AEP
ECOLOGY | BIOBANKING | OFFSETS | BUSHFIRE

BIODIVERSITY ASSESSMENT METHOD COMPLIANCE PATHWAY

FOR

PLANNING PROPOSAL

AT

1 BRICKWORKS ROAD, THORNTON, NSW

Prepared for: **North Thornton Group**
C/- de Witt Consulting

23 June 2020

Rev: 1

AEP Ref: No. 1639

BOAMs Ref: 0019986

P 0418 681 581 E CRAIG@ANDERSONEP.COM.AU PO BOX 210 ADAMSTOWN NSW 2289 ABN 27 170 660 510

EXECUTIVE SUMMARY

Anderson Environment & Planning (AEP) was commissioned by DeWitt Consulting on behalf of North Thornton Group to undertake a Biodiversity Assessment Method Compliance Pathway Report (BAMCP) over land identified as Lot 161 DP 136183 located at 1 Brickworks Road, Thornton NSW (the Subject Site), in the Maitland Local Government Area. The Subject Site area totals 18.94ha with approx. 6.51ha of native vegetation, including 5.59 which are proposed to be cleared.

The land is proposed for rezoning for RU2 – Rural Landscape to B5 – Business Development. Future development may include businesses, food and drink services and a hospital.

This report has been prepared to meet the requirements of Stage 1 of the *Biodiversity Assessment Method 2017* (BAM) established under Section 6.7 of the *Biodiversity Conservation Act 2016* (NSW). This assessment utilises methods detailed within the BAM Order 2017 to identify biodiversity values inherent within the site, including known and potentially occurring threatened species and ecological communities.

The land subject to the planning proposal is located on the site of a disused quarry, with evidence of ongoing use of hardstand areas including storage of construction equipment and other materials/goods. There is evidence that some areas of native vegetation have been subject to management/removal is some parts of the site. Furthermore, a dwelling is located in the northern section, where land is used for grazing purposes by cattle and horses.

The Subject Site, which totals 18.94ha, with approx. 6.51ha of native vegetation, has been found to contain three (3) plant community types (PCT): 1592 *Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter* (5.93ha), 1600 *Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter* (0.51ha) and 1071 *Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion* (0.07ha). PCT 1592 occurs in three (3) vegetation management zones: moderate condition (1.86ha), regrowth condition (2.08ha) and highly managed condition (1.99ha). PCTs 1592 and 1600 correspond with the State listed Endangered Ecological Community (EEC) *Lower Hunter Spotted Gum - Ironbark Forest in the Sydney Basin Bioregion.*

Fauna species recorded were typical of those expected in this locality, particularly due to the degraded nature of the habitat with existing connection to larger patches of habitat offsite. Of the threatened species recorded on site, two will incur the retirement of Species Credits: Southern Myotis (*Myotis macropus*) and Squirrel Glider (*Petaurus norfolcensis*). Squirrel Glider was assumed present due to records not allowing for definite assessment, although the species is high likely to occur on site. Other threatened species definitively recorded within the study area included White-Bellied Sea-Eagle (*Haliaeetus leucogaster*), Little Lorikeet (*Glossopsitta pusilla*), Eastern Coastal Free-tailed Bat (*Micronomus norfolkensis*), Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventris*) and Little Bent-winged Bat (*Miniopterus australis*). Powerful Owl (*Ninox strenua*) was also recorded calling distantly to the south of the study area on one occasion. However, the absence of suitable habitat for breeding purposes on site means such species do not require credit retirement.

Assessment in accordance with BAM showed no Serious and Irreversible Impacts (SAIIs) are likely to occur as a result of the rezoning of the land and any subsequent development.

Impacts to biodiversity from the planning proposal to rezone the Subject Site have been assessed, and avoidance or minimisation measures have been suggested to ensure all potential impacts are mitigated. Six (6) hollow-bearing trees, containing approximately 16 hollows, are expected to be removed. Therefore, the installation of compensatory habitat in retained vegetation and the rehabilitated wildlife corridor in the form of artificial hollows/nest boxes will be required. The planning proposal is only expected to impact connectivity for fauna during construction period.

Assessment of the proposal under other relevant environmental policy instruments including *State Environmental Planning Policy (Koala Habitat Protection) 2019* and the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act) were undertaken. The Subject Site provides only limited seasonal foraging habitat, is not mapped as important habitat for Swift Parrot, Regent Honeyeater or migratory shorebirds, and no Grey-headed Flying-fox roost camp is present within the site, therefore referral under the EPBC is not likely to be necessary for this planning proposal.

Table of Contents

Figures

Tables

Plates

Appendices

Study Certification and Licensing

This report was written by Edouard Loisance MMgt & Dip Cons & Land Mmgt (expected 2020) with Tim Mouton BEnvSc, Cert II Cons & Land Mmgt, & MEnvSc (BAAS: 19083) and Yann Buissiere BEnvMgt & Dip Cons & Land Mgmt, reviewed by Natalie Black BSc (Hons), MPL & Cert IV TAE & MSc (BAAS:19076) and certified by Ian Benson BEng (Civil) & GradDipSc (Ecology) (BAAS: 18147) of Anderson Environment & Planning.

Research was conducted under the following licences:

- NSW National Parks and Wildlife Service Scientific Investigation Licence SL101313;
- Animal Research Authority (Trim File No: 14/600(2)) issued by NSW Agriculture; and
- Animal Research Establishment Accreditation Number 53724.

Certification:

As the principal author, I, Ian Benson, make the following certification:

- This report has been written to comply with the requirements of the BAM 2017 and obligations outlined within the BAM Assessor Code of Conduct and includes, in the opinion of the writer, a true and accurate account of the species recorded, or considered likely to occur within the Survey Area, and inferences of such for biodiversity credit calculations;
- BAM Assessment methodology, as well as Commonwealth, state and local government policies and guidelines formed the basis of project surveying methodology, unless specified departures from industry standard guidelines are justified for scientific and/or animal ethics reasons;
- All research workers have complied with relevant laws and codes relating to the conduct of flora and fauna research, including the *Animal Research Act 1995*, *National Parks and Wildlife Act 1974* and the Australian Code of Practice for the Care and Use of Animals for Scientific Purposes.

Principal Author and Certifier:

IAN BENSON
Principal Ecologist
Anderson Environment & Planning
BAAS 18147
23 June 2020

Glossary of Terms

APZ	Asset Protection Zone
BAM	*Biodiversity Assessment Method Order* (2017) that determines: • Methodology applicable to quantifying biodiversity values inherent within a development site; • Avoid and mitigation efforts required to be employed as part of any development proposal; and • Number and class of credits required to offset residual impacts of the proposal upon the biodiversity values therein.
BC Act	The NSW *Biodiversity Conservation Act 2016.*
Biodiversity Credit Report	Specifies the number and type of biodiversity credits required to offset the impacts of a development.
BAM Calculator (BAM-C)	The online tool used to interpret site survey data and regional location information to quantify ecosystem and species credits required / generated at a development / stewardship site.
Biodiversity credits	Ecosystem or Species Credits required to offset the loss of biodiversity values on a development site.
Biodiversity offsets	Specific measures that are put in place to compensate for impacts on biodiversity values.
Biodiversity values	The composition, structure and function of ecosystems, and threatened species, populations and ecological communities, and their habitats.
CEEC	Critically Endangered Ecological Community.
Council	Maitland City Council.
Development Lands	Land upon which the development is proposed, and within which impacts upon biodiversity are required to be offset.
DoEE	The Commonwealth Department of the Environment and Energy.
DPI	The NSW Department of Primary Industries.
DPIE	The NSW Department of Planning, Industry and Environment.
Ecosystem credit	The class of biodiversity credits created or required for the impact on EECs, CEECs and threatened species habitat for species that can be reliably predicted to occur within a vegetation type.
EEC	Endangered Ecological Community (under BC Act).
EPBC Act	The Commonwealth *Environment Protection and Biodiversity Conservation Act 1999.*
OEH	The former NSW Office of Environment and Heritage.
PFC	Percentage Foliage Cover.

SEWPaC	The former Department of Sustainability Environment Water Populations and Communities, now the Commonwealth Department of the Environment.
Subject Site	The development footprint as shown in **Figure 1**.
Species credit	Class of biodiversity credits created or required for the impact on threatened species that cannot be reliably predicted to use an area based on habitat surrogates.
TBDC	Threatened Biodiversity Data Collection
TEC	Threatened Ecological Community

1.0 Stage 1 – Biodiversity Assessment

1.1 Introduction

A Planning Proposal is proposed within land known as 1 Brickworks Road, Thornton. At the request of de Witt Consulting on behalf of North Thornton Group Pty Ltd, Anderson Environment & Planning (AEP) have undertaken the necessary investigations to inform the production of a Biodiversity Assessment Method Compliance Pathway (BAMCP) informing the Planning Proposal.

As directed by The NSW Department of Planning, Industry and Environment. (DPIE), this BAMCP undertaken adheres to the approach outlined in the Biodiversity Assessment Methodology (OEH 2017a) (BAM) and the BAM Calculator User Guide (OEH 2017b).

1.1.1 Assessment Scope

This report includes:

- **Stage 1 – Biodiversity Assessment** – including the mapping of remnant vegetation communities and if present Endangered Ecological Communities (EECs) within the site, the location of previously identified threatened species and their habitats, and potential contemporary occurrence of threatened species identified within the BAM Calculator; and,
- Avoid and minimise considerations in accordance with Maitland City Council's Greening Plan, 2002, and Development Control Plan, 2011.

1.1.2 The Proposal

The Planning Proposal is for the rezoning of the Subject Site from RU2 Rural Landscape to B5 Business Development. This zone enables a mix of business and warehouse uses, and bulky goods premises that require a large floor area, located close to residential centres.

The proposal also includes a wildlife corridor connecting retained vegetation, the southern parklands, rehabilitated pond and restoration areas to vegetation in the north east on surrounding lands. The proposed wildlife corridor will run along the southern, western and northern boundaries with arboreal crossing for Squirrel Gliders across the minor interior roads, where large trees are not present to allow for such crossings, thus reducing vehicle strike on Haussman Drive.

The planning proposal requires the clearing of 5.59ha of native vegetation for the development of the lots and associated civil infrastructure. With the rehabilitation of parklands and restoration of a pond and wildlife corridor, 0.92ha of native vegetation will be retained.

The Study Area and Subject Site is shown in the context of the broader development plans in **Appendix A**.

1.1.3 Site Particulars

- **Address** – 1 Brickworks Road, Thornton.
- **Title** – Lot 161 DP 136183.
- **LGA –** Maitland City Council.
- **Study Area –** Covers approx. 18.94ha
- **Subject Site** – Covers approx. 18.94ha with the proposed development footprint covering approx. 17.73ha (i.e. the Subject Site minus the wildlife corridor).
- **Zoning –** Under the Maitland Local Environment Plan 2011 (the LEP), the Subject Site is zoned RU2 - Rural Landscape.
- **Current Land Use** – The Study Area, which totals 18.94ha, contains three (3) plant community types (PCT) which were identified as 1592 *Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter* (5.93ha), 1600 *Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter* (0.51ha) and 1071 *Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion* (0.07ha). PCT 1592 occurs in three (3) vegetation management zones: moderate condition, regrowth condition and highly managed condition. Each zone is further described in **Section 1.2.6.2.**

  PCT 1600 occurs in a highly disturbed condition with evidence of trampling and overgrazing by cows and horses along the northern boundary.

  Aquatic habitat of note is provided by the quarry final void which is being partially filled as part of bund removal works, but will remain as a sizeable permanent waterbody. While the waterbody is denuded of aquatic fauna, fringe vegetation associated with PCT 1071 has been identified on the banks.

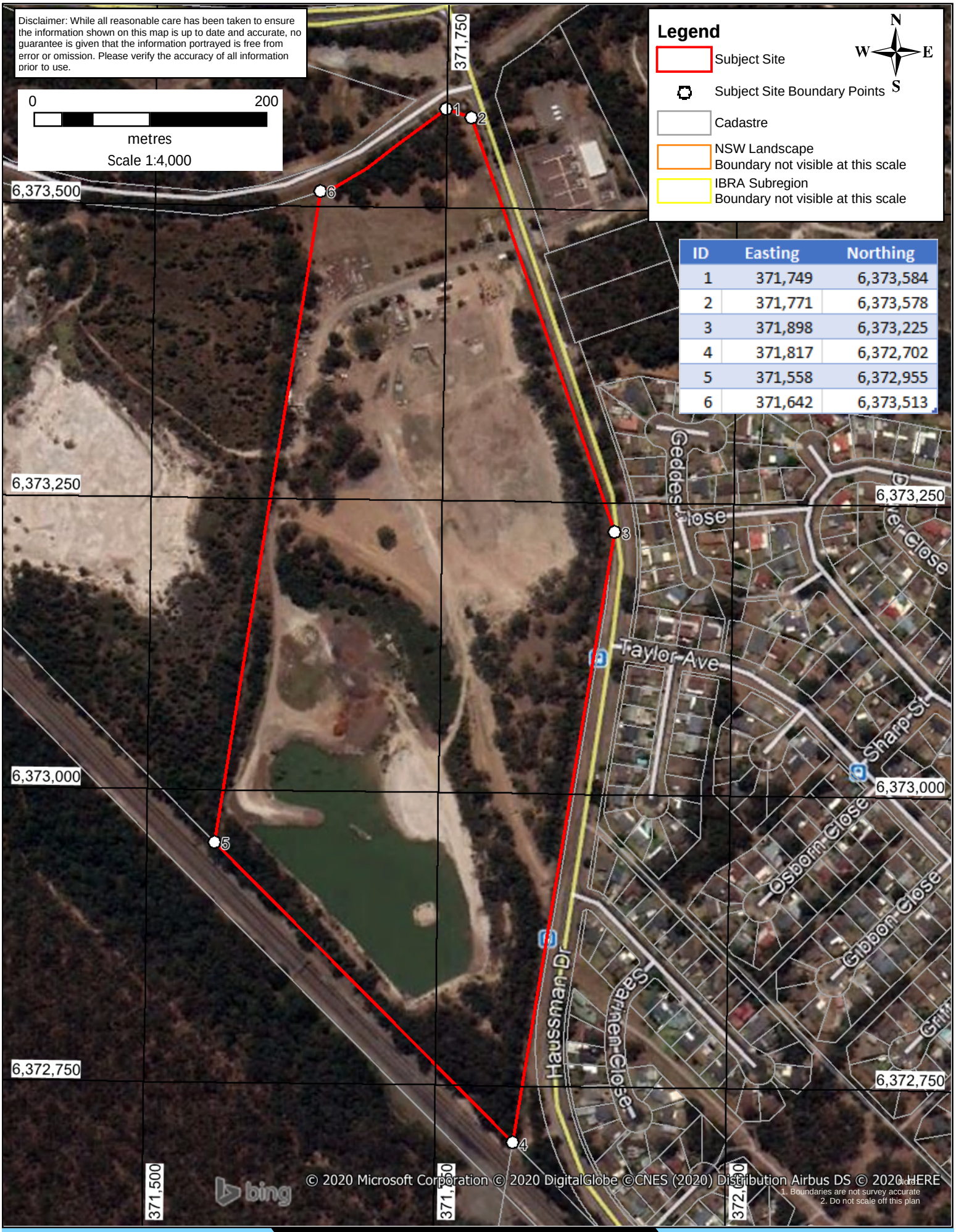
  The Subject site is currently used as a hardstand for storage of heavy construction vehicles and material, with evidence of clearing occurring throughout much of the site, mainly in the form of large access tracks. A dwelling is also located in the north-east.

- **Surrounding Land Use** – The site is bounded by Haussman Drive to the east, Brickworks Road to the north and the Main Northern Railway to the south. Land located to the west of the Subject Site is zoned RU2 – Rural Landscape and occurs as a disused quarry. The vegetation within the Subject Site remains tenuously linked in part with 72ha of mapped Lower Hunter Spotted Gum Ironbark Forest (LHSGIF) (zoned E3 Environmental Management) to the south (connectivity restricted by the intersecting rail corridor) and with LHSGIF vegetation to the northeast. Approved upgrades of Haussman Drive will further erode any potential links in the east.
- **Figure 1** depicts the extent of the site and defines the Subject Site and **Figure 2** depicts the location of the site within the landscape.

1.1.4 Information Sources

Information and spatial data provided within this BAMCP has been compiled from various sources including:

- State survey guidelines (DEC 2004, DECC 2009, OEH 2016);
- PlantNET NSW;
- Aerial Photograph Interpretation (API) of the site and surrounding locality (Bing 2019; NSW Department of Finance, Services and Innovation 2019);
- Review of regional mapping for the site by Parsons Brinckerhoff (2013): *Lower Hunter Vegetation Mapping*, report for Department of Sustainability, Environment, Water, Population and Communities, Canberra, ACT;
- OEH Threatened Biodiversity Profiles (https://www.environment.nsw.gov.au/threatenedSpeciesApp/);
- Search and review of flora and fauna sighting records in the OEH BioNet Atlas within 10km of the site;
- Protected Matters Search within a 5km radius of the site held by the Commonwealth Department of the Environment and Energy, summarising Matters of National Environmental Significance that may occur in, or may relate to the Subject Site;
- Contact with BAM Support to determine whether the site is mapped as *Important Swift Parrot Habitat* or *Important Regent Honeyeater Habitat* (**Appendix J**);
- Collective knowledge gained from previous ecological survey and assessment in the Maitland City Council area over the past 20 years; and
- Anecdotal records.



AEP

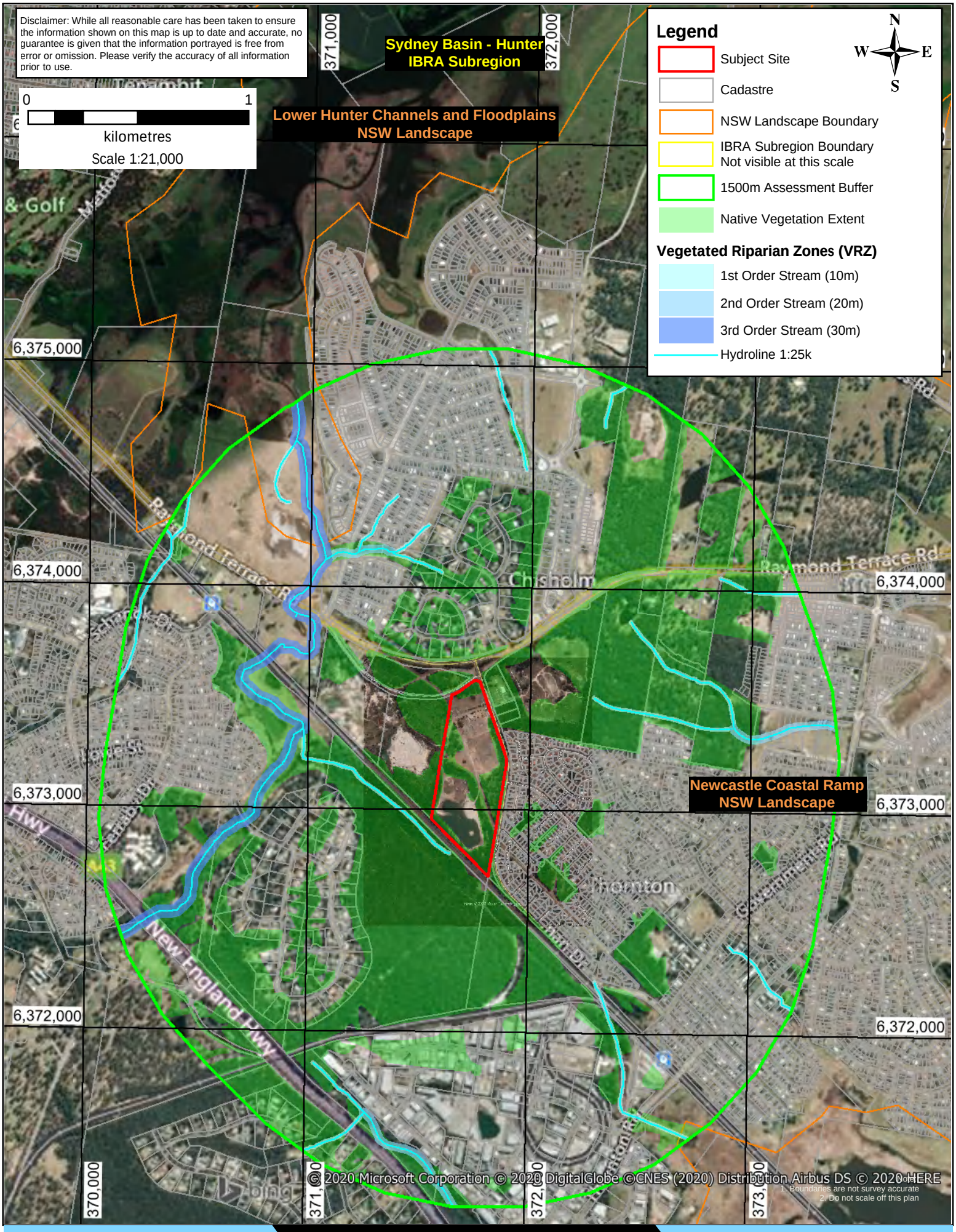
Title: Figure 1 - Site Map

Date: May 2020

Location: 1 Brickworks Road, Thornton NSW

Client: North Thornton Group Pty Ltd

BOAMS Ref: 19986
AEP Ref: 1639



AEP

Title: Figure 2 - Location Map

Date: May 2020

Location: 1 Brickworks Road, Thornton, NSW

Client: North Thornton Group Pty Ltd

BOAMS Ref: 19986
AEP Ref: 1639

1.2 Landscape Features

1.2.1 Regional Landscapes

The Subject Site was identified as occurring within the following landscape areas:

- *IBRA Bioregion* – Sydney Basin.
- *IBRA Subregion* – Hunter.
- *NSW Landscape* – Newcastle Coastal Ramp.

Delineation of *NSW Landscape* areas are shown in both the Site and Location Maps (**Figure 1** and **Figure 2**).

1.2.2 Identified Landscape Features

The Calculator identifies seven (7) landscape features that require assessment for their relevance to the site. These features are:

- *Rivers and Streams*: No mapped rivers or streams occur on the site. However, one man-made dam is located in the southern half of the Subject Site and consists of highly contaminated and toxic water resulting from the past use of the site as a quarry.
- *Wetlands*: No mapped wetlands (SEPP Coastal Management (2018) or otherwise) occur within the site.
- *Native Vegetation Extent*: Approximately 6.51ha of modified remnant vegetation community occurs on the site, which is mapped as *Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter* by Parsons Brinckerhoff (2013), and was further ground-truthed and confirmed as PCT 1592 – *Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter*, PCT 1600 – *Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter* and PCT 1071 *Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion.*
- *Connectivity Features*: The vegetation is connected to approx. 72ha of remnant vegetation remnant vegetation extending to the south of the site. Furthermore, a tenuous link to vegetation located in adjacent lots to the north and north-east also exists. The Planning Proposal is proposing a wildlife corridor along the northern, western and southern boundaries, which will result in a wildlife corridor supporting mobility in the locality.
- *Areas of geological significance and soil hazard features*: No area of geological significance occurs on site. The dam is considered to be highly contaminated and toxic and as such represents of a hazard on site.
- *Features identified in SEARs for major projects*: None of note on the site.
- *Areas of Outstanding Biodiversity Value (AOBV) under the BC Act*: The Study Area and vegetation immediately adjacent are not included within AOBV

1.2.3 Site Context Components

1.2.3.1 Method

Site layout allowed for the landscape values to be determined based upon a site-based method, rather than that of a linear method.

1.2.3.2 Landscape Native Vegetation Cover

In accordance with section 4.2.1.2 of the BAM, a 1500m was buffer placed around the site, totalling approximately 1,018ha in size (includes the total area of the Subject Site). Of this, approximately 323.2ha comprise native vegetation as per Section 4.3.2 of the BAM. This equates to approximately **32%** native vegetation cover and was entered as such within the Calculator.

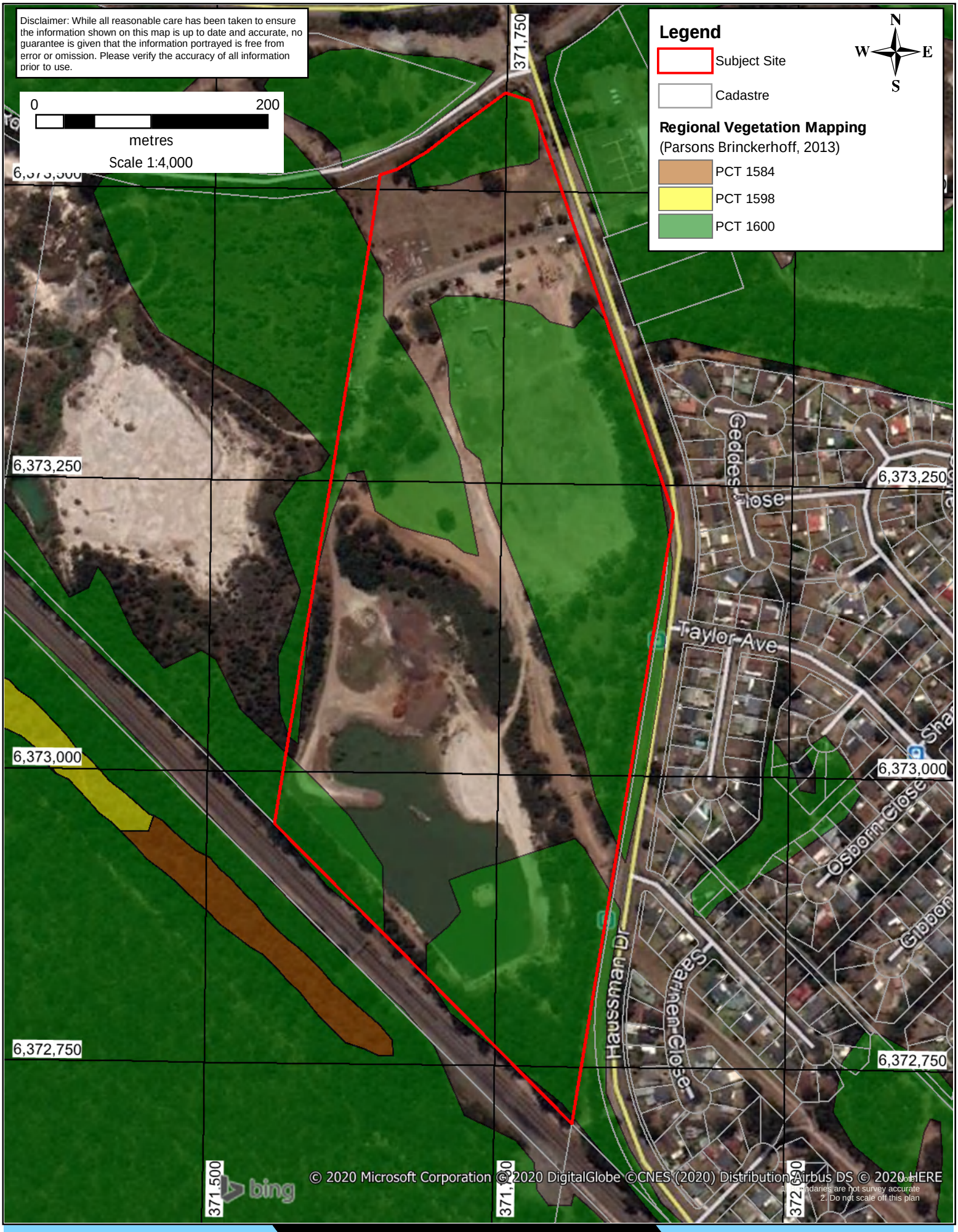
1.2.4 Regional Mapping

Preliminary vegetation mapping has been produced for the site. This has been achieved by adoption and subsequent updating and refinement of Parsons Brinckerhoff (2013) Regional Vegetation Mapping via field inspection and Aerial Photograph Interpretation (API). The communities mapped within the site for the dataset are provided in **Table 1** below (see **Figure 3)**:

Table 1 - Regional Vegetation Mapping Results

Vegetation Community	Area (ha)
	Parsons Brinckerhoff (2013)
Lower Hunter Spotted Gum – Ironbark Forest	9.91
Other*	9.03
Total	**18.94**

* Includes non-descript regenerating native vegetation, non-remnant vegetation, agricultural / cleared / unmapped areas/etc.



AEP

Title: Figure 3 - Regional Vegetation Mapping

Date: May 2020

Location: 1 Brickworks Road, Thornton, NSW

Client: North Thornton Group Pty Ltd

BOAMS Ref: 19986
AEP Ref: 1639

1.2.5 Field Survey Results

Flora survey was undertaken to produce a flora species list for the Subject Site, to search specifically for threatened flora species known from the wider area, and to gather data necessary to both derive vegetation community type(s) and to meet relevant survey guidelines. Such works included:

- Identification of all vascular plant species encountered during fieldwork. Subject Site coverage was both systematic to ensure all key points of the site were checked, and therein the Random Meander Technique (Cropper, 1993) was utilised to maximise species encountered.

- Six (6) BAM plots were undertaken within the Subject Site. A summary of the plot data and flora list is provided in **Appendix B** and the location of Plots is featured in **Figure 4.**

1.2.5.1 Plant Community Types (PCTs)

Field surveys undertaken in preparation of this report identified three (3) native vegetation community on the site, being *Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter, Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter* and *Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion.* PCTs were determined using the following search sequence (**Table 2**) in the OEH/DPIE Excel table of PCTs (last updated December 2018), using data gathered during field surveys.

Table 2 - PCT Determination

Search Item	Plot 1	Plot 2	Plot 3	Plot 4	Plot 6	Plot 5
IBRA Region	Sydney Basin					
IBRA Subregion	Hunter					
NSW Landscape	Newcastle Coastal Ramp					
Vegetation Formation	Dry Sclerophyll Forest (Shrubby Formation)					Freshwater Wetlands
Upper Stratum Species	"*Corymbia maculata*", "*Eucalyptus punctata*" AND "*Eucalyptus fibrosa*" (1592)	Absent	"*Corymbia maculata*" AND "*Eucalyptus globoidea"* does not yield any PCT. A search for "*Corymbia maculata"* returns 1548, 1549, 1584, 1589, 1590, 1592, 1593, 1600, 1601, 1602 and 1604	"*Eucalyptus crebra"* AND "*Eucalyptus paniculata"* does not yield any PCT. A search for "*Eucalyptus paniculata"* yields 1541, 1588 and 1620 However all three PCTs must be ruled out due to inappropriate location. "*Eucalyptus crebra"* yields 612, 617, 618, 621, 623, 624, 676, 713, 922, 1178, 1308, 1314, 1582, 1600, 1601, 1602, 1603, 1604, 1605, 1606, 1607, 1611, 1612, 1623, 1654, 1656, 1658, 1660, 1661, 1668, 1691 and 1696	"*Corymbia maculata*" AND "*Eucalyptus paniculata*" (1549, 1589, 1592)	"*Melaleuca quinquenervia" (1737, 1741, 1742)*
Mid Stratum Species	"*Bursaria spinosa*" AND "*Daviesia ulicifolia"* (1590, 1592, 1600, 1601)	"*Leucopogon juniperinus"* AND "*Bursaria spinosa*" (1590, 1591, 1598, 1600) "*Acacia elongata"* only returns PCT 1732.	"*Acacia falcata*" OR "*Acacia ulicifolia*" does not return any results. A search for "*Bursaria spinosa"* AND "*Daviesia*	"*Pittosporum undulatum"* reduces the options to 612, 617, 618, 621, 624 and 1605. However, the	*Leucopogon juniperinus* and *Acacia elongata or A. ulicifolia* are not seen in the assemblages proposed in 1549, 1589	N/A

Search Item	Plot 1	Plot 2	Plot 3	Plot 4	Plot 6	Plot 5
		However this proposed assemblage is not consistent with vegetation on site.	*ulicifolia"* yields 1590, 1592, 1600, 1601	locations of these PCTs are not appropriate. Regional mapping suggests 1600 occurs on site, and the shrub layer is somewhat consistent with this description (*Bursaria spinosa, Breynia oblongifolia*)	or 1592. However, *Bursaria spinosa* and *Daviesia ulicifolia* are diagnostic of 1592	
Ground Stratum Species	"*Themeda australis*" AND "*Microlaena stipoides*" AND "*Lobelia purpurascens*" AND "*Lomandra multiflora*" (1592)	*Themeda australis*" AND "*Cheilanthes sieberi*" AND "*Microlaena stipoides*" AND "*Lobelia purpurascens"* AND *"Lomandra multiflora"* (1590)	"*Microlaena stipoides*" AND "*Lobelia purpurascens*" AND "*Lomandra multiflora*" (1590, 1592, 1601)	*Lobelia purpurascens, Lomandra filiformis* and *Aristida vagans* are diagnostic of 1600	"*Themeda australis*", "*Aristida vagans*" AND "*Microlaena stipoides*" dominate the ground stratum of the plot, and are also diagnostic of 1592	"*Juncus usitatus"* does not return any PCT with the above canopy species. However, "*Typha orientalis"* yields 1737
Other	A search for "*Eucalyptus globoidea*" only yields PCT 1618 which is not appropriate for the site.	Whilst 1590 is provided as a suitable result when querying the database, the highly disturbed location of this plot and the dominant presence of 1592 on site means that it is more likely for 1592 to have been the PCT occurring in this section too. As such this was	This plot is located in a highly managed and disturbed zone somewhat contiguous to the zone where Plot 1 was located. It is considered that 1592 is an appropriate fit in the context of the vegetation therein.			It was considered that the presence of *Melaleuca quinquenervia* is not diagnostic. Based on descriptions provided in the VIS database, PCT 1071 was preferred to describe the vegetation in this zone, despite the fact that the assemblage is largely incomplete.

Search Item	Plot 1	Plot 2	Plot 3	Plot 4	Plot 6	Plot 5
		chosen as the relevant PCT for this plot.				
Result	**1592**	**1592**	**1592**	**1600**	**1592**	**1071**
Vegetation Formation (Type)	Dry Sclerophyll Forests (Shrub/grass sub-formation)					Freshwater Wetlands
Vegetation Class	Hunter – Macleay Dry Sclerophyll Forests					Coastal Freshwater Lagoons
Estimate cleared value of PCT (%)	44	44	44	66	44	75
TEC	Lower Hunter Spotted Gum-Ironbark Forest					Several TECs are proposed as being commensurate with this PCT. However, the artificial, incomplete, disturbed and contaminated nature of this section of the site means it is not considered to match any TEC description.

Analysis of the floristic composition and landscape position of the BAM plots in the community against the Vegetation Information System (VIS) classification system provided a conclusive identification of three (3) PCTs. Further explanation of the selection process is provided as follows.

PCT 1592 - Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter

The floristic compositions identified in Plots 1, 2, 3 and 6 were considered to be consistent with the description of PCT 1592. Diagnostic canopy species included *Eucalyptus punctata, E. fibrosa* and *Corymbia maculata*. The presence of other canopy species was considered to be the result of a history of disturbance on site and in the locality. Diagnostic mid-stratum species were identified as *Bursaria spinosa* and *Daviesia ulicifolia,* although not consistently dominant in all areas considered to be consistent with PCT 1592. Diagnostic ground species occurring within these Plots were identified as *Lobelia purpurascens, Themeda australis, Microlaena stipoides, Lomandra multiflora* and *Aristida vagans*, with other species also noted and considered to be typical of land in a disturbed condition.

The variations in floristics across the four plots justifies the creation of three vegetation zones in the BAM Calculator. These zones are described as Moderate Condition, Highly Managed Condition and Regrowth Condition. They are further discussed in **Section 1.2.6.2** of this report.

PCT 1592 is not associated with any EPBC-listed EEC. However, it is commensurate with NSW-listed *Lower Hunter Spotted Gum Ironbark Forest EEC*, and it covers an area of approximately 5.93ha.

Other PCTs were afforded consideration in the PCT selection process, and were ruled out as follows:

- 1548 Tallowwood - Small-fruited Grey Gum - Kangaroo Grass grassy tall open forest on foothills of the lower North Coast – mainly restricted to coastal ranges of the lower North Coast;

- 1549 Tallowwood - Spotted Gum - Grey Gum grassy tall open forest of the lower North Coast - mainly restricted to coastal ranges of the lower North Coast;

- 1584 White Mahogany - Spotted Gum - Grey Myrtle semi-mesic shrubby open forest of the central and lower Hunter Valley – floristic composition and location (mainly in gullies and lower slopes) are inadequate;

- 1589 Spotted Gum - Broad-leaved Mahogany - Grey Gum grass - shrub open forest on Coastal Lowlands of the Central Coast – occurs on coastal lowlands;

- 1590 Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest – floristic composition is somewhat adequate. However, PCT 1592 offered a better fit at a canopy and shrub level;

- 1593 Red Ironbark - Spotted Gum - Prickly-leaved Paperbark shrubby open forest of the Lower Hunter - floristic composition is somewhat adequate. However, PCT 1592 offered a better fit at a canopy and shrub level;

- 1600 Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter – this PCT is considered as occurring on site according to regional mapping. However specifically in the locations covered by Plots 1, 3 and 6, the canopy layer was more consistent with PCT 1592 which is closely related;

- 1601 Spotted Gum - Narrow-leaved Ironbark-Red Ironbark shrub - grass open forest of the central and lower Hunter – similarly to the argument against PCT 1600, the floristic composition of the plots was described marginally more appropriately by PCT 1592.

- 1602 Spotted Gum - Narrow-leaved Ironbark shrub - grass open forest of the central and lower Hunter – the canopy layer proposed in PCT 1602 is incomplete in comparison with other more fitting PCTs

- 1604 Narrow-leaved Ironbark - Grey Box - Spotted Gum shrub - grass woodland of the central and lower Hunter – the canopy and shrub composition of PCT 1604 are inadequate and PCT 1592 offers a more complete fit.

PCT 1600 - Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter

The floristic composition identified in Plot 4 was considered to be highly disturbed yet remotely consistent with the description of PCT 1600. The only diagnostic canopy species identified was *Eucalyptus crebra*. The assemblage of other canopy species noted in this section (*Eucalyptus paniculata* and *Eucalyptus* globoidea) did not yield valid PCT options, which further illustrates the highly disturbed condition of this section of the Subject Site. However, all canopy species identified are included in the Final Determination of *Lower Hunter Spotted Gum Ironbark Forest*, which PCT 1600 is commensurate with. At a shrub level, diagnostic species included *Bursaria spinosa* and *Breynia oblongifolia*. Diagnostic ground species were identified as *Lobelia purpurascens*, *Lomandra filiformis* and *Aristida vagans.*

This vegetation zone is located along the northern boundary and is disturbed by constant pasture use by cows and horses, rubbish discarding and the presence of a shed and dwelling.

PCT 1600 is not associated with any EPBC-listed EEC. However, it is commensurate with NSW-listed *Lower Hunter Spotted Gum Ironbark Forest EEC*, and it covers an area of approximately 0.51ha.

As described in **Table 2**, a large list of PCTs were identified as options when querying canopy species and dominant shrubs (*Pittosporum undulatum*). However, they were all ruled out due to their inadequate location. The occurrence of other PCTs consistent with LHSGIF EEC description was noted throughout the site, and PCT 1600 was mapped by Parsons Brinckerhoff as occurring on site, therefore it was considered the most likely fit for this zone.

PCT 1071 - Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion

Analysis of the floristic composition and landscape position of BAM Plot 5 (as per **Table 2**) against the Vegetation Information System (VIS) classification system did not provide a conclusive identification of a PCT. The sparse presence of *Typha orientalis* led to the assignment of PCT 1071 to this vegetation zone. However, no other species on site are included in the PCT description.

The area in which Plot 5 was undertaken is in a highly disturbed, man-made part of the Subject Site, with a highly contaminated void containing water resulting from previous quarry activities. As such, the assemblage of species noted in the plot most likely results from human inadvertent dispersion during earthworks procedures.

While it is suggested that PCT 1071 may be associated with NSW Listed *Freshwater Wetlands on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions*, and NSW-Listed *Sydney Freshwater Wetlands in the Sydney Basin Bioregion* vegetation communities, the floristic assemblage are too sparse and incomplete and warrant such associations. Therefore, this vegetation zone is not commensurate with any EEC and it covers approx. 0.07ha.

Non-remnant / Cleared Areas

The remainder of the Subject Site (approx. 12.43ha) comprises tracks, exotics-dominated pasture lands, cleared lands including hardstand areas, a dwelling, several heavy construction vehicles and machinery, sheds and various piles of stored materials.

Vegetation community mapping for the site is shown in **Figure 4**. Additional site photographs are included in **Appendix I**.

1.2.5.2 Habitat Features

Six (6) hollow-bearing trees containing an assumed total of 16 hollows were identified within the Subject Site as listed in **Table 3**. Where hollow presence is assumed, it is due to the height and orientation of the hollow, which in some cases made definite identification not possible. Despite thorough surveying, very small hollows may also have gone unnoticed that would be suitable for small species such as microbats. Other hollows may have gone unobserved due to the height and orientation of potential hollows.

Table 3 - Habitat Tree Detail

ID	GPS ID	Species	DBH (mm)	Hollows				Vegetation Zone	Proposed for retention or removal
				S	M	L	XL		
1	330	Stag	500	3	1	-	-	1592 moderate	Removal
2	331	Grey Gum	650	1	2	-	-	1592 moderate	Retention
3	333	Grey Gum	700	2	3	-	-	1592 highly disturbed	Removal
4	334	Ironbark sp.		2				1600 highly disturbed	Retention
5	369	Ironbark sp.		1				1592 moderate	Removal
6	370	Stringybark sp.	270	1				1600 highly disturbed	Retention
				10	**6**	**-**	**-**		
			Total Hollows	**16**					

Notes for hollow size: S <10cm, M 10-20cm, L >20cm, XL >30cm
DBH - diameter at breast height

Furthermore, a stick nest was observed in the south-east of the Subject Site as featured on **Figure 6**. However, it was not considered to be in use by any threatened species.

1.2.6 Vegetation Integrity Assessment

1.2.6.1 Patch Size

The native vegetation that exists within the Subject Site is connected to vegetation to the west and south that, as defined by the BAM, extends as a patch for more than 100 ha.

1.2.6.2 Vegetation Zones

Fieldwork revealed there were six (6) vegetation management zones within the Subject Site. These are mapped in **Figure 5.**

PCT 1592 - Spotted Gum – Red Ironbark – Grey Gum shrub – grass open forest of the Lower Hunter - Moderate Condition

Plot 1 was executed in this zone. The diagnostic canopy species present were *Corymbia maculata*, *Eucalyptus punctata* and *Eucalyptus fibrosa. Eucalyptus globoidea* was also noted on site but is considered to be characteristic of the disturbance occurring throughout the Subject Site. The diagnostic shrub layer consisted of *Bursaria spinosa* (with many specimen dead or in poor condition) and *Daviesia ulicifolia*. Species of Acacia, specifically *A. irrorata* and *A. elongata* were present on site, although not diagnostic, which further provides evidence of the disturbed nature of this zone. The diagnostic groundcover species included *Lomandra multiflora, Themeda australis, Lobelia purpurascens* and *Microlaena stipoides.* Other species typical of rural land under urban influence were present, including *Entolasia sp., Cynodon dactylon*. Evidence of disturbance was also noted in the form of soil mounds and tracks running through this section of the site. The proximity of the railway line in the south and Haussman to the west further contribute to such disturbance. Furthermore, this zone provides connectivity with the large expanse of vegetation located on the other side of the railway track to the south.

This vegetation zone covers approx. 1.86ha of the Subject Site.

Plate 1 – BAM Plot 1

Plate 2 – BAM Plot 1

<u>PCT 1592 - Spotted Gum – Red Ironbark – Grey Gum shrub – grass open forest of the Lower Hunter - Highly Managed Condition</u>

Plot 3 was executed in this zone. Vegetation therein occurs in a highly managed form, with hardly any shrubs identified while some canopy species regrowth occurs. Canopy species identified included *Corymbia maculata, Eucalyptus globoidea* and one specimen of *Melia azedarach* and diagnostic shrubs noted in this zone were *Bursaria spinosa* and *Daviesia ulicifolia*, although with a very sparse presence. Ground covers were consistent with other PCT 1592 zones on site although disturbed.

This vegetation zone is bounded by a track to the west, Haussman drive to the east, and cleared land to the north. It covers approx. 1.99ha of the Subject Site.

Plate 3 – BAM Plot 3

Plate 4 – BAM Plot 3

PCT 1592 - Spotted Gum – Red Ironbark – Grey Gum shrub – grass open forest of the Lower Hunter – Regrowth Condition

Plots 2 and 6 were executed in this zone. Vegetation therein occurs in a less mature condition than other zones of PCT 1592. In the western plot, it is evidenced by the dominance of *Corymbia maculata* and *Eucalyptus paniculata* in the canopy layer, and the occurrence of *Bursaria spinosa* and *Daviesia ulicifolia.* Influence from disturbance and other vegetation communities was seen with the presence of *Acacia* species which are not diagnostic, yet native. The shrub layer is somewhat more diagnostic in the central regrowth area; however, this plot was located on highly disturbed grounds. The ground cover was also identified as disturbed yet consistent with PCT 1592 (dominance of *Microlaena stipoides, Aristida vagans* and *Themeda australis).* This vegetation zone covers approx. 2.08ha.

Plate 5 – BAM Plot 2

Plate 6 – BAM Plot 2

Plate 7 – BAM Plot 6

Plate 8 – BAM Plot 6

PCT 1600 - Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter - Highly Disturbed Condition

Plot 4 was executed in this zone. The highly disturbed condition is evidenced by the presence of cows and horses on this section of land, and the widespread occurrence of weedy grasses such as, but not limited to, *Senecio madagascariensis, Cenchrus clandestinum, Sida rhombifolia and Modiola caroliniana.* Diagnostic PCT species included *Eucalyptus crebra, Bursaria spinosa, Daviesia ulicifolia, Lobelia purpurascens, Lomandra filiformis* and *Aristida vagans.* Therefore, this assemblage is highly incomplete, yet somewhat consistent with PCT 1600.

This vegetation zone is bounded by Brickworks Road to the north, exotics-dominated pasture land to the south and west, and Haussman drive to the east. It covers approx. 0.51ha of the Subject Site.

Plate 9 – BAM Plot 4

Plate 10 – BAM Plot 4

PCT 1071 - Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion – Highly Disturbed

Plot 5 was executed in this zone. As discussed previously, PCT 1071 was assigned to this zone although only species occurs which is diagnostic, and it is not dominant in this section. The dam is contaminated and toxic, with negligible biodiversity value until it is rehabilitated. Furthermore, the dam banks are equally disturbed, with evidence of earthworks and excavation. The vegetation therein is considered to have resulted from dispersion and disturbance. Whilst the vegetation integrity score featured in the BAM-C is 51.7, it is driven by an assemblage of cosmopolitan species, dominated by Common Couch, which offer minimal habitat value and has no consistency with any PCT. This vegetation zone covers approx. 0.07ha.

Plate 11 – BAM Plot 5

Plate 12 – BAM Plot 5

The remaining 12.43ha have been identified as cleared land, tracks, dwelling, and pasture land dominated by exotics (see **Figure 5**).

Table 4 presents the PCTs and condition classes present within the development footprint, as well as any corresponding threatened ecological communities (TECs) and PCT extent.

Table 4 – Vegetation Management Zones

Zone	Vegetation Community	TEC	Area of Removal (ha)	Area of Retention (ha)	Total Area (ha)
1	PCT 1592 (moderate condition)	Lower Hunter Spotted Gum-Ironbark Forest in the Sydney Basin Bioregion	1.47	0.39	1.86
2	PCT 1592 (highly managed)		1.99	-	1.99
3	PCT 1592 (regrowth)		1.8	0.28	2.08
4	PCT 1600 (highly disturbed)		0.26	0.25	0.51
5	PCT 1071 (highly disturbed)		0.07	-	0.07
Total – Remnant Vegetation			**5.59**	**0.92**	**6.51**
Non-remnant / cleared areas / dams		-	12.13	0.3	12.43
Total – Development Lands			**17.72**		
Total - Proposed wildlife corridor				**1.21**	
Total - Subject Site			**18.94**		

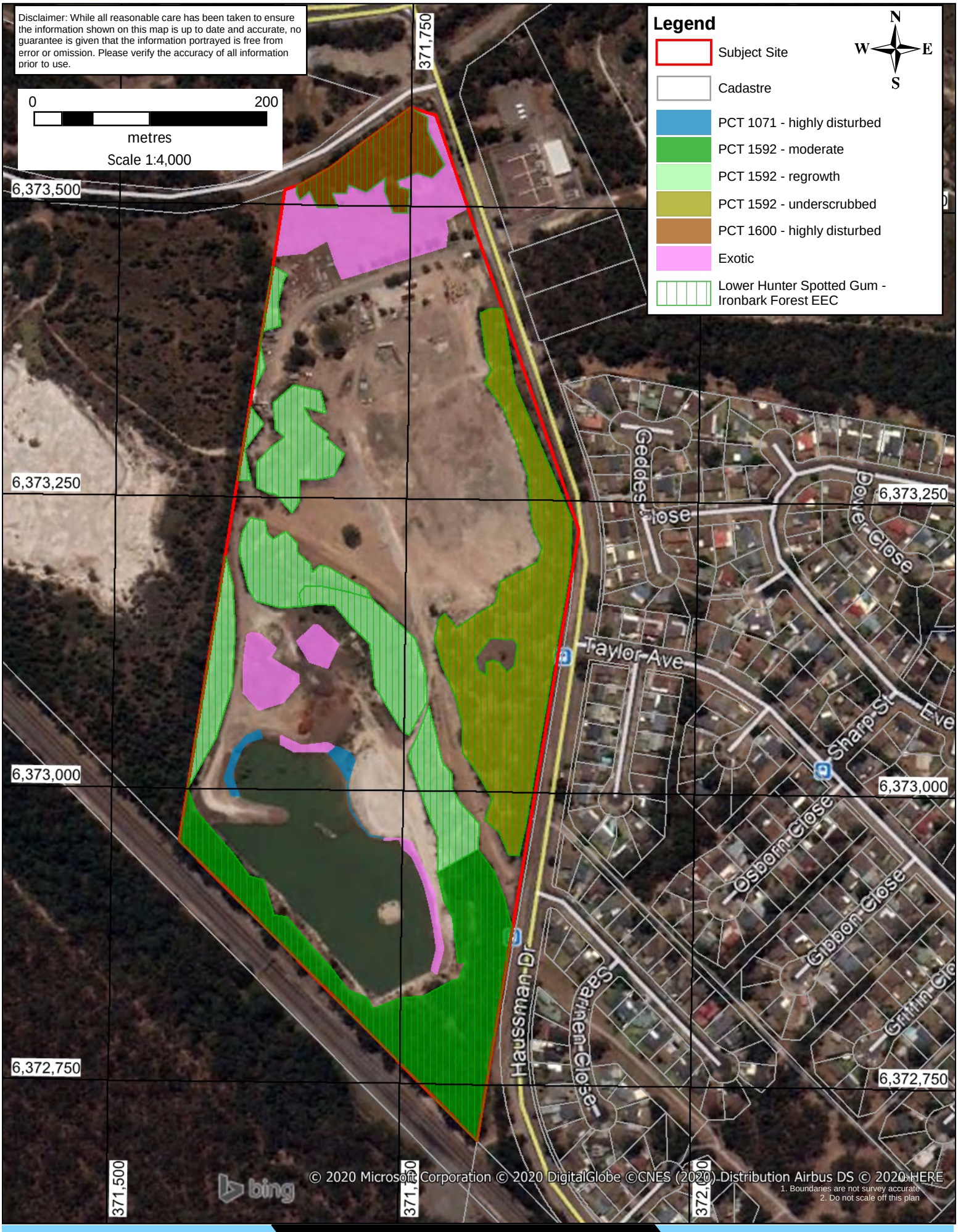
1.2.6.3 Survey Effort

Six (6) BAM plots were conducted within the Subject Site in May 2020 by AEP Ecologists. **Figure 4** displays the location of the BAM plots.

Field sheets are provided in **Appendix G** and BAM Plot field data is provided in **Appendix F**. Flora and fauna species lists for those species recorded during field surveys are provided in **Appendix B** and **Appendix C**. See **Figure 4** for survey effort undertaken.

1.2.6.4 Vegetation Integrity Score

BAM plot data was used to determine the composition, structure and function condition score for each zone, which informed the Vegetation Integrity Score. Plot data has been tabulated and includes corresponding condition scores along with the overall Vegetation Integrity Score for each zone (**Appendix D**). Section 6.2 of the BAM states that ecosystem credits will apply to impacts on vegetation within these zones.



AEP

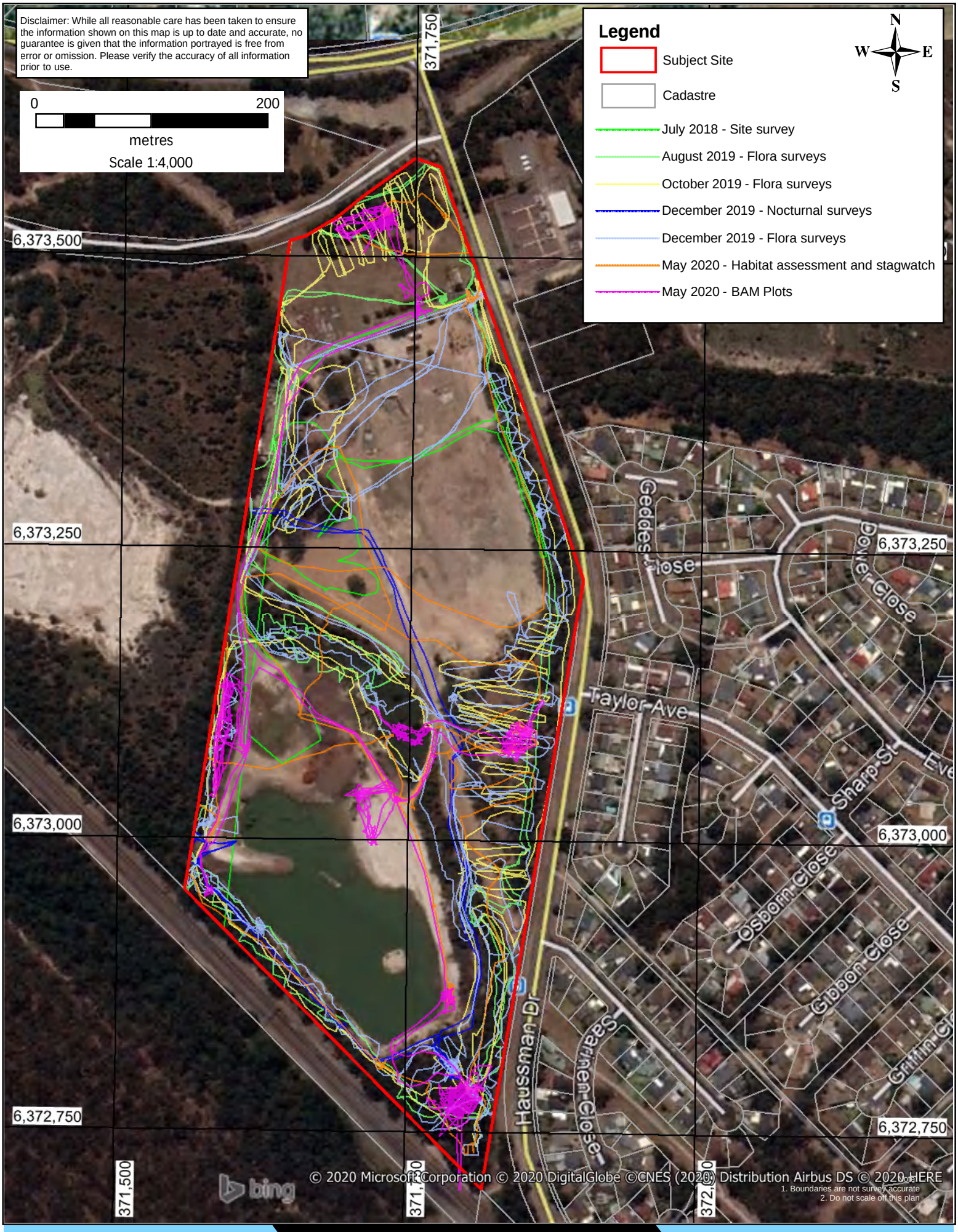
Title: Figure 4 - Plant Community Types

Date: May 2020

Location: 1 Brickworks Road, Thornton,NSW

Client: North Thornton Group Pty Ltd

BOAMS Ref: 19986
AEP Ref: 1639



AEP

Title: Figure 5 - Fauna and Flora Surveys

Date: May 2020

Location: 1 Brickworks Road, Thornton,NSW

Client: North Thornton Group Pty Ltd

BOAMS Ref: 19986
AEP Ref: 1639

AEP

Title: Figure 6 - Fixed Point and Habitat Assessments

Date: May 2020

Location: 1 Brickworks Road, Thornton,NSW

Client: North Thornton Group Pty Ltd

BOAMS Ref: 19986
AEP Ref: 1639

1.3 Threatened Species Surveys

Under the BAM, threatened species are classified into two types: 'Ecosystem Credit' and 'Species Credit' type species, as detailed within the BioNet Atlas Threatened Biodiversity Profile Data Collection (OEH).

Multiple field surveys have been undertaken on the site and within the surrounding area, including comprehensive surveys during 2019 and 2020. A summary of survey effort within the Subject Site is presented in **Table 7** and shown in **Figure 4** and **Figure 5**.

1.3.1 Ecosystem Credit Species

Those Ecosystem Credit species predicted to occur within the site are provided in **Table 5**.

Table 5 – Predicted threatened species (Ecosystem credits)

Scientific name	Common name	Sensitivity to Gain Class	Recorded within 10km (NSW BioNet Wildlife Atlas 2020) Y/N	Recorded within site nearby surrounds Y/N
Artamus cyanopterus cyanopterus	Dusky Woodswallow	Moderate	N	N
Callocephalon fimbriatum	Gang-gang Cockatoo	Moderate	Y	N
Chthonicola sagittata	Speckled Warbler	High	N	N
Circus assimilis	Spotted Harrier	Moderate	N	N
Climacteris picumnus victoriae	Brown Treecreeper (eastern subspecies)	High	N	N
Daphoenositta chrysoptera	Varied Sittella	Moderate	Y	N
Dasyurus maculatus	Spotted-tailed Quoll	High	N	N
Epthianura albifrons	White-fronted Chat	Moderate	N	N
Falsistrellus tasmaniensis	Eastern False Pipistrelle	High	Y	N
Glossopsitta pusilla	**Little Lorikeet**	**High**	**Y**	**Y**
Haliaeetus leucogaster	**White-bellied Sea-Eagle**	**High**	**Y**	**Y**
Hieraaetus morphnoides	Little Eagle	Moderate	Y	N
Lophoictinia isura	Square-tailed Kite	Moderate	Y	N
Melanodryas cucullata cucullata	Hooded Robin (south-eastern form)	Moderate	N	N

Scientific name	Common name	Sensitivity to Gain Class	Recorded within 10km (NSW BioNet Wildlife Atlas 2020) Y/N	Recorded within site nearby surrounds Y/N
Melithreptus gularis gularis	Black-chinned Honeyeater (eastern subspecies)	Moderate	Y	N
Micronomus norfolkensis	**Eastern Coastal Free-tailed Bat**	**High**	**Y**	**Y**
Miniopterus australis	**Little Bent-winged Bat**	**High**	**Y**	**Y**
Miniopterus orianae oceanensis	**Large Bent-winged Bat**	**High**	**Y**	**Y**
Neophema pulchella	Turquoise Parrot	High	Y	N
Ninox connivens	Barking Owl	High	Y	N
Ninox strenua	**Powerful Owl**	**High**	**Y**	**Y**
Oxyura australis	Blue-billed Duck	Moderate	Y	N
Pandion cristatus	Eastern Osprey	Moderate	Y	N
Petaurus australis	Yellow-bellied Glider	High	N	N
Petroica boodang	Scarlet Robin	Moderate	Y	N
Pomatostomus temporalis temporalis	Grey-crowned Babbler (eastern subspecies)	Moderate	Y	N
Pteropus poliocephalus	Grey-headed Flying-fox	High	Y	N
Rostratula australis	Australian Painted Snipe	Moderate	N	N
Saccolaimus flaviventris	**Yellow-bellied Sheathtail-bat**	**High**	**Y**	**Y**
Scoteanax rueppellii	**Greater Broad-nosed Bat**	**High**	**Y**	**Y**
Stagonopleura guttata	Diamond Firetail	Moderate	N	N

Scientific name	Common name	Sensitivity to Gain Class	Recorded within 10km (NSW BioNet Wildlife Atlas 2020) Y/N	Recorded within site nearby surrounds Y/N
Stictonetta naevosa	Freckled Duck	Moderate	Y	N
Tyto longimembris	Eastern Grass Owl	Moderate	Y	N
Tyto novaehollandiae	Masked Owl	High	Y	N

^ *Habitat surrogates relating to Ecosystem Credits relevant for foraging habitat only*

1.3.2 Species Credit Species

In addition to the above, Species Credit species identified within the Calculator as potentially occurring within the Subject Site are listed below in **Table 6** along with the results of targeted surveys for each within the Subject Site.

Table 6 – Confirmed Candidate threatened species (Species credits)

Scientific Name	Common Name	Specified Survey Period	Recorded within 10km (NSW BioNet Wildlife Atlas 2019) Y/N	Recorded within site or nearby surrounds Y/N
Fauna				
Burhinus grallarius	Bush Stone-curlew	All year	N	N
Callocephalon fimbriatum	Gang-gang Cockatoo	Oct - Jan	Y	N
Calyptorhynchus lathami	Glossy Black-Cockatoo	Mar - Aug	Y	N
Cercartetus nanus	Eastern Pygmy-possum	Oct - Mar	N	N
Chalinolobus dwyeri	Large-eared Pied Bat	Nov – Jan	Y	N
Crinia tinnula	Wallum Froglet	Al year	N	N

Scientific Name	Common Name	Specified Survey Period	Recorded within 10km (NSW BioNet Wildlife Atlas 2019) Y/N	Recorded within site or nearby surrounds Y/N
Delma impar	Striped Legless Lizard	Sept - Dec	N	N
Haliaeetus leucogaster	White-bellied Sea-Eagle	Jul- Dec	Y	N
Hieraaetus morphnoides	Little Eagle	Aug-Oct	Y	N
Hoplocephalus bitorquatus	Pale-headed Snake	Nov-Mar	N	N
Litoria aurea	Green and Golden Bell Frog	Nov - Mar	Y	N
Litoria brevipalmata	Green-thighed Frog	Oct - Mar	N	N
Lophoictinia isura	Square-tailed Kite	Sept - Jan	Y	N
Miniopterus australis (Breeding)	Little Bent-winged Bat	Dec - Feb	Y	N
Miniopterus orianae oceanensis (Breeding)	Large Bent-winged Bat	Dec - Feb	Y	N
Myotis macropus	**Southern Myotis**	**Oct – Mar**	**Y**	**Y**
Ninox connivens	Barking Owl	May – Dec	Y	N
Ninox strenua	Powerful Owl	May – Aug	Y	N
Petaurus norfolcensis	**Squirrel Glider**	**All Year**	**Y**	**Y**
Phascogale tapoatafa	Brush-tailed Phascogale	All Year	Y	N
Planigale maculata	Common Planigale	All Year	N	N

Scientific Name	Common Name	Specified Survey Period	Recorded within 10km (NSW BioNet Wildlife Atlas 2019) Y/N	Recorded within site or nearby surrounds Y/N
Tyto novaehollandiae	Masked Owl	May-Aug	Y	N
Uperoleia mahonyi	Mahony's Toadlet	Oct-Mar	N	N
Vespadelus troughtoni	Eastern Cave Bat	Nov-Dec	Y	N
Flora				
Acacia bynoeana	Bynoe's Wattle	All year	N	N
Asperula asthenes	Trailing Woodruff	Oct-Dec	N	N
Callistemon linearifolius	Netted Bottle Brush	Oct - Jan	Y	N
Cryptostylis hunteriana	Leafless Tongue Orchid	Nov - Jan	N	N
Cynanchum elegans	White-flowered Wax Plant	All year	N	N
Diuris praecox	Rough Doubletail	Aug	N	N
Diuris tricolor	Pine Donkey Orchid	Oct - Dec	N	N
Eucalyptus glaucina	Slaty Red Gum	All year	N	N
Eucalyptus parramattensis subsp. decadens	-	All year	N	N
Grevillea parviflora subsp. parviflora	Small-flower Grevillea	Aug - Nov	Y	N
Maundia triglochinoides	-	Nov - Mar	Y	N
Melaleuca biconvexa	Biconvex Paperbark	All year	N	N
Monotaxis macrophylla	Large-leafed Monotaxis	Aug - Feb	N	N
Ozothamnus tesselatus	-	Sep - Oct	N	N

Scientific Name	Common Name	Specified Survey Period	Recorded within 10km (NSW BioNet Wildlife Atlas 2019) Y/N	Recorded within site or nearby surrounds Y/N
Pomaderris queenslandica	Scant Pomaderris	All Year	N	N
Pterostylis chaetophora	-	Sep - Nov	N	N
Rutidosis heterogama	Heath Wrinklewort	All year	N	N
Tetratheca juncea	Black-eyed Susan	Sep - Oct	Y	N

The following candidate threatened species did not require further survey effort as habitat constraints are not met and were therefore excluded from **Tables 6** and **8**

- *Anthochaera phrygia* (Regent Honeyeater): Consultation of the BAM Important Areas online map (DPIE, 2020) confirmed that the Subject Site is not within mapped areas of important habitat for this species, therefore no further survey is required;
- *Calidris ferruginea* (Curlew Sandpiper): Geographic limitation not met – the Subject Site is not in a mapped area of occurrence for this species;
- *Calidris tenuirostris* (Great Knot): Geographic limitation not met – the Subject Site is not within 5km of the coast or tidal influenced water body;
- *Diuris praecox* (Rough Doubletail): Geographic limitation not met – the Subject Site is not located in the Newcastle LGA;
- *Eucalyptus castrensis* (Singleton Mallee): Geographic limitation not met – the Subject Site is not located near Singleton;
- *Eucalyptus pumila* (Pokolbin Mallee): Geographic limitation not met – the Subject Site is not located west of Pokolbin, or near Wyong or Sandy Hollow;
- *Lathamus discolor* (Swift Parrot) Consultation with BOS Support (15 January 2020) confirmed that the Subject Site is not within draft mapped areas of important habitat for this species, therefore no further survey is required. Copy of such correspondence is provided in **Appendix J**;
- *Limicola falcinellus* (Broad-billed Sandpiper): Geographic limitation not met – the Subject Site is not in a mapped area of occurrence for this species;
- *Limosa limosa* (Black-tailed Godwit): Geographic limitation not met – the Subject Site is not in a mapped area of occurrence for this species;
- *Persoonia pauciflora* (North Rothbury Persoonia): Geographic limitation not met – the Subject Site is not located within 10km of North Rothbury;

- *Petrogale penicillata* (Brush-tailed Rock-wallaby): Habitat constraint not met – the Subject Site is not located within 1km of rocky escarpments, gorges, steep slopes, boulder piles, rock outcrops or clifflines;
- *Phascolarctos cinereus* (Koala): Habitat degraded – assessment against SEPP Koala Habitat Protection revealed the site does not constitute core Koala habitat (see **Appendix I**);
- *Prostanthera cineolifera* (Singleton Mint Bush): Geographic limitation not met – only occurs near Scone, Cessnock and St Albans;
- *Pteropus poliocephalus* (Grey-headed Flying-fox): Habitat constraint not met – no breeding camp occurs on site;
- *Zannichellia paslustris*: Habitat constraint not met – the quarry void, which is now partially full of water located on the Subject Site is highly toxic and largely devoid of underwater vegetation.

1.3.2.1 Threatened Species Survey Effort

Overall survey effort within the Subject Site (for plots, targeted searches, camera traps, Anabat and habitat assessments) is detailed in **Table 7**, and was conducted using relevant guidelines, in particular OEH survey guidelines for plants (2016) and amphibians (2009), along with applicable EPBC guidelines (2010; 2011). Survey effort is shown in **Figures 5 and 6**.

Table 7 – Field Survey Effort – Subject Site

Date	Time	Field Activity	Personnel on Site
10/07/2018	0800 – 1200	Site inspection, incidental fauna survey	2
26/08/2019	0900-1630	Flora transect (*Diuris praecox*), bird survey (Swift Parrot, Regent Honeyeater), incidentals	1
29/08/2019	0830-1240	Flora transect (*Diuris praecox*), bird survey (Swift Parrot, Regent Honeyeater), incidentals	2
22/10/2019	1230-1450	Flora transect (*Tetratheca juncea*), incidentals	2
18/12/2019	0920-1430 2040-2130	Flora transect (*Acacia bynoeana, Callistemon linearifolius, Diuris pedunculata, Eucalyptus glaucina, Eucalyptus parramattensis subsp. decadens, Cynanchum elegans, Grevillea parviflora subsp. parviflora, Persoonia pauciflora, Pomaderris queenslandica, Rutidosis heterogama, Pterostylis chaetophora, Cryptostylis hunteriana*); Targeted fauna survey (Eastern Pygmy-possum, Brush-tailed Rock Wallaby, Bush-stone curlew, Brush-tailed Phascogale, Koala, Common Planigale, Striped Legless Lizard, Square-tailed Kite, Gang-gang cockatoo, White-bellied Sea-eagle), incidentals	2

Date	Time	Field Activity	Personnel on Site
19/12/2019	1000-1400	Deployment of 1 Anabat, 3 camera traps and 1 songmeter; bird survey, incidentals	1
19/12/2019	0900-1200	Flora survey: *Cyanchum elegans, Pomaderris queenslandica, Rutidosis heterogama* and *Pomaderris queenslandica*	2
07/01/2020	0900-1030	Retrieval of Anabat, camera traps and songmeter; incidentals	1
16/01/2020	1000-1030	Anabat installation; incidentals	1
17/01/2020	2015-2215	Nocturnal survey: Broad transect of site including both water bodies on site as well as survey of adjacent sites. Target species: Green-thighed Frog, Green and Golden Bell Frog, Squirrel Glider	1
28/01/2020	1000-1030	Retrieval of Anabat; incidentals	1
10/02/2020		Frog Survey, Nocturnal Survey and Incidentals	1
13/05/2020	0830-1615	4 BAM Plots, incidentals	2
13/05/2020	1200-1930	Habitat assessment, nocturnal stagwatch	1
14/05/2020	0800-1200	2 BAM Plots, incidentals	2

1.3.2.2 Species Presence

All candidate species as identified in **Table 7** were included for presence analysis based on targeted surveys. Species credit species are assessed for potential to occur on site in **Table 9**.

Table 8 – Species Credit Species

Species Biodiversity Risk Weighting (BRW)	Habitat Requirements / Habitats Searched / General Notes	Survey Guidelines	Survey Technique	Timing and Effort	Conclusion
Fauna					
Bush Stone-curlew *Burhinus grallarius* **BRW-2**	The species has a strong preference for habitats with extensive fallen/standing dead timber including logs. The species is mainly found in western slopes and plains and the Riverina, smaller numbers on Central and North Coast with increasing numbers in Tweed Valley. It may be easier to detect during breeding season, possibly calls all year, but it is unclear how well it responds to playback. The species was allocated to a species credit as experts determined that it cannot be predicted to occur at a site based on vegetation surrogates but can be detected reliably from survey.	Diurnal bird census – Flushing by walking through potential habitat. Spotlighting by foot or from a vehicle driven in first gear. Call playback - Sites for Bush Stone-curlew surveys should be 2-4km apart and conducted during the breeding season. BAM-C Survey Period: All Year.	Habitat Assessment Diurnal Bird Census Nocturnal Bird Census Spotlighting Call playback	Diurnal Bird Census conducted August and December 2019. Nocturnal surveys and spotlighting on foot conducted December 2019, January and May 2020. Incidental surveys conducted August, October, November and December 2019; January, February and May 2020	No known records within 10km of Subject Site. Lack of fallen or standing dead timber on Subject Site. Not observed during surveys, does not occur on site. **Therefore, species credits do not apply.**
Gang-gang Cockatoo *Callocephalon fimbriatum* **BRW-2**	The species favours tall mountain forests and woodlands (particularly heavily timbered/mature wet sclerophyll forests) in spring and summer. In winter and autumn, the species moves to lower latitudes and occupies drier more open eucalypt forests and woodlands including dry forest in coastal areas and is often found in urban areas.	Area based survey methods. BAM-C Survey Period: Oct to Jan.	Diurnal Bird Census	Diurnal Bird Census conducted December 2019. Incidental surveys conducted August, October, November and December 2019; January and February	Not observed during surveys, does not occur on site and lack of suitable habitat. **Therefore, species credits do not apply.**
Glossy Black-Cockatoo *Calyptorhynchus lathami* **BRW-2**	The species inhabits open forest and woodlands of the coast where stands of She-oak occur. The species is dependent on large hollow-bearing eucalypts for nest sites.	Area based survey methods. BAM-C Survey Period: Mar to Aug.	Diurnal Bird Census	Diurnal Bird Census conducted August 2019. Incidental surveys conducted August, 2019 and May 2020	Lack of suitable large hollow-bearing eucalypts on Subject Site. Not observed during surveys, does not occur on site. **Therefore, species credits do not apply.**
Eastern Pygmy-possum *Cercartetus nanus* **BRW-2**	The species can be found in a broad range of habitats from rainforest through sclerophyll (including Box-Ironbark) forest and woodland to heath, but in most areas woodlands and heath appear to be preferred, except in north-eastern NSW where they are most frequently encountered in rainforest. Feeds largely on nectar and pollen collected from banksias, eucalypts and bottlebrushes; an important pollinator of heathland plants such as banksias; soft fruits are eaten when flowers are unavailable. Also feeds on insects throughout the year; this feed source may be more important in habitats where flowers are less abundant such as wet forests. Shelters in tree hollows, rotten stumps, holes in the ground, abandoned bird-nests, Ringtail Possum (*Pseudocheirus peregrinus*) dreys or thickets of vegetation, (e.g. grass-tree skirts); nest-building appears to be restricted to breeding females; tree hollows are favoured but spherical nests have been found under the bark of eucalypts and in shredded bark in tree forks. Appear to be mainly solitary, each individual using several nests, with males having non-exclusive home-ranges of about 0.68 hectares and females about 0.35 hectares. Young can be born whenever food sources are available, however most births occur between late spring and early autumn.	The minimum survey effort for site under 100ha should be 2 per vegetation community or habitat type for 14 consecutive nights. Effort per stratification unit up to 50 hectares: Spotlighting on foot - 2 x 1 hour and 1km up to 200 hectares of stratification unit, walking at approximately 1km per hour on 2 separate nights. BAM-C Survey Period: Oct to Mar.	Habitat Assessment Camera Trapping Spotlighting	Nocturnal surveys and spotlighting on foot conducted December 2019, January and May 2020. Camera trapping in December 2019	Not observed during surveys, does not occur on site and lack of suitable habitat. **Therefore, species credits do not apply.**

Species Biodiversity Risk Weighting (BRW)	Habitat Requirements / Habitats Searched / General Notes	Survey Guidelines	Survey Technique	Timing and Effort	Conclusion
Large-eared Pied Bat *Chalinolobus dwyeri* **BRW-3** **Candidate SAII**	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. Females have been recorded raising young in maternity roosts (c. 20-40 females) from November through to January in roof domes in sandstone caves and overhangs. They remain loyal to the same cave over many years. Found in well-timbered areas containing gullies. The relatively short, broad wing combined with the low weight per unit area of wing indicates manoeuvrable flight. This species probably forages for small, flying insects below the forest canopy. Likely to hibernate through the coolest months. It is uncertain whether mating occurs early in winter or in spring.	Minimum four hours of recording immediately after dusk, with whole night recording recommended, ultrasonic recorders located in areas of greatest potential activity. BAM-C/TSDC Survey Period: Nov to Jan.	Habitat Assessment Echolocation Recordings	Nocturnal surveys and spotlighting on foot conducted December 2019, January and May 2020. Anabat echolocation call detector deployed for 12 nights in January 2020	The Subject Site is not located within two kilometres of potential habitat for the species. Furthermore, the species was not detected during echolocation surveys. Therefore, it is considered unlikely to occur on site and Species Credits are not incurred for this species, nor is further SAII assessment required. **Therefore, species credits do not apply.**
Wallum Froglet *Crinia tinnula* **BRW 1.5**	Wallum Froglets are found in a wide range of habitats, usually associated with acidic swamps on coastal sand plains. They typically occur in sedgelands and wet heathlands. They can also be found along drainage lines within other vegetation communities and disturbed areas, and occasionally in swamp sclerophyll forests. The species breeds in swamps with permanent water as well as shallow ephemeral pools and drainage ditches. Breeding is thought to peak in the colder months, but can occur throughout the year following rain. Wallum Froglets shelter under leaf litter, vegetation, other debris or in burrows of other species. Shelter sites are wet or very damp and often located near the water's edge. Males may call throughout the year and at any time of day, peaking following rain.	Systematic day habitat search – one hour per stratification unit. Spotlighting on foot - 2 x 1 hour and 1km up to 200 hectares of stratification unit, walking at approximately 1km per hour on 2 separate nights. BAM-C Survey Period: All Year	Habitat Assessment Targeted Searches after rain Spotlighting	Nocturnal surveys and spotlighting on foot conducted December 2019, January and May 2020. Search after rain conducted in February 2020 (41.8mm rain at Raymond Terrace.)	There are no records in the locality. There is a lack of suitable habitat and the Subject Site is significantly disturbed and in low condition, with toxic water and contaminated riparian zones. **Therefore, species credits do not apply.**
Striped Legless Lizard *Delma Impar* **BRW 1.5**	The Striped Legless Lizard occurs in the Southern Tablelands, the South West Slopes, the Upper Hunter and possibly on the Riverina. Populations are known in the Goulburn, Yass, Queanbeyan, Cooma, Muswellbrook and Tumut areas. Also occurs in the ACT, Victoria and south-eastern South Australia. Habitat is where grassland is dominated by perennial, tussock-forming grasses such as Kangaroo Grass *Themeda australis*, spear-grasses *Austrostipa* spp. and Poa tussocks *Poa* spp., and occasionally wallaby grasses *Austrodanthonia* spp. Sometimes present in modified grasslands with a significant content of exotic grasses. Sometimes found in grasslands with significant amounts of surface rocks, which are used for shelter. Actively hunts for spiders, crickets, moth larvae and cockroaches. Two papery eggs are laid in early summer. Goes below ground or under rocks or logs over winter.	In areas with surface rock, artificial shelter site surveys should be the primary technique. In areas with little to no rocky habitat (such as the ACT), artificial shelter site surveys or pitfall trapping should be used in conjunction with hand searches around tussocks. Artificial shelter site surveys will almost always be preferable to pitfall surveys, as they cause less damage to habitat and detection rates using artificial shelter sites are nearly double that of pit-falling when undertaken during spring. Rock turning can be detrimental to striped legless lizard populations, especially when undertaken regularly. Therefore, this method should be used only when other methods are unavailable and it should never be employed for long-term monitoring. BAM-C Survey Period: Oct to Mar	Habitat Assessment Camera Trapping Spotlighting	Nocturnal surveys and spotlighting on foot conducted December 2019, January and May 2020. Camera trapping in December 2019	Not observed during surveys, does not occur on site and lack of suitable habitat. **Therefore, species credits do not apply.**
White-bellied Sea-Eagle *Haliaeetus leucogaster* **BRW-2**	Terrestrial habitat includes coastal dunes, tidal flats, grassland, heathland, woodland and forest. Requires large emergent eucalypts for nesting. Living or dead mature trees within suitable vegetation within 1km of a rivers, lakes, large dams or creeks, wetlands and coastlines.	Area based survey methods. Habitat assessment – 30 minutes searching each relevant habitat. BAM-C Survey Period: Jul to Dec.	Habitat Assessment Diurnal Bird Census Targeted Surveys	Diurnal Bird Census conducted August and December 2019. Incidental surveys conducted August, October, November and December 2019	Observed incidentally flying over the Subject Site during surveys. No nests were sighted, no potential nesting tees were sighted within the Subject Site. **Therefore, species credits do not apply.**

Species Biodiversity Risk Weighting (BRW)	Habitat Requirements / Habitats Searched / General Notes	Survey Guidelines	Survey Technique	Timing and Effort	Conclusion
Little Eagle *Hieraaetus morphnoides* **BRW-1.5**	Little Eagle are a dual credit species. Foraging habitat is considered an ecosystem credit and breeding is considered a species credit. The species nest in live (occasionally dead) large old trees within vegetation. Paddock trees can provide important breeding habitat (there are examples of nest trees in ACT). Breeding habitat is live (occasionally dead) large old trees within suitable vegetation AND 1. the presence of a male and female; or 2. female with nesting material; or 3. an individual on a large stick nest in the top half of the tree canopy. Where a breeding site has been identified in accordance with the BAM the species polygon should be established by providing a circular buffer of 300m around the nest tree. The purpose of the buffer is to minimise disturbance/avoid clearing, for a development application, or to conserve and improve habitat, for a biodiversity stewardship agreement, within the area essential for breeding. This includes habitat suitable for feeding/grooming perches and fledgling requirements. It does not account for foraging habitat. Little Eagles are less likely than urban-adapted raptors to readily cross urban or peri-urban spaces to hunt. The 300m buffer is in accordance with the ACT offset guidelines for this species.	Habitat assessment – 30 minutes searching each relevant habitat. BAM-C Survey Period: Aug to Oct.	Habitat Assessment Diurnal Bird Census	Diurnal Bird Census conducted August 2019. Incidental surveys conducted August and October 2019	Not observed during surveys. A small stick nest was observed on site in the south-east. However, it was not deemed suitable for this species. Does not occur on site. **Therefore, species credits do not apply.**
Pale-headed Snake *Hoplocephalus bitorquatus* **BRW-2**	Utilises hollows within 500m of sandstone escarpments during summer though gravid females remain near cliffs during the summer. Best surveyed at night by searching areas of rocky sheltering sites close to sandstone escarpments.	Survey in dry weather only to minimise damage to sandstone, must not be too warm. As temperatures increase the species moves to utilising hollows in trees, often in sandstone gullies downslope of outcrops. BAM-C Survey Period: Nov to Mar.	Spotlighting	Nocturnal surveys and spotlighting on foot conducted December 2019, January and May 2020. Camera trapping in December 2019	Not observed during surveys, does not occur on site. No known records within 10km of Subject Site. **Therefore, species credits do not apply.**
Green and Golden Bell Frog *Litoria aurea* **BRW-2**	Habitat for the species includes semipermanent/ephemeral wet areas, within 1km of swamps, waterbodies or wet areas. In high altitude populations calling seasons are restricted to summer months. While chytrid is a potential threat to some populations of the species, other populations are subject to manageable threats. Inhabits marshes, dams and stream-sides, particularly those containing bullrushes (*Typha* spp.) or spikerushes (*Eleocharis* spp.). Some sites, particularly in the Greater Sydney region occur in highly disturbed areas.	Systematic day habitat search – one hour per stratification unit. Spotlighting on foot - 2 x 1 hour and 1km up to 200 hectares of stratification unit, walking at approximately 1km per hour on 2 separate nights. BAM-C Survey Period: Nov to Mar.	Habitat Assessment Targeted Searches after rain Spotlighting	Nocturnal surveys and spotlighting on foot conducted December 2019, January and May 2020. Search after rain conducted in February 2020 (41.8mm rain at Raymond Terrace.)	Not observed during surveys, does not occur on site. There is one record over 3km to the south of the site. There is a lack of suitable habitat. **Therefore, species credits do not apply.**
Green-thighed Frog *Litoria brevipalmata* **BRW-1.5**	The species was allocated to species credit species because presence cannot be predicted from vegetation or landscape surrogates. Experts noted that it is difficult to detect from survey, detection could be optimised by detailed/strict survey guidelines. Survey: reliant on rainfall events for calling/breeding when it is usually detected/surveyed, strongly suggest >75 mm in 24 hrs or 150 mm over 72 hrs as the most probable time to survey and detect the species. Note that tadpole's susceptible to injury during netting, they can be identified from observation. Whilst there is some information on the species ecology little is known about the species response to management. A ground-dwelling frog that inhabits coastal forest and bushland. Calling males gather around temporary or semi-permanent ponds and flooded ditches after heavy rain. Egg masses are often laid in temporary ponds. Tadpoles are predominately surface dwellers, but feed throughout the water body.	Systematic day habitat search – one hour per stratification unit. Spotlighting on foot - 2 x 1 hour and 1km up to 200 hectares of stratification unit, walking at approximately 1km per hour on 2 separate nights. BAM-C Survey Period: Oct to Mar.	Targeted Searches after rain Spotlighting	Nocturnal surveys and spotlighting on foot conducted December 2019, January and May 2020. Search after rain conducted in February 2020 (41.8mm rain at Raymond Terrace.)	There are no records in the locality. There is a lack of suitable habitat and the Subject Site is significantly disturbed and is low condition. **Therefore, species credits do not apply.**
Square-tailed Kite *Lophoictinia isura* **BRW-1.5**	Found in a variety of timbered habitats including dry woodlands and open forests. Nesting sites generally located along or near water courses, in a fork or on large horizontal limbs. The species is allocated to dual credit because they tend to be sensitive to disturbance around nests. It will be difficult to identify a Kite nest (there are lots of comparable sized stick nests built by other species), especially given Kites have large territories and other stick nesters will undoubtedly also be nesting where Kites might be recorded. Kites will need to be in attendance to confirm breeding sites.	Habitat assessment – 30 minutes searching each relevant habitat. BAM-C Survey Period: Sep - Jan	Habitat Assessment Diurnal Bird Census	Diurnal Bird Census conducted December 2019. Incidental surveys conducted October, November and December 2019; and January 2020	Not observed during surveys. No suitable stick nests were observed within the Subject Site. Does not occur on site although observed foraging in the locality. **Therefore, species credits do not apply.**

Species Biodiversity Risk Weighting (BRW)	Habitat Requirements / Habitats Searched / General Notes	Survey Guidelines	Survey Technique	Timing and Effort	Conclusion
Little Bent-winged Bat *Miniopterus australis* (Breeding) **BRW-3** **Candidate SAII**	Moist eucalypt forest, rainforest, vine thicket, wet and 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. They often share roosting sites with the Large Bent-winged Bat and, in winter, the two species may form mixed clusters.	2 separate nights continuous recording from dusk per site (minimum 4 hrs); 4 separate nights continuous recording from dusk per site (minimum 4 hours) unattended detectors or 3 separate nights for 1-2 hrs after dusk if detectors are attended in target habitat. Potential threatened species roost sites that may be impacted by proposal should be targeted and investigated – for stag watching, observe roost entrance from 30 min prior to sunset until 60 min after sunset – cameras may also be used for this purpose if they are able to be positioned in a suitable location. BAM-C Survey Period: Dec to Feb.	Habitat assessment Echolocation call recording and analysis	Nocturnal surveys and spotlighting on foot conducted December 2019, January and May 2020. Anabat echolocation call detector deployed for 12 nights in January 2020	Recorded in January, however the site has no breeding potential. The Subject Site would provide seasonal foraging habitat for the species; however, this impact is covered within the ecosystem credits. **Therefore, species credits do not apply.**
Large Bent-winged Bat *Miniopterus orianae oceanensis* (Breeding) **BRW-3** **Candidate SAII**	The habitat constraint for the species *is Cave, tunnel, mine, culvert or other structure known or suspected to be used breeding including species records with microhabitat code "IC - in cave;" observation type code "E nest-roost;" with numbers of individuals >500.* Any impacts on breeding habitat could be considered potentially serious and irreversible. This species is retained as dual credit because foraging habitat is broad ranging but breeding habitat is highly specific. At lower altitudes this species is usually more abundant during winter months, the lower numbers of individuals from October to February are due to females moving to maternity sites. Additionally, selected <1 for average number of offspring because females do not give birth every time (often miscarry, etc.). Potential breeding habitat is caves, tunnels, mines or other structures known or suspected to be used by *M. orianae oceanensis* 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. All breeding habitat including the cave, or other features, used for breeding and the area immediately surrounding this feature must be mapped. Species polygon boundaries should have a 100m radius buffer around an accurate GPS point location centred on the cave/feature entrance.	2 separate nights continuous recording from dusk per site (minimum 4 hrs); 4 separate nights continuous recording from dusk per site (minimum 4 hours) unattended detectors or 3 separate nights for 1-2 hrs after dusk if detectors are attended in target habitat. Potential threatened species roost sites that may be impacted by proposal should be targeted and investigated – for stag watching, observe roost entrance from 30 min prior to sunset until 60 min after sunset – cameras may also be used for this purpose if they are able to be positioned in a suitable location. BAM-C Survey Period: Dec to Feb.	Habitat assessment Echolocation call recording and analysis	Nocturnal surveys and spotlighting on foot conducted December 2019, January and May 2020. Anabat echolocation call detector deployed for 12 nights in January 2020	Not observed definitely within the Subject Site during surveys, no breeding potential at site. The Subject Site also lacks suitable habitat and is disturbed and in low condition. **Therefore, species credits do not apply.**
Southern Myotis *Myotis macropus* **BRW-2**	The habitat constraint for Southern Myotis is hollow bearing trees within 200m of riparian zone. The species was allocated to species credit because it is dependent on waterways with pools of 3m wide or greater for foraging (which will be protected under legislation), habitat surrounding waterways is used for breeding and roosting. The species can be detected via survey using appropriate techniques (see Threatened Bat Survey Guide). Constraints based on information from Campbell Susan (2009). All habitat on the subject land where the subject land is within 200m of a waterbody with pools/ stretches 3m or wider including rivers, creeks, billabongs, lagoons, dams and other waterbodies on the subject land must be mapped. Use aerial imagery to map waterbodies with pools/ stretches 3m or wider on or within 200m of the subject land. Species polygon boundaries should align with PCTs on the subject land to which the species is associated that are within 200m of waterbodies mapped.	Minimum four hours of recording immediately after dusk, with whole night recording recommended, ultrasonic recorders located in areas of greatest potential activity A minimum of four nights survey and 16 nights total survey effort per <2.5km riparian length with acoustic recorders. Roost search: Potential breeding habitat searched for bat or bat sign using a torch. If detected, trapping may be necessary to identify species and/or breeding status. BAM-C Survey Period: Oct to Mar.	Habitat assessment	Nocturnal surveys and spotlighting on foot conducted December 2019, January and May 2020. Anabat echolocation call detector deployed for 12 nights in January 2020	The species was identified as part of species group, meaning it cannot be definitively ruled out solely based on call analysis. Microbats were observed fishing within the dam and hollow-bearing trees, means the species may occur utilise the site for roosting or breeding. Therefore a species polygon was produced to calculate species credits. **<u>Species Credit Species</u>**

Species Biodiversity Risk Weighting (BRW)	**Habitat Requirements / Habitats Searched / General Notes**	**Survey Guidelines**	**Survey Technique**	**Timing and Effort**	**Conclusion**
Barking Owl *Ninox connivens* **BRW-2**	Inhabits woodland and open forest, including fragmented remnants and partly cleared farmland. Roosts in shaded portions of tree canopies. Requires large old trees with hollows for nesting. Barking Owl are a dual credit species. Foraging habitat is considered an ecosystem credit and breeding is considered a species credit	Call playback - Sites should be separated by 800 metres – 1km, and each site must have the playback session repeated as follows: at least 5 visits per site, on different nights. Day habitat search: Search habitat for pellets, and likely hollows. Stag-watching: Observing potential roost hollows for 30mins prior to sunset and 60mins following sunset. BAM-C Survey Period: May to Dec.	Habitat Assessment Diurnal Bird Census Nocturnal Bird Census Spotlighting Call Playback	Diurnal Bird Census conducted August and December 2019. Nocturnal surveys and spotlighting on foot conducted December 2019 and May 2020. Incidental surveys conducted August, October, November and December 2019; and May 2020	Not observed during surveys. Suitable large hollows for breeding are not present. **Therefore, species credits do not apply.**
Powerful Owl *Ninox strenua* **BRW-2**	The species inhabits a range of vegetation types from woodland and open sclerophyll forest to tall open wet forest and rainforest. Requires large tree hollows (≥0.5m deep) in large eucalypts (DBH 80-240cm) that are at least 150 years old. Powerful Owl are a dual credit species. Foraging habitat is considered an ecosystem credit and breeding is considered a species credit.	Call playback - Sites should be separated by 800 metres – 1km, and each site must have the playback session repeated at least 5 visits per site, on different nights. Day habitat search: Search habitat for pellets, and likely hollows. Stag-watching: Observing potential roost hollows for 30mins prior to sunset and 60mins following sunset. BAM-C Survey Period: May to Aug.	Habitat Assessment Diurnal Bird Census Nocturnal Bird Census Spotlighting Call Playback	Diurnal Bird Census conducted August 2019. Nocturnal surveys and spotlighting on foot conducted May 2020. Incidental surveys conducted August 2019 and May 2020	Not observed during surveys. Suitable large hollows for breeding are not present. **Therefore, species credits do not apply.**
Squirrel Glider *Petaurus norfolcensis* **BRW-2**	Inhabits Blackbutt-Bloodwood forest with heath understorey in coastal areas. Lives in family groups. Requires abundant tree hollows for refuge and nesting. Survey year round but sites with bi-pinnate acacia, autumn winter flowering trees and shrubs such as Eucalyptus robusta and Banksia sp (integrifolia etc.) should be subject to a more retracted survey period of between March-August. Relies on large old trees with hollows for breeding and nesting. These trees are also critical for movement and typically need to be closely-connected (i.e. no more than 50 m apart). Important known food plants – Eucalyptus siderophloia/tereticornis/pilularis/robusta, Corymbia maculata/gummifera, Melaleuca quinquenervia, Acacia irrorata/longifolia, Banksia.	Effort per stratification unit up to 50 hectares: Spotlighting on foot - 2 x 1 hour and 1km up to 200 hectares of stratification unit, walking at approximately 1km per hour on 2 separate nights. Stagwatching - Observing potential roost hollows for 30 minutes prior to sunset and 60 minutes following sunset BAM-C/TBDC Survey Period: All Year	Targeted Searches, Habitat Assessment, Spotlighting, Camera Trapping	Nocturnal surveys and spotlighting on foot conducted December 2019, January and May 2020. Camera trapping in December 2019	Camera trapping produced inconclusive photographic evidence of Glider presence on site. Furthermore, the presence of hollow-bearing trees and vegetation corridors in moderate condition along the western, southern and south-eastern boundaries mean the species has potential to occur on site. Therefore, presence of Squirrel Glider on site is assumed and a species polygon was produced to calculate credits. **Species Credit Species**
Brush-tailed Phascogale *Phascogale tapoatafa* **BRW-2**	The species preferred habitat includes hollow logs, under bark, rocks, cracks in soil, grass tussocks or building debris. The species prefer dry sclerophyll open forest with sparse groundcover of herbs, grasses, shrubs or leaf litter, however they can also inhabit heath, swamps, rainforest and wet sclerophyll forest. Agile climber foraging preferentially in rough barked trees of 25 cm DBH or greater. They feed mostly on arthropods but will also eat other invertebrates, nectar and sometimes small vertebrates. Females have exclusive territories of approximately 20 - 40 ha, while males have overlapping territories often greater than 100 ha. They nest and shelter in tree hollows with entrances 2.5 - 4 cm wide and can use many different hollows over a short time span. Mating occurs May – July.	Effort per stratification unit up to 50 hectares: Spotlighting on foot - 2 x 1 hour and 1km up to 200 hectares of stratification unit, walking at approximately 1km per hour on 2 separate nights BAM-C Survey Period: All Year.	Targeted Searches, Habitat Assessment, Spotlighting, Camera Trapping	Nocturnal surveys and spotlighting on foot conducted December 2019, January and May 2020. Camera trapping in December 2019	Not observed during surveys. There is one record approx. 2km to the east of the site and four records approx. 4km to the north and south of the site. Given the disturbed nature and lack of HBTs on site it has been determined that there is limited nesting and foraging opportunities for this species. **Therefore, species credits do not apply.**
Common Planigale *Planigale maculata* **BRW-2**	Inhabit rainforest, eucalypt forest, heathland, marshland, grassland and rocky areas where there is surface cover, and usually close to water. They are active at night and during the day shelter in saucer-shaped nests built in crevices, hollow logs, beneath bark or under rocks.	Effort per stratification unit up to 50 hectares: Spotlighting on foot - 2 x 1 hour and 1km up to 200 hectares of stratification unit, walking at approximately 1km per hour on 2 separate nights BAM-C Survey Period: All year.	Camera Trapping Spotlighting	Nocturnal surveys and spotlighting on foot conducted December 2019, January and May 2020. Camera trapping in December 2019	Not observed during surveys. There are no BioNet records within 10km of the Subject Site. **Therefore, species credits do not apply.**

Species Biodiversity Risk Weighting (BRW)	**Habitat Requirements / Habitats Searched / General Notes**	**Survey Guidelines**	**Survey Technique**	**Timing and Effort**	**Conclusion**
Masked Owl *Tyto novaehollandiae* **BRW-2**	Lives in dry eucalypt forests and woodlands from sea level to 1100m. Uses large tree hollows or sometimes caves for nesting. Dead stags are used for roosting/breeding habitat Masked Owl can nest in living or dead trees with hollows greater than 20cm diameter. In Tas and Vic Masked owls have been recording nesting in paddock trees. Has been found to nest in caves in Tasmania but there is no evidence to suggest that this occurs in NSW.	Call playback - Sites should be separated by 800 metres – 1km, and each site must have the playback session repeated as follows: · at least 5 visits per site, on different nights. Day habitat search: Search habitat for pellets, and likely hollows. Stag-watching: Observing potential roost hollows for 30mins prior to sunset and 60mins following sunset. BAM-C Survey Period: May to Aug.	Habitat Assessment Spotlighting Call playback	Nocturnal surveys and spotlighting on foot conducted December 2019, January and May 2020. Camera trapping in December 2019	Not observed during surveys. Suitable large hollows for breeding are not present. **Therefore, species credits do not apply.**
Mahony's Toadlet *Uperoleia mahonyi* **BRW-2**	Current observations indicate Mahony's Toadlet inhabits ephemeral and semi-permanent swamps and swales on the coastal fringe of its range. Known records occur in heath or wallum habitats almost exclusively associated with leached (highly nutrient impoverished) white sand. Commonly associated with acid paperbark swamps, Mahony's Toadlet also is known to occur in wallum heath, swamp mahogany-paperbark swamp forest, heath shrubland and Sydney red gum woodland. Recent studies suggest intact vegetation adjacent to and within water bodies is an important habitat feature for this species. Known records are associated with shallow ephemeral/semi-permanent water bodies with limited flow of water. Aquatic vegetation at breeding sites includes sedges (Schoenoplectus spp., Baumea spp. and Lepyrodia articulata) and Broadleaf Cumbungi (Typha orientalis). Females have been recorded up to 400m from water-bodies indicating moderate dispersal distances and use of multiple habitat types. Tadpoles have been observed using leaf litter in the shallow verges of water bodies on sandy substrate. Rocks, logs and leaf litter may also be used for shelter and provide important foraging areas for invertebrate prey items.	Systematic day habitat search – one hour per stratification unit. Spotlighting on foot - 2 x 1 hour and 1km up to 200 hectares of stratification unit, walking at approximately 1km per hour on 2 separate nights. BAM-C Survey Period: Oct to Mar.	Targeted Searches after rain Spotlighting	Nocturnal surveys and spotlighting on foot conducted December 2019, January and May 2020. Search after rain conducted in February 2020 (41.8mm rain at Raymond Terrace.)	Not observed during surveys, does not occur on site. There is one record over 3km to the south of the site. There is a lack of suitable habitat. **Therefore, species credits do not apply.**
Eastern Cave Bat *Vespadelus troughtoni* **BRW-3** **Candidate SAII**	The species is a full species credit because it cannot be reliably predicted to occur on a site based on vegetation and other landscape features (breeding or foraging). SAII threshold is potential breeding habitat and presence of breeding individuals. The fecundity of the species is not well known, therefore precautionary approach taken to assign category. Additionally, selected <1 for average number of offspring because females do not give birth every (often miscarry etc). Potential breeding habitat is PCTs associated with the species within 100m of rocky areas, caves, overhangs crevices, cliffs and escarpments, or old mines or tunnels, old buildings and sheds within the potential habitat. Surveys must be undertaken as per the Threatened Bat Survey Guide to confirm breeding habitat. All breeding habitat on or within 100m of the subject land and the area immediately surrounding the feature must be mapped. Artificial structures should be inspected and included on the map if the species is using these features for breeding. All habitat for this species should also be mapped if present. Species mapping polygon for breeding habitat must use high resolution aerial imagery and topographic maps to identify features on the subject land (caves, scarps, cliffs etc). Polygon boundaries must be at least 100m wide (or 100m diameter for point locations such as caves) with the breeding habitat features (may be multiple) as the centroid (see Threatened Bat Survey Guide). When the species is present on the subject land and the proposed impact is not a potential SAII, standard species credits will be generated. All habitat on the subject land where the subject land is within 2km of caves, scarps, cliffs, rock overhangs and disused mines must be mapped. Use high resolution aerial imagery and topographic maps to	Minimum 4 nights of harp trapping or acoustic detectors placed close to exits of caves, mines or tunnels. Two traps per night over two nights, repeated at least two weeks later is required Roost search 1 per structure (30 mins) Radio tracking can be used to refine but not eliminate from Subject Site. BAM-C/ TBDC Survey Period: Nov to Jan.	Harp Trapping or Acoustic detector or Radio Tracking (Optional) (Note that it is almost impossible to tell the difference between some *Vespadelus* sp. calls via acoustic equipment)	Nocturnal surveys and spotlighting on foot conducted December 2019, January and May 2020. Anabat echolocation call detector deployed for 12 nights in January 2020	Identified as potentially occurring as part of a species group. However, no nesting potential at site. The Subject Site also lacks suitable habitat given its disturbed condition. **Therefore, species credits do not apply.**

Species Biodiversity Risk Weighting (BRW)	Habitat Requirements / Habitats Searched / General Notes	Survey Guidelines	Survey Technique	Timing and Effort	Conclusion
	identify potential roost habitat features on the subject land within 2km caves, scarps, cliffs etc. Species polygon boundary should align with PCTs on the subject land to which the species is associated that are within 2km of identified potential roost habitat features.				
Flora					
Bynoe's Wattle *Acacia bynoeana* **BRW - 2**	Occurs in heath or dry sclerophyll forest on sandy soils. Seems to prefer open, sometimes slightly disturbed sites such as trail margins, edges of roadside spoil mounds and in recently burnt patches. Associated overstorey species include Red Bloodwood, Scribbly Gum, Parramatta Red Gum, Saw Banksia and Narrow-leaved Apple. Bynoe's wattle is found in central eastern NSW, from the Hunter District (Morisset) south to the Southern Highlands and west to the Blue Mountains. The species is currently known from about 30 locations, with the size of the populations at most locations being very small (1-5 plants). It has recently been found in the Colymea and Parma Creek areas west of Nowra	Parallel walking transects – Maximum distance between transects 20m in open, 10m in dense vegetation. For each hectare of potential habitat average field traverse length 1km at 10m separation or 0.5km at 20m separation. BAM-C/ TBDC Survey Period: Sept to Mar.	Habitat Assessment Targeted Search Parallel Transects	Parallel transects conducted October and December 2019	This species was not observed on site. There are many constraints within the Subject Site that restrict and / or prohibit this species from the site such as trampling, high weed loads and the low condition. **Therefore, species credits do not apply.**
Trailing Woodruff *Asperula asthenes* **BRW-2**	This small herb occurs only in NSW. It is found in scattered locations from Bulahdelah north to near Kempsey, with several records from the Port Stephens / Wallis Lakes area / Forster (including Myall Lakes NP, New England NP, Wallingat NP and Darawnk NR). Occurs in damp sites, often along river banks.	Parallel walking transects – Maximum distance between transects 10m in open, 5m in dense vegetation. For each hectare of potential habitat average field traverse length 2km at 5m separation or 1km at 10m separation. BAM-C/ TBDC Survey Period: Oct to Dec.	Habitat Assessment Targeted Search Parallel Transects	Parallel transects conducted October and December 2019	This species was not observed on site. There are many constraints within the Subject Site that restrict and / or prohibit this species from the site such as trampling, high weed loads and the low condition. **Therefore, species credits do not apply.**
Netted Bottle Brush *Callistemon linearifolius* **BRW-2**	Recorded from the Georges River to Hawkesbury River in the Sydney area, and north to the Nelson Bay area of NSW. Grows in dry sclerophyll forest on the coast and adjacent ranges. Flowers Spring to Summer	Parallel walking transects – Maximum distance between transects 20m in open, 10m in dense vegetation. For each hectare of potential habitat average field traverse length 1km at 10m separation or 0.5km at 20m separation. BAM-C Survey Period: Oct to Jan.	Habitat Assessment Targeted Search Random Meander Parallel Transects	Parallel transects conducted October and December 2019	This species was not observed on site. There are many constraints within the Subject Site that restrict and / or prohibit this species from the site such as trampling, high weed loads and the disturbed condition, resulting in the vegetation being in a degraded state. **Therefore, species credits do not apply.**
Leafless Tongue Orchid *Cryptostylis hunteriana* **BRW-2**	A leafless orchid only undetectable when flowering. Does not appear to have well defined habitat preferences, known from a range of communities including swamp-heath and woodland. Associated with *Eucalyptus sclerophylla*, *E. sieberi*, *Corymbia gummifera* and *Allocasuarina littoralis*. Often occurs in association with more common *C. subulata* and *C. erecta* which can signify suitable niche habitat within a locale.	Parallel walking transects – Maximum distance between transects 10m in open, 5m in dense vegetation. For each hectare of potential habitat average field traverse length 2km at 5m separation or 1km at 10m separation. When local reference population is flowering. BAM-C Survey Period: Nov to Jan.	Habitat Assessment Targeted Search Random Meander Parallel Transects	Parallel transects conducted December 2019	This species was not observed on site. There are many constraints within the Subject Site that restrict and / or prohibit this species from the site such as trampling, high weed loads and the disturbed condition, resulting in the vegetation being in a degraded state. **Therefore, species credits do not apply.**

Species Biodiversity Risk Weighting (BRW)	Habitat Requirements / Habitats Searched / General Notes	Survey Guidelines	Survey Technique	Timing and Effort	Conclusion
White-flower Wax Plant *Cynanchum elegans* **BRW-2**	The White-flowered Wax Plant usually occurs on the edge of dry rainforest vegetation. Other associated vegetation types include littoral rainforest; Coastal Tea-tree *Leptospermum laevigatum* – Coastal Banksia *Banksia integrifolia subsp. integrifolia* coastal scrub; Forest Red Gum *Eucalyptus tereticornis* aligned open forest and woodland; Spotted Gum *Corymbia maculata* aligned open forest and woodland; and Bracelet Honeymyrtle *Melaleuca armillaris* scrub to open scrub. Flowering occurs between August and May, with a peak in November. Flower abundance on individual plants varies from sparse to prolific. The fruit can take up to six months to mature.	Parallel walking transects – Maximum distance between transects 10m in open, 5m in dense vegetation. For each hectare of potential habitat average field traverse length 2km at 5m separation or 1km at 10m separation. BAM-C Survey Period: All year.	Habitat Assessment Targeted Search Parallel Transects	Parallel transects conducted August, October and December 2019	This species was not observed on site. There are many constraints within the Subject Site that restrict and / or prohibit this species from the site such as trampling, high weed loads and the degraded condition. **Therefore, species credits do not apply.**
Pine Donkey Orchid *Diuris tricolor* **BRW-1.5**	Disturbance regimes are not known, although the species is usually recorded from disturbed habitats. Associated species include *Callitris glaucophylla*, *Eucalyptus populnea*, *Eucalyptus intertexta*, Ironbark and Acacia shrubland. The understorey is often grassy with herbaceous plants such as Bulbine species. Usually flowers between early September to late October. The species is a tuberous, deciduous terrestrial orchid and the flowers have a pleasant, light sweet scent. The Pine Donkey Orchid grows in sclerophyll forest among grass, often with native Cypress Pine (Callitris spp.). It is found in sandy soils, either on flats or small rises. Also recorded from a red earth soil in a Bimble Box community in western NSW. Usually recorded as common and locally frequent in populations, however only one or two plants have also been observed at sites. The species has been noted as growing in large colonies.	Parallel walking transects – Maximum distance between transects 10m in open, 5m in dense vegetation. For each hectare of potential habitat average field traverse length 2km at 5m separation or 1km at 10m separation. BAM-C Survey Period: Sep to Oct.	Habitat Assessment Targeted Search Parallel Transects	Parallel transects conducted October 2019	This species was not observed on site. There are many constraints within the Subject Site that restrict and / or prohibit this species from the site such as trampling, high weed loads and the degraded condition. **Therefore, species credits do not apply.**
Rough Doubletail *Diuris Praecox* **BRW – 1.5**	Known from between Bateau Bay and Smiths Lake Grows on hills and slopes of near-coastal districts in open forests which have a grassy to fairly dense understorey Exists as subterranean tubers most of the year. It produces leaves and flowering stems in winter from Jul to early Sep	Parallel walking transects – Maximum distance between transects 10m in open, 5m in dense vegetation. For each hectare of potential habitat average field traverse length 2km at 5m separation or 1km at 10m separation. When local reference population is flowering. BAM-C/ TBDC Survey Period: Jul to Aug	Habitat Assessment Targeted Search Parallel Transects	Parallel transects conducted August 2019	This species was not observed on site. There are many constraints within the Subject Site that restrict and / or prohibit this species from the site such as trampling, high weed loads and the disturbed condition, resulting in the vegetation being in a degraded state. **Therefore, species credits do not apply.**
Slaty Red Gum *Eucalyptus glaucina* **BRW – 2**	Found only on the north coast of NSW and in separate districts near Casino where it can be locally common and farther south from Taree to Broke west of Maitland. Grows in grassy woodland and dry eucalypt forest, on deep, moderately fertile and well-watered soils.	Parallel walking transects - Maximum distance between transects 40m in open vegetation, 20m in dense vegetation. For each hectare of potential habitat average field traverse length 0.5km at 20m separation or 0.25km at 40m separation. BAM-C/ TBDC Survey Period: All year	Habitat Assessment Targeted Search Parallel Transects	Parallel transects conducted August, October and December 2019	This species was not observed on site. There are many constraints within the Subject Site that restrict and / or prohibit this species from the site such as trampling, high weed loads and the disturbed condition, resulting in the vegetation being in a degraded state. **Therefore, species credits do not apply.**

Species Biodiversity Risk Weighting (BRW)	**Habitat Requirements / Habitats Searched / General Notes**	**Survey Guidelines**	**Survey Technique**	**Timing and Effort**	**Conclusion**
Eucalyptus parramattensis subsp. decadens **BRW – 2**	There are two separate meta-populations of E. parramattensis subsp. decadens. The Kurri Kurri meta-population is bordered by Cessnock—Kurri Kurri in the north and Mulbring—Aberdare in the south. Large aggregations of the subspecies are located in the Tomalpin area. The Tomago Sandbeds meta-population is bounded by Salt Ash and Tanilba Bay in the north and Williamtown and Tomago in the south. Generally, occupies deep, low-nutrient sands, often those subject to periodic inundation or where water tables are relatively high. It occurs in dry sclerophyll woodland with dry heath understorey. It also occurs as an emergent in dry or wet heathland. Often where this species occurs, it is a community dominant.	Parallel walking transects – Maximum distance between transects 40m in open, 20m in dense vegetation For each hectare of potential habitat average field traverse length 0.5km at 20m separation or 0.25km at 40m separation BAM-C/ TBDC Survey Period: All year	Habitat Assessment Targeted Search Parallel Transects	Parallel transects conducted August, October and December 2019	This species was not observed on site. There are many constraints within the Subject Site that restrict and / or prohibit this species from the site such as trampling, high weed loads and the disturbed condition, resulting in the vegetation being in a degraded state. **Therefore, species credits do not apply.**
Small-flower Grevillea *Grevillea parviflora subsp. parviflora* **BRW-2**	Grows in sandy or light clay soils usually over thin shales, often with lateritic ironstone gravels and nodules. Sydney region occurrences are usually on Tertiary sands and alluvium, and soils derived from the Mittagong Formation. Occurs in a range of vegetation types from heath and shrubby woodland to open forest. In Sydney it has been recorded from Shale Sandstone Transition Forest and in the Hunter in Kurri Sand Swamp Woodland. However, other communities are occupied in other locations where the species can be found.	Parallel walking transects – Maximum distance between transects 15m in open, 10m in dense vegetation. For each hectare of potential habitat average field traverse length 1km at 10m separation or 0.75km at 15m separation. BAM-C Survey Period: Aug – Nov.	Habitat Assessment Targeted Search Random Meander Parallel Transects	Parallel transects conducted August and October 2019	This species was not observed on site. There are many constraints within the Subject Site that restrict and / or prohibit this species from the site such as trampling, high weed loads and the disturbed condition, resulting in the vegetation being in a degraded state. **Therefore, species credits do not apply.**
*Maundia triglochinoides***BRW-2**	Restricted to coastal NSW and extending into southern Queensland. The current southern limit is Wyong; former sites around Sydney are now extinct. Grows in swamps, lagoons, dams, channels, creeks or shallow freshwater 30 - 60 cm deep on heavy clay, low nutrients. Flowering occurs during warmer months. Associated with wetland species e.g. *Triglochin procerum*. Probably wind pollinated. Diaspore is the seed and root tubers, which are probably dispersed by water. Spreads vegetatively, with tufts of leaves arising along rhizome. Populations expand following flood events and contract to more permanent wetlands in times of low rainfall.	Parallel walking transects – Maximum distance between transects 10m in open, 5m in dense vegetation. For each hectare of potential habitat average field traverse length 2km at 5m separation or 1km at 10m separation. BAM-C/ TBDC Survey Period: Nov to Mar.	Habitat Assessment Targeted Search Random Meander Parallel Transects	Parallel transects conducted October and December 2019	This species was not observed on site. There are many constraints within the Subject Site that restrict and / or prohibit this species from the site such as trampling, high weed loads and the disturbed condition, resulting in the vegetation being in a degraded state. **Therefore, species credits do not apply.**
Biconvex Paperbark *Melaleuca biconvexa* **BRW-2**	Biconvex Paperbark is only found in NSW, with scattered and dispersed populations found in the Jervis Bay area in the south and the Gosford-Wyong area in the north. Biconvex Paperbark generally grows in damp places, often near streams or low-lying areas on alluvial soils of low slopes or sheltered aspects.	Parallel walking transects – Maximum distance between transects 20m in open, 10m in dense vegetation For each hectare of potential habitat average field traverse length 1km at 10m separation or 0.5km at 20m separation BAM-C/ TBDC Survey Period: All year	Habitat Assessment Targeted Search Parallel Transects	Parallel transects conducted August, October and December 2019	Survey efforts failed to detect any sign of the conspicuous species. **Therefore, species credits do not apply.**

Species Biodiversity Risk Weighting (BRW)	Habitat Requirements / Habitats Searched / General Notes	Survey Guidelines	Survey Technique	Timing and Effort	Conclusion
Large-leafed Monotaxis *Monotaxis macrophylla* **BRW-2**	The distribution and supposed rarity of *Monotaxis macrophylla* within NSW is related to the occurrence of fire. At least within NSW, the species has not been found in the absence of fire. There is a great diversity in the associated vegetation within NSW (less though in Queensland), encompassing coastal heath, arid shrubland, forests and montane heath from almost sea level to 1300 m altitude. *Monotaxis macrophylla* displays the properties of a fire ephemeral species in many ways. Germination is stimulated by the passage of fire, individual plants have a short life span, a large biomass is produced in a short period of time, flowering occurs shortly after germination, and populations do not persist in the absence of fire. Flowers in August. Plants have a short life span and do not seem to persist longer than six months. Plants germinate, attain heights of up to 50 cm and reach flowering stage within 2 to 3 months. In only a few months after germination, the species was observed to produce a thick sward that dominated the community, yielding a very large biomass in a short time. Many hundreds of plants have been observed growing with *Muehlenbeckia costata* on recently burnt rock outcrops. Plants are recorded as common but localised in populations. In the northern NSW sites, *Monotaxis macrophylla* was locally abundant on outcrops especially where burnt. Grows on rocky ridges and hillsides.	Parallel walking transects – Maximum distance between transects 10m in open, 5m in dense vegetation. For each hectare of potential habitat average field traverse length 2km at 5m separation or 1km at 10m separation. BAM-C/ TBDC Survey Period: Aug to Feb.	Habitat Assessment Targeted Search Parallel Transects	Parallel transects conducted August, October and December 2019	This species was not observed on site. There are many constraints within the Subject Site that restrict and / or prohibit this species from the site such as inadequate habitat, trampling, high weed loads and the disturbed condition, resulting in the vegetation being in a degraded state. **Therefore, species credits do not apply.**
Ozothamnus tesselatus **BRW-1.5**	Restricted to a few locations in an east-west zone south of Bunnan and between west Bylong and east Ravensworth. Grows in eucalypt woodland.	Parallel walking transects – Maximum distance between transects 10m in open, 5m in dense vegetation. For each hectare of potential habitat average field traverse length 2km at 5m separation or 1km at 10m separation. When local reference population is flowering. BAM-C/ TBDC Survey Period: Sep	Habitat Assessment Targeted Search Parallel Transects	Parallel transects conducted August and October 2019	Targeted survey efforts failed to detect any sign of the species. **Therefore, species credits do not apply.**
Tall Knotweed *Persicaria elatior* **BRW-2**	Species normally grows in damp places, especially beside streams and lakes. Occasionally in swamp forest or associated with disturbance. Tall Knotweed has been recorded in south-eastern NSW (Mt Dromedary (an old record), Moruya State Forest near Turlinjah, the Upper Avon River catchment north of Robertson, Bermagui, and Picton Lakes. In northern NSW it is known from Raymond Terrace (near Newcastle) and the Grafton area (Cherry Tree and Gibberagee State Forests). The species also occurs in Queensland. Survey: Sometimes this species dies off above ground off in winter, but in other situations can persist through winter. It can be identified from its leaves without flowers. References: RMS surveys.	Targeted survey in suitable habitat including damp places, especially beside streams and lakes. BAM-C/ TBDC Survey Period: Dec to May	Habitat Assessment Targeted Search Parallel Transects	Parallel transects conducted August, October and December 2019	Targeted survey efforts failed to detect any sign of the species. **Therefore, species credits do not apply.**

Species Biodiversity Risk Weighting (BRW)	**Habitat Requirements / Habitats Searched / General Notes**	**Survey Guidelines**	**Survey Technique**	**Timing and Effort**	**Conclusion**
Scant Pomaderris *Pomaderris queenslandica* **BRW-2**	Limited information is available on this species. Found in moist eucalypt forest or sheltered woodlands with a shrubby understorey, and occasionally along creeks.	Parallel walking transects – Maximum distance between transects 20m in open, 10m in dense vegetation. For each hectare of potential habitat average field traverse length 1km at 10m separation or 0.5km at 20m separation. BAM-C/ TBDC Survey Period: All year	Habitat Assessment Targeted Search Parallel Transects	Parallel transects conducted August, October and December 2019	The species was not detected within the Subject Site despite targeted searches. Potential habitat present is highly degraded. **Therefore, species credits do not apply.**
Pterostylis chaetophora **BRW-2**	Recorded in Queensland and NSW. In NSW it is currently known from 18 scattered locations in a relatively small area between Taree and Kurri Kurri, extending to the south-east towards Tea Gardens and west into the Upper Hunter, with additional records near Denman and Wingen. There are also isolated records from the Sydney region. The species occurs in two conservation reserves, Columbey National Park and Wingen Maid Nature Reserve. The preferred habitat is seasonally moist, dry sclerophyll forest with a grass and shrub understorey. Flowers from September to November. Vegetative reproduction is not common in this group of Greenhoods, but some species may form more than one dropper annually. Fails to flower in dry seasons. Plants are deciduous and die back to the large, underground tubers after seed release. New rosettes are produced following soaking autumn and winter rains.	Parallel walking transects – Maximum distance between transects 10m in open, 5m in dense vegetation. For each hectare of potential habitat average field traverse length 2km at 5m separation or 1km at 10m separation. When local reference population is flowering. BAM-C Survey Period: Sep to Nov.	Habitat Assessment Targeted Search Parallel Transects	Parallel transects conducted October and December 2019	The species was not detected within the Subject Site despite targeted searches. Potential habitat present is highly degraded. **Therefore, species credits do not apply.**
Heath Wrinklewort *Rutidosis heterogama* **BRW-2**	Grows in heath on sandy soils and moist areas in open forest, and has been recorded along disturbed roadsides.	Parallel walking transects – Maximum distance between transects 10m in open, 5m in dense vegetation. For each hectare of potential habitat average field traverse length 2km at 5m separation or 1km at 10m separation. When local reference population is flowering. BAM-C Survey Period: All year.	Habitat Assessment Targeted Search Parallel Transects	Parallel transects conducted August, October and December 2019	This species was not observed on site. There are many constraints within the Subject Site that restrict and / or prohibit this species from the site such as trampling, high weed loads and the disturbed condition, resulting in the vegetation being in a degraded state. **Therefore, species credits do not apply.**
Black-eyed Susan *Tetratheca juncea* **BRW-2**	Cryptic shrub – difficult to distinguish the clumped grass like stems from other vegetation when not in flower. Generally found in low open forest/woodland with a mixed shrub understorey and grassy groundcover, also occurs in heathland and moist forest and is most often associated with low nutrient soils of the Awaba Soil Landscape. Confined to the northern portion of the Sydney Basin bioregion and the southern portion of the North Coast bioregion in the local government areas of Wyong, Lake Macquarie, Newcastle, Port Stephens, Great Lakes and Cessnock.	Parallel walking transects – Maximum distance between transects 10m in open, 5m in dense vegetation. For each hectare of potential habitat average field traverse length 2km at 5m separation or 1km at 10m separation When local reference population is flowering (typically Jul–Aug peak period). BAM-C Survey Period: Jul to Dec.	Habitat Assessment Targeted Search Random Meander Parallel Transects	Parallel transects conducted August, October and December 2019	This species was not observed on site. There are many constraints within the Subject Site that restrict and / or prohibit this species from the site such as trampling, high weed loads and the disturbed condition, resulting in the vegetation being in a degraded state. **Therefore, species credits do not apply.**

Given the works conducted on the development site and adjacent lands as detailed in **s1.3.2.1** and **Table 7**, it is considered that sufficient information exists to determine the presence of species or otherwise, and relative impact levels from development.

Threatened fauna species recorded within the site or nearby surrounds (this survey, previous surveys, Atlas records, anecdotal records) which will require impact offsetting (Credit Species) include:

- Squirrel Glider (*Petaurus norfolcensis*) – assumed present due to inconclusive photographic records on which it is not possible to definitively distinguish Sugar Glider from Squirrel Glider.

- Southern Myotis (*Myotis macropus*) – possibly recorded as part of a species group using Anabat recorder (i.e. possibly identified as either *Myotis macropus* or *Nyctophilus sp.*) on site, however observed fishing within the dam. As hollow-bearing trees are located within 200m of a dam which is located within the Subject Site, foraging habitat species credits apply for the proposed development as per the habitat constraint within the TBDC.

Furthermore, various other threatened species of microbats were recorded during echolocation call surveying. However, there is no evidence of site use for breeding purposes by any such species. Therefore, species credits do not apply.

2.0 Stage 2 – Impact Assessment (Biodiversity Values)

Section 8 of the BAM provides a list of measures that need to be taken into consideration during project planning and design, to minimise impacts upon native vegetation, habitat and other prescribed biodiversity values. As part of the BAMCP the principles of Section 8 have been reviewed along with the objectives and goals of Maitland City Council's planning proposal impact assessment guidelines.

When detailed designs are finalised for the Subject Site, the preparation of a Biodiversity Development Assessment Report (BDAR) including a detailed review of Section 8 of the BAM will be undertaken.

2.1 Avoid and Minimise Impacts

While the majority is highly disturbed, with evidence of earthworks and clearing throughout, and the presence of exotic weeds to various extents, the presence of vegetation corridors along the western, southern and eastern boundaries provides potential habitat for a number of species.

Enhancement of areas that allow for connectivity with vegetation on adjoining properties have been considered as having biodiversity value. The Planning Proposal is recommending to minimise the impacts of development on the site by avoiding, protecting and rehabilitating a wildlife corridor located along the northern, western and southern boundaries, in order to support mobility of species and connectivity to adjacent vegetated lands. Furthermore, hollow-bearing trees located in the wildlife corridor will be retained. **Figure 7** shows the location of the wildlife corridor and retained hollow-bearing trees. The wildlife corridor will be 20m wide along the northern boundary, and 10m wide along the western and southern boundaries. Further rehabilitation is proposed as part of the development design, with parklands and a restored pond. The canopy species within the proposed corridor will reflect PCTs 1592 in the west and south, and PCT 1600 in the north, and the shrub and understorey layers will require weed management and plantings. The protection of these 0.28ha of native vegetation will allow for the Subject Site to be developed with minimal impact on biodiversity within the local area.

Key Avoid and Minimise Elements within the Planning Proposal

The Maitland City Council Greening Plan

The Maitland City Council Greening Plan (MCCGP) is a strategic framework to guide the future management of vegetation including bushlands, wetlands and wildlife corridors within the Maitland Local Government Area (LGA). As per Figures 6 and 33 of the MCCGP, the site has been identified as containing bushland and occurring within a wildlife corridor. This has been taken into to consideration in the Planning Proposal as discussed above, with the proposed northern wildlife corridor providing a safe and diverse corridor through the site to the connecting vegetation in the north-east of the site.

A Vegetation Management Plan (VMP) over the wildlife corridor will ensure the enhancement of PCTs 1592and 1600. Furthermore, the proposed rehabilitation of the void to provide a permanent waterbody and adjacent vegetation, using PCT 1071 as the basis for revegetation, is

likely to provide an increase in water quality on and off site. The location of the wildlife corridor also supports three of the six hollow-bearing trees identified on the site, providing continual habitat for existing fauna.

The Maitland Development Control Plan

Section B.5 Tree Management of the Maitland DCP contains provisions which will be addressed as part of the proposed "Avoid and Minimise" measures.

Whilst there are principles therein that relate to vegetation protection and retention where possible, considerations and thereafter approvals gained via meeting avoid / minimise / offset obligations under the BC Act will effectively meet the principles listed within the DCP.

The development footprint within the Subject Site holds low biodiversity values and impact avoidance within the development footprint has been proposed above in the 1.21ha wildlife corridor. The implementation of a VMP and a Construction Environmental Management Plan (CEMP) within the wildlife corridor will reduce the impacts on the species currently inhabiting this area and will be drafted to ensure best practice is adhered to during the construction process.

Furthermore, due to the presence of Squirrel Glider on site, it is proposed to ensure that their ability to move throughout the landscape is maintained, via the presence of arboreal crossings over minor interior roads, thus deterring the fauna from moving towards Haussman Drive and reducing the likelihood of vehicle strikes. Such crossings will consist of suitable trees allowing for the species to cross the site. Where such natural crossings are not present, the installation of Glider poles will be required, together with tree plantings. Glider poles will remain in place until suitable trees have achieved a minimum height allowing for the Squirrel Glider to move through the landscape.

More specifically, as part of Vegetation Management Plan (VMP) works, Squirrel Glider feed trees (*E. robusta*) and shrubs (Melaleuca, Banksia and Xanthorrhoea species) will be planted, evenly spaced within the identified corridor approx. 10m apart. Details of plantings will be provided in the VMP.

Compensatory habitat

Depending on the extent of clearing required, the removal of up to six (6) hollow-bearing trees containing a total of 16 hollows will require the installation of compensatory habitat in the form of nest boxes and artificial hollows at a ratio of 1:1, in areas where canopy vegetation is retained.

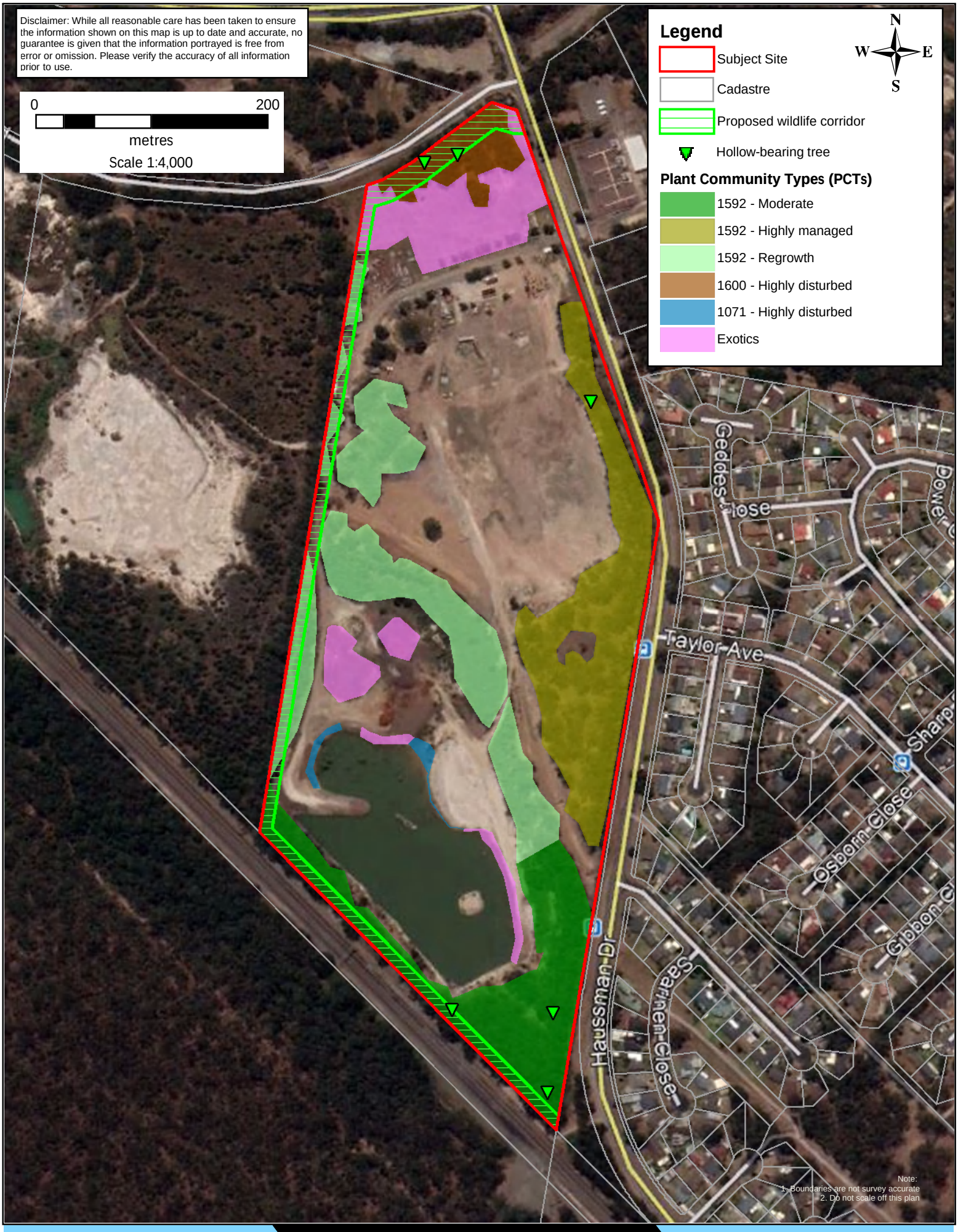
Furthermore, ground habitat in the form of large woody debris carried over from cleared trees elsewhere on site, will be deposited in various sections of the retained vegetated lands, in particular along the northern boundary where such debris is currently sparse.

Protection fencing, such as logs, will further reduce impacts from vehicles in the wildlife corridor.

Offset credit retirement

The residual impacts resulting from the clearing of vegetation associated with PCTs 1592, 1600 and 1071 will be offset by the retirement of Ecosystem and Species Credits in compliance with the BAM.

It is unknown at this point in time whether the proponent will look to establish their own stewardship site to generate credits, purchase credits off the open market or mark payment into the Biodiversity Conservation Fund. Subject to credit availability the proponent may look to undertake a combination of the above.



AEP

Title: Figure 7 - Proposed Wildlife Corridor

Date: May 2020

Location: 1 Brickworks Road, Thornton,NSW

Client: North Thornton Group Pty Ltd

BOAMS Ref: 19986
AEP Ref: 1639

3.0 Conclusion

The vegetation within the site was found to be commensurate with PCTs 1592, 1600 and 1071 which are in a moderate to highly disturbed condition across the Subject Site. The Planning Proposal will ensure retention of connectivity with surrounding vegetation and through the LMP this corridor will be enhanced to reflect the shrub and groundcovers species, thus providing a more diverse environment.

The client has committed to undertaking Stage 2 of the BAM to quantify the required offsets within a BDAR. The BDAR would subsequently be lodged with the DA for the site.

4.0 References

AEP (2018) *BioBanking Assessment Report for Residential Development of Lot 1 DP1032753, Thornton North, NSW*. Prepared for Mr Robert Munro. Rev 1 – January 2018.

AEP (2017a) *BioBanking Assessment Report for Residential Development of Lot 1 DP198776, Thornton North, NSW*. Prepared for Mr P Goodwin. Rev 1 - December 2017.

AEP (2017b) *BioBanking Assessment Report for Residential Development of Lot 18 DP999725, Thornton North, NSW*. Prepared for Mr G Seccombe. October 2017.

AEP (2017c) *BioBanking Assessment Report for Residential Development of Lot 20 DP832786, Thornton North, NSW*. Prepared for Catholic Diocese of Maitland – Newcastle. Rev 1 - December 2017.

AEP (2017d) *BioBanking Assessment Report for Residential Development of Lot 21 DP832786, Thornton North, NSW*. Prepared for Sidlay. Rev 1 – November 2017.

AEP (2017e) *Ecological Assessment Report for Residential Subdivision within Lot 43 DP1009594 and Part Lot 1 DP1020710, Part Lot 2532 DP1224018, 'Waterford County', Chisholm*.

AEP (2017f) *Biodiversity Development Assessment Report for Proposed Residential Subdivision of 239 McFarlanes Road, 'Waterford County' Chisholm*. May 2018

AEP (2017g) *Ecological Assessment Report for Proposed Residential Subdivision within Lot 43 DP1009594, Part Lot 1 DP1020710 and Part Lot 2831 DP1238911 'Waterford', Chisholm*, May 2018.

DECC (2009) *Threatened Species Survey and Assessment Guidelines: Field Survey Methods for fauna – amphibians*. NSW Department of Environment and Climate Change.

EcoLogical (2017) *Waterford County Subdivision – Environmental Constraints Assessment*. Prepared for ADW Johnson. June 2017.

Hill L (2003) *The Natural Vegetation of Maitland Local Government Area*. Prepared for Maitland City Council. September 2003.

Keith D (2004) *Ocean Shores to Desert Dunes*. DEC, Sydney.

NPWS (2000) *Lower Hunter and Central Coast Regional Environmental Management Strategy (LHCCREMS) mapping project*. NSW National Parks and Wildlife Service.

NSW Department of Environment and Conservation (2004) *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities*. Working Draft, November 2004.

OEH (2017a) *Biodiversity Assessment Methodology*. August 2017. NSW Office of Environment and Heritage.

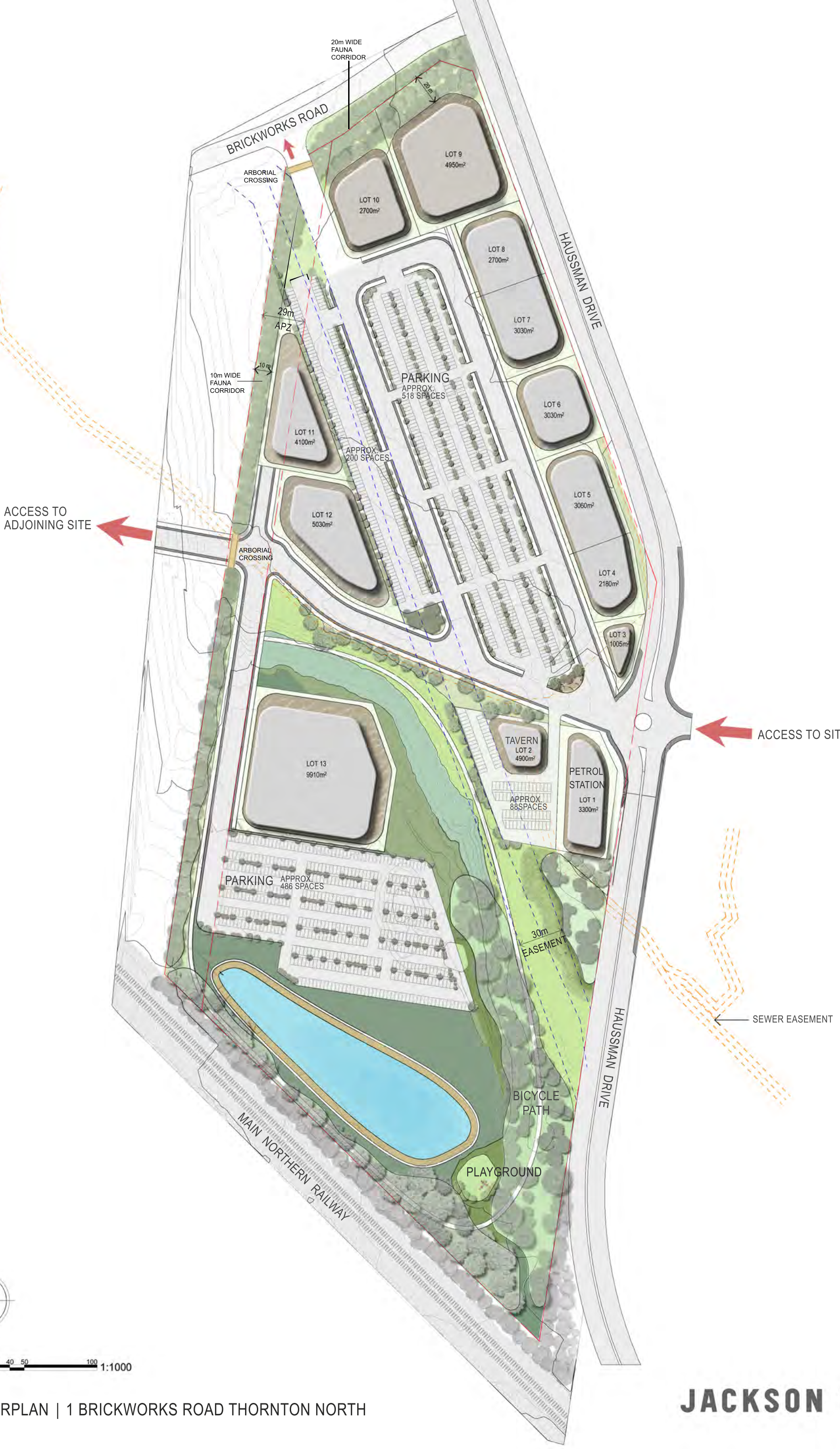
OEH (2017b) *Biodiversity Assessment Method (BAM) Calculator User Guide*. August 2017. NSW Office of Environment and Heritage.

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

OEH (2020) *Bionet: the website for the Atlas of NSW Wildlife*. (http://www.bionet.nsw.gov.au) Accessed May 2020. NSW OEH, Sydney. NSW Office of Environment and Heritage.

Parsons Brinckerhoff (2013): *Lower Hunter Vegetation Mapping, report for Department of Sustainability, Environment, Water, Population and Communities*, Canberra, ACT.

Appendix A – Planning Proposal



MASTERPLAN | 1 BRICKWORKS ROAD THORNTON NORTH

JACKSON TEECE

Appendix B – Flora Species List

FLORA SPECIES LIST

The following list includes all species of vascular plants observed in the study area during field investigations. It should be noted that such a list cannot be considered comprehensive, but rather indicative of the flora present on the site. It can take many years of flora surveys to record all of the plant species occurring within any area, especially plant species that are only apparent in some seasons such as Orchids.

A number of species cannot always be accurately identified during a brief survey, generally due to a lack of suitable flowering and/or fruiting material. Any such species are identified as accurately as possible, and are indicated in the list as thus:

- specimens that could only be identified to genus level are indicated by the generic name followed by the abbreviation "sp.", indicating an unidentified species of that genus;
- specimens for which identification of the genus was uncertain are indicated by a question mark ("?") placed in front of the generic, which is followed by the abbreviation "sp." and;
- specimens that could be accurately identified to genus level but could be identified to species level with only a degree of certainty are indicated by a ("?") placed in front of the epithet.

Authorities for the scientific names are not provided in the list. These follow the references outlined below.

Harden, G. (ed) (2000). *Flora of New South Wales, Volume 1*. Revised edition. UNSW, Kensington, NSW.

Harden, G. (ed) (2002). *Flora of New South Wales, Volume 2*. Revised edition. UNSW, Kensington, NSW.

Harden, G. (ed) (1992). *Flora of New South Wales, Volume 3.* UNSW, Kensington, NSW.

Harden, G. (ed) (1993). *Flora of New South Wales, Volume 4*. UNSW, Kensington, NSW.

Names of families and higher taxa follow a modified Cronquist System (1981).

Introduced species are indicated by an asterisk "*".

Family	Scientific Name	Common Name
Amaranthaceae	*Alternanthera denticulata*	Lesser Joyweed
Anthericaceae	*Laxmannia gracilis*	Slender Wire Lily
Apiaceae	*Centella asiatica*	Swamp Pennywort
Apocynaceae	*Parsonsia straminea*	Common Silkpod
Asteraceae	*Cyanthillium cinereum*	
Asteraceae	*Senecio madagascariensis**	Fireweed
Asteraceae	*Conyza bonariensis**	Flax-leaf Fleabane
Asteraceae	*Cirsium vulgare**	Spear Thistle
Asteraceae	*Sonchus oleraceus**	Common Sow-thistle
Asteraceae	*Hypochaeris radicata**	Flatweed
Asteraceae	*Cotula sp.**	
Asteraceae	*Ozothamnus diosmifolius*	Ball Everlasting
Asteraceae	*Chrysocephalum apiculatum*	Common Everlasting
Asteraceae	*Cassinia quinquefaria*	
Asteraceae	*Conyza sumatrensis**	Tall Fleabane
Asteraceae	*Coronidium oxylepis subsp. oxylepis*	
Bignoniaceae	*Pandorea pandorana*	Wonga Vine
Brassicaceae	*Lepidium sp.*	A Peppercress
Chenopodiaceae	*Einadia hastata*	Berry Saltbush
Convolvulaceae	*Dichondra repens*	Kidney Weed
Cyperaceae	*Cyperus eragrostis**	Umbrella Sedge
Cyperaceae	*Lepidosperma gunnii*	
Dilleniaceae	*Hibbertia pedunculata*	
Epacridaceae	*Leucopogon juniperinus*	Prickly Beard-heath
Euphorbiaceae	*Breynia oblongifolia*	Coffee Bush
Euphorbiaceae	*Poranthera microphylla*	Small Poranthera
Euphorbiaceae	*Poranthera ericifolia*	
Fabaceae	*Acacia elongata*	Swamp Wattle
Fabaceae	*Trifolium repens**	White Clover
Fabaceae	*Medicago sp.**	A Medic
Fabaceae	*Glycine tabacina*	Twining Glycine
Fabaceae	*Trifolium sp.**	A Clover
Fabaceae	*Daviesia ulicifolia*	Gorse Bitter Pea
Fabaceae	*Desmodium varians*	Slender Tick-trefoil
Fabaceae	*Glycine clandestina*	Twining Glycine
Fabaceae	*Acacia ulicifolia*	Prickly Moses
Fabaceae	*Acacia falcata*	Sickle Wattle
Fabaceae	*Senna pendula var. glabrata**	
Fabaceae	*Hardenbergia violacea*	False Sarsaparilla

Family	Scientific Name	Common Name
Fabaceae	*Dillwynia retorta*	Eggs and Bacon
Fabaceae	*Acacia podalyriifolia*	Queensland Silver Wattle
Fabaceae	*Acacia irrorata*	Green Wattle
Goodeniaceae	*Goodenia rotundifolia*	
Haloragaceae	*Gonocarpus teucrioides*	Raspwort
Juncaceae	*Juncus usitatus*	Common Rush
Lobeliaceae	*Lobelia purpurascens*	Whiteroot
Lomandraceae	*Lomandra filiformis*	Wattle Matt-rush
Lomandraceae	*Lomandra multiflora subsp. multiflora*	Many-flowered Mat-rush
Lomandraceae	*Lomandra longifolia*	Spiky-headed Mat-rush
Malvaceae	*Sida rhombifolia**	Paddy's Lucerne
Malvaceae	*Modiola caroliniana**	Red-flowered Mallow
Meliaceae	*Melia azedarach*	White Cedar
Myrtaceae	*Melaleuca quinquenervia*	Broad-leaved Paperbark
Myrtaceae	*Corymbia maculata*	Spotted Gum
Myrtaceae	*Eucalyptus tereticornis*	Forest Red Gum
Myrtaceae	*Eucalyptus paniculata*	Grey Ironbark
Myrtaceae	*Eucalyptus crebra*	Narrow-leaved Ironbark
Myrtaceae	*Eucalyptus globoidea*	White Stringybark
Myrtaceae	*Eucalyptus punctata*	Grey Gum
Myrtaceae	*Eucalyptus fibrosa*	Broad Leaved Ironbark
Ochnaceae	*Ochna serrulata**	Mickey Mouse Plant
Oxalidaceae	*Oxalis perrenans*	Yellow-flowered Wood Sorrel
Phormiaceae	*Dianella revoluta*	Blueberry Lily
Phormiaceae	*Dianella longifolia*	Blue Flax Lily
Phytolaccaceae	*Phytolacca octandra**	Inkweed
Pittosporaceae	*Pittosporum undulatum*	Sweet Pittosporum
Pittosporaceae	*Bursaria spinosa*	Native Blackthorn
Plantaginaceae	*Plantago lanceolata**	Ribwort
Poaceae	*Cynodon dactylon*	Common Couch
Poaceae	*Paspalum dilatatum**	Paspalum
Poaceae	*Cenchrus clandestinum**	Kikuyu
Poaceae	*Andropogon virginicus**	Whisky Grass
Poaceae	*Entolasia stricta*	Wiry Panic
Poaceae	*Setaria parviflora**	Slender Pigeon Grass
Poaceae	*Cortaderia selloana**	Pampas Grass
Poaceae	*Chloris gayana**	Rhodes Grass
Poaceae	*Axonopus fissifolius**	Narrow-leaved Carpet Grass
Poaceae	*Microlaena stipoides*	Weeping Grass

Family	Scientific Name	Common Name
Poaceae	*Entolasia marginata*	Bordered Panic
Poaceae	*Aristida vagans*	Three-awn Speargrass
Poaceae	*Themeda australis*	Kangaroo Grass
Poaceae	*Echinopogon caespitosus*	Bushy Hedgehog-grass
Poaceae	*Paspalidium distans*	
Poaceae	*Dichelachne micrantha*	Short-hair Plume Grass
Poaceae	*Panicum simile*	Two Colour Panic
Poaceae	*Aristida ramosa*	Purple Wiregrass
Poaceae	*Sporobolus creber*	Slender Rat's Tail Grass
Poaceae	*Ehrharta erecta**	Panic Veldtgrass
Poaceae	*Cymbopogon refractus*	Barbwire Grass
Poaceae	*Austrostipa sp.*	A Speargrass
Proteaceae	*Hakea sericea*	Needlebush
Pteridaceae	*Cheilanthes sieberi*	Rock Fern
Rubiaceae	*Opercularia diphylla*	
Rutaceae	*Boronia polygalifolia*	Dwarf Boronia
Solanaceae	*Solanum mauritianum**	Wild Tobacco
Solanaceae	*Solanum nigrum**	Black Nightshade, Black-berry Nightshade
Stylidiaceae	*Stylidium graminifolium*	Grass Trigger Plant
Typhaceae	*Typha orientalis*	Cumbungi
Verbenaceae	*Verbena bonariensis**	Purpletop
Verbenaceae	*Lantana camara**	Lantana

Appendix C – Expected Fauna Species List

EXPECTED FAUNA SPECIES LIST

The following list includes fauna species that could be reasonably expected to occur within the study area at some point, given site attributes and location.

"●"- species observed or indicated by scats, tracks etc. on, over or near the site during the various field investigations undertaken by AEP (2018-2020).

* - Introduced species

? - Unconfirmed record, anecdotal records etc.

A - NSW Atlas of Wildlife record of threatened species for the site.

Threatened species listed under the *Biodiversity Conservation Act 2016* (BC Act) and the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) are indicated in **bold font**.

Family	Presence	Scientific Name	Common Name
Birds			
Phasianidae		*Coturnix ypsilophora*	Brown Quail
Anatidae	●	*Anas castanea*	Chestnut Teal
	●	*Anas gracilis*	Grey Teal
	●	*Anas superciliosa*	Pacific Black Duck
	●	*Chenonetta jubata*	Australian Wood Duck
Podicipedidae	●	*Tachybaptus novaehollandiae*	Australasian Grebe
Columbidae		*Columba leucomela*	White-headed Pigeon
	●	*Columba livia**	Rock Dove
		Geopelia humeralis	Bar-shouldered Dove
		Leucosarcia melanoleuca	Wonga Pigeon
		Macropygia amboinensis	Brown Cuckoo-Dove
	●	*Ocyphaps lophotes*	Crested Pigeon
	●	*Streptopelia chinensis**	Spotted Turtle-Dove
Corcoracidae	●	*Corcorax melanorhamphos*	White-winded Chough
Podargidae	●	*Podargus strigoides*	Tawny Frogmouth
Caprimulgidae		*Eurostopodus mystacalis*	White-throated Nightjar
Aegothelidae		*Aegotheles cristatus*	Australian Owlet-nightjar
Apodidae		*Hirundapus caudacutus*	White-throated Needletail
Phalacrocoracidae	●	*Microcarbo melanoleucos*	Little Pied Cormorant
		Phalacrocorax sulcirostris	Little Black Cormorant
Ardeidae		*Ardea ibis*	Cattle Egret
		Ardea intermedia	Intermediate Egret
	●	*Ardea modesta*	Eastern Great Egret
		Ardea pacifica	White-necked Heron
		Egretta garzetta	Little Egret
	●	*Egretta novaehollandiae*	White-faced Heron
	●	*Nycticorax caledonicus*	Nankeen Night Heron
Threskiornithidae		*Threskiornis molucca*	Australian White Ibis
		Threskiornis spinicollis	Straw-necked Ibis
Accipitridae		*Accipiter cirrocephalus*	Collared Sparrowhawk
		Accipiter fasciatus	Brown Goshawk
		Accipiter novaehollandiae	Grey Goshawk
		Aviceda subcristata	Pacific Baza
		Circus approximans	Swamp Harrier
		Haliastur sphenurus	Whistling Kite
	●	***Haliaeetus leucogaster***	**White-bellied Sea-eagle**
Falconidae		*Falco berigora*	Brown Falcon
		Falco cenchroides	Nankeen Kestrel
		Falco longipennis	Australian Hobby
Rallidae		*Fulica atra*	Eurasian Coot
		Gallinula tenebrosa	Dusky Moorhen
		Gallirallus philippensis	Buff-banded Rail
		Lewinia pectoralis	Lewin's Rail
		Porphyrio porphyrio	Purple Swamphen
Charadriidae		*Vanellus miles*	Masked Lapwing
	●	*Cacatua galerita*	Sulphur-crested Cockatoo

Family	Presence	Scientific Name	Common Name
Cacatuidae	●	*Cacatua sanguinea*	Little Corella
	●	*Cacatua tenuirostris*	Long-billed Corella
	●	*Calyptorhynchus funereus*	Yellow-tailed Black-Cockatoo
	●	*Eolophus roseicapillus*	Galah
Psittacidae		*Alisterus scapularis*	Australian King-Parrot
	●	*Glossopsitta concinna*	Musk Lorikeet
	●	***Glossopsitta pusilla***	**Little Lorikeet**
		Platycercus elegans	Crimson Rosella
	●	*Platycercus eximius*	Eastern Rosella
		Trichoglossus chlorolepidotus	Scaly-breasted Lorikeet
	●	*Trichoglossus haematodus*	Rainbow Lorikeet
Centropodidae		*Centropus phasianinus*	Pheasant Coucal
Cuculidae		*Cacomantis flabelliformis*	Fan-tailed Cuckoo
		Chalcites basalis	Horsfield's Bronze-Cuckoo
		Chalcites lucidus	Shining Bronze-Cuckoo
		Eudynamys orientalis	Eastern Koel
		Scythrops novaehollandiae	Channel-billed Cuckoo
Strigidae		*Ninox novaeseelandiae*	Southern Boobook
Tytonidae		*Tyto javanica*	Eastern Barn Owl
Alcedinidae	●	*Dacelo novaeguineae*	Laughing Kookaburra
	●	*Todiramphus sanctus*	Sacred Kingfisher
Coraciidae	●	*Eurystomus orientalis*	Dollarbird
Climacteridae	●	*Cormobates leucophaea*	White-throated Treecreeper
Ptilonorhynchidae	●	*Ptilonorhynchus violaceus*	Satin Bowerbird
Maluridae	●	*Malurus cyaneus*	Superb Fairy-wren
		Malurus lamberti	Variegated Fairy-wren
Acanthizidae		*Acanthiza lineata*	Striated Thornbill
		Acanthiza nana	Yellow Thornbill
	●	*Acanthiza pusilla*	Brown Thornbill
		Gerygone mouki	Brown Gerygone
		Gerygone olivacea	White-throated Gerygone
		Sericornis frontalis	White-browed Scrubwren
Pardalotidae	●	*Pardalotus punctatus*	Spotted Pardalote
		Pardalotus striatus	Striated Pardalote
Meliphagidae	●	*Acanthorhynchus tenuirostris*	Eastern Spinebill
	●	*Anthochaera carunculata*	Red Wattlebird
		Anthochaera chrysoptera	Little Wattlebird
	●	*Caligavis chrysops*	Yellow-faced Honeyeater
		Entomyzon cyanotis	Blue-faced Honeyeater
		Lichmera indistincta	Brown Honeyeater
	●	*Manorina melanocephala*	Noisy Miner
	●	*Manorina melanophrys*	Bell Miner
	●	*Meliphaga lewinii*	Lewin's Honeyeater
		Melithreptus brevirostris	Brown-headed Honeyeater
		Melithreptus lunatus	White-naped Honeyeater
		Myzomela sanguinolenta	Scarlet Honeyeater
	●	*Philemon corniculatus*	Noisy Friarbird

Family	Presence	Scientific Name	Common Name
	●	*Phylidonyris niger*	White-cheeked Honeyeater
		Phylidonyris novaehollandiae	New Holland Honeyeater
		Plectorhyncha lanceolata	Striped Honeyeater
Psophodidae	●	*Psophodes olivaceus*	Eastern Whipbird
Campephagidae	●	*Coracina novaehollandiae*	Black-faced Cuckoo-shrike
		Coracina tenuirostris	Cicadabird
Pachycephalidae		*Colluricincla harmonica*	Grey Shrike-thrush
		Pachycephala pectoralis	Golden Whistler
		Pachycephala rufiventris	Rufous Whistler
Oriolidae	●	*Oriolus sagittatus*	Olive-backed Oriole
		Sphecotheres vieilloti	Australasian Figbird
Artamidae	●	*Artamus leucorynchus*	White-breasted Woodswallow
		Cracticus nigrogularis	Pied Butcherbird
	●	*Cracticus tibicen*	Australian Magpie
	●	*Cracticus torquatus*	Grey Butcherbird
	●	*Strepera graculina*	Pied Currawong
Dicruridae		*Dicrurus bracteatus*	Spangled Drongo
Rhipiduridae	●	*Rhipidura albiscapa*	Grey Fantail
	●	*Rhipidura leucophrys*	Willie Wagtail
		Rhipidura rufifrons	Rufous Fantail
Corvidae	●	*Corvus coronoides*	Australian Raven
Monarchidae	●	*Grallina cyanoleuca*	Magpie-lark
		Monarcha melanopsis	Black-faced Monarch
		Myiagra rubecula	Leaden Flycatcher
Petroicidae	●	*Eopsaltria australis*	Eastern Yellow Robin
		Petroica rosea	Rose Robin
Cisticolidae		*Cisticola exilis*	Golden-headed Cisticola
Acrocephalidae		*Acrocephalus australis*	Australian Reed-Warbler
Megaluridae		*Megalurus gramineus*	Little Grassbird
		Megalurus timoriensis	Tawny Grassbird
Timaliidae	●	*Zosterops lateralis*	Silvereye
Hirundinidae		*Hirundo neoxena*	Welcome Swallow
		Petrochelidon ariel	Fairy Martin
		Petrochelidon nigricans	Tree Martin
Sturnidae	●	*Sturnus tristis**	Common Myna
		*Sturnus vulgaris**	Common Starling
Nectariniidae	●	*Dicaeum hirundinaceum*	Mistletoebird
Estrildidae	●	*Neochmia temporalis*	Red-browed Finch
	●		Masked Finch
	●	*Taeniopygia bichenovii*	Double-barred Finch
Passeridae		*Passer domesticus**	House Sparrow
Amphibians			
Bufonidae		*Rhinella marina**	Cane Toad
Hylidae		*Litoria caerulea*	Green Tree Frog
		Litoria dentata	Bleating Tree Frog
		Litoria fallax	Eastern Dwarf Tree Frog

Family	Presence	Scientific Name	Common Name
		Litoria freycineti	Freycinet's Frog
	●	*Litoria latopalmata*	Broad-palmed Frog
		Litoria nasuta	Rocket Frog
	●	*Litoria peronii*	Peron's Tree Frog
		Litoria phyllochroa	Leaf-green Tree Frog
		Litoria tyleri	Tyler's Tree Frog
		Litoria verreauxii	Verreaux's Frog
Myobatrachidae		*Crinia signifera*	Common Eastern Froglet
		Limnodynastes peronii	Brown-striped Frog
		Limnodynastes tasmaniensis	Spotted Grass Frog
		Pseudophryne bibronii	Bibron's Toadlet
		Pseudophryne coriacea	Red-backed Toadlet
		Uperoleia fusca	Dusky Toadlet
		Uperoleia laevigata	Smooth Toadlet
		Uperoleia tyleri	Tyler's Toadlet
Reptiles			
Chelidae		*Chelodina longicollis*	Eastern Snake-necked Turtle
Scincidae		*Bellatorias major*	Land Mullet
		Cryptoblepharus virgatus	Cream-striped Shinning-skink
		Ctenotus robustus	Robust Ctenotus
		Ctenotus taeniolatus	Copper-tailed Skink
		Cyclodomorphus michaeli	Mainland She-oak Skink
		Egernia cunninghami	Cunningham's Skink
	●	*Eulamprus quoyii*	Eastern Water-skink
		Hemiergis decresiensis	Three-toed Earless Skink
		Lampropholis delicata	Dark-flecked Garden Sunskink
		Lampropholis guichenoti	Pale-flecked Garden Sunskink
		Saiphos equalis	Three-toed Skink
		Tiliqua scincoides	Eastern Blue-tongue
Agamidae	●	*Amphibolurus muricatus*	Jacky Lizard
		Intellagama lesueurii	Eastern Water Dragon
Varanidae		*Varanus varius*	Lace Monitor
Colubridae		*Dendrelaphis punctulatus*	Common Tree Snake
Elapidae		*Demansia psammophis*	Yellow-faced Whip Snake
		Hemiaspis signata	Black-bellied Swamp Snake
		Pseudechis porphyriacus	Red-bellied Black Snake
		Pseudonaja textilis	Eastern Brown Snake
Mammals			
Tachyglossidae		*Tachyglossus aculeatus*	Short-beaked Echidna
Dasyuridae		*Antechinus stuartii*	Brown Antechinus
Peramelidae		*Isoodon macrourus*	Northern Brown Bandicoot
		Perameles nasuta	Long-nosed Bandicoot
Petauridae	●	*Petaurus breviceps*	Sugar Glider
	?	*Petaurus norfolcensis*	Squirrel Glider
Pseudocheiridae	●	*Pseudocheirus peregrinus*	Common Ringtail Possum
Acrobatidae	●	*Acrobates pygmaeus*	Feathertail Glider

Family	Presence	Scientific Name	Common Name
Phalangeridae	●	*Trichosurus vulpecula*	Common Brushtail Possum
Macropodidae		*Macropus giganteus*	Eastern Grey Kangaroo
		Macropus rufogriseus	Red-necked Wallaby
		Wallabia bicolor	Swamp Wallaby
Rhinolophidae		*Rhinolophus megaphyllus*	Eastern Horseshoe-bat
Molossidae	●	*Austronomus australis*	White-striped Freetail-bat
	?	*Ozimops planiceps*	South-eastern Free-tailed Bat
	●	*Ozimops ridei*	Eastern Free-tailed Bat
	●	***Micronomus norfolkensis***	**Eastern Coastal Free-tailed Bat**
Emballonuridae	●	***Saccolaimus flaviventris***	**Yellow-bellied Sheathtail-bat**
Vespertilionidae	●	*Chalinolobus gouldii*	Gould's Wattled Bat
	●	*Chalinolobus morio*	Chocolate Wattled Bat
	?	***Falsistrellus tasmaniensis***	**Eastern False Pipistrelle**
	●	***Miniopterus australis***	**Little Bent-winged Bat**
	?	***Miniopterus orianae oceanensis***	**Large Bent-winged Bat**
	?	***Myotis macropus***	**Southern Myotis**
	?	*Nyctophilus geoffroyi*	Lesser Long-eared Bat
	?	*Nyctophilus gouldi*	Gould's Long-eared Bat
	?	*Scotorepens orion*	Eastern Broad-nosed Bat
	?	*Vespadelus darlingtoni*	Large Forest Bat
	?	*Vespadelus pumilus*	Eastern Forest Bat
	?	*Vespadelus regulus*	Southern Forest Bat
	?	*Vespadelus vulturnus*	Little Forest Bat
	?	***Vespadelus troughtoni***	**Eastern Cave Bat**
Muridae		*Mus musculus**	House Mouse
		Rattus fuscipes	Bush Rat
		Rattus lutreolus	Swamp Rat
	●	*Rattus rattus**	Black Rat
Canidae	●	*Canis lupus**	Dingo, domestic dog
	●	*Vulpes vulpes**	Fox
Felidae		*Felis catus**	Cat
	●		Horse
	●		Cow
Leporidae		*Lepus capensis**	Brown Hare
	●	*Oryctolagus cuniculus**	Rabbit

Appendix D – Vegetation Integrity Score Table

Site Attribute	PCT 1592	PCT 1592	PCT 1592	PCT 1592	PCT 1600	PCT 1071
Plot #	1	2	6	3	4	5
Location	371791E 6372770N	371753E 6373084N	371597E 6373131N	371840E 6373080N	371727E 6373537N	371705E 6373039N
Bearing	38°	302°	192°	36°	255°	155°
Tree	4	0	4	3	3	3
Shrub	8	8	7	4	3	1
Grass & Grass-like	14	7	11	9	4	4
Forb	4	6	10	3	6	4
Fern	1	1	1	1	0	0
Other	4	1	3	2	1	0
Total Composition Score	**77**	**76.4**		**49.5**	**36.9**	**78.1**
Tree	48.3	0	39	35.1	57	10.2
Shrub	2.5	63.1	5.4	0.8	2.7	0.5
Grass & Grass-like	47.2	50.5	32.1	28.5	1.5	45.3
Forb	2	0.6	1.1	0.5	1	0.5
Fern	0.1	1	0.1	0.1	0	0
Other	0.6	0.1	0.4	0.2	0.1	0
Total Structure Score	**65.4**	**58.5**		**41**	**33.4**	**34.2**
Regenerating Stems (<5cm DBH)	1	1	1	1	1	1
Stem Classes (cm DBH)	5-9cm; 10-19cm; 20-29cm; 30-49cm; 50-79cm	5-9cm; 30-49cm	5-9cm; 10-19cm; 20-29cm;	10-19cm; 20-29cm; 30-49cm; 50-79cm	5-9cm; 10-19cm; 20-29cm; 30-49cm	-
# Large Trees	1	0	0	2	0	0
Hollow-bearing Trees	1	0	0	0	1	0

Site Attribute	PCT 1592	PCT 1592	PCT 1592	PCT 1592	PCT 1600	PCT 1071
Plot #	1	2	6	3	4	5
Litter Cover (%)	91	24	80	22	56	1.4
Coarse Woody Debris (m)	18	1	110	1	4	0
High Threat Weed Cover	1.6	0.2	0.5	0.3	5.9	3.6
Total Function Score	**62.7**	**57.6**		**61.9**	**44.5**	**-**
Overall Vegetation Integrity Score	**68.1**	**63.6**		**50.1**	**38**	**51.7**

Appendix E – Anabat Echolocation Call Analysis

Site Name: 1 Brickworks Road, Thornton NSW

AEP Reference Number: 1639

Date: May 2020

1.0 Method

Analysis of bat echolocation calls was undertaken using Anabat Insight software. Identification was carried out utilising Pennay *et al.* (2004) along with comparison from recorded reference calls associated with the Sydney Basin.

Reference calls used were obtained from the NSW database and AEP confirmed bat call collection.

All calls were viewed, with unique calls tagged and identified. Calls that were too short (three pulses or less) were not analysed and tagged as unknown.

Certain microbat species have similar call frequencies, call shape and other characteristics which can make identification to species impossible using just call analysis. Where it was not possible to differentiate calls due to similar call characteristics the call was marked as species group.

Table 1: Confidence ratings of bat call sequences

Confidence	Description
Definite	Call has been identified to a particular species and could not be confused with another species.
Probable	Call has been identified to a particular species, with a low chance that it could be confused with another species.
Possible	Call has been identified to a particular species, but there is a moderate chance of confusion with another species.
Species group	Call could not be identified as a particular species due to call characteristics (poor quality/short sequence, bat species with overlapping frequencies, etc).
Unknown	Call sequences that are too short or of very poor quality.

2.0 Differentiation of species with similar calls

Separation of species with similar calls is possible using particular call characteristics, a short description of characteristics used to distinguish species is included in **Table 2**. Note that it is not always possible to separate similar calls and is affected by the length and quality of recorded calls.

Species names are based on the Australian Chiroptera taxonomic list (Reardon et al. 2015) with changes made to keep the naming conventions in line with DPIE.

Table 2 – Call characteristics used to differentiate species

Species	Characteristic
Miniopterus australis/ Vespadelus pumilus	Differences in frequency or presence of a down-sweeping tail indicating *M.australis*.
Chalinolobus morio/ Vespadelus sp.	Presence of a down-sweeping tail on majority of calls indicated *C.morio*.
Vespadelus troughtoni / Vespadelus vulturnus / Vespadelus pumilus	It is not currently possible to differentiate between *V.vulturnus* and *V.troughtoni* on call characteristics alone. *Vespadelus pumilus* can be differentiated only when call frequency is above 54khz.
Ozimops ridei / Micronomus norfolkensis	Call frequency and alternation of pulses within the call indicates *M.norfolkensis*.
Ozimops ridei / Ozimops planiceps	Differentiated using characteristic frequency.
Chalinolobus gouldii	Differentiated from other species by frequency and presence of curved alternating calls.
Austronomus australis	Differentiated using characteristic frequency.
Saccolaimus flaviventris	Differentiated using characteristic frequency.
Rhinolophus megaphyllus	Differentiated using characteristic frequency and shape.

Species	Characteristic
Myotis macropus/ Nyctophilus spp.	M.macropus differentiated based on calls with initial slope >400 OPS and pulse intervals <75ms. Secondary characters used include central kink and slope variances between pulses.
Scotorepens orion / Scoteanax rueppellii	Calls from these species are very similar. Differentiation is based on the characteristic frequency and the frequency of the knee when compared to the characteristic frequency.
Falsistrellus tasmaniensis	Can be differentiated within good call sequences from *Scotorepens orion / Scoteanax rueppellii* based on length of pre-characteristic.
Miniopterus orianae oceanensis/ Vespadelus sp.	*M.orianae oceanensis* differentiated based on call timing, shape and frequency.
Vespadelus regulus / Vespadelus darlingtoni	These species are not differentiated from each other by us.

It should be noted that the number of call sequences for specific species does not allow for a quantitative understanding of the numbers present on site. Instead it should be taken as an idea of activity within the site for that particular species. It is not possible to compare activity levels between species due to differences in species detectability, foraging strategies and call characteristics.

3.0 Results

8,000 call sequences were recorded of which approx. 6,000 were analysable (not short calls or noise files). Species that were identified definitively include:

- *Austronomus australis* (White-striped Free-tailed Bat)
- *Chalinolobus gouldii* (Gould's Wattled Bat)
- *Chalinolobus morio* (Chocolate Wattled Bat)
- *Micronomus norfolkensis* (Eastern coastal Free-tailed Bat)
- *Miniopterus australis* (Little Bent-winged Bat)
- *Ozimops ridei* (Ride's Free-tailed Bat)
- *Saccolaimus flaviventris* (Yellow-bellied Sheath-tailed Bat)

Bats that are likely to be on site but could not be definitively identified (i.e. those that were classified as possible or within a species group) include:

- *Falsistrellus tasmaniensis* (Eastern Falsistrelle)
- *Miniopterus orianae oceanensis* (Eastern Bent-winged Bat)
- *Myotis macropus* (Large-footed Myotis)
- *Nyctophilus geoffroyi* (Lesser Long-eared Bat)
- *Nyctophilus gouldi* (Gould's Long-eared Bat)
- *Ozimops planiceps* (Southern Free-tailed Bat)
- *Scotorepens orion* (Eastern Broad-nosed Bat)
- *Scoteanax rueppellii* (Greater Broad-nosed Bat)
- *Vespadelus darlingtoni* (Large Forest Bat)
- *Vespadelus pumilus* (Eastern Forest Bat)
- *Vespadelus regulus* (Southern Forest Bat)
- *Vespadelus troughtoni* (Eastern Cave Bat)
- *Vespadelus vulturnus* (Little Forest Bat)

While all care has been taken it should be noted that certain bat species are difficult to identify by bat call and others may not have been recorded by the detectors. It is therefore recommended that a habitat assessment should be used in conjunction with this analysis to determine the likely occurrence of other bat species.

4.0 Sample Time vs Frequency graphs

A sample call for each unique bat species, that was identified (definitive/probable), is included below.

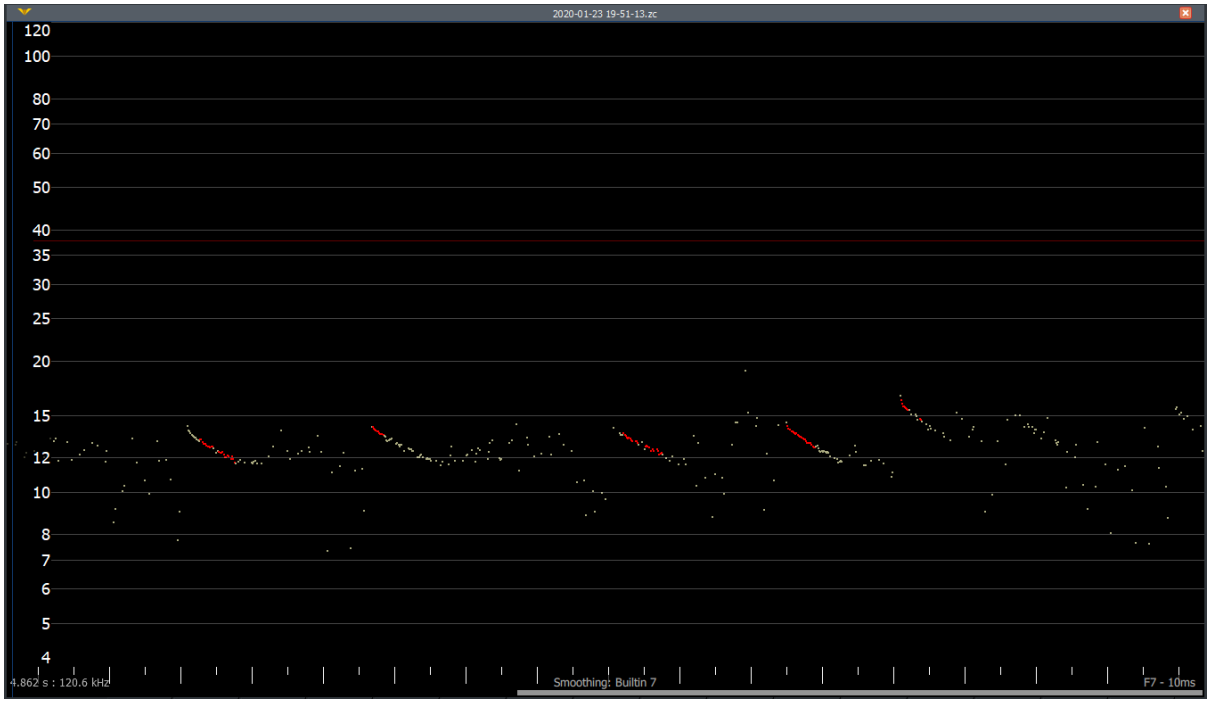


Figure 1 – *Austronomus australis* definite call

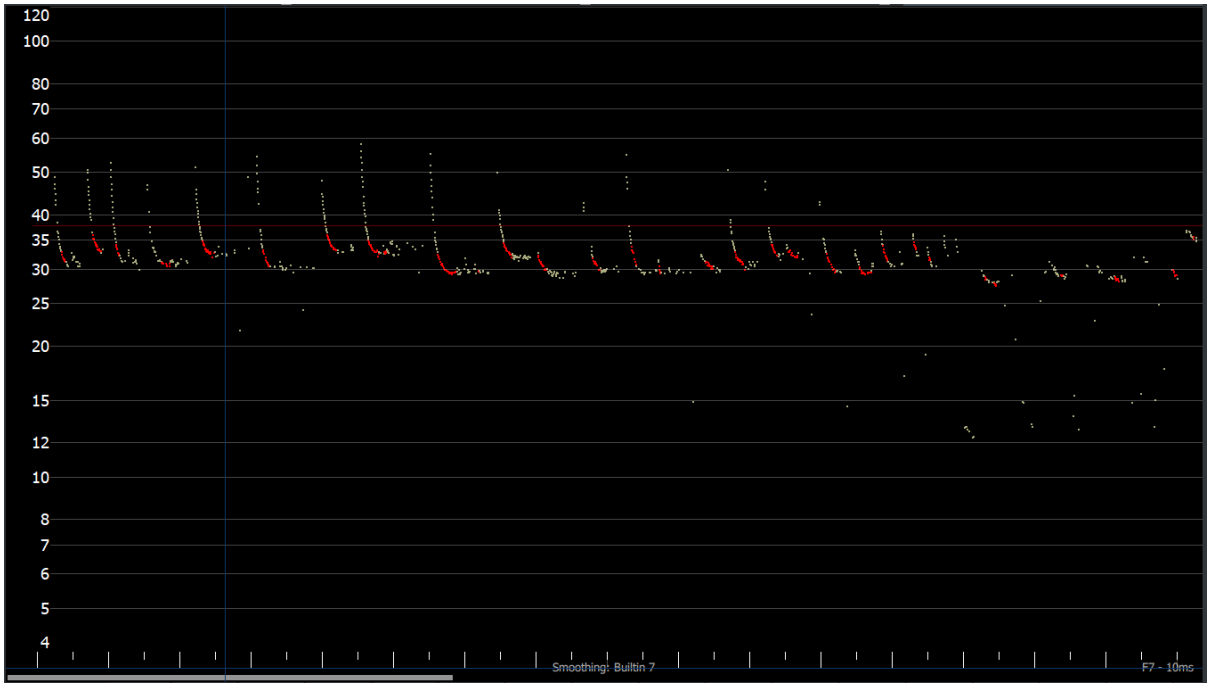


Figure 2– *Chalinolobus gouldii* definite call

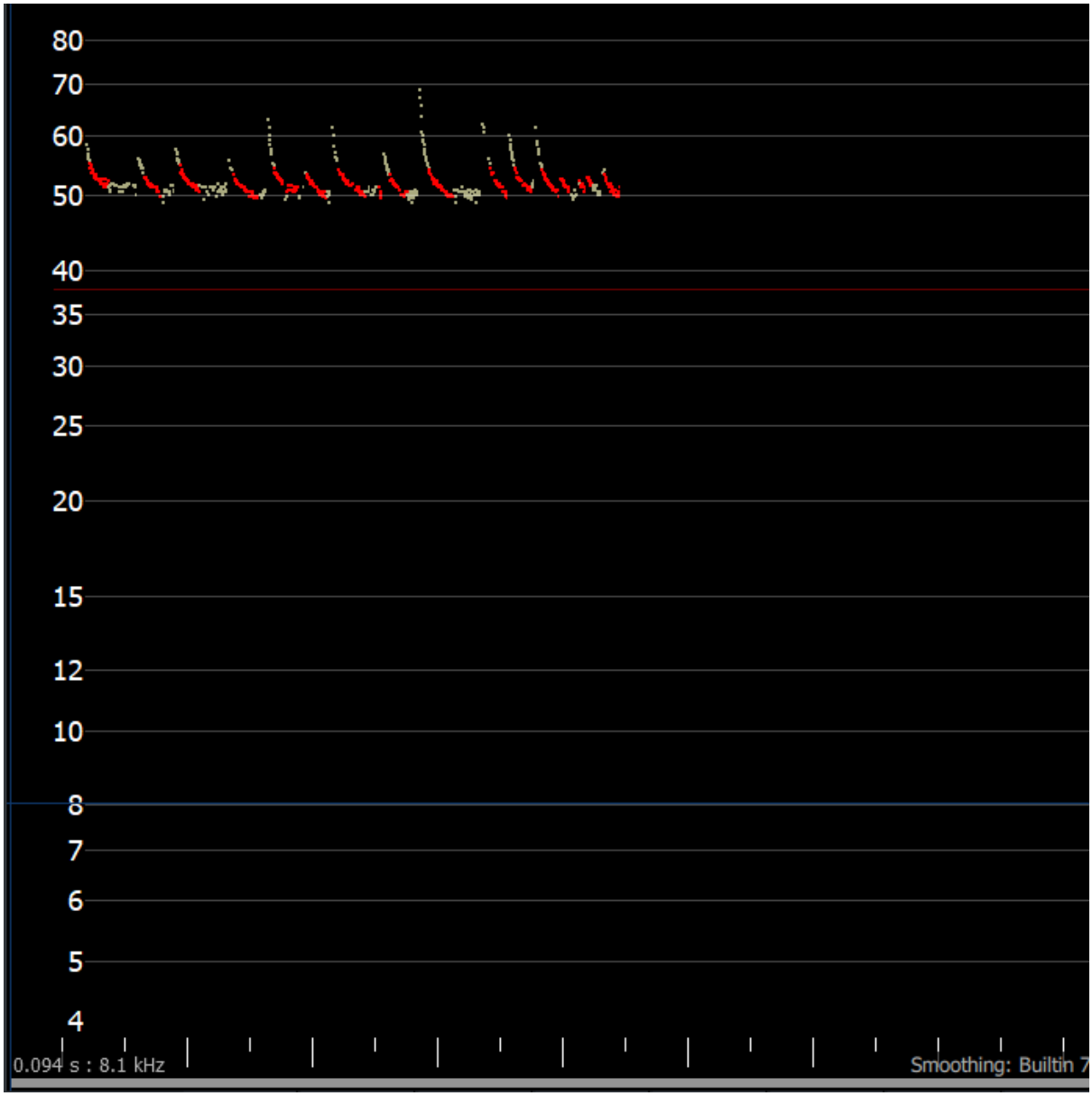


Figure 3 – *Chalinolobus morio* definite call

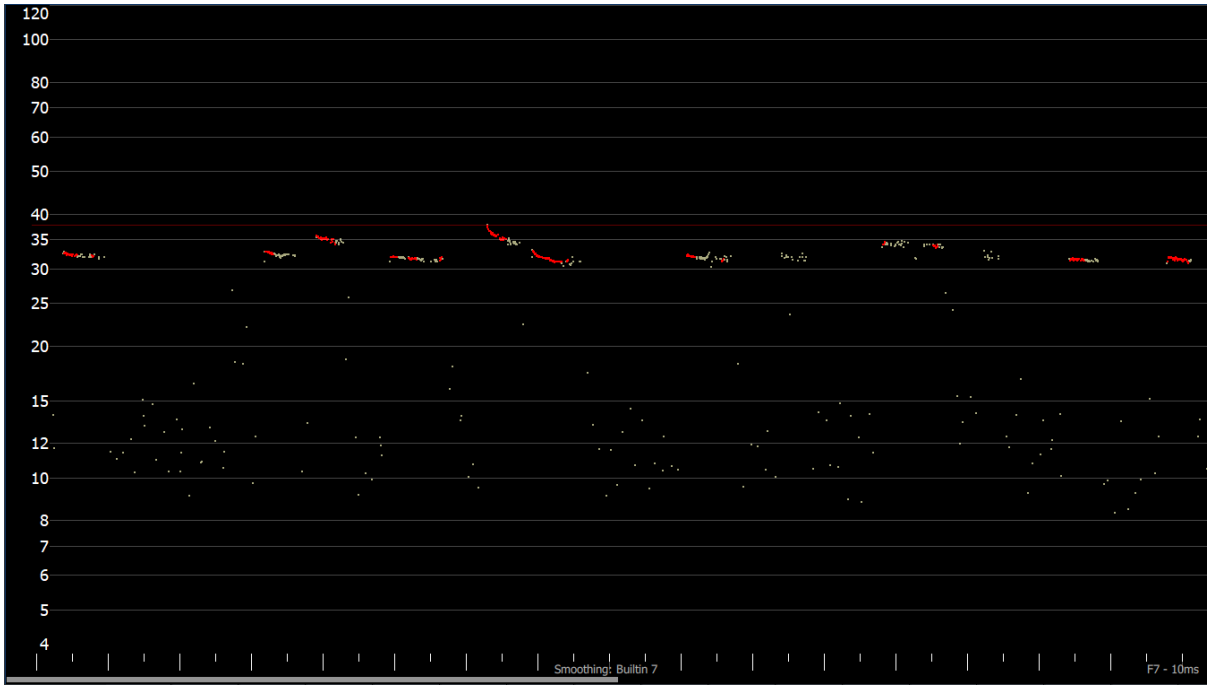


Figure 4 – *Micronomus norfolkensis* definite call

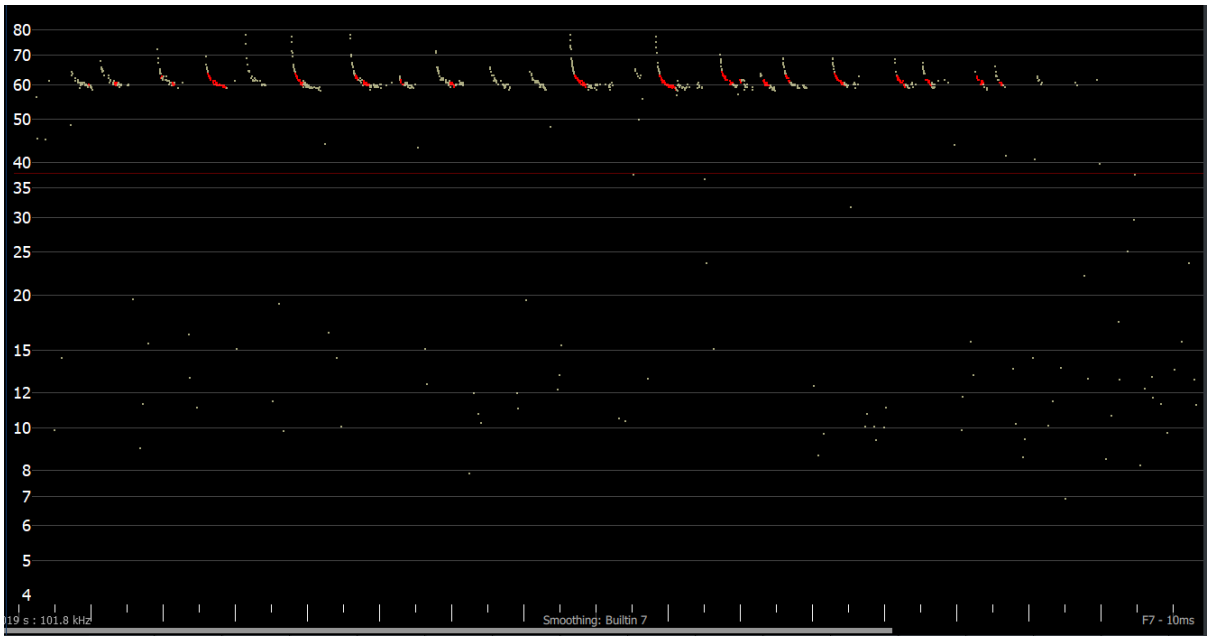


Figure 5 – *Miniopterus australis* definite call

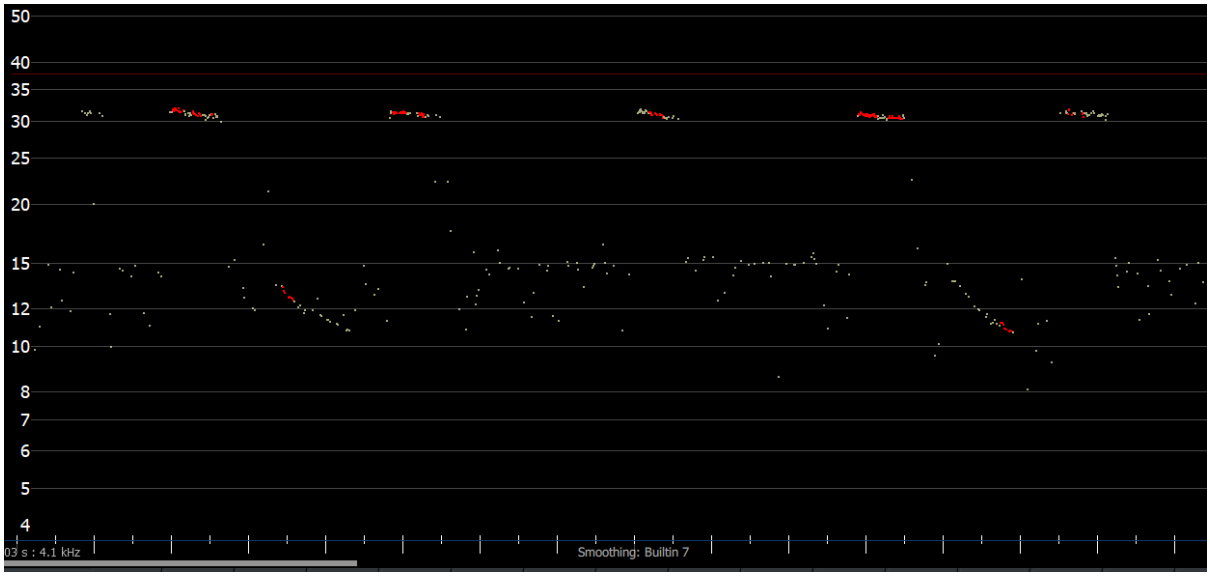


Figure 6 – *Ozimops ridei* definite call

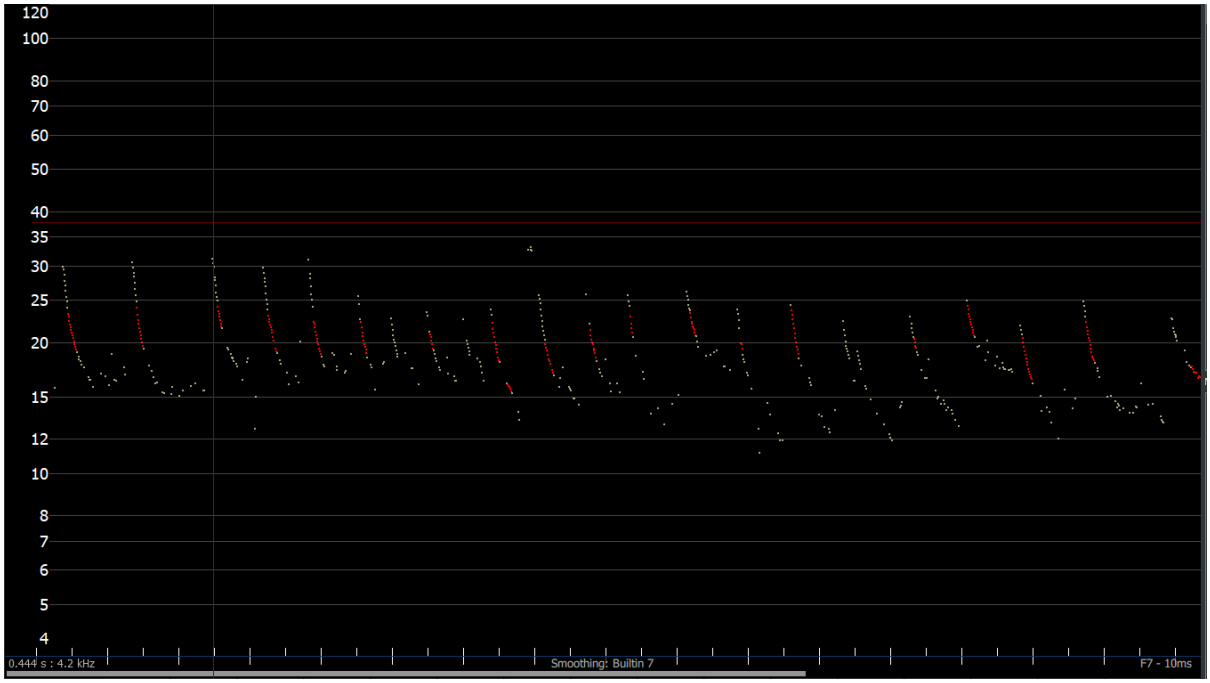


Figure 7 – *Saccolaimus flaviventris* definite call

Appendix F – Plot Field Data

Family	Scientific Name	Synonym	Common Name	Stratum	NSW Status	Comm Status	BAM Growth Form	Column1	BAM Growth Form Group	HTE	Present on Site	Plot 1	Plot 2	Plot 3	Plot 4	Plot 5	Plot 6
Amaranthaceae	*Alternanthera denticulata*		Lesser Joyweed				Forb	F	Forb (FG)		1					0.1	
Anthericaceae	*Laxmannia gracilis*		Slender Wire Lily				Forb	F	Forb (FG)		1						0.1
Apiaceae	*Centella asiatica*		Swamp Pennywort				Forb	F	Forb (FG)		1		0.1		0.1	0.1	
Apocynaceae	*Parsonsia straminea*		Common Silkpod				Vine	L	Other (OG)		1	0.3					0.1
Asteraceae	*Cyanthillium cinereum*	*Vernonia cinerea*					Forb	F	Forb (FG)		1					0.2	
Asteraceae	*Senecio madagascariensis**		Fireweed				nil - exotic			Y	1				3	0.1	
Asteraceae	*Conyza bonariensis**		Flax-leaf Fleabane				nil - exotic				1					0.1	
Asteraceae	*Cirsium vulgare**		Spear Thistle				nil - exotic				1					0.1	
Asteraceae	*Sonchus oleraceus**		Common Sow-thistle				nil - exotic				1			0.1	0.1		0.1
Asteraceae	*Hypochaeris radicata**		Flatweed				nil - exotic				1			0.1	0.1		
Asteraceae	*Cotula sp.**						nil - exotic				1				0.1		
Asteraceae	*Ozothamnus diosmifolius*		Ball Everlasting				Shrub	S	Shrub (SG)		1						0.1
Asteraceae	*Chrysocephalum apiculatum*		Common Everlasting				Forb	F	Forb (FG)		1						0.1
Asteraceae	*Cassinia quinquefaria*						Shrub	S	Shrub (SG)		1		0.1				0.1
Asteraceae	*Conyza sumatrensis**	*Conyza albida*	Tall Fleabane				nil - exotic				1			0.1			
Asteraceae	*Coronidium oxylepis subsp. oxylepis*						Shrub		Shrub (SG)		1	0.1					
Bignoniaceae	*Pandorea pandorana*		Wonga Vine				Vine	L	Other (OG)		1	0.1					
Brassicaceae	*Lepidium sp.*		A Peppercress				Forb		Forb (FG)		1				0.1		
Chenopodiaceae	*Einadia hastata*		Berry Saltbush				Forb	F	Forb (FG)		1				0.1		
Convolvulaceae	*Dichondra repens*		Kidney Weed				Forb	F	Forb (FG)		1	0.1			0.1		
Cyperaceae	*Cyperus eragrostis**		Umbrella Sedge				nil - exotic			Y	1					0.5	
Cyperaceae	*Lepidosperma gunnii*						Sedge	V	Grass & grasslike (GG)		1		0.2				0.1
Dilleniaceae	*Hibbertia pedunculata*						Shrub	S	Shrub (SG)		1		0.2				
Epacridaceae	*Leucopogon juniperinus*		Prickly Beard-heath				Heath shrub	Z	Shrub (SG)		1		25				3
Euphorbiaceae	*Breynia oblongifolia*		Coffee Bush				Shrub	S	Shrub (SG)		1	0.1			0.1		
Euphorbiaceae	*Poranthera microphylla*		Small Poranthera				Forb	F	Forb (FG)		1						0.1
Euphorbiaceae	*Poranthera ericifolia*						Forb	F	Forb (FG)		1			0.1			
Fabaceae	*Acacia elongata*	*Racosperma elongatum*	Swamp Wattle				Shrub	S	Shrub (SG)		1	0.3	20			0.5	1
Fabaceae	*Trifolium repens**		White Clover				nil - exotic				1					0.1	
Fabaceae	*Medicago sp.**		A Medic				nil - exotic				1					0.1	
Fabaceae	*Glycine tabacina*		Twining Glycine				Vine	L	Other (OG)		1			0.1	0.1		
Fabaceae	*Trifolium sp.**		A Clover				nil - exotic				1				0.1		
Fabaceae	*Daviesia ulicifolia*		Gorse Bitter Pea				Shrub	S	Shrub (SG)		1	0.1		0.1			1
Fabaceae	*Desmodium varians*		Slender Tick-trefoil				Vine	L	Other (OG)		1						0.2
Fabaceae	*Glycine clandestina*		Twining Glycine				Vine	L	Other (OG)		1	0.1	0.1	0.1			0.1
Fabaceae	*Acacia ulicifolia*		Prickly Moses				Shrub	S	Shrub (SG)		1	0.1		0.1			0.1
Fabaceae	*Acacia falcata*	*Mimosa obliqua*	Sickle Wattle				Shrub	S	Shrub (SG)		1		0.8	0.1			
Fabaceae	*Senna pendula var. glabrata**						nil - exotic			Y	1	0.2					
Fabaceae	*Hardenbergia violacea*		False Sarsparilla				Vine	L	Other (OG)		1	0.1					
Fabaceae	*Dillwynia retorta*		Eggs and Bacon				Shrub	S	Shrub (SG)		1		1				
Fabaceae	*Acacia podalyriifolia*		Queensland Silver Wattle				Shrub	S	Shrub (SG)		1	0.2					
Fabaceae	*Acacia irrorata*	*Acacia pauciglandulosa*	Green Wattle				Shrub		Shrub (SG)		1	1.5					
Goodeniaceae	*Goodenia rotundifolia*						Forb		Forb (FG)		1					0.1	0.1
Haloragaceae	*Gonocarpus teucrioides*		Raspwort				Forb	F	Forb (FG)		1		0.1				0.1
Juncaceae	*Juncus usitatus*		Common Rush				Rush	R	Grass & grasslike (GG)		1					25	
Lobeliaceae	*Lobelia purpurascens*	*Pratia purpurascens*	Whiteroot				Forb	F	Forb (FG)		1	1	0.1	0.3	0.5		0.2
Lomandraceae	*Lomandra filiformis*		Wattle Matt-rush				Rush	R	Grass & grasslike (GG)		1	0.1		0.1	0.1		0.2
Lomandraceae	*Lomandra multiflora subsp. multiflora*		Many-flowered Mat-rush				Rush	R	Grass & grasslike (GG)		1	1	0.3	1			0.5
Lomandraceae	*Lomandra longifolia*		Spiky-headed Mat-rush				Rush	R	Grass & grasslike (GG)		1	10		2			0.2
Malvaceae	*Sida rhombifolia**		Paddy's Lucerne				nil - exotic				1				0.5		
Malvaceae	*Modiola caroliniana**		Red-flowered Mallow				nil - exotic				1				0.5		
Meliaceae	*Melia azedarach*		White Cedar				Tree	T	Tree (TG)		1			0.1			
Myrtaceae	*Melaleuca quinquenervia*		Broad-leaved Paperbark				Tree	T	Tree (TG)		1					10	
Myrtaceae	*Corymbia maculata*		Spotted Gum				Tree	T	Tree (TG)		1	45		20		0.1	4
Myrtaceae	*Eucalyptus tereticornis*		Forest Red Gum				Tree	T	Tree (TG)		1					0.1	
Myrtaceae	*Eucalyptus paniculata*		Grey Ironbark				Tree	T	Tree (TG)		1				50		2
Myrtaceae	*Eucalyptus crebra*		Narrow-leaved Ironbark				Tree	T	Tree (TG)		1				5		
Myrtaceae	*Eucalyptus globoidea*		White Stringybark				Tree	T	Tree (TG)		1	0.8		15	2		3
Myrtaceae	*Eucalyptus punctata*		Grey Gum				Tree	T	Tree (TG)		1	0.5					30
Myrtaceae	*Eucalyptus fibrosa*		Broad Leaved Ironbark				Tree	T	Tree (TG)		1	2					
Ochnaceae	*Ochna serrulata**		Mickey Mouse Plant				nil - exotic			Y	1			0.2			
Oxalidaceae	*Oxalis perrenans*		Yellow-flowered Wood Sorrel				Forb		Forb (FG)		1	0.1	0.1	0.1	0.1		0.1
Phormiaceae	*Dianella revoluta*		Blueberry Lily				Forb		Forb (FG)		1						0.1
Phormiaceae	*Dianella longifolia*		Blue Flax Lily				Forb	F	Forb (FG)		1	0.8					0.1
Phytolaccaceae	*Phytolacca octandra**		Inkweed				nil - exotic				1				0.1	0.1	
Pittosporaceae	*Pittosporum undulatum*		Sweet Pittosporum				Shrub	S	Shrub (SG)		1				2.5		
Pittosporaceae	*Bursaria spinosa*		Native Blackthorn				Shrub		Shrub (SG)		1	0.1	15	0.5	0.1		0.1
Plantaginaceae	*Plantago lanceolata**		Ribwort				nil - exotic				1				0.1	0.1	
Poaceae	*Cynodon dactylon*		Common Couch				Other Grass	D	Grass & grasslike (GG)		1	0.3	15			20	
Poaceae	*Paspalum dilatatum**		Paspalum				nil - exotic			Y	1	0.3	0.2			2	
Poaceae	*Cenchrus clandestinum**	*Pennisetum clandestinum**	Kikuyu				nil - exotic			Y	1				2.5	0.5	
Poaceae	*Andropogon virginicus**		Whisky Grass				nil - exotic			Y	1					0.2	
Poaceae	*Entolasia stricta*		Wiry Panic				Tussock Grass	G	Grass & grasslike (GG)		1	10	25			0.1	3
Poaceae	*Setaria parviflora**		Slender Pigeon Grass				nil - exotic				1	0.1		0.1		0.1	0.1
Poaceae	*Cortaderia selloana**		Pampas Grass				nil - exotic			Y	1					0.1	
Poaceae	*Chloris gayana**		Rhodes Grass				nil - exotic			Y	1					0.1	
Poaceae	*Axonopus fissifolius**	*Axonopus affinis**	Narrow-leaved Carpet Grass				nil - exotic			Y	1					0.1	
Poaceae	*Microlaena stipoides*		Weeping Grass				Other Grass		Grass & grasslike (GG)		1	5	3	10	1		3
Poaceae	*Entolasia marginata*		Bordered Panic				Tussock Grass	G	Grass & grasslike (GG)		1	15	5	15	0.3		
Poaceae	*Aristida vagans*		Three-awn Speargrass				Tussock Grass	G	Grass & grasslike (GG)		1	0.3		0.1	0.1		4
Poaceae	*Themeda australis*	*Themeda triandra*	Kangaroo Grass				Tussock Grass	G	Grass & grasslike (GG)		1	5	2				20
Poaceae	*Echinopogon caespitosus*		Bushy Hedgehog-grass				Tussock Grass		Grass & grasslike (GG)		1	0.1		0.1			0.5
Poaceae	*Paspalidium distans*						Tussock Grass	G	Grass & grasslike (GG)		1						0.5
Poaceae	*Dichelachne micrantha*		Short-hair Plume Grass				Tussock Grass	G	Grass & grasslike (GG)		1						0.1
Poaceae	*Panicum simile*		Two Colour Panic				Tussock Grass	G	Grass & grasslike (GG)		1	0.1		0.1			
Poaceae	*Aristida ramosa*		Purple Wiregrass				Tussock Grass	G	Grass & grasslike (GG)		1			0.1			
Poaceae	*Sporobolus creber*		Slender Rat's Tail Grass				Tussock Grass	G	Grass & grasslike (GG)		1	0.1					
Poaceae	*Ehrharta erecta**		Panic Veldtgrass				nil - exotic			Y	1	0.1					
Poaceae	*Cymbopogon refractus*		Barbwire Grass				Tussock Grass	G	Grass & grasslike (GG)		1	0.1					
Poaceae	*Austrostipa sp.*		A Speargrass				Tussock Grass		Grass & grasslike (GG)		1	0.1					
Proteaceae	*Hakea sericea*		Needlebush				Shrub	S	Shrub (SG)		1		1				
Pteridaceae	*Cheilanthes sieberi*		Rock Fern				Fern and fern allies	E	Fern (EG)		1	0.1	1	0.1			0.1
Rubiaceae	*Opercularia diphylla*						Forb	F	Forb (FG)		1						0.1
Rutaceae	*Boronia polygalifolia*		Dwarf Boronia				Forb	F	Forb (FG)		1		0.1				
Solanaceae	*Solanum mauritianum**		Wild Tobacco				nil - exotic				1					0.1	
Solanaceae	*Solanum nigrum**		Black Nightshade, Black-berry Nightshade				nil - exotic				1				0.1		
Stylidiaceae	*Stylidium graminifolium*		Grass Trigger Plant				Forb	F	Forb (FG)		1		0.1				
Typhaceae	*Typha orientalis*		Cumbungi				Rush	R	Grass & grasslike (GG)		1					0.2	
Verbenaceae	*Verbena bonariensis**		Purpletop				nil - exotic				1					1	
Verbenaceae	*Lantana camara**		Lantana				nil - exotic			Y	1	1		0.1	0.4		0.5

		Overall Species Count	100	40	24	28	29	29	39
		Exotic Species	0	5	1	6	12	17	3
		Exotic Cover %		1.7	0.2	0.7	7.6	5.4	0.7
		HTE %		1.6	0.2	0.3	5.9	3.6	0.5
		Composition							
		Condition							
		Tree (TG)		4	0	3	3	3	4
		Shrub (SG)		8	8	4	3	1	7
		Grass & grasslike (GG)		14	7	9	4	4	11
		Forb (FG)		4	6	3	6	4	10
		Fern (EG)		1	1	1	0	0	1
		Other (OG)		4	1	2	1	0	3
		Structure Condition							
		Tree (TG)		48.3	0	35.1	57	10.2	39
		Shrub (SG)		2.5	63.1	0.8	2.7	0.5	5.4
		Grass & grasslike (GG)		47.2	50.5	28.5	1.5	45.3	32.1
		Forb (FG)		2	0.6	0.5	1	0.5	1.1
		Fern (EG)		0.1	1	0.1	0	0	0.1
		Other (OG)		0.6	0.1	0.2	0.1	0	0.4
		High Threat Exotics		1.6	0.2	0.3	5.9	3.6	0.5

** indicates exotic*
^ indicates non-endemic native eg WA or SA species not naturally occuring

Key

U	Upper
M	Middle
L	Lower
E4	Extinct
CE	Critically Endangered
E	Endangered
V	Vulnerable
P	Protected

Date: 13/5/20	Job number:	Site: 1 Brickworks Rd	Plot ID: P01	Bearing: S8 NE	Observers: TM EL

AEP
ECOLOGY | BIOBANKING | OFFSETS | BUSHFIRE

Upper stratum	C	Ab	Mid stratum	C	Ab	Lower stratum	C	Ab	Lower stratum	C	Ab
C. maculata	45		Acacia irrorata	1.5	10	Lomandra long.	10		Setaria parviflora	0.1	5
E. puatata	0.5	1	Lantana camara	1	3	Entolasia marginata	15		Cymbopogon refractus	0.1	5
E. fibrosa	2	2	Bursaria spinosa	0.1	1	Lobelia purpurescens	1	100	Austrostipa.	0.1	5
~~Eucalyp~~?	0.8	1	Parsonsia stram.	0.3	6	Microlaena stipoides	5		Oxalis perrenans	0.1	5
E. globoidea			Acacia elongata	0.3	5	Themeda triandra	5		Paspalum dilatum	0.3	20
			Breynia oblongifolia	0.1	2	Entolasia stricta	10		Sporobolus creber	0.1	2
			Senna pendula	0.2	5	Dianella spelongifolia	0.8	30	Helichrysum collinum	0.1	1
			Acacia ulicifolia	0.1	2	Lomandra filiformis	0.1	10	Pomderea pondaroana	0.1	1
			Daviesia ulicifolia	0.1	4	Hardenbergia violacea	0.1	5			
			Acacia podalyriifolia	0.2	1	Dichondra repens	0.1	5			
						Cheilanthes sieberi	0.1	30			
						Glycine clandestina	0.1	50			
						Landra multiflora	1	50			
						Aristida vagans	0.3	50			
						Ehrharta erecta	0.1	1			
						Cynodon dactylon	0.3	20			
						Echinopogon caespitosus	0.1	10			
						Panicum simile	0.1	5			
Total Cover DO FIRST											

20mx20m plot = 400m² **Note:** 0.1% = 63x63cm, 0.5% = 1.4x1.4m, 1% = 2x2m, 5% = 4x5m, 25% = 10x10m

C (%): 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ... (to nearest 5%). Include overhanging plants.

Abundance: 1-20, 50, 100, 500, 1000 etc. (numbers >20 are estimates only. For overhanging plants, record abundance as 1.

canopy total ≈ 40 - 50%
shrub ≈ 5%
Grasses ≈ 50 - 60%

Appendix H – Site Photographs

Above and below: Cleared land in the centre of the site

Above and below: Highly disturbed dam and riparian zone

Above: Dam largely devoid of aquatic vegetation
Below: Rubbish dumping on dam banks

Above: North of the dam – cleared land and shrubby regrowth
Below: Pasture land in the north of the Subject Site

Above and below: Evidence of site use for grazing purposes

Above: Glider sp. (probable Sugar Glider);
Below: Sugar Glider

Appendix I – Other Legislation

EPBC Act Assessment

A search was conducted in May 2020 of Matters of National Environmental Significance (MNES) as relevant to the *Environment Protection & Biodiversity Conservation Act 1999* (EPBC Act). The following MNES are considered in this assessment.

World Heritage Properties:

The Subject Site is not a World Heritage area and is not in close proximity to any such area.

National Heritage Places:

The Subject Site is not a National Heritage place, and it is not in close proximity to any such place.

Wetlands of International Significance (declared Ramsar wetlands);

While the Subject Site lies within 10km (approx. 9km) of the Ramsar listed Hunter Estuary Wetlands, it is not considered the development would negatively impact the wetlands.

Great Barrier Reef Marine Park:

The Subject Site is not part of, or within close proximity to, the Great Barrier Reef Marine Park.

Commonwealth Marine Areas:

The Subject Site is not part of, or within close proximity to, any Commonwealth Marine Area.

Threatened Ecological Communities:

The site does not contain any EPBC-listed TEC.

Threatened Species:

No threatened species listed under the EPBC Act were recorded on Subject Site. The Subject Site is not mapped as important habitat for Swift Parrot or Regent Honeyeater.

Migratory Species:

A number of EPBC listed migratory species have some potential to visit the Subject Site on an irregular basis. However, it is not considered that the development of this land as proposed is likely to significantly impact the potential habitat of such species or disrupt migratory patterns.

EPBC Act Assessment Conclusion:

Given that the development may only provide potential seasonal foraging habitat, the Subject Site is not mapped as important habitat for Swift Parrot and no roost camp is present within the site, referral under the EPBC Act is likely to be unnecessary for this development.

SEPP Koala Habitat Protection 2019

State Environmental Planning Policy (Koala Habitat Protection) 2019 (the Koala SEPP) applies to land within the Maitland LGA. As the Subject Site does not have a Koala Plan of Management (KPOM) over it and parts of the land are identified on the Koala Development Application Map as highly suitable Koala Habitat (**Figure 1**), an assessment for "Core Koala Habitat" under the Koala SEPP is required.

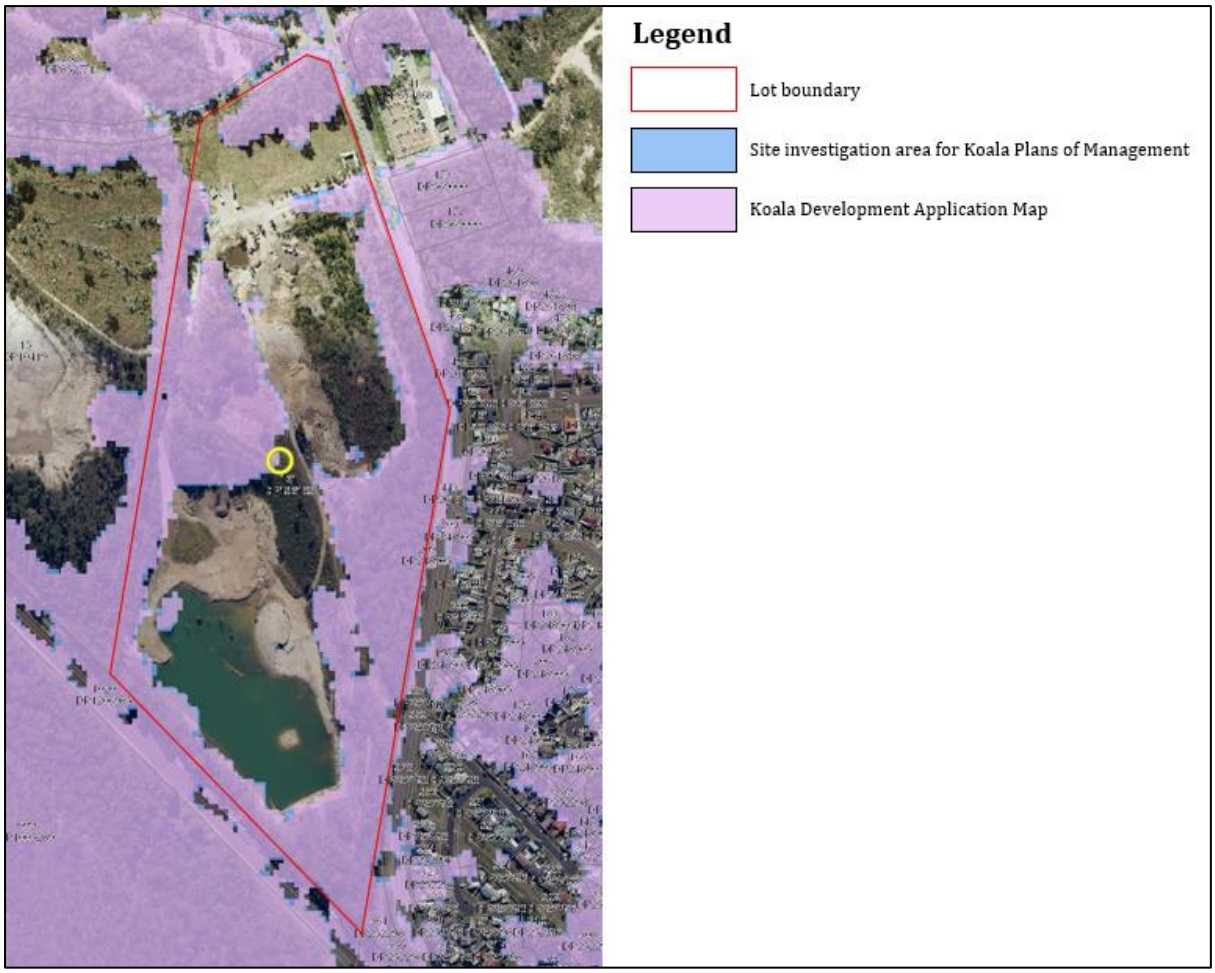


Figure 1 - Koala SEPP Mapping (accessed 22/05/2020)

Within the guidelines, **Core Koala Habitat** is defined as:

a) an area of land where koalas are present, or

b) an area of land –

i) which has been assessed by a suitably qualified and experienced person in accordance with the Guideline as being highly suitable koala habitat, and

ii) where koalas have been recorded as being present in the previous 18 years.

Noting that "**An area of land**" is defined as including both the development footprint and broader area of land on which the development is proposed (i.e. the Parent Lots).

A desktop search in the NSW BioNet Atlas of threatened species revealed two records of Koala within a 10km x 10km area around the Subject Site in the last 18 years. Both records lie approx. 4.8km from the Subject Site across farmland and /or residential land, which is greater than the required 2.5km assessment distance, and have no corridor or avenue of connectivity for Koala to the Subject Site.

Although surveys identified listed Koala feed trees within sufficient densities in particular areas of the site (therefore constituting *highly suitable koala habitat* under the Koala SEPP), targeted surveys (2019) and previous assessments, and past BioNet records have not identified the presence of Koalas on or near the site (with only two records from 2002 within 10km discussed above).

Subsequently, the site does not constitute "Core Koala Habitat" and as such no further provisions of the SEPP would apply.

Appendix J – BOS Support Correspondence

From: Natalie Black
To: Edouard Loisance
Subject: FW: BSM-419 FW: Survey Submission Confirmation: Biodiversity Offsets Scheme enquiry form
Date: Thursday, 28 May 2020 11:16:48 AM

FYI

From: Denise Wallace <Denise.Wallace@environment.nsw.gov.au> **On Behalf Of** OEH ROD BAM Support Mailbox
Sent: Wednesday, 15 January 2020 5:03 PM
To: Natalie Black <natalie@andersonep.com.au>
Subject: BSM-419 FW: Survey Submission Confirmation: Biodiversity Offsets Scheme enquiry form

Hi Natalie

The lot is not within regent honeyeater important areas or draft swift parrot important areas.

This call is now closed.

Regards
The BAM Support Team

From: Benjamin Thomas <Benjamin.Thomas@environment.nsw.gov.au> **On Behalf Of** OEH ROD BAM Support Mailbox
Sent: Wednesday, 8 January 2020 2:39 PM
To: natalie@andersonep.com.au
Subject: BSM-419 FW: Survey Submission Confirmation: Biodiversity Offsets Scheme enquiry form

Hi Natalie,

Thank you for your enquiry which has been received by the BAM Support Team. Your reference is BSM-419.

Your enquiry has been forwarded to a subject matter expert for attention.

Subject Matter Expert

Please respond to the bam.support@environment.nsw.gov.au mailbox.

Regards
The BAM Support Team

From: noreply@survey.environment.nsw.gov.au <noreply@survey.environment.nsw.gov.au>
Sent: Wednesday, 8 January 2020 9:16 AM
To: OEH ROD BAM Support Mailbox <bam.support@environment.nsw.gov.au>
Subject: Survey Submission Confirmation: Biodiversity Offsets Scheme enquiry form

Survey Name:	Biodiversity Offsets Scheme enquiry form
Submitted On:	8/01/2020 9:15:57 AM
Q 1: Your enquiry relates to:	

Consultants
Q 2: What would you like to ask about?
A development application or other planning approval
Q 3: Tell us more:
Can you please confirm the mapping for Lot 161 DP 136183, 1 Brickworks Road, Thornton North, NSW with regards to the important habitat for Regent Honeyeaters and Swift Parrot.
Q 4: Upload a document:
N/A
Q 5: First name:
Natalie
Q 6: Surname:
Black
Q 7: Email:
natalie@andersonep.com.au
Q 8: Phone:
0431249360

This email is intended for the addressee(s) named and may contain confidential and/or privileged information.
If you are not the intended recipient, please notify the sender and then delete it immediately.
Any views expressed in this email are those of the individual sender except where the sender expressly and with authority states them to be the views of the NSW Office of Environment and Heritage.

PLEASE CONSIDER THE ENVIRONMENT BEFORE PRINTING THIS EMAIL

Appendix K – CVs

Edouard Loisance

Curriculum Vitae

Edouard works with AEP in the role of Ecologist. He is currently completing a Diploma of Conservation and Land Management and holds a Master in Management. He has extensive experience in business development and corporate strategy consulting, including report writing, and started specialising in ecology in 2018, after acquiring experience in bush regeneration and fauna observation.

Qualifications

- Diploma of Conservation and Land Management, Tocal Agricultural College, Paterson, NSW (Expected 2020)
- Master of Management, ESCP Europe Business School, Paris, France (2007)

Ecological Consulting Experience

- Field assessment including: targeted fauna and flora surveys, BAM plots, Koala Spot Assessment Technique (SAT) surveys and tree surveys
- Assessment of sites using the Biodiversity Assessment Method (BAM) under the Biodiversity Offsets Scheme, production of Biodiversity Development Assessment Reports and Ecological Assessment Reports
- Production of assessments against various legal instruments such as EPBC Act fauna and flora assessments, comprehensive Koala plans of management and SEPP 44 and SEPP Koala Habitat Protection assessments
- Bushfire threat analysis and reporting

Volunteer Experience

- Bush Regeneration Volunteer, Hunter Wetlands Centre Australia, Shortland
- Bush Regeneration Volunteer, National Parks and Wildlife Service jointly with Blue Mountains City Council (various sites in Wentworth Falls and Blackheath, NSW)

Ecological Employment History

November 2018 – Current **Ecologist**
Anderson Environment & Planning, Newcastle

Business Management Employment History

April 2014 – June 2018 **Lead Consultant**
Quantium, Sydney

Oct 2012 – Mar 2014 **Account Director**
Catalina Marketing, Leeds, UK

Feb 2011 – Sept 2012	**Business Development Director**	
	Catalina Marketing, Paris, France	
Jan 2009 – Feb 2011	**Account Executive**	
	Procter and Gamble, Paris, France	
June 2005 – Aug 2006	**Assistant Business Manager**	
	Procter and Gamble, Weybridge, UK	

Yann Buissiere
Curriculum Vitae

Yann works with AEP in the role of Ecologist. Over the past 10 years, he has developed extensive experience in restoration ecology and land management including flora and fauna pest management, fire hazard reduction and community engagement.

Qualifications

- Diploma of Conservation and Land Management, TAFE (2013)
- Bachelor of Resources and Environmental Management, Macquarie University (2008)

Further Education & Training (select summary)

- Advanced Plant Identification (University of New South Wales)
- NSW Class C Driver's Licence.
- Operate and Maintain a Four-Wheel Drive Vehicle and undertake Winch Recovery
- Work Health & Safety White Card
- First Aid Certificate
- Vertebrate Pest Control
- Local Control Authority Officer – Biosecurity Act 2015
- Working Safely at Heights

Fields of Special Competence

- Vegetation community and weed mapping.
- Ecological field surveys including habitat assessment, hollow bearing tree surveys, bird surveys and fauna trapping.
- Botanical surveys including vegetation monitoring, targeted threatened flora search and undertaking BAM plots.
- Bush regeneration and habitat restoration
- Planning and undertaking fire hazard reduction work
- Feral animal control

Relevant Employment History

2019 - Current	**Ecologist (botanist)** Anderson Environment & Planning, Newcastle
2018 - 2019	**Ecologist (botanist)** Kleinfelder, Newcastle
2015 - 2018	**Bushland Team Coordinator** Northern Beaches Council (formerly Manly Council)
2010 - 2015	**Project Manager/Team Leader** Australian Bushland Restoration, Sydney
2010 - 2013	**Bushcare Supervisor** Mosman Council
2008 - 2010	**Bush regenerator** Australian Bushland Restoration, Sydney

Tim Mouton
Curriculum Vitae

Tim works with AEP in the role of Ecologist. Tim has over 10 years of professional experience managing projects in the fields of ecology, natural area restoration, biodiversity conservation, community education, and construction environmental management. Tim also has 5 years experience working in the field as a bush regenerator.

Qualifications

- Bachelor of Environmental Science University of Newcastle (2001)
- Conservation Land Management Certificate II Tafe (2003)
- Master of Environmental Science Southern Cross University (2008)

Further Education & Training (select summary)

- Biodiversity Assessment Methodology (BAM) Accredited Assessor (BAAS: 19083)
- NSW Class C Driver's Licence. Experienced 4WD operator.
- OH&S NSW White Card
- Erosion & Sediment Control Training (4 day Blue Book course / CPESC)
- Feral Animal Control training (1080 & Pindone baiting)
- Certificate 3 in Chemical Application (AQF3)

Fields of Special Competence

- Ecological field survey, covering terrestrial and aquatic flora and fauna
- Highly proficient at botanical surveys and establishing monitoring programs
- Project Management and auditing
- Restoration Science

Professional Affiliations / Memberships (past / present)

- Board of Management member for Worimi Conservation Lands (NPWS & Worimi LALC)
- Certified Practitioner in Erosion & Sediment Control (CPESC) (not currently active)

Natalie Black
Curriculum Vitae

Natalie works with AEP in the role of Senior Environmental Manager. She has extensive knowledge in environmental management, environmental planning, and report writing and assessment. With a detail understanding of planning, catchment management, coastal management and rehabilitation. Natalie has had a successful career with both state and local government in conservation, planning and field investigation roles. Natalie has also gained extensive communication skills and project management through her previous career in lecturing. Her background and experience in the ecological and planning fields is utilised in a diverse array of application in her current role.

Qualifications

- B.Sc (Hons), University of Newcastle, 2002 Sustainable Resource Management and Marine Science.
- Master Planning, University of Technology Sydney 2007.
- Certificate IV Training and Assessment at NSW TAFE 2012.
- BAM Assessor; accreditation number: BAAS19076.

Certification

- Evidence Gathering and Legal Process (Australian Institute of Environmental Health).
- Conflict Resolution Course (LGSA).
- Report Writing Course (LGSA).
- Powerful Presentation (LGSA).
- NSW Rural Fire Services Bush Fire Assessment
- Relocation of Threatened Species (Botanical Gardens Sydney).
- Sustainable Home Assessment Reduction Revolution.
- Flora and Fauna Survey Assessments Niche Environment and Heritage.
- First Aid TAFE.

Fields of Special Competence

- Environmental Planning
- Environmental Management and rehabilitation of catchments coastal waterways. Statement of Environmental Effects (preparation and assessing).
- Fish Passage
- Marine ecosystems including; mangroves, seagrasses, algae, Fauna and habitat assessment.
- vegetation.
- Communicating with a wide range of stakeholders.
- Development Application.
- Education in both Environmental and Planning industries.
- Koala Plans of Management.
- Policy Development.

Employment History

2019 to present AEP Senior Environmental Manager

2010 to 2019

2001-2002 John Holland Construction
Environmental Officer

- Environmental site management and monitoring and reporting on large scale infrastructure projects.

Relevant Volunteer Experience

2014 - Current Burwood Beach Coastcare - Facilitator (Volunteer)

Supporting and managing volunteers, on-ground works, promotion and funding opportunities on a monthly basis, to undertake conservation and restoration activities within Glenrock State Conservation Area (NPWS estate).

2013 - 2016 Humane Society International – EPBC Act Nomination Support

Preparation of Threatened Ecological Community (TEC) nominations under the Commonwealth Environment Protection and Biodiversity Conservation Act, 1999 (EPBC Act).

IAN BENSON
Curriculum Vitae

Ian works with AEP in the role of Principal Ecologist. He is an experienced field ecologist, bird watcher and a regular participant in wader surveys. Ian has previously had a successful career as a project manager with a local geotechnical engineering firm. His background in project management and soil sciences combined with his ecological knowledge is utilised in a diverse array of applications in his current role.

Qualifications

- Graduate Diploma in Science (Ecology) University of New England (2014)
- Bachelor Engineering (Civil) University of Newcastle (2008)

Further Education & Training (select summary)

- Biobank and Biocertification Assessors Training Course
- Advanced Plant Identification (University of New South Wales)
- NSW Class C Driver's Licence. Experienced 4WD operator
- Occupational Health & Safety Training
- Rail Industry Worker
- ARTC Safety Induction for Contractors (NSW)
- ARTC Hunter Bulk Terminal Induction

Fields of Special Competence

- Biobanking & Biodiversity Offset Commissions – initial scoping and feasibility, BAM impact assessments and BDAR reporting, biobank calculations, Stewardship site creation
- Detailed knowledge of environmental legislation and approval pathways
- Ecological field survey and habitat assessment covering terrestrial and aquatic flora and fauna. Experienced in camera trap methods particularly targeting cryptic and difficult to identify mammal species.
- Highly proficient at avifauna surveys, including challenging wetland and shorebird environs
- High level of experience undertaking nocturnal survey of arboreal mammals and nocturnal birds
- Project Management
- Soil science

Professional Affiliations / Memberships (past / present)

- Hunter Bird Observers Club (HBOC)
- Australasian Seabird Group
- Graduate Member of The Institution of Engineers Australia in the Civil College

Relevant Employment History

2019-Current **Principal Ecologist**
Anderson Environment & Planning, Newcastle

Currently employed by Anderson Environment & Planning in the role of Principal Ecologist overseeing a team of 15 professional ecology staff and all aspects of the business including training and management of field and office staff undertaking ecology and bushfire works to assist in the provision of consulting services to land, property, mining industry, legal and government sectors. Covering ecological, project management, environmental, planning services, advices, strategy and representation.

2018-2019 **Senior Ecologist**
Anderson Environment & Planning, Newcastle

2016-2018 **Ecologist**
Anderson Environment & Planning, Newcastle

2012-2016 **Project Manager**
Douglas Partners, Newcastle

As a project manager with Douglas Partners I was responsible for proposal and tender preparation, planning, implementation and reporting of geotechnical and geo-environmental investigations for a broad range of projects including site classification, foundations, pavements, bridges and slope stability. I was required to liaise with clients regarding project requirements, project goals and deadlines. I was responsible for the development and implementation of Work Health and Safety Plans as well as Environmental Plans and documentation. This included the development of safe work procedures, safety inspections on site and implementing improved safety procedures with staff. I was responsible for ensuring projects were completed on time and on budget whilst meeting the clients' expectations and achieving quality assurance standards.

2008-2012 **Geotechnical Engineer**
Douglas Partners, Newcastle

As a geotechnical engineer for Douglas Partners I was involved in the planning and implementation of geotechnical investigations for a wide range of development in the Hunter Valley area. I was primarily involved in site supervision of geotechnical investigations using drilling rigs for boreholes, truck mounted cone penetration testing and test pit excavations using excavators and backhoes. My role also included site inspections involving the assessment of conditions for piles, piers and shallow footings. I also undertook site walkovers for assessment of mine subsidence and slope stability.

2007-2008 **Undergraduate Geotechnical Engineer**
Douglas Partners, Newcastle

Whilst an undergraduate engineer with Douglas Partners I experienced a broad range of practice areas and developed a diverse range of engineering skills.

Relevant Ecological Experience

2013 - Current **Bird Surveyor**
Hunter Bird Observers Club

Volunteer survey work for Hunter Bird Observers Club for regular wader and water bird counts and Tomago and Kooragang Island.

2017 – Current **Birdata Moderator**
Birdlife Australia

Volunteer moderating and vetting bird surveys from *Birdata* which is the Birdlife Australia Atlas to ensure a robust database for both the Hunter Valley and Central Coast reporting areas totalling approximately 5000 surveys per year.