of paddock grassland typical of the site

FIGURES



Figure 1. Site location

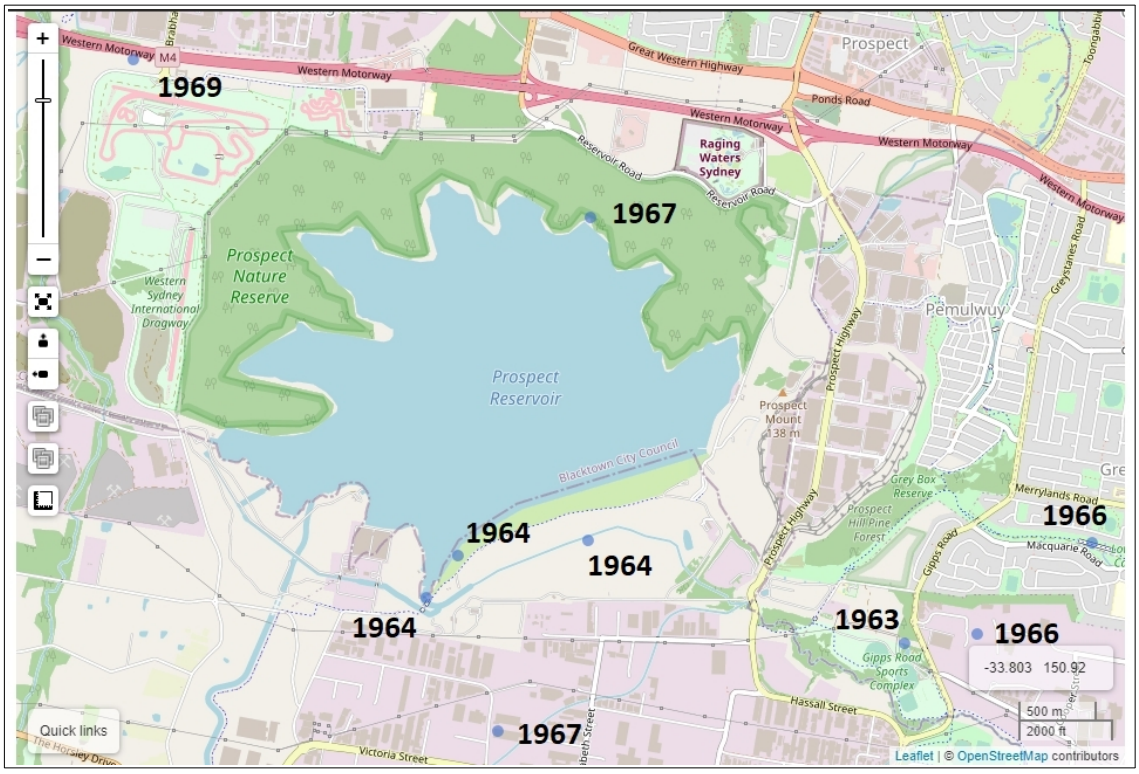


Figure 2. Green and Golden Bell Frog records (blue circles) in close proximity to the site with the dates of the records labelled

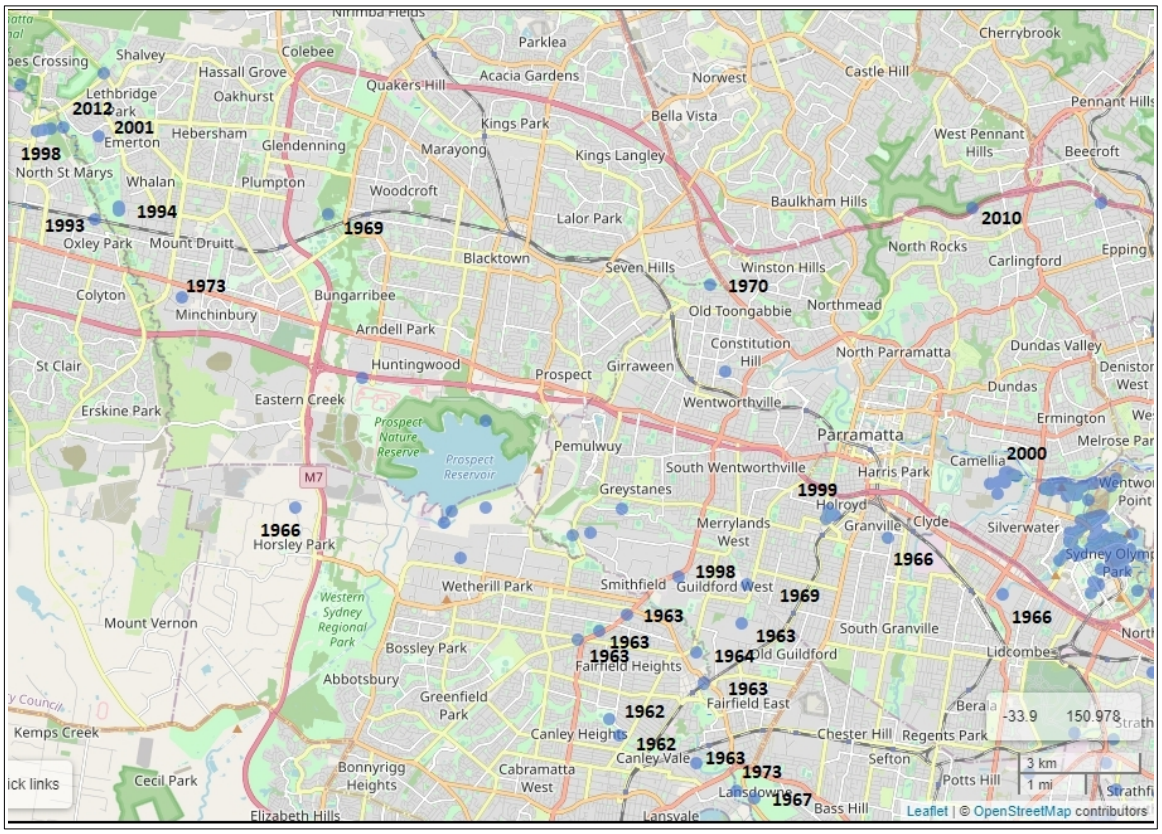


Figure 3. Records of Green and Golden Bell Frogs (blue circles) in the broader area with the dates of the records labelled

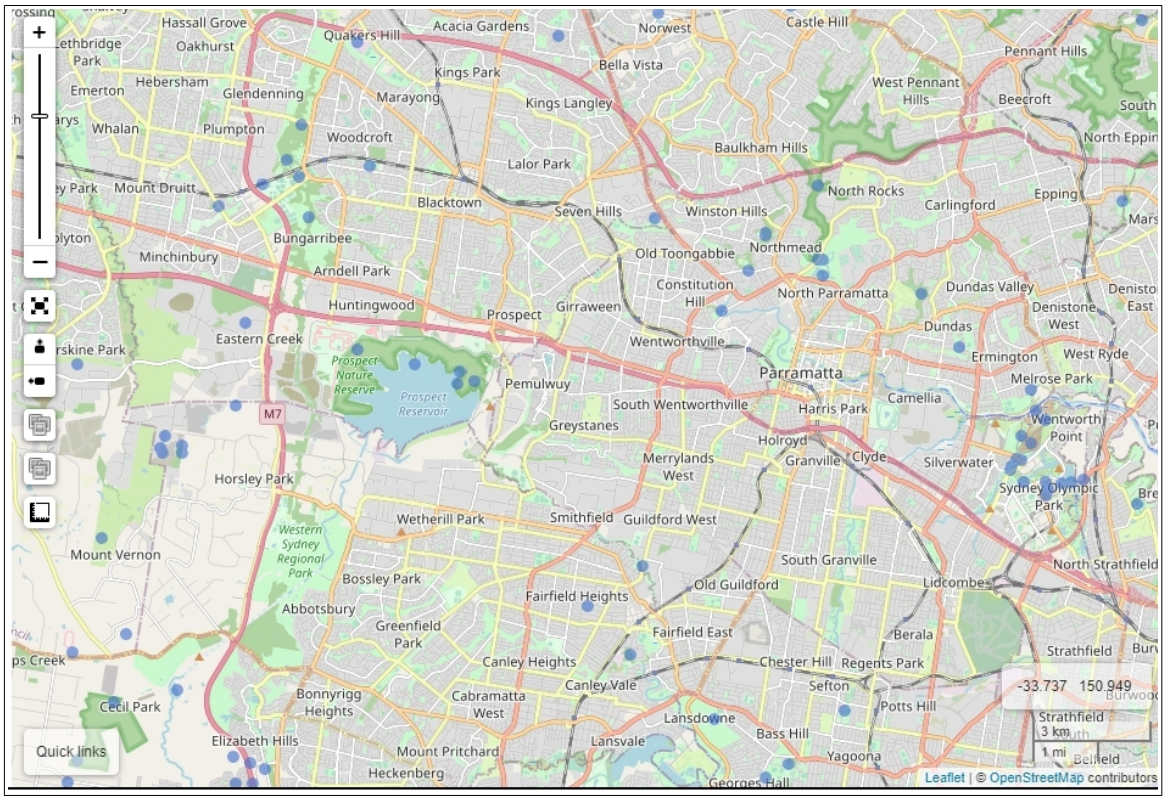


Figure 4: Records of Southern Myotis (blue circles) in the broader area around the site.



Figure 5. Historic aerial photograph of the site in 1956

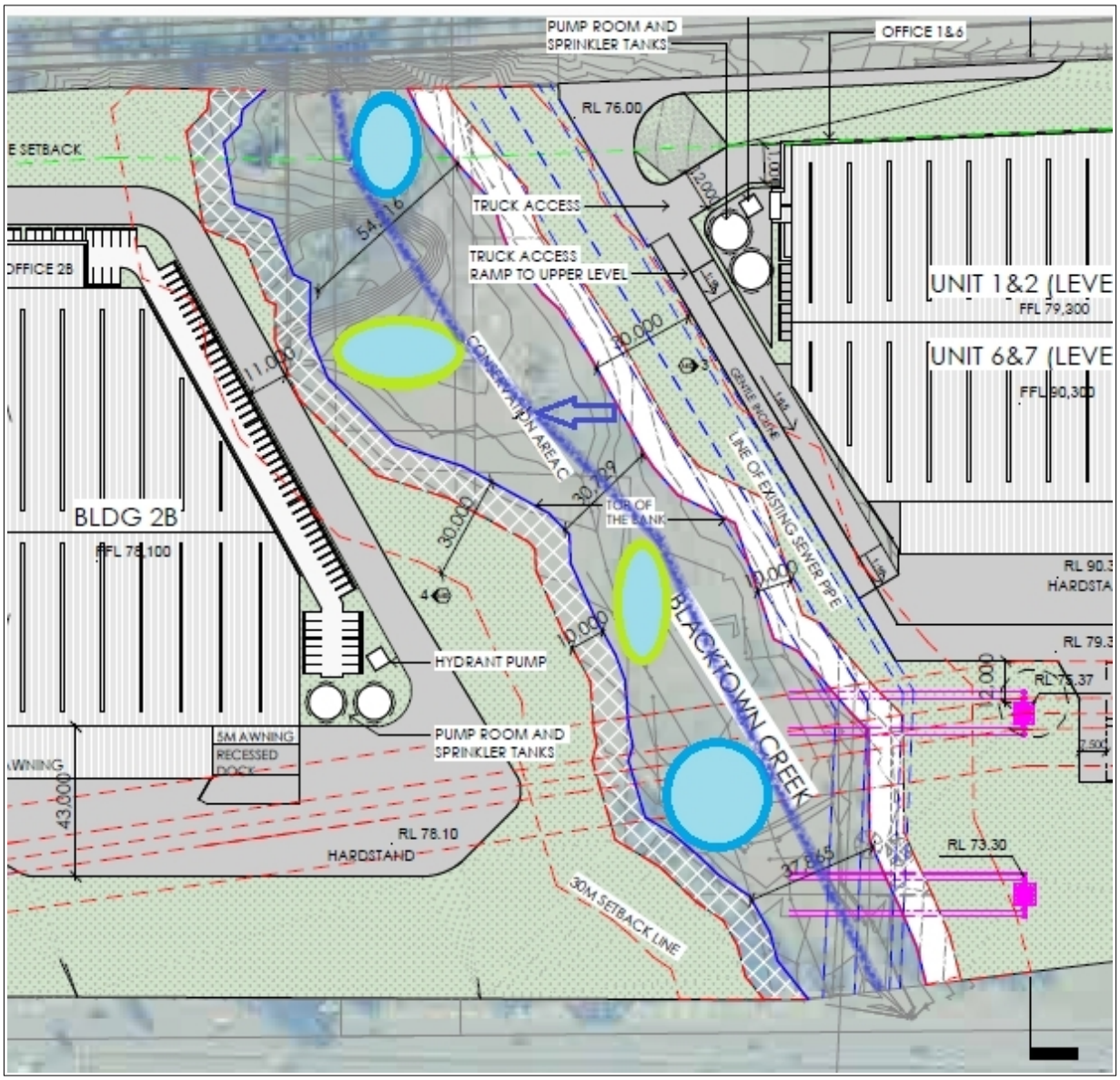


Figure 6. Sketch of proposed permanent and ephemeral ponds with direct connectivity to Blacktown Creek.

Note: Permanent Ponds = Blue outline; ephemeral ponds = green outline; approximate alignment of water channel is the shaded dark blue line, indicated with blue arrow.

TABLES

Table 1. Threatened microbat species records within 10 km of the site

(Note: all species other than the Large-eared Pied Bat are recorded within 5km of the site)

Emballonuridae	Yellow-bellied Sheathtail-bat	Saccolaimus flaviventris	☐	V,P		1
Molossidae	Eastern Coastal Free-tailed Bat	Micronomus norfolkensis	☐	V,P		23
Vespertilionidae	Large-eared Pied Bat	Chalinolobus dwyeri	☐	V,P	V	1
	Eastern False Pipistrelle	Falsistrellus tasmaniensis	☐	V,P		9
	Southern Myotis	Myotis macropus	☐	V,P		10
	Greater Broad-nosed Bat	Scoteanax rueppellii	☐	V,P		11
Miniopteridae	Little Bent-winged Bat	Miniopterus australis	☐	V,P		4
	Large Bent-winged Bat	Miniopterus orianae oceanensis	☐	V,P		41

Table 2. Threatened fauna species records in the vicinity of the site (within a 10 km radius).

	Common name	Scientific name	Map [Clear all]	NSW status	Comm. status	No. of records
Animalia Amphibia Hylidae	Green and Golden Bell Frog	Litoria aurea	☐	E1,P	V	10
Aves Apodidae	Fork-tailed Swift	Apus pacificus	☐	P	C,J,K	4
	White-throated Needletail	Hirundapus caudacutus	☐	P	V,C,J,K	1
Accipitridae	Little Eagle	Hieraaetus morphnoides	☐	V,P		12
Falconidae	Black Falcon	Falco subniger	☐	V,P		1
Charadriidae	Grey Plover	Pluvialis squatarola	☐	P	C,J,K	1
Scolopacidae	Latham's Snipe	Gallinago hardwickii	☐	P	J,K	1
Psittacidae	Little Lorikeet	Glossopsitta pusilla	☐	V,P		2
	Swift Parrot	^^Lathamus discolor	☐	E1,P,3	CE	28
	Turquoise Parrot	^^Neophema pulchella	☐	V,P,3		1
Strigidae	Barking Owl	^^Ninox connivens	☐	V,P,3		2
	Powerful Owl	^^Ninox strenua	☐	V,P,3		4
Tytonidae	Masked Owl	^^Tyto novaehollandiae	☐	V,P,3		3
Meliphagidae	Regent Honeyeater	Anthochaera phrygia	☐	E4A,P	CE	13
Neosittidae	Varied Sittella	Daphoenositta chrysoptera	☐	V,P		6
Artamidae	Dusky Woodswallow	Artamus cyanopterus cyanopterus	☐	V,P		10
Petroicidae	Flame Robin	Petroica phoenicea	☐	V,P		1
Mammalia Dasyuridae	Spotted-tailed Quoll	Dasyurus maculatus	☐	V,P	E	7
Pteropodidae	Grey-headed Flying-fox	Pteropus poliocephalus	☐	V,P	V	318
Emballonuridae	Yellow-bellied Sheathtail-bat	Saccolaimus flaviventris	☐	V,P		1
Molossidae	Eastern Coastal Free-tailed Bat	Micronomus norfolkensis	☐	V,P		23
Vespertilionidae	Large-eared Pied Bat	Chalinolobus dwyeri	☐	V,P	V	1
	Eastern False Pipistrelle	Falsistrellus tasmaniensis	☐	V,P		9
	Southern Myotis	Myotis macropus	☐	V,P		10
	Greater Broad-nosed Bat	Scoteanax rueppellii	☐	V,P		11
Miniopteridae	Little Bent-winged Bat	Miniopterus australis	☐	V,P		4
	Large Bent-winged Bat	Miniopterus orianae oceanensis	☐	V,P		41
Gastropoda Camaenidae	Cumberland Plain Land Snail	Meridolum corneovirens	☐	E1		74

Table 3. Key fauna species for habitat reconstruction / restoration

Species	Common Name	Preferred Habitat (source: NSW OEH species profiles)	Proposed Habitat creation
Frogs			
Litoria aurea	Green and Golden Bell Frog	Wetlands and slow flowing streams with emergent vegetation in woodland and open forest, or urban areas.	At least 4 open water ponds: – two permanent (20x10m & 10x5m, depth 1.1-1.9m), and – two ephemeral (20x5m & 10x5m, depth 0.3-0.7m). Rock piles/logs for shelter.
Microbats			
Myotis macropus	Southern Myotis	Forages over streams and ponds. Roosts close to water in hollow-bearing trees or dense foliage, and artificial structures such as under bridges, storm water channels or buildings.	Wetlands proposed as for Green and Golden Bell Frog. Installation of microbat nest boxes mounted on wood pylons in the riparian zone. If possible, retrofit microbat roosts in culverts.
Micronomus norfolkensis	Eastern Coastal Free-tailed Bat	Dry sclerophyll forests and woodland, roosts in tree hollows but also under bark or artificial structures.	Planting and restoration of native woodland in conservation areas. Installation of microbat nest boxes. If possible, retrofit microbat roosts in culverts.
Scoteanax rueppellii	Greater Broad-nosed Bat	Woodland and moist or dry eucalypt forest. Roosts in tree hollows and buildings.	Planting and restoration of native woodland in conservation areas. Installation of microbat nest boxes.
Miniopterus australis	Little Bent-winged Bat	Moist eucalypt forest and wet/dry sclerophyll forests. Roosts in tree hollows, storm water drains, culverts, bridges and buildings.	Planting and restoration of native woodland in conservation areas. Installation of microbat nest boxes. If possible, retrofit microbat roosts in culverts.
Miniopterus orianae oceanensis	Large Bent-winged Bat	Roosts in caves or artificial structures such as storm water tunnels and buildings. Forages in forested areas.	Planting and restoration of native woodland in conservation areas. If possible, retrofit microbat roosts in culverts.
Falsistrellus tasmaniensis	Eastern False Pipistrelle	Moist habitats with trees taller than 20 m. Roosts in eucalypt hollows but also under loose bark or in buildings.	Riparian corridor plantings e.g. *Eucalyptus amplifolia, Angophora floribunda, Casuarina glauca*. Installation of microbat nest boxes.
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	Roosts in tree hollows, buildings or burrows. Occurs in most habitat types.	Planting and restoration of native woodland in conservation areas. Installation of microbat nest boxes.
Other Mammals			
Pteropus poliocephalus	Grey-headed Flying-fox	Forests and woodlands, including urban areas.	Planting *Eucalyptus tereticornis, E.*

Species	Common Name	Preferred Habitat (source: NSW OEH species profiles)	Proposed Habitat creation
		Favours *Eucalyptus spp* and *Melaleuca spp* for feeding.	*moluccana, E. crebra, Melaleuca styphelioides.*
Birds			
Lathamus discolor	Swift Parrot	Woodlands and forests, favours *Eucalyptus robusta, E. tereticornis, E. moluccana, E. sideroxylon* and *Corymbia maculata.*	Restore sections of native woodland, plant *Eucalyptus tereticornis, E. moluccana*.
Glossopsitta pusilla	Little Lorikeet	Open eucalypt forest/woodlands, nests in hollows often in riparian zones.	Restore sections of native woodland, plant eucalypts, install small nest boxes.
Acrocephalus australis	Australian Reed-Warbler	Riparian zones with dense emergent vegetation and reed beds.	Sequentially replace sections of *Juncus acutus* with native species e.g. *Typha domingensis*, *Bolboschoenus caldwellii, Carex appressa.*
Hieraaetus morphnoides	Little Eagle	Open eucalypt forest and woodland, nests in tall living trees.	Restore sections of native woodland; retain existing living native trees.
Anthochaera phrygia	Regent Honeyeater	Open forest and woodland, particularly box-ironbark woodlands, favours mistletoes.	Restore sections of native woodland, plant *Eucalyptus moluccana, E. crebra.*
Daphoenositta chrysoptera	Varied Sittella	Eucalypt forests and woodlands, favours trees with dead branches.	Restore sections of native woodland; retain /prune dead trees where practicable.
Artamus cyanopterus cyanopterus	Dusky Woodswallow	Dry, open eucalypt forests or woodlands with a sparse understory of shrubs, groundcovers and debris.	Restore sections of native woodland, ensuring natural vegetation structuring and features such as logs are present.
Invertebrates			
Meridolum corneovirens	Cumberland Plain Land Snail	Cumberland Plain Woodland, i.e. open woodland with grassy understory and areas of shrubs.	Restore native vegetation, ensuring natural vegetation structuring and features such as logs are present.

Table 4. Aquatic and fringing vegetation suitable for Green and Golden Bell Frogs that is recommended for planting within and around the proposed permanent and ephemeral ponds (Beranek et al 2020).

Species	
Bolboschoenus caldwellii	*Persicaria decipiens*
Bolboschoenus fluviatilis	*Persicaria praetermissa*
Carex appressa	*Ranunculus inundates*
Eleocharis acuta	*Schoenoplectus validus*
Eleocharis sphacelata	*Cycnogeton procerum*
Juncus usitatus	*Lomandra longifolia*

Appendix 8

Targeted survey for the Cumberland Plain Land Snail (Meridolum corneovirens (Pfeiffer, 1851)) at Augusta Street, Huntingwood.

INVERTEBRATE IDENTIFICATION AUSTRALASIA
• Identifications • Surveys • Environmental Interpretations

4 October 2022

Targeted survey for the Cumberland Plain Land Snail (*Meridolum corneovirens* (Pfeiffer, 1851)) at Augusta Street, Huntingwoood.

Introduction

The study area located off the eastern end of Augusta Street, Huntingwood is bounded by the Great Western Highway to the north and the M4 Motorway along the south and the Prospect Highway to the east (Figure 1).

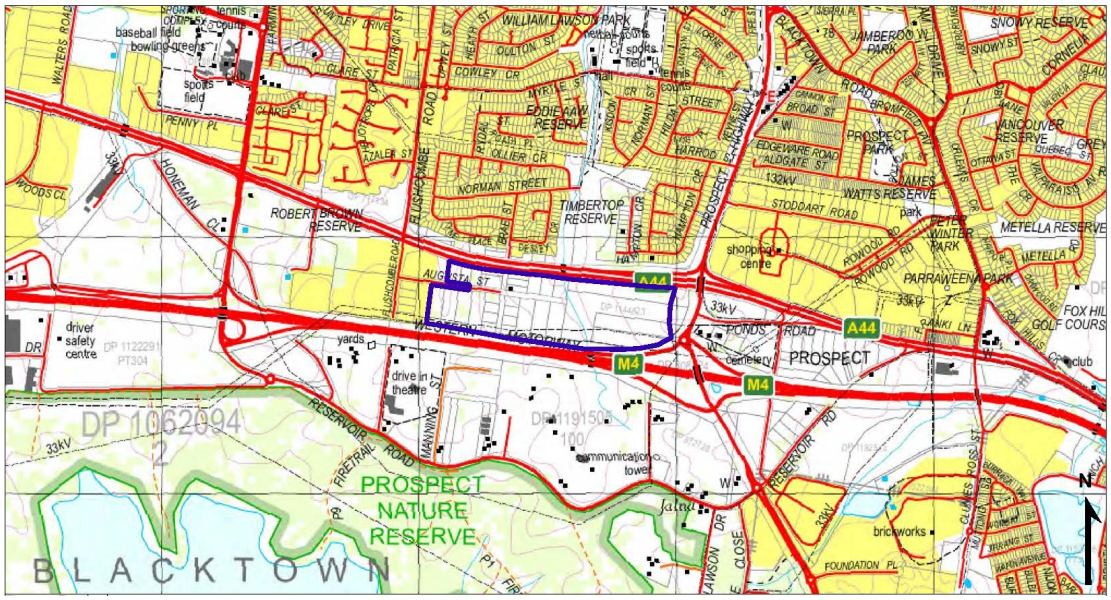


Figure 1. The purple line outlines the study area.

Methods

The study area was visited on 9th August, 2022. Search effort was concentrated where the major vegetation patches are located in the eastern and western sections of the study area and around the southern reach of Blacktown Creek near where it flows north of the M4 Motorway. Logs and non-natural debris such as old pieces of tin, bricks and other debris were turned where possible and leaf litter accumulations around the base of large eucalypts such as *Eucalyptus tereticornis* (Forest Red Gum) were searched. On the day it was cloudy, around 20 °C and light rain.

In addition, Blacktown Creek was sampled about 50m N. of the M4 Motorway. This sample was preserved in 95% ethanol and sorted under the microscope in the lab.

Results

No evidence of *Meridolum corneovirens* was found, what little potential suitable habitat present is heavily weed infested and no other species of snails or slugs were found.

However, four species of freshwater snails were found in Blacktown Creek about 25-50 N. of the M4 Motorway (Table 1). In addition, two species of small terrestrial snails, each represented by single old specimens were present in the sample which had been washed into the creek from nearby. The presence of the freshwater snail *Posticobia*, plus other aquatic insects such as caddis flies and diving beetles suggests the aquatic macroinvertebrate biodiversity is reasonable considering the streams location in western Sydney.

Family	Species	Habitat
Lymnaeidae	*Pseudosuccinea columella* (Say, 1817) **	Freshwater
Physidae	*Physella acuta* (Draparnaud, 1805) **	Freshwater
Tateidae	*Posticobia brazieri* (Smith, 1882)	Freshwater
Tateidae	*Potamopyrgus antipodarum* (Gray, 1843) **	Freshwater
Euconulidae	*Wilhelminaia mathildae* Preston, 1913	Terrestrial
Succineidae	*Austrosuccinea macgillivrayi* (Cox, 1864)	Terrestrial

Table 1. List of species of snail found in Blacktown Creek. ** - introduced species.

Yours sincerely



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Director

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http://www.invertebrateidentification.com/

Appendix 9

Comparison of the recorded data with the Final Determination and Conservation Advice.

Comparison of the recorded data with the Final Determination and Listing Advice

1.0 Introduction

The best fit Plant Community Type onsite, *PCT 3319 Cumberland Shale Hills Woodland*, has the following associated Threatened Ecological Communities (TECs) (from the online PCT profile, Vegetation Classification public application):

PCT	Associated TEC
PCT 3319 Cumberland Shale Hills Woodland	*• Listed BC Act: Critically Endangered Ecological Community: Cumberland Plain Woodland in the Sydney Basin Bioregion (Part);* *• Listed EPBC Act: Critically Endangered: Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest (Part).*

Listed TECs under the BC Act are legally defined by the Final Determinations. The listed TECs under the EPBC Act are defined in the Listing Advice.

Of the nine surveyed BAM plots, there were:

- Two plots (Plots 1, 6) with no native canopy trees recorded. These plots had Vegetation Integrity Scores (VIS) of <5;
- Seven plots (Plots 2, 3, 4, 5, 7, 8, 9) had local native canopy trees recorded. These plots had VIS's varying from <15 (Plots 3, 8) to >50 (Plots 2, 7), namely:

Sampled in	Vegetation mapped as	Composition condition score	Structure condition score	Function condition score	Current vegetation integrity score
Without native canopy trees					
Plot 1	exotic grassland	12.7	0	14.9	1.6
Plot 6	riparian corridor	1.5	42.1	0	4
With native canopy trees					
Plot 2*	less degraded	80.4	40.8	45	52.9
Plot 3	exotic grassland	2.3	15.4	24.3	9.5
Plot 4	degraded	38.8	40.4	49.1	42.5
Plot 5	degraded	6.5	3.3	59.7	10.8
Plot 7	less degraded	72	46.7	54.7	56.9
Plot 8	degraded	10.8	8	11	9.9
Plot 9	degraded	38.2	25.5	62	39.3

* Plot 2 was offsite to the east

For a VIS <15, section 9.2.1 of the BAM (DPIE 2020) states that:

> ***9.2.1 Impacts on native vegetation and TECs (ecosystem credits)***
> *1. The assessor must determine an offset for all impacts of proposals on PCTs that are associated with a vegetation zone that has a vegetation integrity score of:*
> *a. ≥15, where the PCT is representative of an EEC or a CEEC*
> *…*

Of the plots with a VIS <15:

- Plot 1 is on the formerly cleared farming land without canopy trees recorded with minor occurrences of native grasses and forbs;
- Plot 3 is on the formerly cleared farming land, with an entirely exotic understorey and two regenerating *Eucalyptus moluccana* trees up to 25 m recorded in one 10 m x 10 m subquadrat;
- Plot 6 is along the riparian corridor without canopy trees recorded;

In the western drainage swale

- Plot 5 had a low VIS attributed to low composition and structure score, but a high function score;
- Plot 8 is an area appearing as densely wooded on the aerial imagery with a canopy of *Eucalyptus moluccana* and *E. tereticornis* and a disturbed understorey, with ground-hollows and low mounds, some containing rubble that appeared to originate from demolition of a brick house.

The recorded data used in the comparisons with the Final Determination and Conservation Advice are from Plots 2, 4, 5, 7, 8, 9. [Note: Despite the low VIS for Plots 5, 8, these two plots are in the same drainage swale as Plots 4, 5, 9].

2.0 Comparison with the Final Determination for the critically endangered ecological community Cumberland Plain Woodland in the Sydney Basin Bioregion

The Scientific Committee has found that:

1. Cumberland Plain Woodland was listed as an Endangered Ecological Community under the *Threatened Species Conservation Act* 1995 in June 1997 (NSW Scientific Committee 1997). Since this listing, a large volume of new data and analyses have become available. In addition, a nomination to change the status of Cumberland Woodland to Critically Endangered status has been received. This Determination addresses additional information now available in accordance with current listing criteria under the *Threatened Species Conservation Regulation* 2002.

No additional comment.

2. Cumberland Plain Woodland is the name given to the ecological community in the Sydney Basin bioregion associated with clay soils derived from Wianamatta Group geology, or more rarely alluvial substrates, on the Cumberland Plain, a rainshadow area to the west of Sydney's Central Business District. The mean annual rainfall of this area is typically in the range of 700-900 mm, and is generally lower than that received on more elevated terrain that partially surrounds the Plain.

The site is on clay soil derived from Wianamatta Group geology (Figures 3a, 3b). Part of the vegetation in the western drainage swale is growing on dumped building material, especially in Plots 8, 9.

The site is located in the rainshadow area to the west of Sydney's Central Business District within 700 to 800 mm rainfall isohytes (Division of National Mapping 1986).

The community typically occurs on flat to undulating or hilly terrain up to about 350 m elevation but may also occur on locally steep sites and at slightly higher elevations. Cumberland Plain Woodland is characterised by the assemblage of species listed in paragraph 3 and typically comprises an open tree canopy, a near-continuous groundcover dominated by grasses and herbs, sometimes with layers of shrubs and/or small trees. Shrubs may sometimes occur in locally dense stands. Less disturbed

stands of the community may have a woodland or forest structure. Small trees or saplings may dominate the community in relatively high densities after partial or total clearing, and the groundcover may be relatively sparse, especially where densities of trees or shrubs are high. The community also includes 'derived' native grasslands which result from removal of the woody strata from the woodlands and forests.

The site is on gently undulating terrain with elevation of the site ranging from approximately 85 m AHD on the top of the hill west of Blacktown Creek and approximately 90 m AHD on the eastern boundary, to less than 70 m AHD along Blacktown Creek close to the northern boundary (Figure 1c-1).

The site is highly disturbed without a near-continuous groundcover dominated by native grasses and herbs.

3. Cumberland Plain Woodland is characterised by the following assemblage of species:
(listed species on https://www.environment.nsw.gov.au/topics/animals-and-plants/threatened-species/nsw-threatened-species-scientific-committee/determinations/final-determinations/2008-2010/cumberland-plain-woodland-critically-endangered-ecological-community-listing, accessed 20 June 2023)

Of the 114 characteristic species, the highest number was recorded offsite in Plot 2 (26 species) in the north-east adjoining Prospect Highway, followed by Plot 7 (19 species) and Plot 4 (15 species) and less than 10 species in Plots 5, 8, 9, namely:

	Plot 2	Plots 4	Plot 5	Plot 7	Plot 8	Plot 9
Number of characteristic species recorded	29	15	4	19	6	9

4. The total species list of the community is larger than that given above, with many species present in only one or two sites or in low abundance. The species composition of a site will be influenced by the size of the site, recent rainfall or drought conditions and by its disturbance (including grazing, land clearing and fire) history. The number and relative abundance of species will change with time since fire, and may also change in response to changes in fire frequency or grazing regime. At any one time, above-ground individuals of some species may be absent, but the species may be represented below-ground in soil seed banks or as dormant structures such as bulbs, corms, rhizomes, rootstocks or lignotubers. Benson and Howell (2002) and Benson & von Richter (2008) document the temporal variability in the species composition of the community. The list of species given above is mainly of vascular plant species, however the community also includes micro-organisms, fungi, cryptogamic plants and a diverse fauna, both vertebrate and invertebrate. The mammalian and avian components of the fauna have been described by Leary (in litt. August 2007) and Farrell (in litt. June 2007). Other components of the community are poorly documented (although see Benson & von Richter 2008).

No additional comments.

5. Cumberland Plain Woodland is characterised by an upper-storey that is usually dominated by *Eucalyptus moluccana* (Grey Box) and *E. tereticornis* (Forest Red Gum), often with *E. crebra* (Grey Ironbark), *E. eugenioides* (Narrow-leaved Stringybark), *Corymbia maculata* (Spotted Gum) or other less frequently occurring eucalypts, including *Angophora floribunda, A. subvelutina* (Broad-leaved Apple), *E. amplifolia* (Cabbage Gum) and *E. fibrosa* (Broad-leaved Ironbark).

Of the upper-storey species recorded, the cover varied from approximately 10% (Plots 5, 9) to 50% (Plot 7), namely:

Upper species recorded	Plot 2	Plots 4	Plot 5	Plot 7	Plot 8	Plot 9
Eucalyptus moluccana	1%	4%	10%	50%	10%	4%
Eucalyptus tereticornis	25%	25%	0.5%		5%	5%
Total	26%	29%	10.5%	50%	15%	9%

The community may have an open stratum of small trees that may include any of these eucalypts, as well as species such as *Acacia decurrens* (Black Wattle), *A. parramattensis* (Parramatta Wattle), *A.implexa* (Hickory Wattle) or *Exocarpos cupressiformis* (Native Cherry). Shrubs are typically scattered in the understorey but may be absent or locally dense as a result of clearing activity or changes in grazing or fire regimes. *Bursaria spinosa* (Blackthorn) is usually dominant, while other species include *Daviesia ulicifolia* (Gorse Bitter Pea), *Dillwynia sieberi, Dodonaea viscosa* subsp. *cuneata* and *Indigofera australis* (Native Indigo).

Of the listed native understorey trees and shrubs recorded, the total cover (and number of species) was highest in Plot 2 (offsite in the east) and the total cover in Plots 4, 5, 7, 8, 9 varied from 0 to 5%.

Understorey trees and shrubs recorded	Plot 2	Plot 4	Plot 5	Plot 7	Plot 8	Plot 9
Acacia falcata	0.1					
Acacia fimbriata	10					
Acacia implexa	0.3					
Bursaria spinosa subsp. spinosa	3	5	0.1	1		4
Dillwynia sieberi	0.5			0.3		
Eremophila debilis				0.7		
Pittosporum undulatum						0.8
Total	**13.9**	**5**	**0.1**	**2**	**0**	**4.8**

The ground cover is dominated by a diverse range of grasses including *Aristida ramosa* (Purple Wiregrass), *A. vagans* (Threeawn Speargrass), *Cymbopogon refractus* (Barbed Wire Grass), *Dichelachne micrantha* (Plumegrass), *Echinopogon caespitosus* (Forest Hedgehog Grass), *Eragrostis leptostachya* (Paddock Lovegrass), *Microlaena stipoides* (Weeping Grass), *Paspalidium distans* and *Themeda australis* (Kangaroo Grass), and with graminoids *Carex inversa* (Knob Sedge), *Cyperus gracilis, Lomandra filiformis* subsp. *filiformis* (Wattle Mat-rush) and *L. multiflorus* subsp. *multiflorus* (Many-flowered Mat-rush). The ground cover also includes a diversity of forbs such as *Asperula conferta* (Common Woodruff), *Brunoniella australis* (Blue Trumpet), *Desmodium varians* (Slender Tick Trefoil), *Dianella longifolia* (Blue Flax Lily), *Dichondra repens* (Kidney Weed), *Opercularia diphylla*, *Oxalis perennans* and *Wahlenbergia gracilis* (Australian Bluebell), as well as scramblers, *Glycine* spp. and *Hardenbergia violacea* (Native Sarsaparilla) and the fern *Cheilanthes sieberi* (Poison Rock Fern).

The native groundcover recorded on the site:

- was not diverse, except in Plots 2, 7; and
- had low recorded cover, except Plot 2 (17%) and Plot 7 (16.1%). The higher cover recorded in Plot 9 (27.5%) was attributed to 25% cover by the cosmoplitian grass *Cynodon dactylon.* Similarly, Plot 4 (22.1%) had 15% cover by the native grass *Microlaena stipoides.*

Native groundcover (%)	Plot 2	Plot 4	Plot 5	Plot 7	Plot 8	Plot 9
Native grasses						
Aristida ramosa	1	1				
Aristida vagans	0.1					
Bothriochloa macra		0.1		0.5		
Carex inversa		0.1				0.1
Chloris ventricosa				0.1		
Cynodon dactylon		0.1		0.1		25
Cyperus gracilis	0.2	0.2		0.3		
Dichelachne micrantha	0.1					
Digitaria diffusa	0.1					
Digitaria parviflora	0.1					
Entolasia marginata				0.5		
Fimbristylis dichotoma	0.5					
Juncus usitatus						0.1
Lomandra filiformis subsp. filiformis	2	0.1				0.1
Microlaena stipoides	5	15	0.5	4		0.3
Oplismenus aemulus					2	
Paspalidium distans				0.3		
Paspalum orbiculare				0.1		
Rytidosperma racemosum	0.1			0.1		0.3
Sporobolus creber		0.1		0.3		
Themeda triandra	0.1					
Native forbs						
Arthropodium milleflorum	0.1					
Asperula conferta		0.1				
Brunoniella australis	4			0.3		
Caesia parviflora	0.1					
Calotis lappulacea				0.1		
Commelina cyanea					0.1	
Dianella longifolia	0.1					
Dichondra repens	2	2		5	1	0.2
Einadia hastata	0.1			0.1		
Einadia nutans					0.3	
Einadia nutans subsp. linifolia				0.1		0.1
Einadia polygonoides				0.3		
Einadia trigonos					0.1	
Einadia trigonos subsp. trigonos				0.1		
Epilobium hirtigerum						
Euchiton sphaericus						0.1
Euphorbia drummondii				0.1		
Geranium solanderi		0.1				0.1
Grona varians	0.1					
Oxalis perennans	0.1			0.1		
Phyllanthus virgatus	0.1			0.1		

Native groundcover (%)	Plot 2	Plot 4	Plot 5	Plot 7	Plot 8	Plot 9
Plectranthus parviflorus						0.1
Portulaca oleracea				0.1		
Senecio hispidulus	0.1					
Tricoryne elatior	0.1					
Vittadinia cuneata var. cuneata				0.1		
Wahlenbergia gracilis	0.1	0.1				
Others						
Amyema miquelii				2		
Glycine clandestina	0.1	0.1				
Glycine tabacina	0.6	3		0.3		1
Hardenbergia violacea				1		
Total	**17**	**22.1**	**0.5**	**16.1**	**3.5**	**27.5**

6. The structure of the community varies depending on past and current disturbances, particularly clearing, fire and grazing. Contemporary tree-dominated stands of the community are largely relics or regrowth of originally taller forests and woodlands, which are likely to have had scattered shrubs and a largely continuous grassy groundcover. At some sites, mature trees may exceed 30m tall, although regrowth stands may be shorter than 10 m tall. After total or partial clearing, the tree canopy may remain sparse or may regrow to form dense stands of saplings and small trees, which are typically associated with a ground layer of reduced cover and diversity. Either or both of the upper-storey and mid-storey may be absent from the community. Native grasslands derived from clearing of the woodland and forest are also part of this community if they contain characteristic non-woody species listed in paragraph 3.

On this former cleared farming land, native canopy trees are restricted to regrowth trees (see Figure 6d-2), located:

- along the drainage swale in the west;
- in the road reserve of the road frontage to Flushcombe Road in the northwest;
- in the extreme north-east corner (extending offsite); and
- close to the M4 Motorway.

7. Cumberland Plain Woodland includes: ‘Shale Hills Woodland’ (map unit 9) and ‘Shale Plains Woodland’ (map unit 10) of Tozer (2003); ‘Spotted Gum Forest’ (map unit 9b), ‘Grey Box Woodland’ (map unit 10c) and ‘Grey Box – Ironbark Woodland’ (map unit 10d) of Benson (1992); and ‘Cumberland Plain Woodlands’ of Benson & Howell (1990a; b). Tindall *et al*. (2004) and Tozer *et al*. (2006) subsequently reproduced Tozer’s (2003) classification and mapping, re-labelling map units 9 and 10 as ‘Cumberland Shale Hills Woodland’ (map unit GW p28) and ‘Cumberland Shale Plains Woodland’ (map unit GW p29), respectively. Cumberland Plain Woodland belongs to the Coastal Valley Grassy Woodlands vegetation class (Keith 2004).

No additional comments.

8. Several other ecological communities listed under the *Threatened Species Conservation Act* 1995 may intergrade with Cumberland Plain Woodland. These include Cooks River/ Castlereagh Ironbark Forest in the Sydney Basin Bioregion; Moist Shale Woodland in the Sydney Basin Bioregion; Shale / Sandstone Transition Forest; Shale Gravel Transition Forest in the Sydney Basin Bioregion; and Sydney Turpentine-Ironbark Forest. While Tozer (2003) provides information on the features that distinguish these communities, some transitional stands will be difficult to assign to a single community with a high level of confidence (Keith 2009). Transitional stands between Cumberland

Plain Woodland and other communities listed under the *Threatened Species Conservation Act* 1995 are considered part of a listed community, and should be assigned to the community with which they share greatest resemblance in species composition and other properties.

No additional comments.

9. Cumberland Plain Woodland in the Sydney Basin Bioregion is included within the critically endangered ecological community listed under the *Environment Protection and Biodiversity Conservation Act* as "Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest". However the Commonwealth listing advice excludes some patches, here regarded as Cumberland Plain Woodland, on the basis of condition or structure thresholds.

The threshold criteria for the ecological community listed under the Environment Protection and Biodiversity Conservation Act (EPBC Act) were applied in section 3 of this Appendix. It was found that none of the vegetation sampled onsite met the thresholds. The vegetation offsite to the NE adjoining Prospect Highway (sampled in Plot 2) appears to meet the thresholds.

10. The following threatened species have been recorded from Cumberland Plain Woodland: (listed species on https://www.environment.nsw.gov.au/topics/animals-and-plants/threatened-species/nsw-threatened-species-scientific-committee/determinations/final-determinations/2008-2010/cumberland-plain-woodland-critically-endangered-ecological-community-listing, accessed 20 June 2023).

A search for Cumberland Land Snail was undertaken onsite by Dr Stephanie Clark with:

> *No evidence of* Meridolum corneovirens *was found, what little potential suitable habitat present is heavily weed infested and no other species of snails or slugs were found.*

The potential habitats for threatened avifauna were assessed. There is some potential foraging habitat, with important habitat for Swift Parrot (*Lathamus discolor*) mapped nearby to the north in Timbertop Reserve.

11. Cumberland Plain Woodland is restricted to the Sydney Basin Bioregion (*sensu* Thackway and Cresswell) and is currently known to occur within the local government areas of Auburn, Bankstown, Baulkham Hills, Blacktown, Camden, Campbelltown, Fairfield, Hawkesbury, Holroyd, Liverpool, Parramatta, Penrith and Wollondilly, but may occur elsewhere within the bioregion. Using map data from Tozer (2003), Cumberland Plain Woodland was estimated to occur within an extent of occurrence of 2810 km^2, and an area of occupancy of just under 2 100 km^2 based on 2 x 2 km grid cells, the spatial scale recommended by IUCN (2008) for assessing areas of occupancy for species.

The site is in Blacktown LGA.

12. Small areas of Cumberland Plain Woodland have been recorded from Kemps Creek, Mulgoa and Windsor Downs Nature Reserves, Scheyville National Park, and Leacock, Rouse Hill and Western Sydney Regional Parks.

No additional comments.

13. Based on aerial photography flown in November 1998, Tozer (2003) estimated the total extent of woody vegetation referred to as Cumberland Plain Woodland was 11 054 (±1 564) ha (upper and lower plausible bounds, *sensu* Keith et al. 2009), representing 8.8 (±1.2)% of the pre-European

distribution of the community. Patches of the community lacking woody vegetation are very small in extent and can be considered to be included within the plausible bounds. For that part of the community's distribution to the east of the Hawkesbury-Nepean River, earlier mapping at coarser resolution by Benson & Howell (1990b) suggests a similar level of depletion, with an estimated 6 420 ha of 'Cumberland Plain Woodlands', representing 6% of the pre-European distribution east of the Hawkesbury-Nepean River. An update of Tozer's (2003) map, based on interpretation of imagery flown in January-March 2007 shows that the extent of Cumberland Plain Woodland east of the Hawkesbury – Nepean River had declined by 442±46 ha, a reduction of 5.2±0.6% in 9 years (NSW Scientific Committee & Simpson 2008). These estimates indicate that the geographic distribution of the community has undergone a very large reduction over a time frame appropriate to the life cycle and habitat characteristics of its component species.

No additional comments.

14. Some areas of Cumberland Plain Woodland subjected to a history of partial clearing and grazing have recently undergone a change in management to conserve the community. Examples include Mt Annan Botanic Garden, Scheyville National Park, Western Sydney Regional Park, Elizabeth Macarthur Agricultural Institute, Orchard Hills Defence Site and the former Australian Defence Industries site at St Marys. Experience from these areas suggests that the community is capable of some recovery, provided the soil has not been disturbed by earthworks, cultivation, fertiliser application or other means of nutrient or moisture enrichment (Benson & Howell 2002; Pellow 2003; Keith *et al*. 2005; J. Howell *in litt*. August 2007; J. Sanders *in litt*. January 2008). In contrast, restoration of Cumberland Plain Woodland has proved to be problematic on sites that have been exposed to such soil disturbance. At Western Sydney Regional Park, for example, Wilkins *et al*. (2003), Nichols (2005) and Nichols *et al.* (2005) studied the recovery of abandoned pastures that had been planted with more than 20 native tree and shrub species of Cumberland Plain Woodland. Over 10 years they found no evidence of convergence in species composition with nearby remnant stands of the community and the species composition of restored areas remained indistinguishable from untreated pastures. There was some evidence that restored vegetation had begun to develop more species-rich assemblages of moths and butterflies compared to untreated pastures, although after 10 years, it lacked a number of species characteristic of remnant woodland (Lomov *et al.* 2006). Ant communities also showed marked differences between restored and remnant vegetation although some ecological processes, such as pollination and seed dispersal, showed some evidence of development at restored sites (Lomov 2005). These results suggest that sites with a history of soil disturbance will be extremely slow to recover characteristics of Cumberland Plain Woodland, if at all, and that experimentation with alternative restoration technologies is required. As a large proportion of the former distribution of the community has either undergone similar histories of soil disturbance or are now occupied by urban development, opportunities for restoration of the community across significant areas appear limited.

No additional comments.

15. The reduction in the geographic distribution of Cumberland Plain Woodland was initially due to tree-felling for timber and clearing for crops and pastures (Benson & Howell 1990a). Benson & Howell (1990b) estimated that the community had been reduced to approximately half of its pre-European extent by 1850. Following World War II, there was a marked acceleration in urban and industrial development, which continues to deplete the distribution of the community to the present day. These trends appear likely to continue into the future as the urban area continues to expand to accommodate Sydney's increasing population, which is projected to grow by 1.0-1.1 million people during the 20 years 2007-2026 and 2.2-3.3 million during the 50 years 2007-2056 (Australian Bureau of Statistics 2008). Recent draft plans to develop growth centres in north-west and south-west Sydney, for example, identify staged release of land for residential and employment development over the next 25 years. These areas contain approximately 2000 ha (one-fifth) of the estimated remaining Cumberland Plain Woodland based on Tozer (2003), of which about two-thirds will be available for development, the loss of which is planned for offsetting through voluntary land

acquisition and/or the establishment of conservation agreements on lands outside the Growth Centres (Growth Centres Commission 2007) for the primary purpose of biodiversity conservation. While important examples of Cumberland Plain Woodland are represented within conservation reserves, much of the remaining area of the community occurs on private land or on public easements, where it is at risk from small-scale clearing associated with housing, industrial development and transport infrastructure. There are significant logistic and technological constraints and time lags associated with efforts to restore the community (Wilkins *et al*. 2003; Nichols 2005; Nichols *et al*. 2005). 'Clearing of native vegetation' is listed as a Key Threatening Process under the *Threatened Species Conservation Act* 1995.

No additional comments.

16. Fragmentation of habitat associated with clearing has resulted in a very large reduction in the ecological function of Cumberland Plain Woodland. The remaining area of the community is severely fragmented, with more than half of the remaining tree cover mapped by Tozer (2003) occurring in patches of less than 80 ha and half of all mapped patches being smaller than 3 ha (Tozer *in litt*. October 2007). The integrity and survival of small, isolated stands is impaired by the small population size of many species, enhanced risks from environmental stochasticity, disruption to pollination and dispersal of fruits or seeds, and likely reductions in the genetic diversity of isolated populations (Young *et al*. 1996; Young & Clarke 2000). The impacts of fragmentation and associated processes are most evident in the loss of vertebrate fauna from the community (Farrell 2005; Farrell *in litt*. June 2007; Leary 2005; *in litt*, August 2007). As well, some invertebrate species, such as the Endangered Cumberland Land Snail, appear to be in decline, at least in the smaller fragments (M. Shea *in litt*. June 2007). The dieback of eucalypt canopies observed in stands of Cumberland Plain Woodland at Scheyville (D. Keith pers. comm. October 2008) may be a result of complex interactions involving insect attack, weed invasion, nutrient enrichment and drought, in which fragmentation also plays a role (Reid & Landsberg 2000; Wardell-Johnson *et al*. 2006). Despite their history of fragmentation, some very small and apparently degraded remnants may contain a surprisingly high diversity of species and important examples of rare species, particularly plants (James *et al*. 1999; Benson & Keith 1984; McBarron *et al*. 1988; Benson & Howell 1990a; Kirkpatrick & Gilfedder 1995). However, clearing and continuing degradation of these patches reduces the likelihood that all of these species will persist, particularly because a large proportion of species are known from very few locations which are not clustered in predictable ways (Benson & Howell 2002; Tozer 2003). Fragmentation also results in reduced fire frequencies within some patches, which may reduce the viability of some native plant populations, and hence the diversity of species within the patches (Clarke 2000; Watson 2005).

No additional comments.

17. Changes in structure contribute to a very large reduction in the ecological function of Cumberland Plain Woodland. Almost all of the remaining area of the community is regrowth forest and woodland from past clearing activities (Benson & Howell 1990a). Mean tree densities in contemporary stands of the community were found to be substantially higher than historical estimates and tree sizes were thought to be smaller (Benson 1992). Large trees approximating the stature of the community prior to European settlement occur very sparsely within remnant patches of vegetation or remain as isolated individuals within paddocks or urban areas. Scheyville National Park, for example, which contains a large remnant of Cumberland Plain Woodland, was extensively logged and partially cleared over many decades prior to its reservation and is thought to contain as few as five large old trees likely to date from pre-European times (J. Sanders, *in litt*. January 2008). Loss of these large trees, which provide habitat resources for a range of fauna, is associated with declines and local extinctions of numerous birds and mammals that were once more common on the Cumberland Plain (Farrell 2005; T. Leary *in litt*. August 2007). Changes in understorey are difficult to assess, as responses to anthropogenic disturbances are confounded with responses to climatic variability (Benson & Howell 2002). Nevertheless, other structural changes to the community include the removal of fallen woody debris and standing dead trees, the removal of woody understorey plants, or conversely the

development of regrowth stands with very high densities of eucalypt saplings or shrubs, notably *Bursaria spinosa*, which may suppress the ground flora. Botanist Allan Cunningham noted high densities of *B. spinosa* in farmland near Liverpool as early as 1817 (Lee 1927; Benson 1992), while similar phases of high shrub abundance have been observed recently at Mt Annan and Scheyville in response to abandonment of farming practices (Benson & Howell 2002; J. Sanders, *in litt.* January 2008). Some areas of the community now devoid of woody plant species may retain a substantial suite of native grasses and herbs in the ground layer. The Orchard Hills Defence Site includes outstanding examples of this phenomenon (Pellow 2003; Keith *et al*. 2005). 'Loss of hollow-bearing trees' and 'Removal of dead wood and dead trees' are listed as Key Threatening Processes under the *Threatened Species Conservation Act* 1995.

No additional comments.

18. While a sample of the original fauna of Cumberland Plain Woodland persists, some components have already been lost and others continue to decline (Leary 2005; *in litt*. Aug. 2008). The original mammal fauna of the Cumberland Plain was estimated to include approximately 60 species (NPWS 1997), of which less than 40 were detected in recent intensive surveys and only 14 species are now considered to be relatively common and widespread (Leary 2005; *in litt*. August 2008). The majority of these latter species are micro-bats, while small ground-dwelling mammals are unexpectedly scarce. A systematic survey involving 22 000 trap nights and 14 000 hair tube nights across conservation reserves containing Cumberland Plain Woodland failed to detect any native rodents or dasyurids, except at sites on the periphery of the plain, close to larger vegetated areas on sandstone (Leary 2005; *in litt*. August 2008). Long-nosed Bandicoots have recently been recorded in inner western Sydney (NSW Scientific Committee 2008), but remain scarce and have not been recorded during the systematic fauna surveys of Cumberland Plain Woodland. A number of bird species have also disappeared from or markedly declined on the Cumberland Plain (Keast 1995; Farrell 2005; Leary 2005; *in litt*. August 2008). A sequence of repeated surveys in Scheyville National Park, the largest remnant of Cumberland Plain Woodland, have documented disappearance of the Black-chinned Honeyeater, Brown Treecreeper, Diamond Firetail, Zebra Finch, Hooded Robin, Red-capped Robin, Scarlet Robin, Flame Robin and Black-eared Cuckoo, while declines have been observed in populations of the Speckled Warbler, Fuscous Honeyeater, Jacky Winter, Weebill and Buff-rumped Thornbill (Farrell 2005; *in litt.* June 2008). Repeated surveys of Nurragingy Reserve near Blacktown indicate that all of these species have also been lost from the reserve, except for the Fuscous Honeyeater and Weebill (Farrell 2005; *in litt*. June 2008). Many of these species either feed or nest on or near the ground. Declines of reptiles and amphibians on the Cumberland Plain have been less well documented, but include at least three species of frog, one species of turtle, one skink, possibly two species of goanna and one species of snake (Leary 2005; *in litt*. August 2008). Two species of plants, *Swainsona monticola* and *Thesium australe*, are presumed to have gone extinct in Cumberland Plain Woodland (Benson & Howell 2002), while James *et al*. (1999) list many other species that have undergone substantial declines, including threatened species such as *Acacia pubescens, Pimelea spicata* and *Pterostylis saxicola*. In addition to these losses and declines across a wide range of biota within the community, Benson & Howell (1990a; 2002) describe other changes in species composition that indicate a very large reduction in the ecological function of Cumberland Plain Woodland.

No additional comments.

19. Weed invasion also poses a major threat to Cumberland Plain Woodland. While very large numbers of weed species have invaded many different areas of the community, principal weed species include (Benson 1992; Tozer 2003; Benson & von Richter 2008): (listed species on https://www.environment.nsw.gov.au/topics/animals-and-plants/threatened-species/nsw-threatened-species-scientific-committee/determinations/final-determinations/2008-2010/cumberland-plain-woodland-critically-endangered-ecological-community-listing, accessed 20 June 2023)

Several of these species, particularly grasses, form a dense ground layer capable of smothering

indigenous plants, reducing both reproduction and survival, and inhibiting emergence and establishment of their seedlings. The propagules of weeds are spread into Cumberland Plain Woodland by stormwater, dumping of refuse, frugivorous birds and wind (Benson & Howell 1990b), making it difficult to abate the invasion process, especially for those species capable of establishing in sites that have been exposed to relatively little disturbance (J. Sanders, *in litt.* January 2008). Hill *et al*. (2005) found that high species richness and abundance of weeds was associated with remnants that either had a history of clearing and grazing, were in close proximity to creeks or downslope from sealed roads. They also found some relationship between weeds and elevated total soil phosphorus, conductivity and water retention capacity, but relationships with these soil properties were weak and varied between sites with different types of disturbance history. The dramatic recent expansion of African Olive poses the greatest invasive threat to Cumberland Plain Woodland. Initially introduced to south-western Sydney in the 1820s, it was generally confined to the Camden-Picton area until the 1970s and now occurs frequently throughout the distribution of the community (Tozer 2003; Cuneo & Leishman 2006). Roberts (1999) mapped approximately 1000 ha of Cumberland Plain Woodland (c. 10% of total remaining) which had a dense understorey of African Olive that was visible on aerial photographs flown in November 1997. Tozer (2003) recorded African Olive in 43% of 198 plots surveyed throughout the distribution of Cumberland Plain Woodland. Cuneo *et al*. (2009) found that 837 ha of Cumberland Plain Woodland in south-west Sydney was invaded by African Olive (8.5% of the area assessed). The species is highly fecund, with fleshy fruit spread widely by a range of frugivorous birds, and seedlings establish readily in relatively undisturbed bushland, as well as fragmented edges (Cuneo & Leishman 2006). As shrubs grow, their canopies cast deep shade and suppress and ultimately eliminate most native shrub and groundcover species. Cook *et al*. (2005) and Tozer (*in litt*. October 2007, based on data from Tozer 2003), both recorded strong inverse relationships between the cover abundance of African Olive and the diversity and cover of native ground layer species. Other weeds that pose future threats to the community include *Ailanthus altissima, Asparagus asparagoides, Acer negundo, Gleditsia triacanthos* and *Macfadyena unguis-cati* (Benson & Howell 2002; J. Howell *in litt*. August 2007; J. Sanders *in litt*. January 2008; L. Harrold pers comm. 2009). The invasion and establishment of exotic weeds is resulting in a very large reduction in the ecological function of Cumberland Plain Woodland. 'Invasion of exotic perennial grasses' and 'Invasion and establishment of exotic vines and scramblers' are listed as Key Threatening Processes under the *Threatened Species Conservation Act* 1995.

There was a dense occurrence of weeds in the western drainage swale (Plots 4, 5, 8, 9), including:

- the woody weeds *Erythrina crista-galli, Lantana camara, Ligustrum lucidium, Ligustrum sinense,* and *Olea europaea* subsp. *cuspidata* recorded in Plots 4, 5, 9; and
- the High Threat Weed, *Eragrostis curvula*, which was abundant.

Percent cover of listed exotic species from paragraph 19	**Plot 2**	**Plot 4**	**Plot 5**	**Plot 7**	**Plot 8**	**Plot 9**
Weedy grasses						
Ehrharta erecta	0.1	0.1	5		4	5
Eragrostis curvula	10				35	
Woody weeds						
Erythrina crista-galli			30			
Lantana camara	3		20		2	5
Ligustrum lucidium		10	15		3	3
Ligustrum sinense		10	3		0.8	10
Olea europaea subsp. *cuspidata*	0.8	15	4			5
Total cover of woody weeds (%)	**3.8**	**35**	**72**	**0**	**5.8**	**23**

20. Moderate to heavy grazing of Cumberland Plain Woodland by livestock and rabbits results in the decline and disappearance of palatable plant species, including shrubs and herbs, and compaction and erosion of topsoil, making re-establishment of a diverse native understorey problematic. The effects of such overgrazing may be exacerbated under drought conditions. Habitat degradation associated with overgrazing and erosion contributes to a large reduction in ecological function of the community.

No additional comments.

21. The soils of Cumberland Plain Woodland have undergone chemical and structural modification associated with agricultural land uses. Trampling by livestock has resulted in localised areas of soil compaction, primarily around watering points. Research carried out at the University of Western Sydney found that mean soil inorganic nitrogen levels were two to three times higher in areas of former agricultural land use than in remnant woodland, but was unable to detect differences in other soil properties (E. C. Morris *in litt*. June 2007). Addition of carbon and burning reduced soil inorganic nitrogen and reduced growth of exotic ground layer species relative to native species, suggesting that elevated soil inorganic nitrogen could favour exotics to the detriment of natives in Cumberland Plain Woodland (E. C. Morris *in litt*. June 2007). Hill *et al*. (2005) found elevated levels of phosphorus and conductivity in former agricultural areas compared to remnant woodland, but did not examine soil nitrogen. The sources of nutrient addition to soils of Cumberland Plain Woodland include addition of fertilisers during previous agricultural land use, deposition of livestock dung, rubbish dumping and stormwater runoff from urban areas. Expansion of urban land uses across the Cumberland Plain is likely to increase urban runoff from sealed surfaces into remaining bushland fragments, resulting in further nutrient enrichment of soils and associated replacement of native flora by exotic species. Disruption of ecological processes and degradation of habitat associated with nutrient enrichment contributes to a very large reduction in ecological function of the community.

The site has been historically cleared and farmed.

22. Fire regimes influence the plant species composition and vegetation structure of Cumberland Plain Woodland (Benson & Howell 2002; Watson 2005) and are also likely to influence other components of the biota. Based on a study of Cumberland Plain Woodland remnants with varying fire histories, Watson (2005) found that variable intervals of 4 - 12 years between successive fires are likely to maintain populations of most understorey species in the community, including resprouting and obligate-seeding shrubs, grasses and herbs. Fragmentation of Cumberland Plain Woodland may exclude fire from some patches for extended periods by reducing fire spread. The consequent reduction in fire frequency sometimes leads to increased dominance of shrubs and associated declines in diversity of grasses and herbs (Watson 2005), as well as increased abundance of woody exotic species, such as African Olive (Benson & Howell 2002; Watson 2005; von Richter *et al*. 2005), which is likely to further reduce the flammability of the community. Conversely, high frequencies of fires may result where fragmentation increases the interface between urban areas and bushland, as this results in increased arson, car dumping, planned fuel-reduction fires and accidental ignitions. High fire frequencies are associated with reduced diversity of native plant species in Cumberland Plain Woodland (Watson 2005). 'High frequency fire resulting in disruption of life cycle processes in plants and animals and loss of vegetation structure and composition' is listed as a Key Threatening Process under the *Threatened Species Conservation Act* 1995. The season of fire, which may be altered as a consequence of hazard reduction fires, may also influence the species composition of the grassy woodland understorey (Knox & Clarke 2006; Benson & von Richter 2008). Disruption of ecological processes associated with alteration of fire regimes contributes to a very large reduction in ecological function of the community.

No additional comments.

23. Cumberland Plain Woodland in the Sydney Basin Bioregion is eligible to be listed as a Critically

Endangered Ecological Community as, in the opinion of the Scientific Committee, it is facing an extremely high risk of extinction in New South Wales in the immediate future, as determined in accordance with the following criteria as prescribed by the *Threatened Species Conservation Regulation* 2002:

Clause 25
The ecological community has undergone, is observed, estimated, inferred or reasonably suspected to have undergone or is likely to undergo within a time span appropriate to the life cycle and habitat characteristics of its component species:
(a) a very large reduction in geographic distribution.

Clause 27
The ecological community has undergone, is observed, estimated, inferred or reasonably suspected to have undergone or is likely to undergo within a time span appropriate to the life cycle and habitat characteristics of its component species:
(a) a very large reduction in ecological function, as indicated by any of the following:
(d) a change in community structure
(e) a change in species composition
(f) disruption of ecological processes
(g) invasion and establishment of exotic species
(h) degradation of habitat
(i) fragmentation of habitat.

No additional comments.

In conclusion:

- there were limited areas of semi-intact vegetation adjoining the site meeting the criteria for C*umberland Plain Woodland in the Sydney Basin Bioregion,* being mainly offsite to the north-east adjoining Prospect Highway (sampled in Plot 2) and on the road verge of Flushcombe Road to the north-west (sampled in Plot 7).
- at least part of the approximately 2 ha of vegetation with regrowth native canopy trees in the western drainage swale meets the criteria for highly degraded *Cumberland Plain Woodland* (sampled in Plots 4, 5, 8, 9);
- part of the vegetation in the western drainage swale is growing on dumped building material, especially in Plots 8, 9;
- dense woody weed occurrence was widespread in the western drainage swale; and
- following more than 150 years of intensive agriculture, none of the paddock meets the criteria for *Cumberland Plain Woodland*.

3.0 Comparison with the Listing Advice for Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)

Table 1 of the Commonwealth Listing Advice outlines the condition thresholds for *Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest.*

On page 8 it states:

> ***Condition Thresholds***
> *The condition thresholds only apply to patches of native vegetation that meet the description of the national ecological community, including the key diagnostic characteristics, as outlined above. Derived grasslands and shrublands are not included in the EPBC-listed ecological community, but if they are contiguous with the ecological community they may be considered under Condition category C in Table 1.*

Note: The threshold requirements for Categories A to D relate to:

- patch sizes (≥ 0.5 ha, ≥5 ha);
- contiguous patches;
- percentage of the perennial understorey vegetation cover that is made up of native species (≥ 50%, ≥30%); and
- presence of large mature trees or trees with hollows (habitat).

From the data recorded onsite, no patches were ≥5 ha in size. There were patches ≥ 0.5 ha, namely:

- the patch along the drainage swale >0.5 ha (sampled in Plots 4, 5, 8, 9);
- the patch extending offsite in the NE >0.5 ha (sampled in Plot 2);
- the patch adjoining the M4 Motorway >0.5 ha (Spot K).

Percentage of perennial understorey vegetation cover made up of native species varied across the site from 1% to 59% (data in Table 1 of the BDAR), namely:

Percent perennial understorey cover being native species:

Percent understorey cover by	Plot 2	Plot 4	Plot 5	Plot 7	Plot 8	Plot 9
Native species	30.9	27.1	0.9	18.2	3.5	32.3
Exotic species	21.5	62.5	78.9	46.9	29.7	33.3
% cover by native of total cover	**59%**	**30%**	**1%**	**28%**	**11%**	**49%**

There was one hollow bearing tree recorded onsite and several larger dbh trees.

Table 1. Condition Thresholds for Patches[3] that meet the Description for the Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest ecological community.

Category and rationale	Thresholds	Met by native vegetation onsite
A. Core thresholds that apply under most circumstances: patches with an understorey dominated by natives and a minimum size that is functional	Minimum patch[3] size is ≥0.5ha; **AND** ≥50% of the perennial	Yes. No,

Category and rationale	Thresholds	Met by native vegetation onsite
and consistent with the minimum mapping unit size applied in NSW.	understorey vegetation cover[4] is made up of native species.	though met in the patch which is mainly offsite in the NE (sampled in Plot 2). **Conclusion:** **No for vegetation onsite, but Yes to patch offsite to the NE adjoining Prospect Highway.**
OR		
B. Larger patches which are inherently valuable due to their rarity.	The patch size is ≥5ha; **AND** ≥30% of the perennial understorey vegetation cover is made up of native species.	No. **Conclusion:** **No, patches are not ≥5 ha**
OR		
C. Patches with connectivity to other large native vegetation remnants in the landscape.	The patch size is ≥0.5 ha; **AND** ≥30% of the perennial understorey vegetation cover is made up of native species; **AND** The patch is contiguous[5] with a native vegetation remnant (any native vegetation where cover in each layer present is dominated by native species) that is ≥5ha in area.	Yes. Yes. Sampled in Plots 2 (mainly offsite), 4, 9. No. **Conclusion:** **No for vegetation onsite.**
OR		
D. Patches that have large mature trees or trees with hollows (habitat) that are very scarce on the Cumberland Plain.	The patch size is ≥0.5 ha in size; **AND** ≥30% of the perennial understorey vegetation cover is made up of native species; **AND** The patch has at least one tree with hollows per hectare or at least one large tree (≥80 cm dbh) per hectare from the upper tree layer species outlined in the Description and Appendix A.	Yes. Yes. Hollow bearing trees recorded - one in Plot 3. Trees > 80 cm recorded in Plots 3, 4, 5, 7. However, density of at least one large tree (≥80 cm dbh) per hectare not met. **Conclusion:** **No. Large mature trees sparse and only one hollow bearing tree recorded.**

[3] A *patch* is defined as a discrete and continuous area that comprises the ecological community, outlined in the Description. Patches should be assessed at a scale of 0.04 ha or equivalent (e.g. 20m x 20m plot). The number of plots (or quadrats or survey transects) per patch must take into consideration the size, shape and condition across the site. Permanent man-made structures, such as roads and buildings, are typically excluded from a patch but a patch may include small-scale disturbances, such as tracks or breaks or other small-scale variations in native vegetation that do not significantly alter the overall functionality of the ecological community, for instance the easy movement of wildlife or dispersal of spores, seeds and other plant propagules.

[4] *Perennial understorey vegetation cover* includes vascular plant species of the ground and shrub layers (as outlined in the Description and Appendix A) with a life-cycle of more than two growing seasons (Australian Biological Resources Study, 2007). Measurements of perennial understorey vegetation cover exclude annuals, cryptogams, leaf litter or exposed soil (although these are included in a patch of the ecological community when they do no alter functionality as per footnote 3 and the Description and Condition Thresholds are met).

[5] *Contiguous* means the woodland patch is continuous with, or in close proximity (within 100 m), of another patch of vegetation that is dominated by native species in each vegetation layer present.

In conclusion, from applying the threshold criteria in Table 1:

- the condition thresholds were <u>not</u> met for vegetation onsite, nor for the road reserve (sampled in Plot 7); and
- the patch sampled in Plot 2, mainly offsite to the northeast adjoining the Prospect Highway, appears to satisfy the thresholds.

Appendix 10

Applying the *Guidance to assist a decision-maker to determine a serious and irreversible impact* for the proposed Augusta Street warehouse and distribution centre in Huntingwood

Applying the *Guidance to assist a decision-maker to determine a serious and irreversible impact* for the proposed Augusta Street warehouse and distribution centre in Huntingwood

1.0 Reason for applying the Guidance

The vegetation onsite that is likely to be affected by the proposal has been assessed in the BDAR as best fit Plant Community Type *PCT 3319 Cumberland Shale Hills Woodland. PCT 3319* has the following associated Threatened Ecological Communities (TECs) (from the online PCT profile, Vegetation Classification public application):

PCT	Associated TEC
PCT 3319 *Cumberland Shale Hills Woodland*	• *Listed BC Act: Critically Endangered Ecological Community: Cumberland Plain Woodland in the Sydney Basin Bioregion (Part);* • *Listed EPBC Act: Critically Endangered: Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest (Part).*

Listed TECs under the BC Act are legally defined by the Final Determinations. The listed TECs under the EPBC Act are defined in the Listing Advice. From comparisons of the vegetation onsite with the criteria in the Final Determination the mapped PCT 3319 vegetation zones onsite meet the criteria for *Cumberland Plain Woodland in the Sydney Basin Bioregion* under the BC Act. None of the vegetation onsite met the condition thresholds for the Commonwealth listed TEC.

In the BAM Credit Summary Report, the clearing of *PCT 3319 Cumberland Shale Hills Woodland* is flagged as a potential Serious and Irreversible Impact (SAII).

2.0 Background to the *Guidance*

Under the *BC Act,* a determination of whether an impact is serious and irreversible must be made in accordance with the principles prescribed in section 6.7 of the *BC Regulation*.

In the explanatory information of *Guidance to assist a decision-maker to determine a serious and irreversible impact* (DPIE 2019, page 1), it states that:

> *The concept of serious and irreversible impacts (SAII) is a central component of the NSW biodiversity offsets scheme. It is fundamentally about protecting threatened species[1] and threatened ecological communities that are most at risk of extinction from potential development impacts or activities.*
>
> *([1]References to threatened species in this document include threatened populations listed in schedules under the BC Act).*

The purpose and scope of the guidance is clarified on page 2:

> *This guidance is intended to assist decision-makers[2] in determining whether a proposed impact on biodiversity values is likely to be serious and irreversible.*

([2] The term 'decision-maker' includes: consent authorities for development applications under Part 4 of the Environmental Planning and Assessment Act 1979 (EP&A Act); the Minister for Planning and Public Spaces for activities under Part 5.1 of the EP&A Act; determining authorities for activities under Part 5 of the EP&A Act; the Native Vegetation Panel for approvals for clearing native vegetation under s.60ZF of the LLS Act 2013 and clause 14 of the State Environmental Planning Policy (Vegetation in Non-Rural Areas) 2017; the Minister for Environment and Energy in relation to biodiversity certification under Part 8 of the BC Act).

Under the *Principles for determining serious and irreversible impacts* on page 3, it is stated that:

> *The principles have been designed to capture those impacts which are likely to contribute* ***significantly to the risk of extinction of a threatened species or ecological community in New South Wales.*** *These are impacts that:*
>
> - *will 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*
> - *will further reduce the population size of the species that is currently observed, estimated, inferred or reasonably suspected to have a very small population size, or will further degrade or disrupt an ecological community that is already observed, inferred or reasonably suspected to be severely degraded or disturbed*
> - *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*
> - *impact on a species or ecological community that is unlikely to respond to measures to improve habitat and vegetation integrity and is therefore irreplaceable.*
>
> *The first three principles broadly align with the IUCN (2017) (see also Bland et al. (2016)) criteria used to identify entities at the greatest risk of extinction (i.e. critically endangered entities) and the fourth principle captures impacts on entities that cannot be offset.*

In the Guidelines, the risk of extinction is at a State level (that is, in the State of New South Wales).

The *Guidelines* outline the Criteria to interpret the principles. *The criteria ... enable the identification of threatened species and ecological communities that:*

- *are in a rapid rate of decline*
- *have a very small population size*
- *are severely degraded or disrupted*
- *have a very limited geographic distribution*
- *are unlikely to respond to measures to improve habitat.*

These criteria enable identification of threatened species and ecological communities most at risk of serious and irreversible impacts.

3.0 Applying the *Guidance*

Considering the four principles in terms of the impacts of the proposal on *Cumberland Plain Woodland*, it was found that:

Principle 1
These are impacts that will 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

In the 1790s, the relatively fertile shale-derived soils of the Cumberland Plain were discovered and these arable lands cleared to feed the colony (Hazelton and Clements 2011). The Huntingwood site is a typical example of former extensive agricultural land use.

The vegetation on the Huntingwood site is largely regrowth *Cumberland Plain Woodland* occurring mainly in a drainage swale and on and close to road reserves (see landform on Figure 1d-2, vegetation mapping on Figure 6c).

Within the drainage swale, there are:
- local native canopy trees;
- dense weedy understorey;
- soil disturbance; and
- building and rubble dumpings.

Close to the road reserve, the most intact of regrowth Cumberland Plain Woodland is offsite to the east adjoining Prospect Highway.

From the Final Determination, paragraph 14:

> *Some areas of Cumberland Plain Woodland subjected to a history of partial clearing and grazing have undergone a change in management to conserve the community. Examples include* ..., Western Sydney Regional Park [approximately 5 km to the south], ...

The proposal is a change in management to conserve, enhance and re-establish the community (see Figure 1f).

Existing threats to *Cumberland Plain Woodland (CPW)* observed onsite include:

Listed threats (from the *Cumberland Plain Woodland in the Sydney Basin Bioregion – profile,* accessed May 2023)	**Threats observed onsite**
Weed and foreign plant invasion, particularly African Olive and exotic grasses.	Yes. Particularly in the drainage swale in the west of the site.
Death of trees caused by fungus, following borers.	No. Not observed onsite.
Bell miner associated dieback.	No. Not observed onsite.
Urban heat island effect and persistent dry/low rainfall conditions.	Yes. The site is mainly historically cleared, formerly productive farmland, now reduced to an approximately 270 m wide site zoned IN1 – General Industrial and bounded by the major highways to the north, south and east. The proposal is directed to reduce urban heat island effect by conservation management.
Lack of awareness and appreciation of Cumberland	No comment.

Listed threats (from the *Cumberland Plain Woodland in the Sydney Basin Bioregion – profile,* accessed May 2023)	**Threats observed onsite**
Plain Woodland, with the perception that the community is unattractive.	
Inappropriate fire regimes, which have altered the appropriate floristic and structural diversity.	The floristic and structural diversity has been altered by the intense historic agricultural use of the site, not by fire regimes.
Disturbance and damage by recreational users being litter, arson, trail & motorbikes, 4WDs, firewood collection, and removal of woody debris.	No. Not observed onsite.
Threat of further clearing for urban or rural development, and the subsequent impacts from fragmentation including increased roadkill of fauna.	Yes, however the proposal is to conserve and enhance as part of an ecologically sustainable development.
Inappropriate water run-off, which leads to increased nutrients and sedimentation.	Yes. Stormwater runoff from the M4 Motorway is directed to Blacktown Creek in the east and to the drainage swale in the west of the site. Both drainage areas are heavily weed infested.
Predation of native fauna by cats and foxes.	No. Not observed onsite.
Grazing and mowing, which stops regrowth of the community.	No. Grazing and mowing not observed onsite.

The Threats listed in the Final Determination paragraphs 19, 20, include:

> *19. Weed invasion also poses a major threat to Cumberland Plain Woodland.*
>
> *20. Moderate to heavy grazing of Cumberland Plain Woodland by livestock and rabbits results in the decline and disappearance of palatable plant species, including shrubs and herbs, and compaction and erosion of topsoil, making re-establishment of a diverse native understorey problematic.*

In terms of Principle 1, the proposal is not likely to cause a further decline of CPW especially with the proposed establishment of conservation areas onsite.

Principle 2
These are impacts that will further reduce the population size of the species that is currently observed, estimated, inferred or reasonably suspected to have a very small population size, or will further degrade or disrupt an ecological community that is already observed, inferred or reasonably suspected to be severely degraded or disturbed

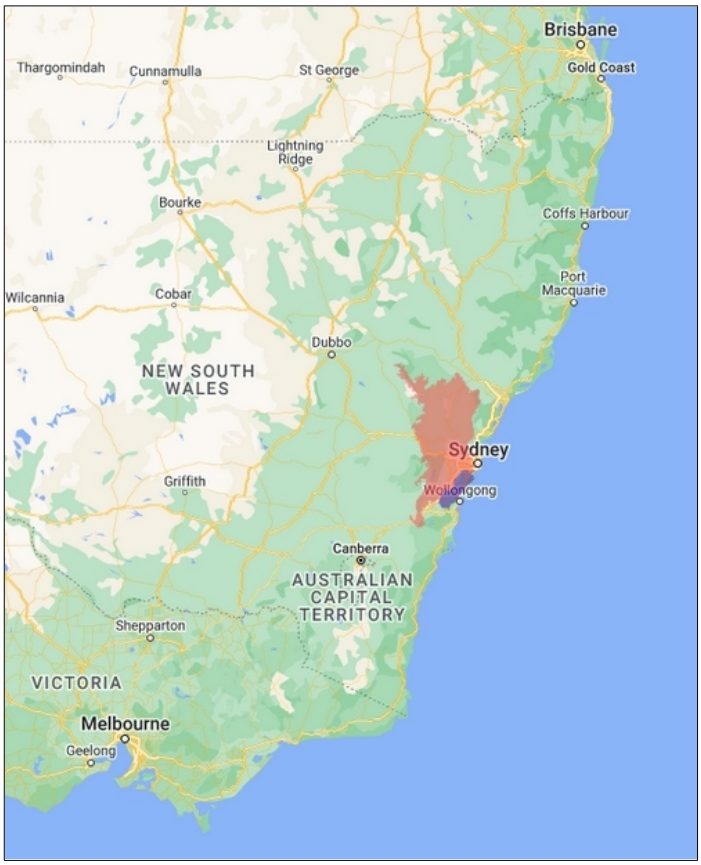
The proposal is not likely to have impacts that are likely to further degrade or disrupt CPW. The establishment of the conservation areas as part of the proposal will reduce the risk of any potential Serious and Irreversible Impacts.

Principle 3
These are impacts that 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.

CPW does not have a very limited geographic distribution. It is distributed in the Sydney Basin Bioregion (sensu Thackway and Cresswell) and is currently known to occur within the local government areas of Auburn, Bankstown, Baulkham Hills, Blacktown, Camden, Campbelltown, Fairfield, Hawkesbury, Holroyd, Liverpool, Parramatta, Penrith and Wollondilly, but may occur elsewhere within the bioregion (paragraph 11 of the Final Determination).

The map of its distribution is shown in *Cumberland Plain Woodland in the Sydney Basin Bioregion – profile.*



The areas shown in pink and/purple are the sub-regions where the species or community is known or predicted to occur. They may not occur throughout the sub-region but may be restricted to certain areas. ... The information presented in this map is only indicative and may contain errors and omissions.

The proposal will not impact an ecological community that is currently observed, estimated, inferred or reasonably suspected to have a very limited geographic distribution.

Principle 4
These are impacts that impact on a species or ecological community that is unlikely to respond to measures to improve habitat and vegetation integrity and is therefore irreplaceable.

CPW is known to respond to conservation measures to improve habitat and vegetation integrity, such as the removal of African Olive and careful bush regeneration.

The proposal will not impact an ecological community that is *unlikely to respond to measures to improve habitat and vegetation integrity and is therefore irreplaceable.*

In conclusion, from applying the *Guidance to assist a decision-maker to determine a serious and irreversible impact,* the proposal with its conservation areas is unlikely to result in a Serious and Irreversible Impact. The proposal is unlikely to contribute significantly to the risk of extinction of the *Cumberland Plain Woodland* ecological community in New South Wales.