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Streamlined Biodiversity Development Assessment Report (Small Area and Planted Native Vegetation)

Proposed residential subdivision at 527, 507, 501, 463 and
457 Cessnock Road, Gillieston Heights NSW 2321



Prepared for: Walker Gillieston Heights Pty Ltd

22 June 2023

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Document Control

Document Name	Streamlined Biodiversity Development Assessment Report (Small Area and Planted Native Vegetation) – Residential Subdivision at 527, 507, 501, 463 & 457 Cessnock Rd Gillieston Heights, NSW
Project Number	2665.02
Client Name	Walker Gillieston Heights Pty Ltd
Accredited Assessor	Ian Benson (BAAS 18147)
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Revision

Revision	Date	Author	Reviewed	Approved
00	16/05/2023	Kelly Drysdale	Simon Purcell	Ian Benson
01	22/06/2023	Kelly Drysdale	Simon Purcell	Ian Benson

Distribution

Revision	Date	Name	Organisation
00	16/05/2023	Dean Davies	Walker Gillieston Heights Pty Ltd
01	22/06/2023	Dean Davies	Walker Gillieston Heights Pty Ltd

Executive Summary

Anderson Environment & Planning (AEP) was commissioned by Walker Gillieston Heights Pty Ltd (the Proponent) to undertake a Streamlined Biodiversity Development Assessment Report – Small Area (SBDAR – Small Area) and a Streamlined Biodiversity Development Assessment Report – Planted Native Vegetation (SBDAR - Planted) over land identified as Lot 2 DP 601226, Lot 1 DP 601226, Lot 1 DP 311179, Lot 2 DP302745 and Lot 1 DP 302745 (the Study Area of 43.94ha), located respectively at 527, 507, 501, 463 & 457 Cessnock Rd Gillieston Heights, NSW. The Study Area is located in the Maitland City Council (LGA) and is currently zoned R1 – ‘General Residential’ and RU2 – ‘Rural Landscape’, C2 – ‘Environmental Conservation’ and C3 – ‘Environmental Management’.

This report has been prepared to meet the requirements of the Biodiversity Assessment Method (BAM) 2020 established under Section 6.7 of the NSW *Biodiversity Conservation Act 2016*. This assessment utilises methods detailed within the BAM Order 2020 to identify biodiversity values inherent within the site, including known and potentially occurring threatened species and ecological communities, and quantifies impacts of the proposal upon these values under a streamlined assessment (small area). Further to this, give the history of the site, the report has also utilised Appendix D of BAM Order 2020- to assess Planted Native Vegetation on site.

The Subject Site consists of Lot 2 DP 601226, Lot 1 DP 601226, Lot 1 DP 311179, Lot 2 DP302745 and Lot 1 DP 302745 (33.03ha) with an easement over part of Lot 1 DP 302745. The proposed residential subdivision development includes; subdivision of the Subject Site into 322 Lots and associated civil infrastructure, with the upgrading of Cessnock Road to be built and assessed by others.

Native vegetation proposed to be removed as part of this development within the Subject Site (0.40ha) consists of:

- Plant Community Type (PCT) 1600 – *Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter*;
 - Associated State Listed Threatened Ecological Community (TEC) - *Lower Hunter Spotted Gum Ironbark Forest in the Sydney Basin and NSW North Coast Bioregions*;
 - 0.30ha of remnant native vegetation in degraded condition.
- PCT 1525 - *Sandpaper Fig - Whalebone Tree warm temperate rainforest*;
 - Associated State Listed Threatened Ecological Community (TEC) – *Lower Hunter Valley Dry Rainforest in the Sydney Basin and NSW North Coast Bioregions*;
 - 0.10ha of remnant native vegetation in poor condition.
- Planted Native Vegetation that has not been assigned a PCT;
 - 0.53ha of planted native vegetation in severely degraded condition.

Remainder of the Subject Site comprises;

- 32.10ha comprising of Exotic / Cleared / Existing Infrastructure (31.93ha) and Farm Dams/Waterbodies (0.17ha) (refer **Figure 4**).

Flora and Fauna species recorded were typical of those expected in this locality and in this type of degraded habitat with limited connection to larger patches of habitat offsite. No threatened species have been identified on site and as such no Species Credits under the Biodiversity Offset Scheme (BOS) will be incurred.

Considerations of Avoid & Minimise has been applied with the proposed development being located within predominantly cleared exotic paddocks. Impacts to native vegetation were deemed to be of minimal consequences due to the very low Vegetation Integrity Score (VIS) for all PCTs present onsite. Further to this, a Biodiversity Management Plan (BMP) has been prepared over approximately 3.56ha

of retained vegetation predominantly PCT 1525 and PCT 1600 along the eastern boundary of the Study Area as part of the Conditions of Consent. Furthermore, the installation of compensatory habitat in the form of nest boxes to mitigate the removal of hollow-bearing trees will be undertaken where required.

To offset residual impacts of the proposal upon identified biodiversity values, the proposal would require retirement of a total of:

- 4 x PCT 1600 Ecosystem Credits
- 2 x PCT 1525 Ecosystem Credit

Assessment of the proposal under other relevant environmental policy instruments including *State Environmental Planning Policy Biodiversity and Conservation) 2021 – Chapter 4 Koala Habitat Protection 2021*, *State Environmental Planning Policy (Resilience and Hazards) 2021 – Chapter 2 Coastal Management*, and the *Environment Protection and Biodiversity Conservation Act 1999* was undertaken and a referral under the *EPBC Act* is not likely to be necessary for this development.

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Study Certification and Licensing

The fieldwork was undertaken by staff identified in the table below. This report was written by Kelly Drysdale Ass Dip App Sc, Grad Cert BA, reviewed by Simon Purcell BAppSc (Wildlife Science) and certified by Ian Benson BEng (Civil) and GradDipSc (Ecology) (BAAS:18147) of Anderson Environment & Planning.

Staff	Title/Qualification	Tasks
Ian Benson	Principal Ecologist and Business Manager BEng (Civil); GradDipSc (Ecology) BAAS 18147	Scientific advice Review and Certification
Simon Purcell	Senior Ecologist/Works Coordinator BAppSc (Wildlife Science) Cert 3 Animal Care and Management	Technical advice, report review
Kelly Drysdale	Ecology Project Manager Ass.Dip. App Sc, Grad Cert BA, TAE	Project Management, report author, BAM plots, PCT determination, field surveys and reporting for RAR & BMP
Callum Reedman	Ecologist Dip Cons & Land Mgmt	Habitat assessment, Koala SATs, BAM plots, PCT determination.
Andrew Harker	Ecologist BEnvScMgt	Habitat assessment, BAM plots, tree and watercourse assessments
Darcy Kilvert	Ecologist / Project Lead B.Sc. (Bio)	BAM Plots, PCT Determination
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Yann Buissiere	Senior Ecologist BSc Resources and Env Mgmt, Dip Cons & Land Mgmt	Biodiversity Management Plan

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.

Conflict of Interest:

The BAM assessment and this BDAR have been undertaken in line with the Accredited Assessors Conflict of Interest and professional behaviour code. There are no known conflicts of interest between AEP staff or Directors and the proponent of the development.

Certification:

As the Accredited Assessor, I, Ian Benson, make the following certification:

This report has been written to comply with the requirements of the BAM 2020 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.

Certifier:



Ian Benson

Principal Ecologist and Business Manager

Anderson Environment & Planning

BAAS no. 18147

Calculator Ref: 00034742/BAAS19076/22/00034725

22 June 2023

Glossary of Terms

APZ	Asset Protection Zone
Assessment Area	Area covering a 1500-metre buffer around the Subject Site, as defined in Section 3.1.2 item 1. (b) of the BAM.
BAM	<i>Biodiversity Assessment Method Order (2020)</i> 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.
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.
BC Act	The NSW <i>Biodiversity Conservation Act 2016</i> .
Biodiversity Credit Report	Specifies the number and type of biodiversity credits required to offset the impacts of a development.
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.
BMP Land	Biodiversity Management Plan Land comprises a total of 3.56ha PCT 1525 primarily including a section (0.28ha) of PCT 1600 along the eastern boundary of the Study Area
BRW	Biodiversity Risk Weighting
BOS	The NSW Biodiversity Offsets Scheme
BV Map	The NSW DPE Biodiversity Values Map
Council	Maitland City Council
DAWE	The former Commonwealth Department of Agriculture, Water and the Environment
DCCEEW	The Commonwealth Department of Climate Change, Energy, the Environment and Water
DoEE	The former Commonwealth Department of the Environment and Energy
DPIE	The former NSW Department of Planning, Industry and Environment.
DPE	The NSW Department of Planning and Environment. Formally known as DPIE.
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 <i>BC Act</i>).
EPBC Act	The Commonwealth <i>Environment Protection and Biodiversity Conservation Act 1999</i> .
Environmental protection works	Means works associated with the rehabilitation of land towards its natural state or any work to protect land from environmental degradation, and includes bush regeneration works, wetland

	protection works, erosion protection works, dune restoration works and the like, but does not include coastal protection works.
IBRA	Interim Biogeographic Regionalisation for Australia
HBT	Hollow-bearing tree as defined in the BAM.
BC SEPP	State Environmental Planning Policy (Biodiversity and Conservation) 2021 Chapter 4 Koala Habitat Protection 2021.
HR SEPP	State Environmental Planning Policy (Hazard and Resilience) 2021 Chapter 2 Coastal Management.
OEH	The former NSW Office of Environment and Heritage.
PFC	Percentage Foliage Cover
Study Area	Consists of 527 (Lot 2 DP 601226), 507 (Lot 1 DP 601226), 501 (Lot 1 DP 311179), 463 (Lot 2 DP302745) and 457 (Lot 1 DP 302745) Cessnock Road, Gillieston Heights NSW 2321 and totals 43.94ha. (refer Figures 1 and 3). It is noted that an easement over a portion of 65 Redwood Drive Gillieston Height (Part Lot 2 DP1230739) is applicable to this proposal.
Subject Site	The Subject Site/development footprint covers 33.03ha, comprising approx. 0.30ha (PCT 1600) and 0.10ha (PCT 1525) of native remnant vegetation, 0.53ha of planted native vegetation. The majority of the Subject Site totalling 31.93ha consists of exotic / cleared / existing infrastructure and 0.17ha dam / waterbody (refer Figure 4).
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.
VIS	Vegetation Integrity Score.

1.0 Stage 1 – Biodiversity Assessment

1.1 Introduction

At the request of Walker Corporation Pty Ltd (the proponent), Anderson Environment & Planning (AEP) have undertaken a Streamlined Biodiversity Development Assessment Report – Small Area (SBDAR – Small Area) and a Streamlined Biodiversity Development Assessment Report – Planted Native Vegetation (SBDAR - Planted) over land identified as 527 (Lot 2 DP 601226), 507 (Lot 1 DP 601226), 501 (Lot 1 DP 311179), 463 (Lot 2 DP 302745) and 457 (Lot 1 DP 302745) Cessnock Road, Gillieston Heights NSW 2321 (the Study Area of 43.94ha), located within the Maitland City Council (LGA). The Study Area is currently zoned R1 – ‘General Residential’ and RU2 – ‘Rural Landscape’, C2 – ‘Environmental Conservation’ and C3 – ‘Environmental Management’.

This report has been prepared to meet the requirements of the Biodiversity Assessment Method (BAM) 2020 established under Section 6.7 of the NSW *Biodiversity Conservation Act 2016*. This assessment utilises methods detailed within the BAM Order 2020 to identify biodiversity values inherent within the site, including known and potentially occurring threatened species and ecological communities, and quantifies impacts of the proposal upon these values under a streamlined assessment (small area and planted native vegetation).

1.1.1 Biodiversity Offset Scheme Threshold Trigger

The Study Area is not BV Mapped (refer **Figure 8**) and as such, the proposal does not automatically trigger entry into the BOS through impacting BV Mapped Land.

However, the proposal will be clearing 0.30ha (PCT 1600) and 0.10ha (PCT 1525) of native remnant vegetation and 0.53ha of planted native vegetation which is above the applicable area clearing threshold for the site (0.25ha). Exceeding the threshold triggers entry into the BOS.

A BDAR is therefore a requirement under Clause 7.1 *Biodiversity Conservation Regulation 2017* by the following threshold:

- (1)(a) the clearing of native vegetation of an area declared by clause 7.2 as exceeding the threshold (which is 0.25ha).
- (1) (b) the clearing of native vegetation, or other action prescribed by clause 6.1, on land included on the *Biodiversity Values Map* published under clause 7.3.

An assessment under Appendix C, Table 12 of the BAM Order, shows that the proposal can be assessed under the Streamlined Assessment Module – Small Area, as the Minimum Lot size associated with the Subject Site is 450m² and the proposed clearing of native remnant vegetation is 0.40ha, hence being under the applicable area clearing limits for an SBDAR (small area) of 1ha.

1.1.2 Assessment Scope

The SBDAR presented herewith aims to quantify impacts of the proposal upon biodiversity values based on the methods described within the *Biodiversity Assessment Method Order 2020* (BAM Order), including threatened entities listed under the NSW *Biodiversity Conservation Act 2016* (BC Act).

The proposed development has been assessed under;

- Streamlined Biodiversity Development Assessment Report – Small Area (SBDAR – Small Area); and
- Streamlined Biodiversity Development Assessment Report – Planted Native Vegetation (SBDAR - Planted)

The two assessment pathways have been adopted considering the history of the site and nature of planted vegetation on site and is considered the most appropriate assessment methods for the site.

As per **Table 6** of the BAM 2020, the maximum area clearing limit for application of the small area development module for this minimum lot size is less than or equal to 1ha. The proposed development is seeking to clear approximately 0.30ha (PCT 1600) and 0.10ha (PCT 1525) of native remnant vegetation and 0.53ha of planted native vegetation, thus, the area clearing threshold for the minimum lot size of 0.25ha is being exceeded and falls within the area clearing limits prescribed in the BAM 2020 under the Streamlined Assessment Module – Small Area as clearing of native vegetation is less than 1ha.

The SBDAR presented herewith aims to quantify impacts of the proposal upon biodiversity values based on the methods described within the BAM Order, including threatened entities listed under the BC Act.

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

This report includes:

- **Stage 1 – Biodiversity Assessment** – including area limits, mapping of remnant vegetation communities within the location of previously identified threatened species and their habitats, and a list of threatened species, populations and communities with a likelihood of occurrence; and
- **Stage 2 – Impact Assessment** – identification of impact avoidance and mitigation measures, and the quantifying of offset requirements in the form of biodiversity credits based upon residual impacts of the proposal.

1.1.3 The Proposal

The Subject Site occurs within the Maitland LGA (refer **Figure 1**). The proposed development is located 527, 507, 501, 463 & 457 Cessnock Rd Gillieston Heights, NSW for a residential subdivision, associated access roads and ancillary infrastructure (refer **Appendix A** – Development Plans). Works are to clear the majority of native vegetation within the Subject Site. Minimal native canopy or shrub species are present within the site and have been assessed as being in a highly degraded condition.

It should be noted that applicable Cessnock Road upgrades have been assessed within GDH (2022) 'Regrowth – Kurri Kurri – Precinct 1 Biodiversity Development Assessment Report dated 2 February 2022' under DA/2022/193-464 Cessnock Road and as such has not been included within this report. Further upgrading and widening of Cessnock Rd will also be undertaken by other parties.

1.1.4 Site Particulars

Table 1 provides site context details to assist with the assessment of landscape features and to establish context of the Subject Site in the surrounding landscape.

Table 1 – Site Particulars

Detail	Comments
Client	Walker Corporation Pty Ltd
Address	527, 507, 501, 463 & 457 Cessnock Rd Gillieston Heights, NSW
Title(s)	Lot 2 DP 601226, Lot 1 DP 601226, Lot 1 DP 311179, Lot 2 DP 302745 and Lot 1 DP 302745 It is noted that an easement over a portion of 65 Redwood Drive Gillieston Height Part Lot 2 DP1230739 is applicable to this proposal.
Study Area	The Study Area consists of the proposed residential subdivision of 322 lots and a portion of the retained lands (3.56ha) is to be placed under a Biodiversity Management Plan (BMP). The Study Area totals 43.94ha (refer to Figure 1).
Subject Site	The Subject Site/development footprint covers 33.03ha, comprising approx. 0.30ha (PCT 1600) and 0.10ha (PCT 1525) of native remnant vegetation and 0.53ha of planted native vegetation. The majority of the Subject Site totalling 32.10ha consists of exotic / cleared / existing infrastructure and includes 0.17ha dam / waterbody (refer Figure 4)..
LGA	Maitland City Council (refer Figure 1).
Zoning	Under the <i>Maitland Local Environmental Plan 2011</i> (the LEP) (pub. 16-12-2011), the Study Area is currently zoned R1 – ‘General Residential’ and RU2 – ‘Rural Landscape’, C2 – ‘Environmental Conservation’ and C3 – ‘Environmental Management’.
Biodiversity values Map	The BV Map (refer Appendix E) shows that the Subject Site is not mapped as containing BV Land. No clearing of native vegetation is to be undertaken within a mapped BV area.
Minimum Lot Size	450m ²
Clearing Threshold	0.25ha
Current Land Use	The Subject site is currently used for cattle grazing with five residential homes and associated agricultural infrastructure. The Subject Site is highly managed with a few patches of remnant and planted native vegetation, and scattered trees which is in a degraded condition overall.
Proposed Development	The proposal includes a residential subdivision and associated civil works within 527, 507, 501, 463 & 457 Cessnock Rd Gillieston Heights, NSW
Surrounding Land Use	The site is bounded by: <ul style="list-style-type: none"> • Urban development to the north zoned R1 – General Residential and C3 – Environmental Management. • Wallis Creek to the east with floodplains/pastures. The zoning is a combination of RU2 – Rural Landscape and C2 – Environmental Conservation. • Testers Hollow to the south with floodplains/pasture. The zoning is a combination of RU2 – Rural Landscape and C2 – Environmental Conservation. • Cessnock Road to the west with rural properties zoned RU2 – Rural Landscape and R1 – General Residential.

Figure 1 depicts the extent of the lot boundary; **Figure 2** defines the Subject Site and depicts the location of the site within the landscape.

1.1.1 Geology and Soils

Reference to the 1:100,000 Sheet Soil Landscapes (eSPADE) of the Study Area indicates that the site is primarily located within the Soil Landscapes;

- Bolwarra Heights Soil Landscape;
- Middlehope Soil Landscape; and
- Hunter Variant A.

The Bolwarra Heights Soil Landscape encompasses the majority of the Subject Site and is characterised as follows:

- Landscape – rolling low hills on Permian sediments in the centre-west of the sheet in the East Maitland Hills region. Slopes are 5–20%, elevation to 100 m, local relief to 80 m. Cleared tall open-forest..
- Soils – moderately deep (<150 cm), well-drained Yellow Podzolic Soils (Dy2.21, Dy2.31), Red Podzolic Soils (Dr2.31, Dr3.21) and Brown Podzolic Soils (Db1.21, Db1.11) with some moderately deep (<100cm), well-drained Lithosols (Um1.41, Um1.42) on crests, moderately deep (<140 cm), imperfectly drained yellow Soloths (Dy2.41, Dy3.41) on lower slopes.
- Limitations – moderate foundation hazard, water erosion hazard, high run-on (localised), seasonal waterlogging (localised), localised steep slopes with mass movement hazard.

Middlehope Soil Landscape encompasses the BMP lands outside of the Subject Site and is characterised as follows:

- Landscape – rolling to steep hills on Permian and Carboniferous sediments. Slope gradients are 15–40%, local relief is 90–140 m, elevation to 110 m. Bands of rock outcrop occur (10–50%). Partially cleared tall open-forest..
- Soils – shallow (<25 cm), rapidly drained Lithosols (Um1.43, Uc1.23, K-Uc1.23), some moderately deep (<100 cm), moderately well-drained yellow Soloths (Dy3.41).
- Limitations – water erosion hazard, rock outcrop, localised steep slopes, shallow soils of low fertility.

Hunter Variant A encompasses the lower alluvial flats outside of the Subject Site and is characterised as follows:

- Landscape – Level plain of broad (up to 2 km wide), swampy backplains, which are commonly extensively drained on Quaternary alluvium derived from the Hunter and Paterson Rivers, in the central east of the Hunter Region. Slopes <1%, local relief <2 m, elevation 2 - 11 m. Completely cleared tall open-forest and closed forest.
- Soils – Deep (100 - <150 cm), very poorly drained Redoxic and Oxyaquic Hydrosols (Alluvial Soils).
- Limitations – widespread foundation hazard, widespread discharge zone, widespread salinity hazard, widespread high run-on, widespread poor drainage, widespread permanently high watertables, widespread permanent waterlogging, widespread seasonal waterlogging, widespread flood hazard.

1.1.2 Information Sources

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

- Aerial Photograph Interpretation (API) of the site and surrounding locality (Google 2023; Nearmap 2023);
- Lower Hunter Vegetation Mapping (Parsons Brinkerhoff 2013).
- Applicable State survey guidelines: DEC 2004, DPIE 2020c, DPIE 2020d, DPE 2022b, DPE 2022b, OEH 2018;
- DPE Threatened Biodiversity Profiles (<https://www.environment.nsw.gov.au/threatenedSpeciesApp/>);
- PlantNET NSW (<http://plantnet.rbgsyd.nsw.gov.au/>);
- Collective knowledge gained from previous ecological survey and assessment; and
- Anecdotal records.

In addition, database searches were carried out, namely:

- Review of flora and fauna records held by DPE Atlas of NSW Wildlife within a 10km radius of the site (March 2023);
- Review of flora and fauna records held by the DCCEEW Protected Matters Search within a 5km radius of the site (March 2023); and
- Review of Important Area Maps (DPE March 2023).

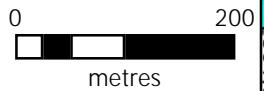
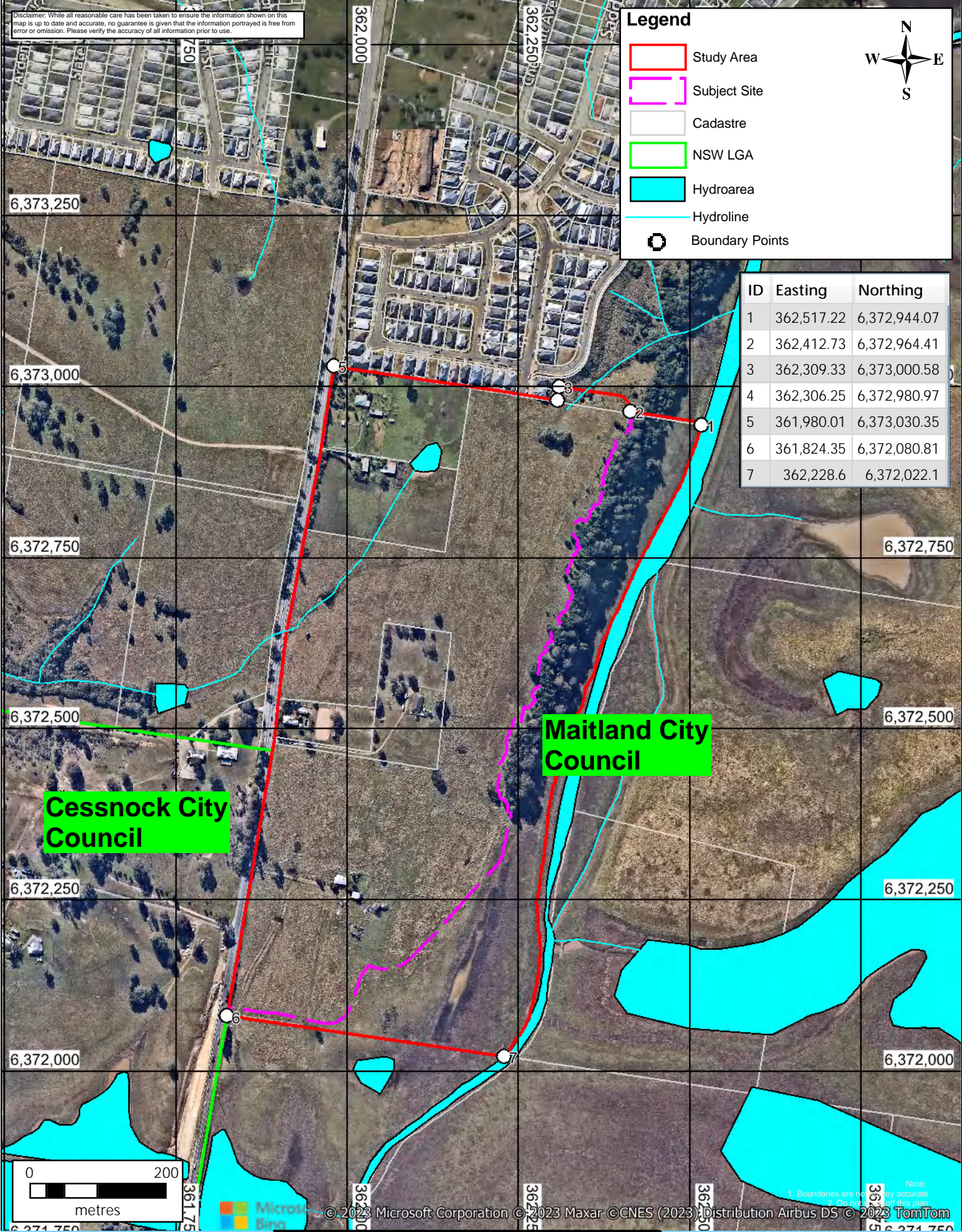
Disclaimer: While all reasonable care has been taken to ensure the information shown on this map is up to date and accurate, no guarantee is given that the information portrayed is free from error or omission. Please verify the accuracy of all information prior to use.

Legend

- Study Area
- Subject Site
- Cadastre
- NSW LGA
- Hydroarea
- Hydroline
- Boundary Points



ID	Easting	Northing
1	362,517.22	6,372,944.07
2	362,412.73	6,372,964.41
3	362,309.33	6,373,000.58
4	362,306.25	6,372,980.97
5	361,980.01	6,373,030.35
6	361,824.35	6,372,080.81
7	362,228.6	6,372,022.1



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Figure 1: Site Map

Date: June 2023

Location: 527 Cessnock Rd, Gilliestons Heights NSW 2321

Client: Walker Gillieston Heights Pty Ltd

AEP Ref: 2665.02

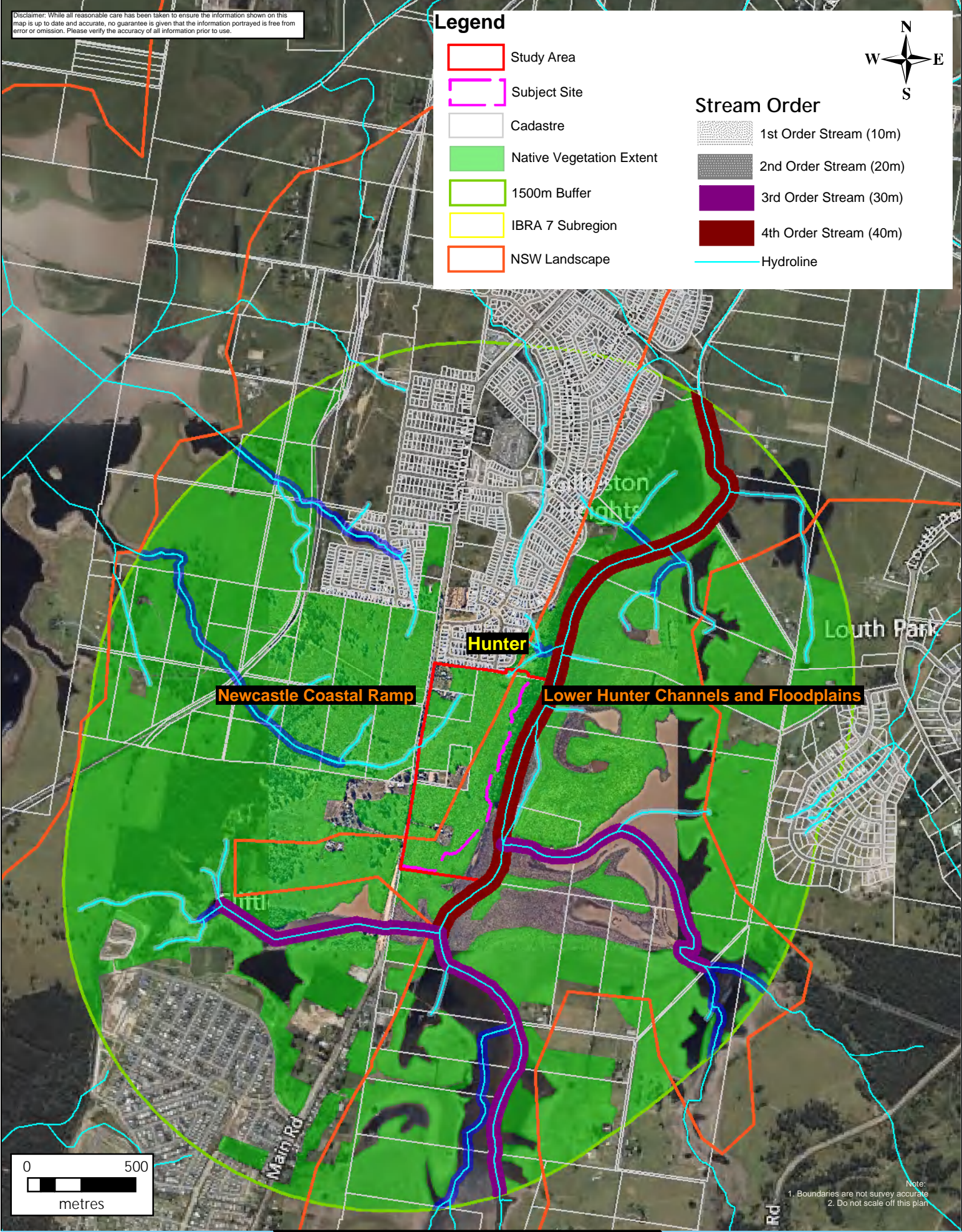
Disclaimer: While all reasonable care has been taken to ensure the information shown on this map is up to date and accurate, no guarantee is given that the information portrayed is free from error or omission. Please verify the accuracy of all information prior to use.

Legend

- Study Area
- Subject Site
- Cadastre
- Native Vegetation Extent
- 1500m Buffer
- IBRA 7 Subregion
- NSW Landscape

Stream Order

- 1st Order Stream (10m)
- 2nd Order Stream (20m)
- 3rd Order Stream (30m)
- 4th Order Stream (40m)
- Hydroline



Note:
1. Boundaries are not survey accurate
2. Do not scale off this plan



Figure 2: Location Map
Date: June 2023
Location: 527 Cessnock Rd, Gillieston Heights NSW 2321
Client: Walker Gillieston Heights Pty Ltd
AEP Ref: 2665.02

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; and
- *NSW Landscape* – Newcastle Coastal Ramp & Lower Hunter Channels and Floodplains.

Delineation of NSW Landscape areas are shown in the Location Map (**Figure 2**).

1.2.2 Identified Landscape Features

The BAM Calculator identifies nine (9) landscape features that require assessment for their relevance to the Subject Site. These features are outlined in **Table 2**.

Table 2 – Landscape Feature Assessment

Landscape Feature	Assessment
<i>Rivers and Streams</i>	<p>There are five farm dams located within the Subject Site and a mapped first order stream in the north western portion of the main allotment (Lot 2 DP 601226) and the beginning of another mapped first order stream at the northern boundary (Lot 2 DP1230739) (refer Figure 1 and 2).</p> <p>Ground-truthing vegetation and habitat features on site within the main allotment, observed water overflow gullies that are heavily degraded due to cattle grazing and overgrown with pasture grasses. Watercourse features as defined by Appendix 6 of the Waterfront Land Tool were not identified and the mapped 1st order stream is not present within the Subject Site.</p> <p>Ground-truthing of the northern allotment confirmed the NSW Hydroline spatial data which identified that the mapped 1st order stream is present within the Subject Site within Lot 2 DP1230739. The proposed Vegetated Riparian Zone (VRZ) for this first order stream is 10m and as works will occur within 40m of waterfront land, a Controlled Activity Approval (CAA) will be required to accompany this development application. Offsets will be incorporated into the VRZ within the BMP Lands.</p> <p>The Subject Site development proposes to decommission the dams and adjust the existing hydrolines that will be outlined in the Stormwater Management Report.</p> <p>Refer Appendix I Riparian Assessment Report.</p> <p>Due to the proximity of Wallis Creek that runs along the eastern boundary of the Study Area (as a fifth order stream and therefore a 40m VRZ is applicable). As the VRZ for Wallis Creek intersects the BMP Lands (Refer Figure 2) it is anticipated that no offsets are required.</p> <p>The proposed subdivision will include ancillary infrastructure such as stormwater management adhering to state requirements.</p>
<i>Wetlands</i>	<p>The Subject Site is mapped as containing Coastal Environmental Area in accordance with the Resilience and Hazards SEPP 2021 (refer Figure 10).</p>

Landscape Feature	Assessment
<p><i>Native Vegetation Extent</i></p>	<p>Approximately 0.40ha of remnant native vegetation occurs in the Subject Site, and 0.53ha of planted native vegetation, all of which all will be impacted. Plant Community Types within the Subject Site include:</p> <ul style="list-style-type: none"> • Approximately 0.30ha (degraded) PCT 1600 – <i>Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest.</i> <ul style="list-style-type: none"> ○ This community has an associated State-listed Endangered Ecological Communities; <i>Lower Hunter Spotted Gum Ironbark Forest in the Sydney Basin and NSW North Coast Bioregions and Central Hunter Ironbark Spotted Gum Grey Box Forest in the New South Wales North Coast and Sydney Basin Bioregions.</i> • Approximately 0.10ha (poor) PCT 1525 - <i>Sandpaper Fig - Whalebone Tree warm temperate rainforest.</i> <ul style="list-style-type: none"> ○ This community is associated with the State-listed Endangered ecological Community; <i>Lower Hunter Valley Dry Rainforest in the Sydney Basin and NSW North Coast Bioregions</i> which is present as scattered trees along the eastern boundary of the Subject Site. The scattered trees have been allocated to PCT 1525 due to the association of plant species with the larger patch of PCT 1525 proposed for retention under a BMP within the Study Area. • Approximately 0.53ha (highly degraded to severely degraded) Planted Native Vegetation with no assigned PCT – that are in stands around the homesteads and house paddocks and planted along the road verges. <p>Further assessment undertaken in Section 1.5.7 determined that the PCTs on site were associated with the State TECs listed above.</p>
<p><i>Connectivity Features</i></p>	<p>It is located within a rural landscape that is becoming increasingly urbanised and adjoins Cessnock Road to the west and urban development to the north. A strip of remnant vegetation exists to the east that has some connectivity further to the north, that forms part of the Study Area that will be retained and placed under a BMP.</p> <p>To the south land is mapped as flood lands and the development footprint has avoided this area. On the western side of Cessnock Road reserve is some connection along the mapped hydrolines that further connects to larger vegetated patches to the west.</p> <p>Development of the site will not significantly impact connectivity through the locality as there is minimal native vegetation within the Subject Site and the retainment of vegetation within the Study Area adjacent to the Subject Site in the east will form part of a broader corridor to allow for movement of local fauna and flora in the area to some degree which also follows Wallis Creek and the wetland area further to the east.</p>
<p><i>Karst, Caves, Crevices, Cliffs, Rock and other Geological Features of Significance</i></p>	<p>There are no identified karst, caves, crevices, cliffs, rock and other geological features of significance within the Subject Site.</p>

Landscape Feature	Assessment
<i>NSW Landscape</i>	The site is defined as <i>Newcastle Coastal Ramp and Lower Hunter Channels and Floodplains</i> and delineation of NSW Landscape areas are shown in the Site Map (Figure 1) and the Location Map (Figure 2).
<i>Soil hazard features</i>	None known on site.
<i>Features identified in SEARs for major projects</i>	Proposal is not a major project.
<i>Areas of Outstanding Biodiversity Value (AOBV) under the BC Act.</i>	No AOBV are present on the Subject Site and the adjacent lands.

1.3 Site Context Components

1.3.1 Landscape Native Vegetation Cover

In accordance with Section 3.1.2, item 1. (b) of the BAM, a 1500m buffer was placed around the site, totalling approx. 1,127.98ha. Of this, approximately 635.17ha comprises native vegetation as per Section 3.2 of the BAM (**Figure 2**). This equates to approximately 56.3% native vegetation cover and was entered as such within the Calculator.

1.4 Biodiversity Mapped Land

The Biodiversity Values Map (BV Map) tool identifies land with high biodiversity value, as defined by the Biodiversity Conservation Act Regulations (BCR). The Biodiversity Offsets Scheme (BOS) applies to all local developments, major projects or the clearing of native vegetation where the State Environmental Planning Policy (Vegetation in Non-Rural Areas) 2017 applies. Any of these will require entry into the BOS if they occur on land mapped on the Biodiversity Values Map (refer **Appendix E**). Exempt and complying development or private native forestry are not subject to the BOS. The BOSET report includes BV mapped land mapped as *Biodiversity Values “mapped for more than 90 days”* or *“added within the last 90 days”* within or adjacent to the Subject Site.

BV mapped land is not present within the Study Area or Subject Site, however, there is BV mapped land that lies to the east that is mapped as ‘Biodiverse riparian land’ that should be noted, as well as other riparian areas mapped to the south and west. As such a Riparian Assessment Report (RAR) had been undertaken and provided in **Appendix I**.

1.4.1 Regional Mapping

Previous datasets consulted include *Lower Hunter Regional Vegetation Mapping 2013*. The vegetation communities mapped outside of the Subject Site are provided in **Table 3** and **Figure 3** as there was no regionally mapped land within the Subject Site.

Table 3 - Regional Vegetation Mapping Results (Parsons Brinkerhoff 2013)

Vegetation Community	Study Area (ha)
PCT 1525 - <i>Sandpaper Fig - Whalebone Tree warm temperate rainforest.</i>	3.05
PCT 1600 – <i>Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest</i>	0.00
PCT 1736 - <i>Water Couch - Tall Spike Rush freshwater wetland</i>	3.58
Not mapped	34.43
Total	41.06

*Discrepancies in totals due to rounding

Regional vegetation models and community profiles informed the survey design and Plant Community Type determination, as well as subsequent Threatened Ecological Community (TEC) designations. Although there was no regionally mapped PCT's assigned to the Subject Site area, this dataset depicts the vegetation extent in the near vicinity to the Subject Site which assisted in the ground truthed confirmations with PCT's 1600 and 1525.





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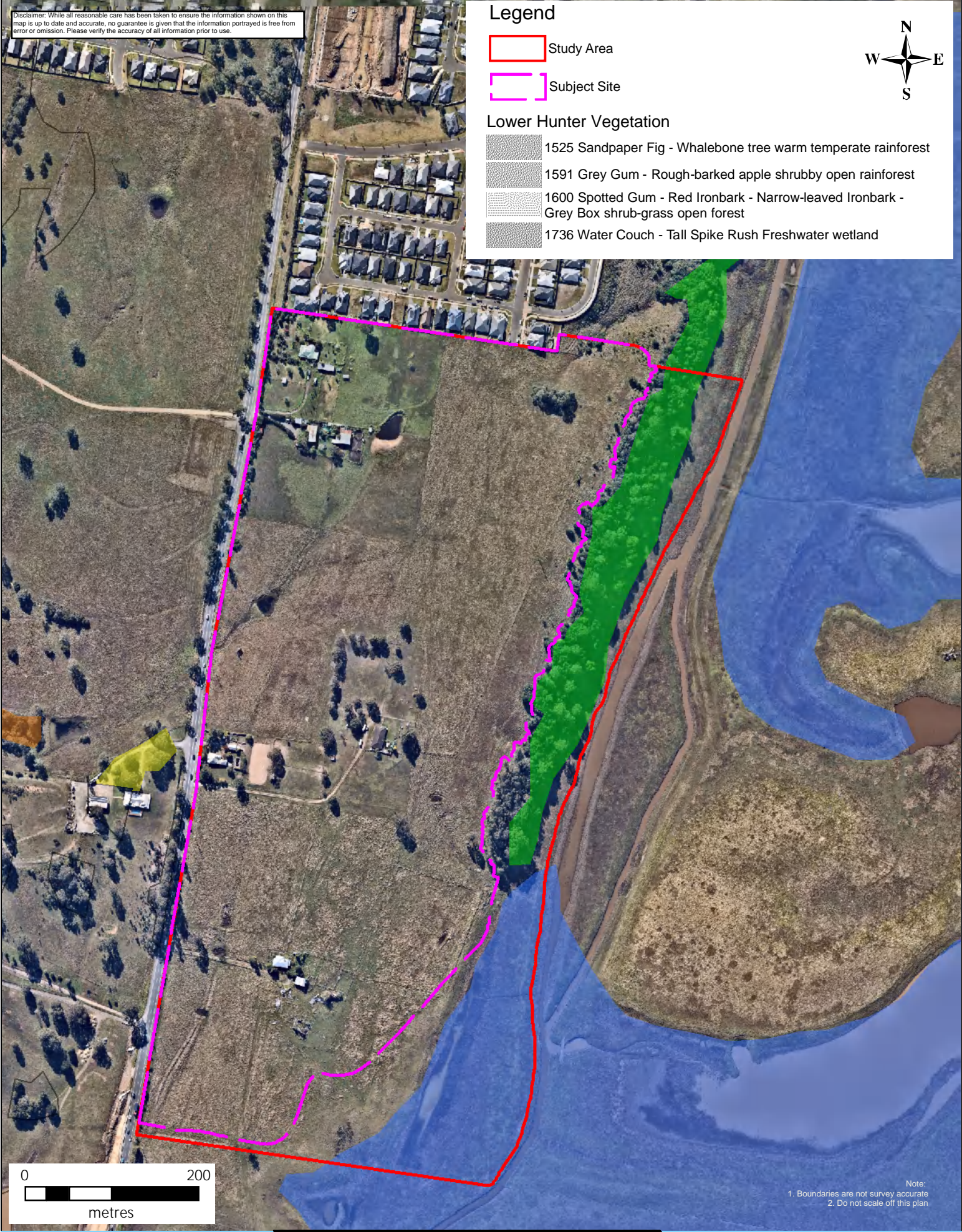
Legend

 Study Area

 Subject Site

Lower Hunter Vegetation

-  1525 Sandpaper Fig - Whalebone tree warm temperate rainforest
-  1591 Grey Gum - Rough-barked apple shrubby open rainforest
-  1600 Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest
-  1736 Water Couch - Tall Spike Rush Freshwater wetland



0 200
metres

Note:
1. Boundaries are not survey accurate
2. Do not scale off this plan



Figure 3: Regional Vegetation (Lower Hunter 2013)

Date: June 2023

Location: 527 Cessnock Rd, Gillieston Heights NSW 2321

Client: Walker Gillieston Heights Pty Ltd

AEP Ref: 2665.02

1.4.2 Plot Based Floristic Surveys

Plot Based Floristic surveys were undertaken by AEP in August & September 2022 and February 2023 to identify the most likely Plant Community Type/s within the Study Area. The surveys are stratified and targeted to assess the expected environmental variation and address any areas with gaps in existing mapping and information. Surveys included:

- Ground-truthing of regional vegetation mapping to identify all vegetation communities present onsite as well as segregate vegetation zones according to condition and current management practices.
- 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.
- The plot-based floristic vegetation survey is based on a 20m × 20m plot (or 400m² equivalent for linear areas). The assessor must assess the plot for the information contained in Table 1 of BAM 2020 and record the data in the BAR.
 - Note that non-standard plots were used along the road reserve areas (BAM plots 7 & 10) given the small area of the vegetation zone.
- Eleven (11) BAM plots were undertaken on site;
 - Plot 1, 2, 4 and 5 were undertaken within exotic plots to assess and confirm native vegetation extent;
 - Plot 3, 8 and 10 were undertaken within representative areas of Planted Native Vegetation;
 - Plot 10 was undertaken where dominant species *Eucalyptus robusta* was planted outside of its natural range within the road reserve.
 - Plot 6 was undertaken as a plot for PCT 1600; however, this plot was discarded due to it representing more of an ecotone;
 - Plot 7 assessed the remnant vegetation on site associated with PCT 1600;
 - Plot 9 was undertaken within the broader patch of PCT 1525 within the Study Area to utilise as a representative plot for trees along the eastern boundary that were associated with PCT 1525; and
 - Plot 11 was exotic and therefore could not be allocated a PCT.
- All plots were located by producing random points via GIS. Minor modifications to plot locations were made on site due to factors such as ecotones and proximity to disturbed edges.
- Field sheets and tabulated data are provided in **Appendix D**. Survey effort including plot location is depicted in **Figure 6**. A summary of the plot data and a flora list for all flora species is provided in **Appendix B**.

1.4.3 PCT Selection Justification

Although the entire site was in a predominantly highly disturbed condition, the road reserve was utilised to confirm PCT 1600 on site which was in a degraded condition with a VIS of 28.5 and 0.30ha of this PCT was entered into the BAM-Calculator.

The trees along the eastern boundary located within open exotic paddock were representative of the broader patch of PCT 1525 to the east within the Study Area. As a BAM plot could not be undertaken within this area of, a reference plot was undertaken within the patch of PCT 1525 within the Study Area

in order to gather accurate data on PCT 1525. As such, the plot undertaken within the remnant patch of PCT 1525 was utilised to assign a PCT to the trees along the eastern boundary as they were more representative of PCT 1525 than PCT 1600. The PCT 1525 plot recorded a VIS of 45.6 poor condition. This VIS was not representative of the trees that have been assigned to PCT 1525 within the Subject Site and it is likely the VIS of PCT 1525 within the Subject Site would be much lower than this, however, this plot data was utilised and entered into the BAM-Calculator for the 0.10ha of PCT 1525 identified within the Subject Site, and was utilised for reporting.

As 0.53ha vegetation present within the Subject Site was classified as 'Planted Native Vegetation', Assessment Method (BAM) 2020 Appendix D: Streamlined Assessment Module – Planted Native dated : 6 December 2022; applies (refer **Table 4**). The Planted Native Vegetation Module may be used in conjunction with the standard BAM to assess parts of the subject land under a single Biodiversity Development Assessment Report (BDAR). The Module is divided into the following parts:

- D.1 – Decision-making key – to identify whether a standard BAM or a streamlined assessment is required
- D.2 – Assessment of planted native vegetation for threatened species habitat.

D.1 of the Module is used to assess if D.2 applies. If Questions 1–3 of the decision-making key are not applicable to the planted native vegetation, apply D.2 – Assessment of planted native vegetation for threatened species habitat. Assessment of planted native vegetation for threatened species habitat has been completed in accordance with appendix D2. This vegetation type is not required to be further assessed using the BAM, and was thus excluded from any credit or offset calculations.

0.40ha of the native vegetation within the Subject Site is assessed as being remnant native vegetation and will be further assessed using the BAM, with any credit or offset calculations applying.

Table 4 – Decision making Key (Appendix D1, BAM 2020)

Item	Standard for Assessment	Options	AEP Assessment
1	Does the planted native vegetation occur within an area that contains a mosaic of planted and remnant native vegetation and which can be reasonably assigned to a PCT known to occur in the same IBRA subregion as the proposal?	<p>Yes - The planted native vegetation must be allocated to the best-fit PCT and the BAM must be applied.</p> <p>No - Go to 2.</p>	<p>No; all species mapped as planted native were not associated with PCT's 1600, 1525 or nearby regionally mapped PCT's 1591 or 1736 or widely occurring species like <i>Eucalyptus tereticornis</i>. All tree/shrub species recorded on site that can be reasonably assigned to a PCT have been. Species such as <i>Corymbia citriodora</i>, <i>Grevillea robusta</i>, <i>Corymbia torelliana</i> and domestic cultivars cannot be reasonably assigned to a PCT.</p> <p>Further to this, these species are common nursery plants that can be readily acquired. This assisted with determining that the vegetation was planted.</p> <p>It was also evident that the plants had been planted in stands (trees were of similar size and were planted in rows) to provide shade within a paddock or along a fence boundary and in association within the curtilage of houses on site. Additionally, personal communication with one of the owners of the property were able to confirm history and planting of the trees on site.</p> <p>Consideration was also given to historical imagery (Refer Appendix K) suggesting that much was planted rather than regenerative vegetation. Considering the information above and species composition, these species were not assigned a PCT and classed as Planted Native Vegetation.</p> <p>NO</p>
2	Is the planted native vegetation: a. planted for the purpose of environmental rehabilitation or restoration under an existing conservation obligation listed in BAM Section 11.9(2.), and b. the primary objective was to replace or regenerate a plant community type or a threatened plant species population or its habitat?	<p>Yes - The planted native vegetation must be assessed in accordance with Chapters 4 and 5 of the BAM.</p> <p>No - Go to 3.</p>	<p>a. The plants within the Subject Site were not planted for the purpose of environmental rehabilitation or restoration under an existing conservation obligation listed in BAM Section 11.9(2.); and</p> <p>b. the primary objective was not to replace or regenerate a plant community type or a threatened plant species population or its habitat, but to utilise native species for cover around horse paddocks and the curtilage of houses.</p> <p>NO</p>
3	Is the planted/translocated		Refer Below

Item	Standard for Assessment	Options	AEP Assessment
	native vegetation individuals of a threatened species or other native species planted/translocated for the purpose of providing threatened species habitat under one of the following:		
3	Is the planted/translocated native vegetation individuals of a threatened species or other native species planted/translocated for the purpose of providing threatened species habitat under one of the following:		
3a	A species recovery project	<p>Yes - The planted native vegetation must be assessed in accordance with Chapters 4 and 5 of the BAM.</p> <p>No - Go to 4.</p>	<p>The planted vegetation within the Subject Site have not been planted / translocated for the purpose of a species recovery project.</p> <p>NO</p>
3b	Saving our Species project		<p>The planted vegetation within the Subject Site have not been planted / translocated for the purpose of Saving our Species project.</p> <p>NO</p>
3c	Other types of government funded restoration project.		<p>The planted vegetation within the Subject Site have not been planted / translocated for the purpose of other types of government funded restoration project</p> <p>NO</p>
3d	Condition of consent for a development approval that required those species to be planted or translocated for the purpose of providing threatened species habitat		<p>The planted vegetation within the Subject Site have not been planted / translocated for the purpose of Condition of consent for a development approval that required those species to be planted or translocated for the purpose of providing threatened species habitat</p> <p>NO</p>
3e	Legal obligation as part of a condition or ruling of court. This includes regulatory directed or ordered remedial plantings (e.g. Remediation Order for clearing		<p>The planted vegetation within the Subject Site have not been planted / translocated for the purpose of legal obligation as part of a condition or ruling of court. This includes regulatory directed or ordered remedial plantings (e.g., Remediation Order for clearing without consent</p>

Item	Standard for Assessment	Options	AEP Assessment
	without consent issued under the BC Act or the Native Vegetation Act)		issued under the BC Act or the Native Vegetation Act). NO
3f	Ecological rehabilitation to re-establish a PCT or TEC that was, or is carried out under a mine operations plan.		The planted vegetation within the Subject Site have not been planted / translocated for the purpose of Ecological rehabilitation to re-establish a PCT or TEC that was, or is carried out under a mine operations plan. NO
3g	Approved vegetation management plan (e.g., as required as part of a Controlled Activity Approval for works on waterfront land under the NSW Water Management Act 2000).		The planted vegetation within the Subject Site have not been planted / translocated for the purpose of an approved vegetation management plan (e.g., as required as part of a Controlled Activity Approval for works on waterfront land under the NSW Water Management Act 2000). NO
4	Was the planted native vegetation (including individuals of a threatened flora species) undertaken voluntarily for revegetation, environmental rehabilitation or restoration without a legal obligation to secure or provide for management of the native vegetation?	Yes - Go to D.2 Assessment of planted native vegetation for threatened species habitat (the use of Chapters 4 and 5 of the BAM are not required to be applied). No - Go to 5.	The planted vegetation within the Subject Site have not been planted / translocated for the purpose of a voluntarily revegetation, environmental rehabilitation or restoration without a legal obligation to secure or provide for management of the native vegetation. NO
5	Is the native vegetation (including individuals of a threatened flora species) planted for functional, aesthetic, horticultural or plantation forestry purposes? This includes examples such as: windbreaks in agricultural landscapes, roadside plantings (including street trees, median strips, roadside batters), landscaping in parks, gardens and sport fields/complexes, macadamia	Yes - Go to D.2 Assessment of planted native vegetation for threatened species habitat (the use of Chapters 4 and 5 of the BAM are not required to be applied). No - Go to 6.	The planted vegetation within the Subject Site appears to be planted / translocated for the functional, aesthetic, horticultural or plantation forestry purposes to serve as windbreaks in agricultural landscapes, roadside plantings and landscaping. Refer to Section 5.1 D.2 Assessment of planted native vegetation for threatened species habitat (the use of Chapters 4 and 5 of the BAM are not required to be applied). YES

Item	Standard for Assessment	Options	AEP Assessment
	plantations or tea tree farms?		
6	Is the planted native vegetation a species listed as a widely cultivated native species on a list approved by the Secretary of the Department (or an officer authorised by the Secretary)?	<p>Yes - Go to D.2 Assessment of planted native vegetation for threatened species habitat (the use of Chapters 4 and 5 of the BAM are not required to be applied).</p> <p>No - There may be other types of occurrences of planted native vegetation that do not easily fit into the decision-making key above. Assessors should contact the BAM Support mailbox at bam.support@environment.nsw.gov.au for further advice on using the BAM to assess other types of occurrences of planted native vegetation.</p>	<p>Applying the precautionary principal further assessment pathways were considered despite 6 not being required to be assessed.</p> <p>The planted vegetation within the Subject Site is not planted native vegetation identified as being widely cultivated on a list approved by the Secretary of the Department (or an officer authorised by the Secretary).</p> <p>NO</p>
Evidence demonstrating the application of the decision-making key to the areas of planted native vegetation must be provided in the BDAR or BCAR.			<p>AEP Contacted BAM Support to assist with determining the appropriate assessment process with other projects to which the native planted principals apply.</p> <p>Following provision of information from BAM support, the planted native vegetation was assessed against the information provided and it was determined that the planted native vegetation module could be applied to some part of the vegetation across the site.</p> <p>Where applicable vegetation that could be assigned a PCT was assessed within the BAM-C.</p>

It has been concluded that the assessment of proposed development could be assessed in accordance with **Appendix D.2** of the BAM 2020. **Appendix D.2** requires the assessor to assess the planted native vegetation for the suitability for use by threatened species, recording results. It is noted that if the surveys show suitable habitat or record sighting of threatened species the assessor must apply **Section 8.4** of the BAM to mitigate and manage impacts as credits are not applied the offset the proposed impacts. The assessor must assess the suitability of the planted native vegetation for use by threatened species and record any incidental sightings or evidence (e.g., scats, stick nests) of threatened species credit species (flora and fauna) using, inhabiting or being part of the planted native vegetation.

The Subject Site areas that are classified as Planted Native Vegetation SBDAR; as per BAM 2020, require no assessment for the percent native vegetation cover when using the planted streamlined assessment method, therefore no Vegetation Integrity Score was required to be determined. However, assessments have been included to further clarify these areas below.

1.4.4 Plant Community Types (PCTs) and Vegetation Zones

The following sections follow the Small Area Streamlined Assessment module for the PCTs identified on site that were associated with PCT 1600 and PCT 1525. The BAM's Streamlined Assessment Module – Small Area requires the identification of the dominant PCT or the most likely PCT, and all

TECs, on the Subject Land. The identification must be in accordance with the NSW PCT classification as described in the BioNet Vegetation Classification. The identification of TECs must be consistent with the NSW Threatened Species Scientific Committee Final Determination for the TEC.

Diagnostic species recorded on site during field work within the Subject Site and adjoining patches of vegetation that support the determination of PCTs are shown in **Tables 5 to 7**. The vegetation zones and relevant information across the Subject Site are detailed in **Table 8 to 10**. This is further supported by vegetation mapping community designation (refer **Figure 4**).

Table 5 – Species Data for Potential PCT Determination

Search Item	Plot 1, 2, 4, 5 & 11	Plot 7 and 6 (Plot 6 discarded due to being more representative of an ecotone)	Plots 3 & 8		Plot 9	Plot 10
Dominant Species	None	<i>Corymbia maculata</i>	<i>Eucalyptus microcorys</i> , <i>Corymbia maculata</i>	<i>Eucalyptus tereticornis</i> , <i>Eucalyptus fibrosa</i>	<i>Acmena smithii</i> , <i>Celastrus subspicata</i> , <i>Maclura cochinchinensis</i> , <i>Oplismenus aemulus</i> , <i>Cupaniopsis anacardioides</i>	<i>Eucalyptus robusta</i>
Diagnostic species present	Upper stratum: None present	Upper stratum: <i>Corymbia maculata</i> , <i>Eucalyptus paniculata</i> , <i>Eucalyptus siderophloia</i> , <i>Eucalyptus crebra</i> (outside of plot)	Upper stratum: <i>Eucalyptus microcorys</i> , <i>Corymbia maculata</i> , <i>Angophora floribunda</i> , <i>Eucalyptus tereticornis</i> , <i>Allocasuarina torulosa</i> , <i>Eucalyptus fibrosa</i> .	Upper stratum: <i>Eucalyptus tereticornis</i> , <i>Eucalyptus fibrosa</i> , <i>Corymbia maculata</i> , <i>Eucalyptus siderophloia</i> , <i>Eucalyptus microcorys</i> .	Upper stratum: <i>Streblus brunonianus</i> ; <i>Acmena smithii</i> ; <i>Alphitonia excelsa</i> ; and <i>Eucalyptus microcorys</i> (outside of plot)	Upper stratum: <i>Eucalyptus robusta</i>
	Mid stratum: None present.	Mid-Stratum: <i>Acacia falcata</i> , <i>Acacia parvipinnula</i> , <i>Acacia ulicifolia</i> , <i>Ozothamnus diosmifolius</i> ; <i>Bursaria spinosa</i> & <i>Pultenaea spinosa</i> & <i>Breynia oblongifolia</i> (both outside of plot)	Mid-Stratum: <i>Callistemon salignus</i> , <i>Allocasuarina torulosa</i> ,	Mid-Stratum: None Present	Mid-Stratum: <i>Notelaea longifolia</i> ; <i>Clerodendrum tomentosum</i> ; <i>Cayratia clematidea</i> ; <i>Breynia oblongifolia</i> ;	Mid stratum: <i>Notelaea longifolia</i> , <i>Acacia ulicifolia</i> & <i>Daviesia ulicifolia</i>
	Ground stratum: No diagnostic species	Ground-Stratum: <i>Cheilanthes sieberi</i> , <i>Microlaena stipoides</i> , <i>Panicum maximum var. maximum</i> , <i>Oxalis sp.</i> , <i>Dichondra repens</i> , <i>Lomandra filiformis</i> & <i>Themeda australis</i> (both outside of plot)	Ground-Stratum: No diagnostic species	Ground-Stratum: No diagnostic species	Ground-Stratum: <i>Oplismenus aemulus</i> ;	Ground stratum: <i>Glycine clandestina</i>
Potential PCTs	Not applicable as almost entirely exotic dominated and therefore a PCT could not be attributed to these plots	1590, 1591, 1592, 1593, 1600, 1601, 1602	It is noted that there is some presence of native species located within plots 3 and 8, however, there was no defined plant community type within the vegetation patches. <i>Eucalyptus microcorys</i> and <i>Eucalyptus tereticornis</i> were dominant upper stratum species that are not associated with PCT 1600 that was identified on site, nor were they associated with other PCTs regionally mapped in the area. It is noted that <i>Angophora floribunda</i> was identified in plot 3 along with <i>Eucalyptus siderophloia</i> that is not a key diagnostic species for PCT 1600. <i>Corymbia maculata</i> and <i>Eucalyptus fibrosa</i> and were also present within these plots that are associated PCT 1600 and were individually mapped out to include into the offsets applicable. <i>Callistemon salignus</i> and <i>Allocasuarina torulosa</i> were dominant mid stratum (albeit in considerably low numbers) within plot 3 and are not considered diagnostic species for PCT 1600. Plot 8 had no mid stratum present. Consideration was rigorously applied to the presence of the upper stratum tree species <i>Corymbia</i>		1525, 1528, 1534, 1538 & 1541	Not applicable, dominant species <i>Eucalyptus robusta</i> has been planted outside of its natural range and a PCT could not be assigned to this plot.

Search Item	Plot 1, 2, 4, 5 & 11	Plot 7 and 6 (Plot 6 discarded due to being more representative of an ecotone)	Plots 3 & 8	Plot 9	Plot 10
			<p><i>maculata</i>, <i>Eucalyptus fibrosa</i>, and <i>Eucalyptus siderophloia</i> occurring within the planted stands however, given the lack of diagnostic species in the mid and lower stratum and presence of non-endemic species dominating the areas of planted vegetation, it was considered that a PCT could not be adequately assigned given the variation in species composition and structure.</p> <p>Further to this, some of these species are common nursery plants that can be readily acquired. This assisted with determining that the vegetation was planted.</p> <p>It was also evident that the plants had been planted in stands (trees were of similar size and were planted in rows) to provide shade within a paddock and in association within the curtilage of houses on site. Additionally, personal communication with the owners of the property were able to confirm history and planting of the trees on site. Considering the information above and species composition, these plots were not assigned a PCT and classed as Planted Native Vegetation apart from individual trees associated with PCT 1600 that were carefully mapped out and included into the total PCT 1600 classification.</p>		

Table 6 – PCT Determination for Plot 7

Potential PCTs	1590	1591	1592	1593	1600	1601	1602
Regional Vegetation	Not mapped	The Lower Hunter Regional Vegetation has mapped this vegetation occurring adjacent to the Subject Site.	Not mapped.	Not mapped	The Lower Hunter Regional Vegetation has mapped this vegetation occurring in close proximity to the Subject Site.	Not mapped	Not mapped
IBRA Region	Sydney Basin	Sydney Basin	Sydney Basin	Sydney Basin	Sydney Basin	Sydney Basin	Sydney Basin
IBRA Subregion	Hunter	Hunter	Hunter	Hunter	Hunter	Hunter	Hunter
NSW Landscape	Newcastle Coastal Ramp	Newcastle Coastal Ramp	Newcastle Coastal Ramp	Newcastle Coastal Ramp	Newcastle Coastal Ramp	Newcastle Coastal Ramp	Newcastle Coastal Ramp
Listed Key Diagnostic Species (VIS)	<p>Canopy Species: <i>Corymbia maculata</i>; <i>Eucalyptus umbra</i>; <i>Eucalyptus fibrosa</i>;</p> <p>Mid-Stratum: <i>Allocasuarina torulosa</i>; <i>Pultenaea villosa</i>; <i>Persoonia linearis</i>; <i>Breynia oblongifolia</i>; <i>Bursaria spinosa</i>; <i>Leucopogon juniperinus</i>; <i>Daviesia ulicifolia</i>; <i>Pandorea pandorana</i>;</p> <p>Ground-Stratum: <i>Microlaena stipoides</i>; <i>Themeda australis</i>; <i>Imperata cylindrica</i>; <i>Cymbopogon refractus</i>; <i>Aristida vagans</i>; <i>Pratia purpurascens</i>; <i>Vernonia cinerea</i>; <i>Dianella caerulea</i>; <i>Lomandra multiflora</i>; <i>Lepidosperma laterale</i>; <i>Cheilanthes sieberi</i>;</p>	<p>Canopy Species: <i>Eucalyptus punctata</i>; <i>Angophora floribunda</i>;</p> <p>Mid-Stratum: <i>Persoonia linearis</i>; <i>Bursaria spinosa</i>; <i>Acacia parvipinnula</i>; <i>Grevillea montana</i>; <i>Leptospermum trinervium</i>; <i>Jacksonia scoparia</i>; <i>Lissanthe strigosa</i>; <i>Leucopogon juniperinus</i>; <i>Melaleuca nodosa</i>;</p> <p>Ground-Stratum: <i>Themeda australis</i>; <i>Microlaena stipoides</i>; <i>Imperata cylindrica</i>; <i>Panicum simile</i>; <i>Aristida vagans</i>; <i>Cheilanthes sieberi</i>; <i>Pomax umbellata</i></p>	<p>Canopy Species: <i>Corymbia maculata</i>; <i>Eucalyptus fibrosa</i>; <i>Eucalyptus punctata</i>;</p> <p>Mid Stratum: <i>Daviesia ulicifolia</i>; <i>Persoonia linearis</i>; <i>Lissanthe strigosa</i>; <i>Bursaria spinosa</i>; <i>Podolobium ilicifolium</i>; <i>Phyllanthus hirtellus</i>;</p> <p>Ground-Stratum: <i>Themeda australis</i>; <i>Aristida vagans</i>; <i>Microlaena stipoides</i>; <i>Joycea pallida</i>; <i>Lomandra multiflora</i>; <i>Pomax umbellata</i>; <i>Pratia purpurascens</i>; <i>Glycine clandestina</i>;</p>	<p>Canopy Species: <i>Eucalyptus fibrosa</i>; <i>Corymbia maculata</i>;</p> <p>Mid Stratum: <i>Melaleuca nodosa</i>; <i>Bursaria spinosa</i>; <i>Melaleuca decora</i>; <i>Pultenaea spinosa</i>; <i>Acacia parvipinnula</i>; <i>Correa reflexa</i>; <i>Maytenus silvestris</i>; <i>Macrozamia flexuosa</i>; <i>Ozothamnus diosmifolius</i>; <i>Persoonia linearis</i>; <i>Myrsine variabilis</i>;</p> <p>Ground-Stratum: <i>Aristida vagans</i>; <i>Entolasia stricta</i>; <i>Microlaena stipoides</i>; <i>Lepidosperma laterale</i>; <i>Dianella revoluta</i>; <i>Pomax umbellata</i>; <i>Goodenia rotundifolia</i>; <i>Cheilanthes sieberi</i>;</p>	<p>Canopy Species: <i>Corymbia maculata</i>; <i>Eucalyptus fibrosa</i>; <i>Eucalyptus crebra</i>; <i>Eucalyptus moluccana</i>;</p> <p>Mid Stratum: <i>Bursaria spinosa</i>; <i>Daviesia ulicifolia</i>; <i>Acacia parvipinnula</i>; <i>Breynia oblongifolia</i>; <i>Leucopogon juniperinus</i>;</p> <p>Ground-Stratum: <i>Aristida vagans</i>; <i>Themeda australis</i>; <i>Lomandra confertifolia</i>; <i>Lomandra filiformis</i>; <i>Vernonia cinerea</i>; <i>Brunoniella australis</i>; <i>Pratia purpurascens</i>; <i>Cheilanthes sieberi</i>;</p>	<p>Canopy Species: <i>Corymbia maculata</i>; <i>Eucalyptus crebra</i>; <i>Eucalyptus fibrosa</i>;</p> <p>Mid Stratum: <i>Daviesia ulicifolia</i>; <i>Lissanthe strigosa</i>; <i>Bursaria spinosa</i>; <i>Acacia parvipinnula</i>;</p> <p>Ground-Stratum: <i>Cymbopogon refractus</i>; <i>Aristida vagans</i>; <i>Aristida ramosa</i>; <i>Microlaena stipoides</i>; <i>Cheilanthes sieberi</i>; <i>Lomandra multiflora</i>; <i>Dianella revoluta</i>; <i>Pratia purpurascens</i>; <i>Brunoniella australis</i>; <i>Laxmannia gracilis</i>;</p>	<p>Canopy Species: <i>Corymbia maculata</i>; <i>Eucalyptus crebra</i>;</p> <p>Mid Stratum: <i>Allocasuarina torulosa</i>; <i>Breynia oblongifolia</i>; <i>Persoonia linearis</i>; <i>Notelaea longifolia</i>; <i>Pandorea pandorana</i>;</p> <p>Ground-Stratum: <i>Cymbopogon refractus</i>; <i>Microlaena stipoides</i>; <i>Themeda australis</i>; <i>Oplismenus aemulus</i>; <i>Pratia purpurascens</i>; <i>Brunoniella australis</i>; <i>Lomandra multiflora</i>; <i>Cheilanthes sieberi</i>;</p>
Present Key Diagnostic Species within Study Area	<p>Canopy Species: <i>Corymbia maculata</i>, <i>Eucalyptus fibrosa</i></p> <p>Mid-Stratum: <i>Allocasuarina Torulosa</i>, <i>Bursaria spinosa</i></p> <p>Ground-Stratum: <i>Themeda australis</i>, <i>Cheilanthes sieberi</i>, <i>Microlaena stipoides</i></p>	<p>Canopy Species: <i>Angophora floribunda</i></p> <p>Mid-Stratum: <i>Bursaria spinosa</i></p> <p>Ground-Stratum: <i>Themeda australis</i>, <i>Cheilanthes sieberi</i>, <i>Microlaena stipoides</i></p>	<p>Canopy Species: <i>Corymbia maculata</i>; <i>Eucalyptus fibrosa</i></p> <p>Mid-Stratum: <i>Bursaria spinosa</i></p> <p>Ground-Stratum: <i>Themeda australis</i>, <i>Microlaena stipoides</i></p>	<p>Canopy Species: <i>Corymbia maculata</i>, <i>Eucalyptus fibrosa</i></p> <p>Mid-Stratum: <i>Ozothamnus diosmifolius</i>, <i>Bursaria spinosa</i>, <i>Pultenaea spinosa</i>, <i>Acacia parvipinnula</i></p> <p>Ground-Stratum: <i>Cheilanthes sieberi</i>, <i>Microlaena stipoides</i></p>	<p>Canopy Species: <i>Corymbia maculata</i>, <i>Eucalyptus fibrosa</i>, <i>Eucalyptus crebra</i> & <i>Eucalyptus moluccana</i> (outside of plot)</p> <p>Mid-Stratum: <i>Bursaria spinosa</i>, <i>Acacia parvipinnula</i>; <i>Breynia oblongifolia</i></p> <p>Ground-Stratum: <i>Themeda australis</i>, <i>Cheilanthes sieberi</i>, <i>Lomandra filiformis</i></p>	<p>Canopy Species: <i>Corymbia maculata</i>, <i>Eucalyptus fibrosa</i>, <i>Eucalyptus crebra</i></p> <p>Mid-Stratum: <i>Bursaria spinosa</i>, <i>Acacia parvipinnula</i></p> <p>Ground-Stratum: <i>Cheilanthes sieberi</i>, <i>Microlaena stipoides</i></p>	<p>Canopy Species: <i>Corymbia maculata</i>, <i>Eucalyptus crebra</i></p> <p>Mid-Stratum: <i>Allocasuarina Torulosa</i>, <i>Notelaea longifolia</i>, <i>Breynia oblongifolia</i></p> <p>Ground-Stratum: <i>Themeda australis</i>, <i>Cheilanthes sieberi</i>, <i>Microlaena stipoides</i></p>
Absence of Key Diagnostic Species within the Study Area	<p>Canopy Species: <i>Eucalyptus umbra</i></p> <p>Mid-Stratum: <i>Pultenaea villosa</i>; <i>Persoonia linearis</i>; <i>Breynia oblongifolia</i>; <i>Leucopogon juniperinus</i>;</p>	<p>Canopy Species: <i>Eucalyptus punctata</i></p> <p>Mid-Stratum: <i>Persoonia linearis</i>; <i>Acacia parvipinnula</i>; <i>Grevillea montana</i>; <i>Leptospermum trinervium</i>; <i>Jacksonia</i></p>	<p>Canopy Species: <i>Eucalyptus punctata</i></p> <p>Mid-Stratum: <i>Daviesia ulicifolia</i>; <i>Persoonia linearis</i>; <i>Lissanthe strigosa</i>; <i>Podolobium ilicifolium</i>; <i>Phyllanthus hirtellus</i>;</p>	<p>Canopy Species: None</p> <p>Mid-Stratum: <i>Melaleuca nodosa</i>; <i>Melaleuca decora</i>; <i>Correa reflexa</i>; <i>Maytenus silvestris</i>; <i>Macrozamia flexuosa</i>; <i>Ozothamnus</i></p>	<p>Canopy Species: None</p> <p>Mid-Stratum: <i>Daviesia ulicifolia</i>; <i>Leucopogon juniperinus</i>;</p> <p>Ground-Stratum: <i>Aristida vagans</i>; <i>Lomandra confertifolia</i>; <i>Vernonia cinerea</i>; <i>Brunoniella australis</i>; <i>Pratia purpurascens</i>;</p>	<p>Canopy Species: None</p> <p>Mid-Stratum: <i>Daviesia ulicifolia</i>; <i>Lissanthe strigosa</i>;</p> <p>Ground-Stratum: <i>Cymbopogon refractus</i>; <i>Aristida vagans</i>; <i>Aristida ramosa</i>; <i>Lomandra multiflora</i>; <i>Dianella</i></p>	<p>Canopy Species: None</p> <p>Mid-Stratum: <i>Persoonia linearis</i>; <i>Notelaea longifolia</i>; <i>Pandorea pandorana</i>;</p> <p>Ground-Stratum: <i>Cymbopogon refractus</i>; <i>Oplismenus aemulus</i>; <i>Pratia</i></p>

Potential PCTs	1590	1591	1592	1593	1600	1601	1602
	<i>Daviesia ulicifolia</i> ; <i>Pandorea pandorana</i> ; Ground-Stratum: <i>Imperata cylindrica</i> ; <i>Cymbopogon refractus</i> ; <i>Aristida vagans</i> ; <i>Pratia purpurascens</i> ; <i>Vernonia cinerea</i> ; <i>Dianella caerulea</i> ; <i>Lomandra multiflora</i> ; <i>Lepidosperma laterale</i> ;	<i>scoparia</i> ; <i>Lissanthe strigosa</i> ; <i>Leucopogon juniperinus</i> ; <i>Melaleuca nodosa</i> ; Ground-Stratum: <i>Imperata cylindrica</i> ; <i>Panicum simile</i> ; <i>Aristida vagans</i> ; <i>Pomax umbellata</i>	Ground-Stratum: <i>Aristida vagans</i> ; <i>Joycea pallida</i> ; <i>Lepidosperma laterale</i> ; <i>Lomandra multiflora</i> ; <i>Pomax umbellata</i> ; <i>Pratia purpurascens</i> ; <i>Glycine clandestina</i> ;	<i>diosmifolius</i> ; <i>Persoonia linearis</i> ; <i>Myrsine variabilis</i> ; Ground-Stratum: <i>Aristida vagans</i> ; <i>Entolasia stricta</i> ; <i>Lepidosperma laterale</i> ; <i>Dianella revoluta</i> ; <i>Pomax umbellata</i> ; <i>Goodenia rotundifolia</i> ;		<i>revoluta</i> ; <i>Pratia purpurascens</i> ; <i>Brunoniella australis</i> ; <i>Laxmannia gracilis</i> ;	<i>purpurascens</i> ; <i>Brunoniella australis</i> ; <i>Lomandra multiflora</i> ;
PCT Description	Open forests with a canopy dominated by <i>Corymbia maculata</i> . The mid-storey consists of a diverse open shrub layer along with various small climbers. The ground layer is characteristically grassy with a mix of forbs; small ferns and other graminoids.	Open forests dominated by <i>Eucalyptus punctata</i> . The mid-storey is typically shrubby and the ground layer is dominated by grasses with a mix of graminoids; small ferns and forbs.	Open forests dominated by <i>Corymbia maculata</i> ; <i>Eucalyptus fibrosa</i> . The mid-storey is typically shrubby with sparse climbers. The ground storey is dominated by grasses with scattered forbs.	Open forests with a canopy dominated by <i>Eucalyptus fibrosa</i> . The mid-storey consists of a diverse open shrub layer. The ground layer is typically dominated by grasses with forbs and small ferns.	Open forests with a canopy dominated by <i>Corymbia maculata</i> . The mid-storey consists of an open shrub layer. The ground layer is predominately grassy with various graminoids; forbs and small ferns.	Open forests with a canopy dominated by <i>Corymbia maculata</i> and <i>Eucalyptus crebra</i> . The mid-storey consists of a sparse shrub layer. The ground layer is predominately grassy with various graminoids; forbs and small ferns	Open forests with a canopy dominated by <i>Corymbia maculata</i> . The mid-storey consists of an open shrub layer. The ground layer is predominately grassy with various graminoids; forbs and small ferns.
Vegetation Formation	Dry Sclerophyll Forests (Shrub/grass sub-formation);	Dry Sclerophyll Forests (Shrubby sub-formation)	Dry Sclerophyll Forests (Shrub/grass sub-formation);	Dry Sclerophyll Forests (Shrub/grass sub-formation);	Dry Sclerophyll Forests (Shrubby sub-formation)	Dry Sclerophyll Forests (Shrub/grass sub-formation);	Dry Sclerophyll Forests (Shrubby sub-formation)
Vegetation Class	Hunter-Macleay Dry Sclerophyll Forests;	Hunter-Macleay Dry Sclerophyll Forests;	Hunter-Macleay Dry Sclerophyll Forests;	Hunter-Macleay Dry Sclerophyll Forests;	Hunter-Macleay Dry Sclerophyll Forests;	Hunter-Macleay Dry Sclerophyll Forests;	Hunter-Macleay Dry Sclerophyll Forests;
Geographical Restrictions	Flats; low rises (hillslopes); Low ranges of the lower Hunter Valley and Central Coast at lower	Lower fertility substrates on lower slopes and flats in the lower Hunter Valley. flats; low rises	Flats; hillslopes; Mainly restricted to the lower Hunter Valley.	Flats; low rises; Restricted to the lower Hunter Valley.	Restricted to the lower Hunter Valley, hillslopes; low rises	Flats; Central and Lower Hunter Valley.	Lower slopes; undulating terrain; Central and Lower Hunter Valley.
Elevation	Information not available	Information not available	Information not available	Information not available	Information not available.	Information not available	Information not available
Soil Profiles	Sandstone, Conglomerate	Conglomerate	Conglomerate, Sandstone, Siltstone	Not available	Siltstone, Conglomerate	Conglomerate, Sandstone	Sandstone, Siltstone
Habitat Restrictions	Information not available	Information not available	Information not available	Information not available	Information not available	Information not available	Information not available
Current Land Use (disturbance and weed loads)	Land management practices including land clearing, grazing and high levels of disturbance and weed growth.						
Previous land use (including disturbance levels, plantings)	Historical disturbance such as land clearing, pasture improvement and ongoing grazing.						
Surrounding Vegetation	Similar condition as Subject Site						
PCT Determination	PCT 1590 was discarded despite seven key diagnostic	PCT 1591 was discarded despite five key diagnostic	PCT 1592 was discarded due to despite five key diagnostic species	PCT 1593 was discarded despite eight key diagnostic	PCT 1600 was chosen due to the presence of <i>Corymbia maculata</i> ,	PCT 1601 was discarded despite seven key diagnostic	PCT 1602 was discarded despite eight key diagnostic

Potential PCTs	1590	1591	1592	1593	1600	1601	1602
	<p>species present; <i>Corymbia maculata</i>, <i>Eucalyptus fibrosa</i>, <i>Allocasuarina Torulosa</i>, <i>Bursaria spinosa</i>, <i>Themeda australis</i>, <i>Cheilanthes sieberi</i> and <i>Microlaena stipoides</i>.</p> <p>PCT 1600 was considered a more accurate determination of the vegetation community. Based on the information above, this PCT was not determined as an accurate description of the vegetation community within the Subject Site.</p>	<p>species present; <i>Angophora floribunda</i>, <i>Bursaria spinosa</i>, <i>Themeda australis</i>, <i>Cheilanthes sieberi</i> and <i>Microlaena stipoides</i>.</p> <p>PCT 1600 was considered a more accurate determination of the vegetation community. Based on the information above, this PCT was not determined as an accurate description of the vegetation community within the Subject Site.</p>	<p>present <i>Corymbia maculata</i>; <i>Eucalyptus fibrosa</i>, <i>Bursaria spinosa</i>, <i>Themeda australis</i> and <i>Microlaena stipoides</i>.</p> <p>PCT 1600 was considered a more accurate determination of the vegetation community. Based on the information above, this PCT was not determined as an accurate description of the vegetation community within the Subject Site.</p>	<p>species present; <i>Corymbia maculata</i>, <i>Eucalyptus fibrosa</i>, <i>Ozothamnus diosmifolius</i>, <i>Bursaria spinosa</i>, <i>Pultenaea spinosa</i>, <i>Acacia parvipinnula</i>, <i>Cheilanthes sieberi</i> and <i>Microlaena stipoides</i>.</p> <p>PCT 1600 was considered a more accurate determination of the vegetation community. Based on the information above, this PCT was not determined as an accurate description of the vegetation community within the Subject Site.</p>	<p><i>Eucalyptus fibrosa</i> and <i>Eucalyptus crebra</i> within the upper stratum as well as having the highest number of diagnostic species ten (10) when comparing with other Spotted Gum/ Ironbark communities that are prevalent within the area. Due to the severely degraded nature of the Subject Site with minimal species within the BAM plots apart from the road reserve and even then, species noted within the less disturbed remnant vegetation but outside of the BAM plot 7 assisted in this determination. Three other shrub species and three ground stratum species added to this information. Furthermore, regional mapping indicated PCT 1600 adjacent to the Subject Site. Based on above information this PCT was determined as the most accurate description of this vegetation community within the Subject Site due to the number of diagnostic species and no geographical or soil substrate restrictions.</p>	<p>species present; <i>Corymbia maculata</i>, <i>Eucalyptus fibrosa</i>, <i>Eucalyptus crebra</i>, <i>Bursaria spinosa</i>, <i>Acacia parvipinnula</i>, <i>Cheilanthes sieberi</i> and <i>Microlaena stipoides</i>.</p> <p>PCT 1600 was considered a more accurate determination of the vegetation community. Based on the information above, this PCT was not determined as an accurate description of the vegetation community within the Subject Site.</p>	<p>species present; <i>Corymbia maculata</i>, <i>Eucalyptus crebra</i>. <i>Allocasuarina Torulosa</i>, <i>Notelaea longifolia</i>, <i>Breynia oblongifolia</i>, <i>Themeda australis</i>, <i>Cheilanthes sieberi</i> and <i>Microlaena stipoides</i>.</p> <p>PCT 1600 was considered a more accurate determination of the vegetation community. Based on the information above, this PCT was not determined as an accurate description of the vegetation community within the Subject Site.</p>
Result	PCT 1600 – Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter						





Estimate cleared value of PCT (%)	71
TEC	<p>Has two associated TEC's; Lower Hunter Spotted Gum Ironbark Forest in the Sydney Basin and NSW North Coast Bioregions (Equivalent) largely equivalent to; Listed EPBC Act, E: Central Hunter Ironbark Spotted Gum Grey Box Forest in the New South Wales North Coast and Sydney Basin Bioregions although this did not have an EPBC listing status within the BAM-C and therefore was not entered as such.</p> <p>Assessment of the Subject Site vegetation confirms that there is an association with the State listed TEC; Lower Hunter Spotted Gum Ironbark Forest in the Sydney Basin and NSW North Coast Bioregions due to composition of species such as <i>Corymbia maculata</i>, <i>Eucalyptus fibrosa</i>, <i>Eucalyptus crebra</i>, <i>Bursaria spinosa</i> <i>Acacia parvipinnula</i>; <i>Breynia oblongifolia</i>, <i>Themeda australis</i>, <i>Cheilanthes sieberi</i>, <i>Lomandra filiformis</i> as discussed above.</p> <p>Further assessment of the federally listed Central Hunter Ironbark Spotted Gum Grey Box Forest in the New South Wales North Coast and Sydney Basin Bioregions is assessed in Appendix H Other Legislation</p>
Vegetation Zones	
Vegetation Zones of this PCT within Subject Site	The Vegetation Integrity Score (VIS) was calculated at 28.5 which is in the 'degraded' category/condition with the one vegetation community present.
Degraded Condition	
Description of Vegetation Zone	<p>This vegetation zone occurs as scattered remnant vegetation across the site, intermixed with planted vegetation for windbreaks and aesthetic gardens. The mid stratum was sparse, and contained various acacia species. The understorey was predominantly disturbed with a low native cover. This community is consistent with the regionally mapped PCT 1600.</p> <p>Canopy: <i>Corymbia maculata</i>, <i>Eucalyptus fibrosa</i>, <i>Eucalyptus siderophloia</i> and <i>Eucalyptus paniculata</i>.</p> <p>Mid stratum: <i>Acacia falcata</i>, <i>Ozothamnus diosmifolius</i>, <i>Breynia oblongifolia</i>, <i>Acacia ulicifolia</i>, <i>Bursaria spinosa</i>, <i>Pultenaea spinosa</i> and <i>Acacia parvipinnula</i>.</p> <p>Understorey: Native grasses, <i>Themeda triandra</i>, <i>Microlaena stipoides</i>, the forb, <i>Dichondra repens</i> and fern, <i>Cheilanthes sieberi</i>.</p> <p>Exotic species: This vegetation zone consists of a predominantly disturbed understorey, containing high threat exotics, <i>Cenchrus clandestinum</i> (Kikuyu), <i>Senecio madagascariensis</i> (Fireweed), <i>Paspalum dilatatum</i>, <i>Chloris gayana</i> (Rhodes Grass), <i>Ehrharta erecta</i> (Panic Veldtgrass), and other exotic pasture species. Most plots across the entire Subject Site consist of cosmopolitan species <i>Cynodon dactylon</i>.</p> <p>Plates 1 & 2 show examples of PCT 1600 (Degraded condition).</p>
Area of Vegetation Zone (ha)	This vegetation zone covers approx. 0.30ha of the Subject Site.
 <p>Plate 1 - PCT 1600 BAM Plot 7 in a degraded condition</p>	 <p>Plate 2 - PCT 1600 BAM Plot 7 linear due to road reserve</p>

Table 7 – PCT Determination for Plot 9 & incidentals

Potential PCTs	1525	1528	1534	1538	1541
Regional Vegetation	This PCT is regionally mapped as occurring adjacent to the Subject Site.	Not mapped	Not mapped	Not mapped	Not mapped
IBRA Region	Sydney Basin	Sydney Basin	Sydney Basin	Sydney Basin	Sydney Basin
IBRA Subregion	Hunter	Hunter	Hunter	Hunter	Hunter
NSW Landscape	Lower Hunter Channels and Floodplains	Not known to occur in landscape	Not known to occur in landscape	Not known to occur in landscape	Not known to occur in landscape
Listed Key Diagnostic Species (VIS)	<p>Canopy Species: <i>Ficus coronata</i>; <i>Streblus brunonianus</i>; <i>Acmena smithii</i>; <i>Doryphora sassafras</i>;</p> <p>Mid Stratum: <i>Claoxylon australe</i>; <i>Diospyros australis</i>; <i>Alectryon subcinereus</i>; <i>Neolitsea dealbata</i>; <i>Synoum glandulosum</i>; <i>Syzygium australe</i>; <i>Cissus antarctica</i>; <i>Cissus hypoglauca</i>;</p> <p>Ground-Stratum: <i>Adiantum formosum</i>; <i>Doodia aspera</i>; <i>Oplismenus imbecillis</i>; <i>Urtica incisa</i>;</p>	<p>Canopy Species <i>Acmena smithii</i>; <i>Cryptocarya glaucescens</i>; <i>Doryphora sassafras</i>; <i>Ceratopetalum apetalum</i>; <i>Ficus coronata</i>; <i>Planchonella australis</i>; <i>Alphitonia excelsa</i>; <i>Archontophoenix cunninghamiana</i>; <i>Eucalyptus saligna</i>;</p> <p>Mid Stratum: <i>Alectryon subcinereus</i>; <i>Neolitsea dealbata</i>; <i>Syzygium oleosum</i>; <i>Guioa semiglauca</i>; <i>Wilkiea huegeliana</i>; <i>Pittosporum multiflorum</i>; <i>Morinda jasminoides</i>; <i>Trophis scandens</i>; <i>Cissus antarctica</i>;</p> <p>Ground-Stratum: <i>Lastreopsis microsora</i>; <i>Hypolepis muelleri</i>; <i>Gymnostachys anceps</i>; <i>Oplismenus imbecillis</i>;</p>	<p>Canopy Species: <i>Heritiera actinophylla</i>; <i>Dendrocnide excelsa</i>; <i>Dysoxylum fraserianum</i>; <i>Ficus macrophylla</i>; <i>Streblus brunonianus</i>; <i>Baloghia inophylla</i>;</p> <p>Mid Stratum: <i>Mallotus philippensis</i>; <i>Capparis arborea</i>; <i>Pittosporum multiflorum</i>; <i>Hibiscus heterophyllus</i>; <i>Claoxylon australe</i>; <i>Diospyros australis</i>; <i>Diospyros pentamera</i>; <i>Cissus antarctica</i>; <i>Tetrastigma nitens</i>;</p> <p>Ground-Stratum: <i>Pellaea falcata</i>; <i>Pellaea paradoxa</i>; <i>Adiantum formosum</i>; <i>Arthropteris tenella</i>; <i>Doodia aspera</i>;</p>	<p>Canopy Species: <i>Backhousia leptopetala</i>; <i>Acmena smithii</i>; <i>Eucalyptus microcorys</i>;</p> <p>Mid Stratum: <i>Notelaea longifolia</i>; <i>Breynia oblongifolia</i>; <i>Pittosporum revolutum</i>; <i>Smilax australis</i>; <i>Parsonsia straminea</i>;</p> <p>Ground-Stratum: <i>Doodia aspera</i>; <i>Gymnostachys anceps</i>;</p>	<p>Canopy Species <i>Streblus brunonianus</i>; <i>Mallotus philippensis</i>; <i>Planchonella australis</i>; <i>Olea paniculata</i>; <i>Elaeocarpus obovatus</i>; <i>Dysoxylum fraserianum</i>; <i>Dendrocnide excelsa</i>;</p> <p>Mid Stratum: <i>Pittosporum multiflorum</i>; <i>Alectryon subcinereus</i>; <i>Notelaea longifolia</i>; <i>Diospyros australis</i>; <i>Claoxylon australe</i>; <i>Capparis arborea</i>; <i>Cissus antarctica</i>; <i>Dioscorea transversa</i>; <i>Cayratia clematidea</i>; <i>Clerodendrum tomentosum</i>;</p> <p>Ground-Stratum: <i>Oplismenus aemulus</i>; <i>Pseuderanthemum variabile</i>; <i>Adiantum formosum</i>; <i>Gymnostachys anceps</i>;</p>
Present Key Diagnostic Species within the Study Area and adjacent to the site.	<p>Canopy Species: <i>Streblus brunonianus</i>; <i>Acmena smithii</i>;</p> <p>Mid Stratum: None</p> <p>Ground-Stratum: <i>Urtica incisa</i>;</p>	<p>Canopy Species <i>Acmena smithii</i>; <i>Alphitonia excelsa</i>;</p> <p>Mid Stratum: None</p> <p>Ground-Stratum: None</p>	<p>Canopy Species: <i>Streblus brunonianus</i>;</p> <p>Mid Stratum: None</p> <p>Ground-Stratum: None</p>	<p>Canopy Species: <i>Acmena smithii</i>; <i>Eucalyptus microcorys</i>;</p> <p>Mid Stratum: <i>Notelaea longifolia</i>; <i>Breynia oblongifolia</i>; <i>Pittosporum revolutum</i>;</p> <p>Ground-Stratum: None</p>	<p>Canopy Species <i>Streblus brunonianus</i>;</p> <p>Mid Stratum: <i>Notelaea longifolia</i>; <i>Clerodendrum tomentosum</i>; <i>Cayratia clematidea</i>;</p> <p>Ground-Stratum: <i>Oplismenus aemulus</i>;</p>
Absence of Key Diagnostic Species within the Study Area	<p>Canopy Species: <i>Ficus coronata</i>; <i>Doryphora sassafras</i>;</p> <p>Mid Stratum: <i>Claoxylon australe</i>; <i>Diospyros australis</i>; <i>Alectryon subcinereus</i>; <i>Neolitsea dealbata</i>; <i>Synoum glandulosum</i>; <i>Syzygium australe</i>; <i>Cissus antarctica</i>; <i>Cissus hypoglauca</i>;</p> <p>Ground-Stratum: <i>Adiantum formosum</i>; <i>Doodia aspera</i>; <i>Oplismenus imbecillis</i>;</p>	<p>Canopy Species <i>Cryptocarya glaucescens</i>; <i>Doryphora sassafras</i>; <i>Ceratopetalum apetalum</i>; <i>Ficus coronata</i>; <i>Planchonella australis</i>; <i>Archontophoenix cunninghamiana</i>; <i>Eucalyptus saligna</i>;</p> <p>Mid Stratum: <i>Alectryon subcinereus</i>; <i>Neolitsea dealbata</i>; <i>Syzygium oleosum</i>; <i>Guioa semiglauca</i>; <i>Wilkiea huegeliana</i>; <i>Pittosporum multiflorum</i>; <i>Morinda jasminoides</i>; <i>Trophis scandens</i>; <i>Cissus antarctica</i>;</p> <p>Ground-Stratum: <i>Lastreopsis microsora</i>; <i>Hypolepis muelleri</i>; <i>Gymnostachys anceps</i>; <i>Oplismenus imbecillis</i>;</p>	<p>Canopy Species: <i>Heritiera actinophylla</i>; <i>Dendrocnide excelsa</i>; <i>Dysoxylum fraserianum</i>; <i>Ficus macrophylla</i>; <i>Baloghia inophylla</i>;</p> <p>Mid Stratum: <i>Mallotus philippensis</i>; <i>Capparis arborea</i>; <i>Pittosporum multiflorum</i>; <i>Hibiscus heterophyllus</i>; <i>Claoxylon australe</i>; <i>Diospyros australis</i>; <i>Diospyros pentamera</i>; <i>Cissus antarctica</i>; <i>Tetrastigma nitens</i>;</p> <p>Ground-Stratum: <i>Pellaea falcata</i>; <i>Pellaea paradoxa</i>; <i>Adiantum formosum</i>; <i>Arthropteris tenella</i>; <i>Doodia aspera</i>;</p>	<p>Canopy Species: <i>Backhousia leptopetala</i>;</p> <p>Mid Stratum: <i>Smilax australis</i>; <i>Parsonsia straminea</i>;</p> <p>Ground-Stratum: <i>Doodia aspera</i>; <i>Gymnostachys anceps</i>;</p>	<p>Canopy Species <i>Mallotus philippensis</i>; <i>Planchonella australis</i>; <i>Olea paniculata</i>; <i>Elaeocarpus obovatus</i>; <i>Dysoxylum fraserianum</i>; <i>Dendrocnide excelsa</i>;</p> <p>Mid Stratum: <i>Pittosporum multiflorum</i>; <i>Alectryon subcinereus</i>; <i>Diospyros australis</i>; <i>Claoxylon australe</i>; <i>Capparis arborea</i>; <i>Cissus antarctica</i>; <i>Dioscorea transversa</i>;</p> <p>Ground-Stratum: <i>Pseuderanthemum variabile</i>; <i>Adiantum formosum</i>; <i>Gymnostachys anceps</i>;</p>
PCT Description	Open forests to closed forests characterised by <i>Ficus coronata</i> and <i>Streblus</i>	Closed forests with a diverse canopy characterised by <i>Acmena smithii</i> ; <i>Cryptocarya</i>	Open to closed forests with a diverse canopy dominated by <i>Heritiera actinophylla</i> ;	Low open forests to low closed forests with a canopy strongly dominated by <i>Backhousia</i>	Open forests to closed forests with a canopy characterised by <i>Streblus brunonianus</i> and

Potential PCTs	1525	1528	1534	1538	1541
	<i>brunonianus</i> . The mid storey consists of a range of smaller trees and tall shrubs and various climbers. The mid-storey is typically ferny with sparse forbs and graminoids. Ranges and foothills of the lower North Coast and Central Coast at elevations below 700m.	<i>glaucescens</i> and <i>Doryphora sassafras</i> . The mid storey consists of a variety of smaller trees; shrubs and diverse climbers. The ground layer typically consists of a mix of graminoids and ferns with forbs sparse and less common. Sheltered riparian sites of the Central coast; mainly on sandstones; at elevations below 50m.	<i>Dendrocnide excelsa</i> ; <i>Dysoxylum fraserianum</i> and <i>Ficus macrophylla</i> . The mid-storey includes a diverse range of small trees along with shrubs and climbers. The ground layer is typically ferny with forbs and graminoids uncommon. Lowland areas of the lower North Coast.	<i>leptopetala</i> . The mid-storey is typically open and shrubby. The ground layer is typically sparse; consisting of graminoids; ferns and forbs. Coastal ranges of the lower North Coast and Central Coast on sandstone and volcanic breccia substrates.	<i>Mallotus philippensis</i> . The mid-storey consists of various small trees; shrubs and climbers. The ground layer is typically sparse and consists of ferns; graminoids and forbs. Sheltered sites on ranges of the Hunter Valley and lower North Coast escarpment at mid to low elevations.
Vegetation Formation	Rainforests	Rainforests	Rainforests	Rainforests	Rainforests
Vegetation Class	Dry Rainforests;	Northern Warm Temperate Rainforests;	Subtropical Rainforests;	Dry Rainforests;	Dry Rainforests;
Geographical Restrictions	minor valleys; valley heads; Ranges and foothills of the lower North Coast and Central Coast at elevations below 700m.	floodplains; valley floors; Sheltered riparian sites of the Central coast; mainly on sandstones; at elevations below 50m.	Lowland areas of the lower North Coast.	hilltops; hillslopes; Coastal ranges of the lower North Coast and Central Coast on sandstone and volcanic breccia substrates.	upper slopes; Flats Valleys; Sheltered sites on ranges of the Hunter Valley and lower North Coast escarpment at mid to low elevations.
Elevation	<700m	<50m	Lowland areas	Hilltops & hillslopes	Mid-low elevations
Soil Profiles	Sandstone, Siltstone	Sandstone	Sandstone, Volcanic breccia	Sandstone, Conglomerate	Sandstone
Habitat Restrictions	Ranges and foothills of the lower North Coast and Central Coast at elevations below 700m.	Sheltered riparian sites of the Central coast; mainly on sandstones; at elevations below 50m.	Lowland areas of the lower North Coast.	Coastal ranges of the lower North Coast and Central Coast on sandstone and volcanic breccia substrates.	Sheltered sites on ranges of the Hunter Valley and lower North Coast escarpment at mid to low elevations.
PCT Determination	Although this community did not contain the highest number of diagnostic species, <i>Acmena smithii</i> was a dominant species along with <i>Streblus brunonianus</i> which is considered a key diagnostic species which the community is named after. However, the number of diagnostic species is still fairly low due to the degraded nature of the vegetation on site and adjacent, with moderate to high densities of Lantana. This PCT is regionally mapped and was considered to accurately represent the vegetation adjacent and within the Study Area. Additionally, this community occurs within the correct landscape, and is considered the best fit PCT.	The community adjacent to the site occurs as a Dry Rainforest, rather than a Warm Temperate Rainforest, additionally this community is not known to occur within the mapped landscape. Only a small number of diagnostic species occurred within the vegetation community. Therefore, other communities were considered a better fit.	This community is not known to occur within the Newcastle Coastal Ramp landscape. The vegetation adjacent to the site occurs as Dry Rainforest, rather than Subtropical Rainforest. This community also only contained one listed diagnostic species. Therefore, other communities were considered.	While the vegetation adjacent and within the Subject Site contains a number of diagnostic species. This community is generally found on hill tops and hill slopes which is not consistent with the landform of the site. Therefore, other communities were considered.	This community had the highest diagnostic species present within the site and within the adjacent community. However, the number of diagnostic species is fairly low due to the degraded nature of the vegetation on site and adjacent, with moderate to high densities of Lantana. The vegetation on site did not contain <i>Mallotus philippensis</i> which is a key diagnostic of this community. PCT 1525 was considered to be the better fit for the community on site as it is regionally mapped and has a more southern distribution, and occurs within the correct landscape, this community is more likely to be found further inland.
Result	PCT 1525 – Sandpaper Fig - Whalebone Tree warm temperate rainforest				

Estimate cleared value of PCT (%)	68
TEC	<p>This PCT is associated with three TEC's; Listed BC Act, V: Lower Hunter Valley Dry Rainforest in the Sydney Basin and NSW North Coast Bioregions (Part) partially subset of; Listed BC Act, E: Lowland Rainforest in the NSW North Coast and Sydney Basin Bioregions (Equivalent); Listed BC Act, E: Lowland Rainforest on Floodplain in the New South Wales North Coast Bioregion (Equivalent);</p> <p>Assessment of the Subject Site and adjacent vegetation confirms that there is an association with the State listed TEC; Listed BC Act, V: Lower Hunter Valley Dry Rainforest in the Sydney Basin and NSW North Coast Bioregions (Part) which occurs within the geographical distribution for this community. A number of diagnostic species were found within the site, such as, <i>Cupaniopsis anacardioides</i>, <i>Alphitonia excelsa</i>, <i>Breynia oblongifolia</i>, <i>Streblus brunonianus</i>, <i>Clerodendrum tomentosum</i>, <i>Cayratia clematidea</i>, <i>Notelaea longifolia</i>, <i>Maclura cochinchinensis</i>, <i>Geitonoplesium cymosum</i>, <i>Myrsine variabilis</i>, <i>Oplismenus aemulus</i> and <i>Sarcopetalum harveyanum</i>.</p>
Vegetation Zones	
Vegetation Zones of this PCT within Subject Site	The Vegetation Integrity Score (VIS) was calculated at 45.6 which is in the 'poor' category with the one vegetation community present.
Poor Condition	
Description of Vegetation Zone	<p>The vegetation within this community occurs residually in the eastern portion of the Study Area as isolated trees including <i>Cupaniopsis anacardioides</i> (Tuckeroo), <i>Notelaea longifolia</i>, <i>Backhousia myrtifolia</i> and <i>Ficus sp.</i> With a disturbed understorey and midstratum (if present), containing <i>Lantana camara</i>, and predominantly exotic grass species. A plot was carried out in the adjacent, intact Rainforest community to the east to determine the residual vegetation community on site as a BAM plot within the Subject Site was unable to be undertaken. The VIS score in the retained vegetation was still utilised for this area.</p> <p>Plates 3 & 4 show examples of the broader patch of PCT 1525 where BAM plots were undertaken (Poor condition).</p>
Area of Vegetation Zone (ha)	This vegetation zone covers approx. 0.10ha of the Subject Site.
 <p>Plate 3 - PCT 1525 BAM Plot 9 start, in poor condition</p>	 <p>Plate 4 - PCT 1525 BAM Plot 9 end</p>

For the purposes of this SBDAR, both PCT 1600 and 1525 have been utilised as both communities are associated with TEC's.

1.4.5 Non-native / Cleared / Existing Infrastructure

The remaining vegetation on site consists of exotic pasture grasses, farm dams, planted vegetation and a number of dwellings and informal driveways.

Sporobolus fertilis (Giant Parramatta Grass), *Cynodon sp.*, and *Cenchrus clandestinum* (Kikuyu) dominant the ground stratum, followed by *Setaria sphacelate* (South African Pigeon Grass), *Axonopus fissifolius* (Narrow-leaved Carpet Grass), with other smaller amounts of exotic pasture weeds. Native cover was determined to be less than 15% which does not meet the threshold for the Native Vegetation Extent (NVE) draft guidelines and was excluded from this calculation. BAM plot data for Plots 1, 2, 4, 5 & 11 had VIS scores <0.1.

Vegetation in close proximity to the mostly abandoned dwellings, shedding and paddock yards contains ornamental garden plants and planted non endemic native trees as discussed prior. The total area of this zone is 32.10ha comprised 31.93ha of exotic/cleared/existing infrastructure and 0.17ha of farm dams/waterbodies.

High Threat exotics (HTE's) across the Subject Site included; *Cenchrus clandestinum*, *Axonopus fissifolius*, *Briza subaristata*, *Ehrharta erecta*, *Chloris Gayana*, *Paspalum dilatatum*, *Opuntia stricta*, *Bidens Pilosa*, *Senecio madagascariensis*, *Opuntia aurantiaca*, *Lantana camara*, *Corymbia torelliana*, *Ligustrum sinense*, *Olea europaea subsp. cuspidate*, *Pinus sp.*, *Stenotaphrum secundatum*, *Eichornia crassipes*, *Sporobolus fertilis* and *Solanum seaforthianum*.

Refer to **Plates 5 - 15** for representative photos of the site including BAM plots and vegetation assessed as planted native vegetation. Additional site photographs are included in **Appendix G**.



Plate 5 – Exotic pasture BAM Plot 1



Plate 6 – Exotic pasture BAM Plot 2



Plate 7 – Exotic pasture BAM Plot 4



Plate 8 – Exotic pasture BAM Plot 5



Plate 9– Exotic pasture BAM Plot 11



Plate 10 – Ecotone plot that was discarded - BAM Plot 6



Plate 11 – BAM Plot 8 – Planted *Eucalyptus spp* in the south of the site.



Plate 12 – BAM Plot 3 – Planted rows of *Eucalyptus spp* in the north of the site.



Plate 13 – BAM Plot 10 - Planted native vegetation



Plate 14 – Planted native vegetation in north (Where BAM Plot 3 was undertaken), note rows and spacing and consistent size of trees

Table 8 – Vegetation Zones

Vegetation Zones	PCT 1525	PCT 1600	Planted	Exotic / Cleared / Existing Infrastructure
Condition of Vegetation Zones within Subject Site	Poor	Degraded	Planted Native	Non-native
Description of Vegetation Zone	<p>The vegetation within this community occurs residually in the eastern portion of the Study Area as isolated trees including <i>Cupaniopsis anacardioides</i> (Tuckeroo), <i>Notelaea longifolia</i>, <i>Backhousia myrtifolia</i> and <i>Ficus sp.</i> With a disturbed understorey and midstratum (if present), containing <i>Lantana camara</i>, and predominantly exotic grass species.</p>	<p>This vegetation zone occurs as scattered remnant vegetation across the site, intermixed with planted vegetation for windbreaks and aesthetic gardens. The mid stratum was sparse, and contained various acacia species. The understorey was predominantly disturbed with a low native cover. This community is consistent with the regionally mapped PCT 1600.</p>	<p>This vegetation zones encompasses vegetation planted throughout the site that cannot be reasonably assigned to a PCT.</p> <p>Great care was taken to incorporate all plated native vegetation that can be assigned to a vegetation community such as <i>Corymbia maculata</i>, <i>Eucalyptus moluccana</i> and <i>Eucalyptus fibrosa</i> which are associated with PCT 1600. Furthermore, additional species such <i>Eucalyptus tereticornis</i> which are likely to occur within the area have been included in PCT 1600 out of an abundance of caution. These plantings occur amongst exotic understorey; typical for an urban landscaped setting.</p> <p>Planted native vegetation comprises native vegetation that cannot be reasonably assigned to a PCT, such as <i>Corymbia citriodora</i>, <i>Grevillea robusta</i> and <i>Callistemon viminalis</i>.</p> <p>It was also evident that the plants had been planted in stands (trees were of similar size and were planted in rows) to provide shade within a</p>	<p>This zone was highly disturbed and consisted of a ground stratum dominated almost entirely by weeds when BAM plots and ground truthing of the area was conducted.</p> <p>With no tree or shrub layer and <15% native cover which calculated out at 6%, it was excluded from the Native Vegetation Extent (NVE) calculation and mapped as exotic/cleared land.</p> <p>Infrastructure and other features consisted of multiple dwellings, informal roads and farm dams.</p>

Vegetation Zones	PCT 1525	PCT 1600	Planted	Exotic / Cleared / Existing Infrastructure
			paddock and in association within the curtilage of houses on site. Additionally, personal communication with one of the owners of the property were able to confirm history and planting of the trees on site. Considering the information above and species composition, these plots were not assigned a PCT and classed as Planted Native Vegetation. Refer also to historical imagery Appendix K.	
Area of Vegetation Zone within Study Area (ha)	3.38	0.57	0.53	39.46
Area of Vegetation Zone within Subject Site (ha)	0.10	0.30	0.53	31.14

Figure 4 shows the location of these vegetation communities within the Subject Site.

Additional site photographs are included in **Appendix G.**

Table 9 provides a summary of the vegetation zones and areas within the Study Area and Subject Site.

Table 9 – Summary of Vegetation Areas

Vegetation Community	Condition	Total Study Area (ha)	Subject Site (ha)	BMP Lands (ha)	Residual Land (ha)
PCT 1525	Poor	3.38	0.10	3.28	0.00
PCT 1600	Degraded	0.57	0.30	0.28	0.00
Planted Native	Severely degraded	0.53	0.53	0.00	0.00
Total Native Vegetation (ha)		4.48	0.93	3.56	0.00
Dam / Waterbody		0.17	0.17	0.00	0.00
Exotic / Cleared / Existing Infrastructure		39.29	31.93	0.00	7.36
Total Dam / Exotic		39.46	32.10	0.00	7.36
Total (ha)		43.94	33.03	3.56	7.36

For the purposes of assessing native vegetation, associated habitat constraints and threatened species, and to comply with the requirements of the Streamlined Assessment Module – Small Area of the BAM, the following Vegetation Zones were entered in the BAM-C. As both the PCT's within the Subject Site have TEC associations, both PCT 1600 and PCT 1525 were entered (refer **Table 10**).

Residual lands will be managed in accordance with Bushfire Management advice, Asset Protection Zone (APZ) requirements and will most likely be grazed by stock and irregularly slashed if required. A portion of this land is flood mapped.








Table 10 – BAM-C Vegetation Zones

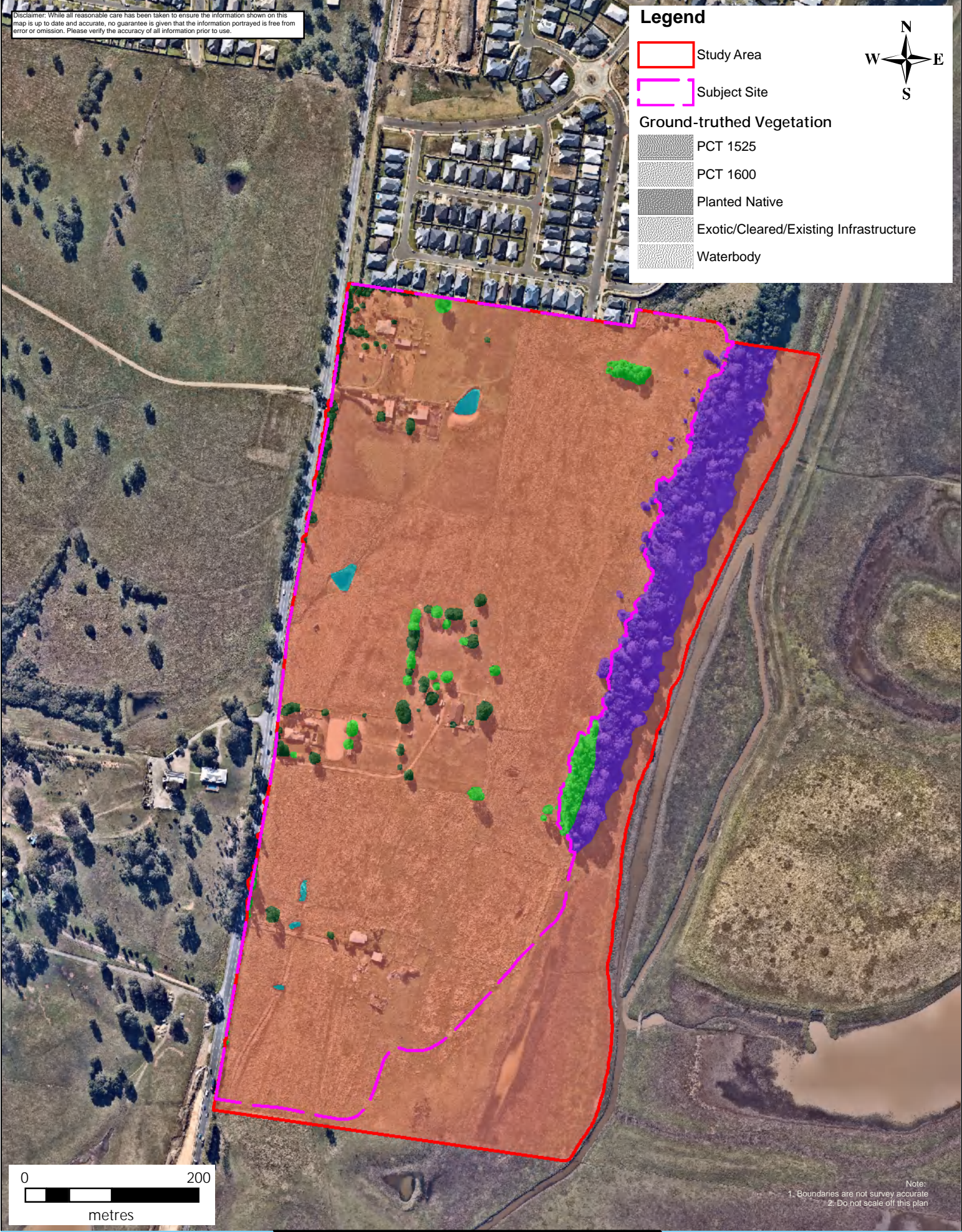
Vegetation Zone	BAM plot ID	Area (ha)	Associated TEC (Y/N)
PCT 1600 – Degraded	7	0.30	Y
PCT 1525 – Poor	9	0.10	Y

In the BAM-C, Plots 1, 2, 4, 5 and 11 (exotic pasture), BAM's 3, 8 & 10 (planted native) and BAM plot 10, data was entered against PCT 1600 to obtain VIS scores but were not utilised for any further calculations within the BAM-C.

Disclaimer: While all reasonable care has been taken to ensure the information shown on this map is up to date and accurate, no guarantee is given that the information portrayed is free from error or omission. Please verify the accuracy of all information prior to use.

Legend

-  Study Area
-  Subject Site
- Ground-truthed Vegetation**
 -  PCT 1525
 -  PCT 1600
 -  Planted Native
 -  Exotic/Cleared/Existing Infrastructure
 -  Waterbody



Note:
1. Boundaries are not survey accurate
2. Do not scale off this plan



Figure 4: Ground-truthed Vegetation

Date: June 2023

Location: 527 Cessnock Rd, Gillieston Heights NSW 2321

Client: Walker Gillieston Heights Pty Ltd

AEP Ref: 2665.02

1.5 Vegetation Integrity Assessment

1.5.1.1 Patch Size

The native vegetation that exists within the Subject Site is relatively fragmented from broader patches of vegetation. The vegetation in the west is connected to a patch of vegetation that, as defined by the BAM, eventually extends as a patch for more than 101ha. The maximum patch size of '≥100ha' is therefore appropriate for each vegetation zone and was entered as such within the Calculator.

The area within the Subject Site that was assessed as Planted Native Small Area BDAR, as per BAM 2020, no assessment for the percent native vegetation cover is required when using the streamlined assessment method, therefore no Vegetation Integrity Score was determined for that area.

1.5.2 Vegetation Integrity Score

Plot data was used to determine the composition, structure and function condition score of the vegetation zones within the Subject Site, which informed the Vegetation Integrity Score (VIS). Plot data has been tabulated (refer **Table 11**) and includes corresponding condition scores along with the overall vegetation integrity score utilising PCT 1600 for all bar Plot 9. Vegetation Condition Class has been rated using the following percentage bands associated with the VIS's:

- 70 - 100 Good;
- 50 - 69 Moderate;
- 35 - 49 Poor;
- 25 - 34 Degraded;
- 17 - 24 Highly Degraded; and
- <17 Severely Degraded.

Table 11 – Vegetation Integrity Score Table

Site Attribute	Exotic	Exotic	Planted Native	Exotic	Exotic	PCT 1600 ecotone plot (Discarded)	PCT 1600 Degraded	Planted Native	PCT 1525 Poor	Planted Native	Exotic
Plot #	1	2	3	4	5	6	7	8	9	10	11
Location	E 361922 N 6372149	E 362043 N 6372446	E 362296 N 6372928	E 362226 N 6372736	E 361995 N 6372563	E 361879 N 6372307	E 361868 N 6372324	E 362075 N 6372652	E 362268 N 6372468	E 361874 N 6372297	E 362118 N 6372832
Bearing	353	184	177	185	3	328	172	0	4	175	306
Tree	0	0	7	0	0	2	3	5	6	2	0
Shrub	0	0	1	0	0	1	4	0	3	2	0
Grass & Grass-like	1	1	1	0	0	1	2	0	3	2	2
Forb	0	1	3	1	1	1	2	1	3	0	1
Fern	0	0	0	0	0	0	1	0	1	0	0
Other	0	0	0	0	0	0	0	0	6	1	0
Composition Total Score	0.3	0.6	15.7	0.3	0.3	5.2	21.3	11.2	47.2	7.0	1.9
Tree	0	0	11.6	0	0	4.1	39	47	80.6	30.2	0
Shrub	0	0	0.8	0	0	0.1	7	0	0.7	0.2	0
Grass & Grass-like	0.1	0.1	0.1	0	0	5	17	0	11.1	5.2	1.1
Forb	0	0.1	0.3	0.1	0.1	0.1	0.3	0.1	1.2	0	0.5
Fern	0	0	0	0	0	0	0.5	0	0.1	0	0
Other	0	0	0	0	0	0	0	0	38.5	0.1	0
Structure Total Score	0	0	3.2	0	0	0.6	37.3	31.8	43.6	22.2	0
Regenerating Stems (<5cm DBH)	Absent	Absent	Absent	Absent	Absent	Absent	Present	Absent	Present	Absent	Absent
Stem Classes (cm DBH)	-	-	5-9, 10-19, 20-29, 30-49	-	-	-	10-19, 20-29, 30-49	5-9, 10-19, 20-29, 30-49	5-9, 10-19, 20-29, 30-49	-	-
# Large Trees	0	0	0	0	0	1	0	0	1	0	0
Hollow-bearing Trees	0	0	0	0	0	1	0	0	1	0	0
Litter Cover (%)	50	28	42	0	0	10.1	6	18	41	11	5
Coarse Woody Debris (m)	0	0	4	0	0	15	0	0	3	0	0
High Threat Weed Cover	51.4	80.2	47.5	10.1	42.5	45.5	39.3	4.9	6.3	38.7	0.2
Function Total Score	14.0	6.9	27.5	0	0	15.9	29	17.8	46.2	0.9	0.1
Overall Vegetation Integrity Score	0	0.1	11.2	0	0	3.6	28.5	18.5	45.6	5.1	0.1

1.5.3 Assessment of Threatened Ecological Communities

1.5.3.1 Lower Hunter Spotted Gum Ironbark Forest in the Sydney Basin and NSW North Coast Bioregions Swamp Sclerophyll Forest

PCT 1600 has two associated TEC's;

- Lower Hunter Spotted Gum Ironbark Forest in the Sydney Basin and NSW North Coast Bioregions (Equivalent) largely equivalent to; and
- Listed EPBC Act, E: Central Hunter Ironbark Spotted Gum Grey Box Forest in the New South Wales North Coast and Sydney Basin Bioregions (Part);

Assessment of the Subject Site vegetation confirms that there is an association with the State listed TEC; Lower Hunter Spotted Gum Ironbark Forest in the Sydney Basin and NSW North Coast Bioregions due to composition of species such as *Corymbia maculata*, *Eucalyptus fibrosa*, *Eucalyptus crebra*, *Bursaria spinosa* *Acacia parvipinnula*; *Breynia oblongifolia*, *Themeda australis*, *Cheilanthes sieberi*, *Lomandra filiformis* as discussed above.

Despite the degraded condition of the PCT on site, as evidenced by a VIS of 28.5, the precautionary principle was applied and it was considered that the PCT as it occurs on site was potentially associated with the BC Act listed EEC. It was entered as such in the BAM-C. Taking the precautionary principal further assessment of the federally listed Central Hunter Ironbark Spotted Gum Grey Box Forest in the New South Wales North Coast and Sydney Basin Bioregions is assessed in **Appendix H** despite its listing status as not an option within the BAM-C.

1.5.3.2 Lower Hunter Valley Dry Rainforest in the Sydney Basin and NSW North Coast Bioregions Swamp Oak Floodplain Forest

PCT 1525 is associated with three TEC's;

- Listed BC Act, V: Lower Hunter Valley Dry Rainforest in the Sydney Basin and NSW North Coast Bioregions (Part) partially subset of; Listed BC Act, E; and
- Lowland Rainforest in the NSW North Coast and Sydney Basin Bioregions (Equivalent); Listed BC Act, E: Lowland Rainforest on Floodplain in the New South Wales North Coast Bioregion (Equivalent);

Assessment of the Subject Site and adjacent vegetation confirms that there is an association with the State listed TEC; Listed BC Act, V: Lower Hunter Valley Dry Rainforest in the Sydney Basin and NSW North Coast Bioregions (Part) which occurs within the geographical distribution for this community. A number of diagnostic species were found within the site, such as, *Cupaniopsis anacardioides*, *Alphitonia excelsa*, *Breynia oblongifolia*, *Streblus brunonianus*, *Clerodendrum tomentosum*, *Cayratia clematidea*, *Notelaea longifolia*, *Maclura cochinchinensis*, *Geitonoplesium cymosum*, *Myrsine variabilis*, *Oplismenus aemulus* and *Sarcopetalum harveyanum*.

Despite the poor condition of the PCT within the Subject Site, as evidenced by a VIS of 45.6, the precautionary principle was applied and it was considered that the PCT as it occurs on site was potentially associated with the BC Act listed EEC. It was entered as such in the BAM-C.

1.6 Threatened Species

Under the BAM, threatened species are classified into two types: 'Ecosystem Credit' and 'Species Credit' species, as detailed within the BioNet Atlas Threatened Species Profile Database.

A predicted Ecosystem Credit Species assessment is presented in **Table 12** and a Species Credit Species assessment is presented in **Table 13**.

Field surveys were undertaken on site from June to September 2022 and in February 2023. A summary of survey effort within the Subject Site is described in **Section 1.4** and **Table 14**, and species listed are presented in **Appendix B** and **Appendix C**.

A Streamlined Assessment for Small Area only requires targeted surveys for candidate threatened species associated with the dominant PCTs and/or TECs on site, that have potential to be subject to Serious and Irreversible Impacts (SAIL) as a result of the proposed development. Furthermore, if a threatened species is incidentally recorded on site, further assessment must be undertaken to determine if species credits are required.

Neither Ecosystem credits or Species credits are applicable to 0.53ha of this development application as that portion of the Subject Site is determined as Planted native vegetation under the Streamlined Assessment Module of the BAM.

Furthermore a D.2 Assessment of Planted native vegetation for threatened species habitat was conducted. This assessment included walking the length of the planted vegetation and searching for nests, hollows, scats and/or other signs of threatened species utilising the vegetation. The habitat assessment did not record any threatened species or find any evidence that any of the planted vegetation within the proposal site is being utilised by threatened species.

1.6.1 Ecosystem Credit Species

Ecosystem Credit species are associated with PCTs and other habitat surrogates that are used to predict their occurrence on a particular site.

The ‘biodiversity risk weighting’ (BRW) for a species is based on the ‘sensitivity to loss’ and ‘sensitivity to potential gain’ score using criteria listed in Appendix I of the BAM and are used in credit calculations to assess impacts of the proposal on a threatened species. The sensitivity to gain class is listed within the BAM calculator for Ecosystem Credit species.

Those Ecosystem Credit species predicted to occur within the site are provided in **Table 12** below.

Table 12 – Predicted Ecosystem Credit Species

Scientific Name	Common Name	Sensitivity to Gain Class	Recorded within 10km (BioNet Atlas 2022) Y/N	Recorded by AEP within site or nearby surrounds Y/N
<i>Anthochaera phrygia</i>	Regent Honeyeater (Foraging)	High	N	N
<i>Callocephalon fimbriatum</i>	Gang-Gang Cockatoo (Foraging)	Moderate	N	N
<i>Calyptorhynchus lathami</i>	Glossy Black-Cockatoo (Foraging)	High	N	N
<i>Chthonicola sagittata</i>	Speckled Warbler	High	Y	N
<i>Climacteris picumnus victoriae</i>	Brown Treecreeper (eastern subspecies)	High	N	N
<i>Daphoenositta chrysoptera</i>	Varied Sittella	Moderate	Y	N
<i>Dasyurus maculatus</i>	Spotted-tailed Quoll	High	N	N

Scientific Name	Common Name	Sensitivity to Gain Class	Recorded within 10km (BioNet Atlas 2022) Y/N	Recorded by AEP within site or nearby surrounds Y/N
<i>Falsistrellus tasmaniensis</i>	Eastern False Pipistrelle	High	Y	N
<i>Glossopsitta pusilla</i>	Little Lorikeet	High	Y	N
<i>Grantiella picta</i>	Painted Honeyeater	Moderate	N	N
<i>Haliaeetus leucogaster</i>	White-bellied Sea-Eagle (foraging)	High	Y	Y
<i>Hieraaetus morphnoides</i>	Little Eagle (Foraging)	Moderate	Y	N
<i>Hirundapus caudacutus</i>	White-throated Needletail	High	N	N
<i>Lathamus discolor</i>	Swift Parrot (foraging)	Moderate	Y	N
<i>Lophoictinia isura</i>	Square-tailed Kite (foraging)	Moderate	Y	N
<i>Melanodryas cucullata cucullata</i>	Hooded Robin (south-eastern form)	Moderate	N	N
<i>Melithreptus gularis gularis</i>	Black-chinned Honeyeater (eastern subspecies)	Moderate	N	N
<i>Micronomus norfolkensis</i>	Eastern Coastal Free-tailed Bat	High	Y	N
<i>Miniopterus australis</i>	Little Bent-winged Bat (foraging)	High	Y	N
<i>Miniopterus orianae oceanensis</i>	Large Bent-winged Bat (foraging)	High	Y	N
<i>Neophema pulchella</i>	Turquoise Parrot	High	Y	N
<i>Ninox connivens</i>	Barking Owl (foraging)	High	Y	N
<i>Ninox strenua</i>	Powerful Owl (foraging)	High	N	N
<i>Petaurus australis</i>	Yellow-bellied Glider	High	N	N
<i>Petroica boodang</i>	Scarlet Robin	Moderate	Y	N
<i>Pomatostomus temporalis temporalis</i>	Grey-crowned Babbler (eastern subspecies)	Moderate	Y	N

Scientific Name	Common Name	Sensitivity to Gain Class	Recorded within 10km (BioNet Atlas 2022) Y/N	Recorded by AEP within site or nearby surrounds Y/N
<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox (foraging)	High	Y	N
<i>Ptilinopus magnificus</i>	Wompoo Fruit-Dove	Moderate	N	N
<i>Ptilinopus regina</i>	Rose-crowned Fruit-Dove	Moderate	N	N
<i>Ptilinopus superbus</i>	Superb Fruit-Dove	Moderate	N	N
<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheath-tail-bat	High	N	N
<i>Scoteanax rueppellii</i>	Greater Broad-nosed Bat	High	Y	N
<i>Stagonopleura guttata</i>	Diamond Firetail	Moderate	N	N
<i>Tyto novaehollandiae</i>	Masked Owl (foraging)	High	N	N

1.6.2 Species Credit Species

For the streamlined assessment, targeted surveys for these species that are not designated as having the potential to be subjected to SAI are not required. This assessment focuses only on those entities at risk of SAI as a result of the proposal. **Figure 5** depicts the BioNet records of threatened species but no listed SAI candidate species were within the Assessment Area.

The flora and fauna species lists for the site are included in **Appendix B** and **Appendix C**.

Table 13 – Candidate SAI Species Credit Species

Species	Risk Weighting (BRW)	SAI (Y/N)	Presence assumed (Y/N)	BioNet Records (10km)	Details of BioNet Record	Habitat Requirements / Habitats Searched / General Notes
Flora						
Singleton Mallee <i>Eucalyptus castrensis</i>	3	Y	N	0	N/A	Known only from a single dense stand near Singleton in the lower Hunter Valley. Here it is locally dominant stand over about ten hectares with a number of smaller outlying stands over a 2.5 km range. Very restricted in range, but locally dominant, occurring as a dense mallee stand over about three hectares, on a low broad ridgetop on loam over sandstone. Occurs on a low broad ridgetop on loam over sandstone. The understorey consists of grasses and scattered shrubs, with bare ground and litter. <i>Eucalyptus fibrosa</i> and <i>Corymbia maculata</i> grow adjacent to, but not within, the stand.
Pokolbin Mallee <i>Eucalyptus pumila</i>	3	Y	N	0	N/A	Currently known only from a single population west of Pokolbin in the Hunter Valley. Historical records also exist for Wyong and Sandy Hollow, however, has not been recorded recently in these areas. The single known population occupies north-west-facing slopes derived from sandstone. Present as a mid-canopy species to a height of 6 m within dry sclerophyll woodland which has a canopy comprising <i>Eucalyptus fibrosa</i> , <i>Callitris endlicheri</i> and, to a lesser extent, <i>Corymbia maculata</i> . Very little is known about the biology or ecology of this species. It is thought to flower in April-May, but like many eucalypts does not flower every year. Individual plants are understood to regrow by sprouting from a basal lignotuber and therefore can persist following fires. However, such vegetative reproduction may suppress the production of fruits/seeds, necessary for the recruitment of new individuals to a population, and the time between such disturbance and the onset of sexual reproduction is not known.
Scrub Turpentine <i>Rhodamnia rubescens</i>	3	Y	N	0	N/A	Occurs in coastal districts north from Batemans Bay in New South Wales, approximately 280 km south of Sydney, to areas inland of Bundaberg in Queensland. Populations of <i>R. rubescens</i> typically occur in coastal regions and occasionally extend inland onto escarpments up to 600 m a.s.l. in areas with rainfall of 1,000-1,600 mm. Found in littoral, warm temperate and subtropical rainforest and wet sclerophyll forest usually on volcanic and sedimentary soils. This species is characterised as highly to extremely susceptible to infection by Myrtle Rust. Myrtle Rust affects all plant parts.

The following candidate threatened species did not require further consideration and were ruled out of the above list as habitat or location constraints were not met in accordance with *Section 5.2.2.2 & 5.2.2.1 (a, b or c)* (refer to **Table 14**) for the Subject Site.

Table 14 – Candidate Species Excluded and Removed from BAM - C

Scientific Name	Common Name	Habitat Constraints (Y / N)	Habitat Degraded (Y / N)	Geographic Limitations (Y / N)	Species is Vagrant (Y / N)	Assessment
<i>Miniopterus orianae oceanensis</i> ;	Large Bent-winged Bat	Y				The species is at risk of SAI if breeding habitat in the form of caves is likely to be impacted by the proposal. However, there is no such habitat feature on site suitable for this species.
<i>Miniopterus australis</i>	Little Bent-winged Bat	Y				The species is at risk of SAI if breeding habitat in the form of caves is likely to be impacted by the proposal. However, there is no such habitat feature on site suitable for this species.
<i>Vespadelus trouhoni</i>	Eastern Cave Bat	Y				Subject Site does not contain caves or is within two kilometres of rocky areas containing caves, overhangs, escarpments, outcrops, crevices or boulder piles, or within two kilometres of old mines, tunnels, old buildings or sheds suitable for this species.
<i>Chalinolobus dwyeri</i>	Large-eared Pied Bat	Y				Subject Site does not contain caves or is within two kilometres of rocky areas containing caves, overhangs, escarpments, outcrops, crevices or boulder piles, or within two kilometres of old mines, tunnels, old buildings or sheds suitable for this species.
<i>Persoonia pauciflora</i>	North Rothbury Persoonia		Y	Y		The extensive grazing and pasture improvement has reduced the inherent biodiversity of the site, causing habitat degradation for listed flora which both require intact native understorey and dense

Scientific Name	Common Name	Habitat Constraints (Y / N)	Habitat Degraded (Y / N)	Geographic Limitations (Y / N)	Species is Vagrant (Y / N)	Assessment
						vegetation: Additionally, <i>Persoonia pauciflora</i> was discounted as the Subject Site is not within 10kms of North Rothbury, as was the given option within the BAM-C.
<i>Lathamus discolor</i>	Swift Parrot	Y				The location is out of the mapped important habitat range for the Swift Parrot (Refer Figure 10.)
<i>Petrogale penicillata</i>	Brush-Tailed Rock Wallaby	Y				The Subject Site does not have land within 1 km of rocky escarpments, gorges, steep slopes, boulder piles, rock outcrops or cliff lines required for the Brush-tailed Rock Wallaby.
<i>Anthochaera phrygia</i>	Regent Honeyeater	Y				The location is out of the mapped important habitat range for the Regent Honeyeater (Refer Figure 10.)

Disclaimer: While all reasonable care has been taken to ensure the information shown on this map is up to date and accurate, no guarantee is given that the information portrayed is free from error or omission. Please verify the accuracy of all information prior to use.

Legend

- Study Area
- Subject Site
- 1500m Buffer



BioNet Threatened Species

- | | | | |
|---|------|--|------|
| ▲ Barking Owl | (1) | ● Grey-headed Flying-fox | (2) |
| ▲ Black-necked Stork | (1) | ● Large Bent-winged Bat | (11) |
| ▲ Grey-crowned Babbler (eastern subspecies) | (16) | ● Large-eared Pied Bat | (2) |
| ▲ Little Lorikeet | (1) | ● Little Bent-winged Bat | (11) |
| ▲ Speckled Warbler | (1) | ● Southern Myotis | (1) |
| ▲ Varied Sittella | (1) | ● Squirrel Glider | (4) |
| ▲ White-bellied Sea-Eagle | (6) | ■ Small-flower Grevillea | (1) |
| ▲ Eastern Coastal Free-tailed Bat | (12) | ■ Eucalyptus parramattensis subsp. decadens | (20) |
| ▲ Greater Broad-nosed Bat | (1) | | |



Figure 5: BioNet Threatened Species 1500m Date: June 2023

Location: 527 Cessnock Rd, Gilliestons Heights NSW 2321

Client: Walker Gillieston Heights Pty Ltd AEP Ref: 2665.02

1.6.3 Field Survey Methods

Surveys are deemed to fulfill minimum survey requirement. Details of the flora and fauna survey are presented in **Table 15 & 17** and were conducted using relevant guidelines, in particular: DPIE survey guidelines for threatened plants (2020c) and DEC survey guidelines for fauna (2004). Flora Survey Effort and Fauna Survey Effort are shown in **Figure 6**.

Field sheets are provided in **Appendix D**, and flora and fauna species list for those species recorded during field surveys are provided in **Appendix B** and **Appendix C**.

1.6.3.1 Habitat Features

An assessment of the relative habitat values present within the Subject Site was undertaken. This assessment focused primarily on the identification of specific habitat types and resources within the Subject Site favoured by known threatened species listed in **Section 1.6**. The assessment also considered the potential value of the Subject Site (and surrounding areas) for all major guilds of native flora and fauna. The assessment was based on the specific habitat requirements of each threatened fauna species in regards to home range, feeding, roosting, breeding, movement patterns and corridor requirements.

Consideration was given to contributing factors including topography, soil, light and hydrology for threatened flora and assemblages. In particular, focus was put on documenting the presence of key habitat features such as tree hollows. Hollows are an important resource utilised by a variety of forest fauna, and are particularly relevant for several of the likely key threatened species in this locality (refer **Section 1.5.4.1** for details on HBTs found on site).

HBTs were mapped within the Subject Site utilising the methodology of tree hollow identification set by OEH in the BioBanking field plot methodology (Feb 2009), namely:

“A hollow is only recorded if: (a) the entrance can be seen; (b) the minimum entrance width is at least 5 cm across; (c) the hollow appears to have depth (i.e., you cannot see solid wood beyond the entrance); and (d) the hollow is at least 1 m above the ground (this omits hollows in cut stumps or at the base of trees)”.

1.6.3.2 Flora Field Survey

All required flora survey techniques were utilised for targeted survey of the species listed in **Table 17** above and guided by the *Threatened Species Survey and Assessment Guidelines (2004 Working Draft)* (DEC 2004), *Surveying Threatened Plants and their Habitats* (DPIE 2020c) and the BAM (DPIE 2020a).

The following survey methods were undertaken to record the presence of threatened species on site:

- Ground-truthing of vegetation mapping to identify all vegetation communities present onsite as well as segregate vegetation zones according to condition and current management practices;
- Seasonal threatened flora surveys utilising the two-phase grid-based systematic approach, targeting a range of threatened flora;
- 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;
- Eleven (11) BAM plots were undertaken in accordance with the BAM; and
- Updated/Refined Vegetation Community Mapping involving traversal over the entire Subject Site, concentrating particularly on mapping the boundaries between the identified Biometric Vegetation Types and refining the original mapping which involved a larger number of vegetation units.

1.6.3.3 Fauna Field Surveys

All required fauna survey techniques were utilised for targeted survey of the species listed in **Table 15 & 17** and guided by the *Threatened Species Survey and Assessment Guidelines* (DEC 2004) Survey effort is shown in **Figure 6**.

1.6.3.4 Incidental Observations

Incidental records of any fauna species observed during fieldwork were noted. This included opportunistic sightings of secondary indications (scratches, scats, diggings, tracks, etc.) of any resident or migratory species. Searches were also conducted for whitewash, regurgitation pellets and prey remain from Owls, chewed Casuarina cones from Black-Cockatoos, chewed fruit remains from frugivorous birds, etc.

These surveys are deemed to fulfill minimum survey requirement. Details of the flora and fauna survey are presented in **Table 15 and 17**. Flora Survey Effort and Fauna Survey Effort are shown in **Figure 6**.

Field sheets are provided in **Appendix D**, and flora and fauna species list for those species recorded during field surveys are provided in **Appendix B** and **Appendix C**.

1.6.4 Survey Effort Results

The survey methods above were utilised across the Subject Site and undertaken on site from June to September 2022 and in February 2023 with further field work and incidental fauna and flora noted during completed of RAR and BMP. **Table 15** outlines provides a summary of field surveys.

Table 15 – Field Survey Periods

Date	Time stamp	Duration	Field activity	Targeted Species	No. of Persons on Site	Staff	Rainfall
22/07/2022	9.15am-4.45pm	7hr30	6 x BAM plots Habitat Assessment HBT and tree survey Riparian assessment Flora and fauna incidental survey	<i>Eucalyptus castrensis</i> , <i>Eucalyptus pumila</i> , <i>Rhodamnia rubescens</i>	2	AH & CR	0
31/08/2022	4.30pm-10pm	5hr30	2 X BAM plots Nocturnal survey including spotlighting and call playback for Koala and nocturnal survey Flora and fauna incidental survey	Koala, <i>Eucalyptus castrensis</i> , <i>Eucalyptus pumila</i> , <i>Rhodamnia rubescens</i>	1	CR	0
01/09/2022	1.45pm-8.15pm	6hr30	2 X Spot analysis technique (SAT) Koala Nocturnal survey including spotlighting and call playback for Koala Flora and fauna incidental survey	Koala, <i>Eucalyptus castrensis</i> , <i>Eucalyptus pumila</i> , <i>Rhodamnia rubescens</i>	1	CR	0
14/09/2022	10am-3pm	5hr	2 x BAM plots	<i>Eucalyptus castrensis</i> , <i>Eucalyptus pumila</i> , <i>Rhodamnia rubescens</i>	2	DK & SJC	0
14/02/2023	9.30am-1pm	3hr30	Habitat assessment, 1 X BAM plot, HBT and tree survey, assess Eucalypts for scratches, scats, riparian assessment, planted tree assessment. Flora and fauna incidental survey	Koala, <i>Eucalyptus castrensis</i> , <i>Eucalyptus pumila</i> , <i>Rhodamnia rubescens</i>	2	DK & KD	0

Date	Time stamp	Duration	Field activity	Targeted Species	No. of Persons on Site	Staff	Rainfall
23/02/2023	1:30-2:45	1hr15	Riparian Assessment		1	BD	0
17/04/2023	7:15-8:15	1hr	Riparian Assessment		1	BrY	0
02/06/2023	9:30-1:45	4hr 15	Riparian Assessment and Biodiversity Management Plan/Vegetation Mapping and analysis		2	YB & KD	0

1.6.4.1 Habitat Trees

Three (3) hollow-bearing trees (HBTs) were present within the Subject Site. Details of the HBT survey is provided in **Table 16** below. Hollow-bearing tree locations are presented in **Figure 6**. One small stick nest was noted in a Tallowwood tree.

Table 16 – Habitat Tree Detail

ID	GPS ID	Species	DBH (cm)	Hollows					Other Habitat Features	Vegetation Zone	Proposed for retention or removal
				XS	S	M	L	XL			
HBT 1	25	<i>Eucalyptus paniculata</i>	65	-	1	1	1	-		Exotic / Cleared	Removal
HBT 2	1	STAG	31	1	2	-	-	-	Potential bat habitat	Exotic / Cleared	Removal
HBT 3	HBT	<i>Corymbia maculata</i>	98	1	1	-	-	-		Exotic / Cleared	Removal
Total Hollows by size				2	4	1	1	-			
Total Hollows				8							

Notes for hollow size: XS <5cm, S 5-10cm, M 10-15cm, L 15-20cm, XL >20cm, DBH - diameter at breast height

1.6.4.2 Water Features

There are five farm dams located within the Subject Site and a mapped first order stream in the north western portion of the main allotment (Lot 2 DP 601226) and the beginning of another mapped first order stream at the northern boundary (Lot 2 DP1230739) (refer **Figure 1** and **2**). The man-made farm dams located within the Subject Site that did not have any native water species and limited potential for amphibians, birds or microbats.

Ground-truthing vegetation and habitat features on site within the main allotment, observed water overflow gullies that are heavily degraded due to cattle grazing and overgrown with pasture grasses. Watercourse features as defined by Appendix 6 of the Waterfront Land Tool were not identified and the mapped 1st order stream is not present within the Subject Site.

Ground-truthing of the northern allotment confirmed the NSW Hydroline spatial data which identified that the mapped 1st order stream is present within the Subject Site within Lot 2 DP1230739. The proposed Vegetated Riparian Zone (VRZ) for this first order stream is 10m and as works will occur within 40m of waterfront land, a Controlled Activity Approval (CAA) will be required to accompany this development application. Offsets will be incorporated into the VRZ within the BMP Lands.

Refer Appendix I Riparian Assessment Report and **Appendix J** Biodiversity Management Plan

1.6.4.3 Other habitat features

The Subject Site possesses very limited habitat features as it is very weedy and there some areas of dumped rubbish, and refuse in dams, around boundaries and around the multiple unused sheds and abandoned houses. Habitat within the site is overall sparse and highly disturbed.

1.6.5 Species Credit Species Survey Results

Overall survey effort within the Study Area (for plots, targeted searches and habitat assessments) and within the Subject Site (from past surveys, including plots, targeted searches, habitat assessments) are detailed in **Table 17**, and was conducted using relevant guidelines., DPIE survey guidelines for threatened plants (2020c) and DEC survey guidelines for fauna (2004). Survey periods are shown in **Table 17** and survey effort is shown in **Figure 6. Table 15** summarises survey results.

Table 17 – Species Credit Species

Species	Specified Survey Period (BAM – C)	Survey Guidelines	Surveyed in Season (Y/N)	Survey Method Undertaken	Date Surveyed	Habitat (Present / Condition)	Records from Deployed Equipment	Observed Within 10km (NSW BioNet Atlas) (Y/N)	Observed within Subject Site (Y/N)	Assumed Present (Y /N)	Species Credits Apply (Y /N)
Flora											
Singleton Mallee <i>Eucalyptus castrensis</i>	All year	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	Y	Parallel walking transects – Maximum distance between transects 40m in open, 20m in dense vegetation Habitat Assessment, Site ground-truthing and Incidental Surveys	22/07/2022, 31/08/2022, 01/09/2022 & 14/02/2023	Habitat condition on site presented as predominantly exotic grassland paddocks in a degraded to highly degraded condition. The site was thoroughly assessed and the species were not identified within the Subject Site. As such they are not anticipated to be on site and no species credit apply for this species.	N/A	N	N	N	N
Pokolbin Mallee <i>Eucalyptus pumila</i>	All year	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	Y	Parallel walking transects – Maximum distance between transects 40m in open, 20m in dense vegetation Habitat Assessment, Site ground-truthing and Incidental Surveys	22/07/2022, 31/08/2022, 01/09/2022 & 14/02/2023	Habitat condition on site presented as predominantly exotic grassland paddocks in a degraded to highly degraded condition. The site was thoroughly assessed and the species were not identified within the Subject Site. As such they are not anticipated to be on site and no species credit apply for this species.	N/A	N	N	N	N
Scrub Turpentine <i>Rhodamnia rubescens</i>	All year	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	Y	Parallel walking transects – Maximum distance between transects 40m in open, 20m in dense vegetation Habitat Assessment, Site ground-truthing and Incidental Surveys	22/07/2022, 31/08/2022, 01/09/2022 & 14/02/2023	Habitat condition on site presented as predominantly exotic grassland paddocks in a degraded to highly degraded condition. The site was thoroughly assessed and the species were not identified within the Subject Site. As such they are not anticipated to be on site and no species credit apply for this species.	N/A	N	N	N	N

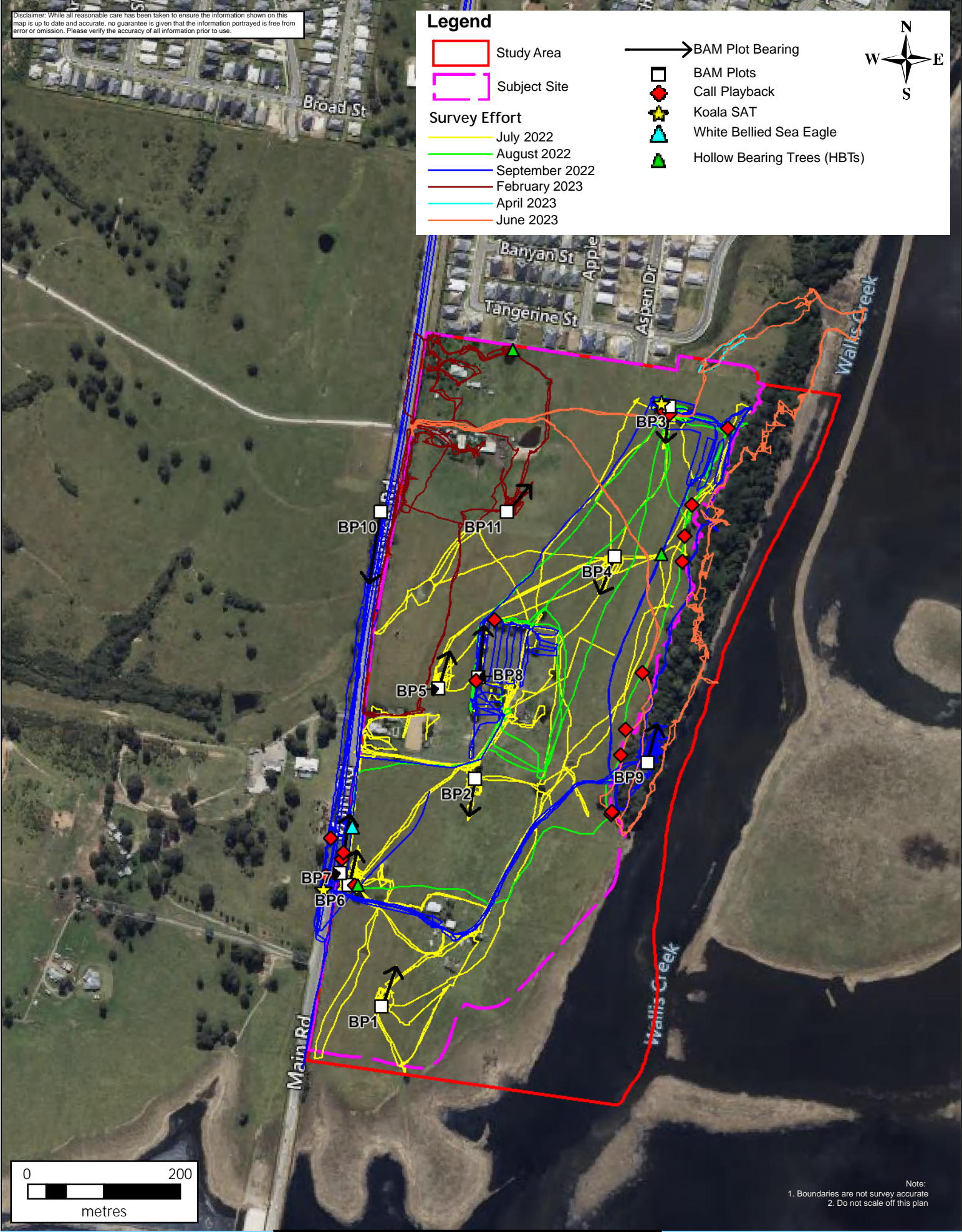
1.6.6 Summary Survey Results

Given the survey works conducted on the development site and adjacent lands as detailed in **Table 17**, with results summarised in **Appendices B** and **C**, it is considered that sufficient information exists to determine that there are no listed species present within the Subject Site.

Disclaimer: While all reasonable care has been taken to ensure the information shown on this map is up to date and accurate, no guarantee is given that the information portrayed is free from error or omission. Please verify the accuracy of all information prior to use.

Legend

- Study Area
- Subject Site
- July 2022
- August 2022
- September 2022
- February 2023
- April 2023
- June 2023
- BAM Plot Bearing
- BAM Plots
- ◆ Call Playback
- ★ Koala SAT
- ▲ White Bellied Sea Eagle
- ▲ Hollow Bearing Trees (HBTs)



Note:
 1. Boundaries are not survey accurate
 2. Do not scale off this plan



Figure 6: Survey Effort

Date: June 2023

Location: 527 Cessnock Rd, Gillieston Heights NSW 2321

Client: Walker Gillieston Heights Pty Ltd

AEP Ref: 2665.02

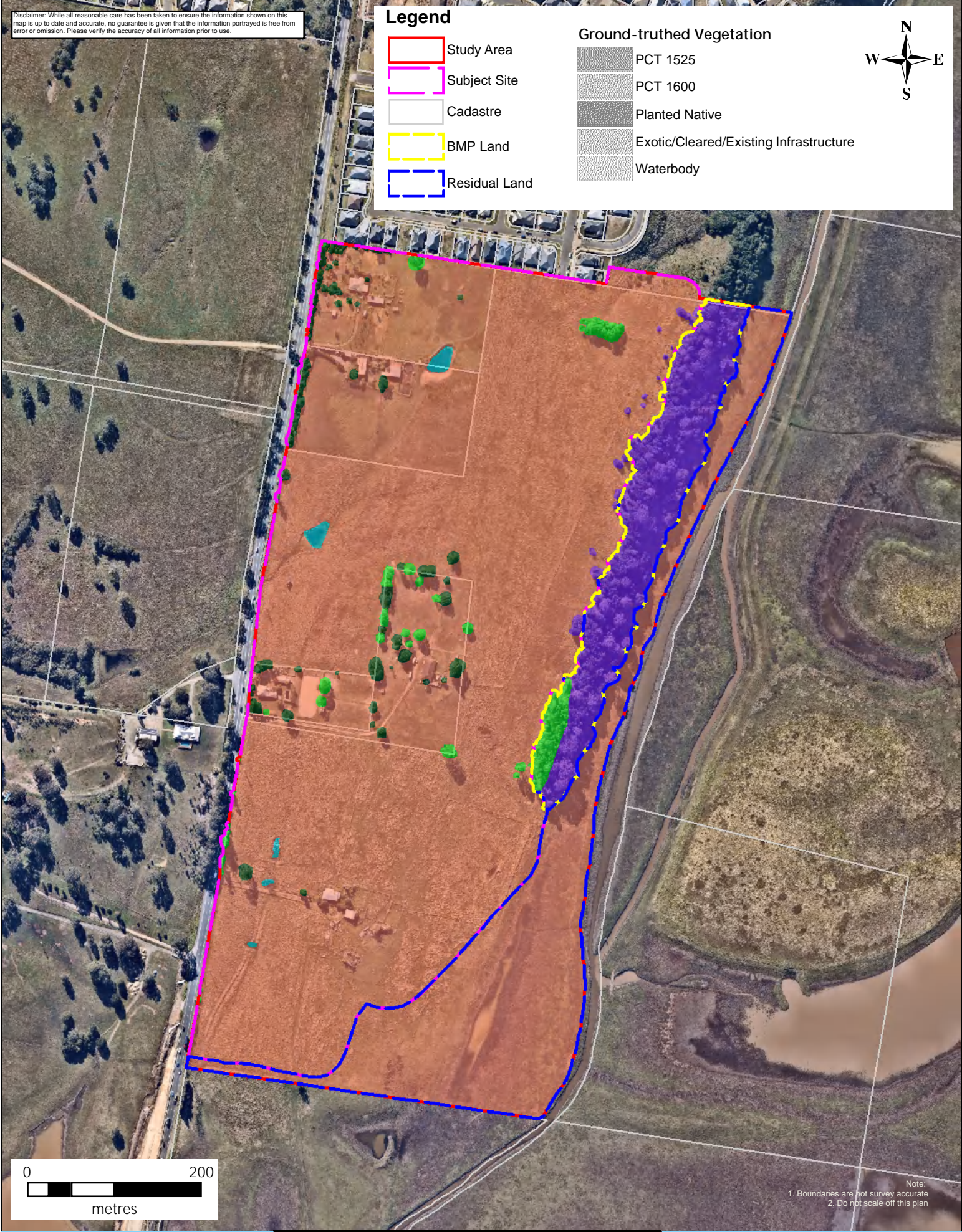
Disclaimer: While all reasonable care has been taken to ensure the information shown on this map is up to date and accurate, no guarantee is given that the information portrayed is free from error or omission. Please verify the accuracy of all information prior to use.

Legend

- Study Area
- Subject Site
- Cadastrate
- BMP Land
- Residual Land

Ground-truthed Vegetation

- PCT 1525
- PCT 1600
- Planted Native
- Exotic/Cleared/Existing Infrastructure
- Waterbody



0 200
metres

Note:
1. Boundaries are not survey accurate
2. Do not scale off this plan



Figure 7: Impacted and Retained

Date: June 2023

Location: 527 Cessnock Rd, Gillieston Heights NSW 2321

Client: Walker Gillieston Heights Pty Ltd

AEP Ref: 2665.02

2.0 Stage 2 – Impact Assessment (Biodiversity Values)

2.1 Avoid and Minimise Summary

Section 7 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. Applicable measures taken as part of this project to minimise impacts are provided below.

The avoid and minimise strategy for this development (in accordance with Section 7 of the BAM), is discussed in greater detail in **Table 17** below.

The prescribed impact risk assessment and mitigation measures (in accordance with Section 9 of the BAM) are included in **Tables 18 to 24** below.

The following measures in **Section 2.2** have been provided to help mitigate the impacts of construction and the ongoing operation of the proposed development on the biodiversity values identified within the Subject Site and surrounds.

2.2 Project Design Avoidance Measures

The Subject Site is located within a semi-rural landscape within the suburb of Gillieston Heights, which lies to the east of the Cessnock Road in the Maitland City Council LGA.

Considerations of Avoid & Minimise has been applied with the proposed development being located within predominantly cleared exotic paddocks. Impacts to native vegetation were deemed to be of minimal consequences due to the very low VIS for all PCTs present onsite. The proposed development footprint and associated civil works has been positioned primarily within R1 – General Residential zoned lands with the C2 – Environmental Conservation lands that will remain largely unimpacted by the proposed development. Native vegetation impacted includes 0.27ha of PCT 1600, 0.10ha PCT 1525 and 0.33ha of planted Native within the total 31.83ha of the Subject Site and within the 43.94ha of the Study Area.

Further to this, a Biodiversity Management Plan (BMP) has been prepared over approximately 3.56ha of retained vegetation PCT 1525 (3.28ha) and PCT 1600 (0.28ha) along the eastern boundary of the Study Area as part of the Conditions of Consent. This will assist in maintaining connectivity for local flora and fauna in the area and reduce impacts to PCT 1525 and associated TEC. Furthermore, the installation of compensatory habitat in the form of nest boxes to mitigate the removal of hollow-bearing trees will be undertaken.

2.3 Water quality and Hydrology

- An Erosion and Sedimentation Control Plan (ESCP) has been prepared for the proposal following guidelines from *Landcom* (2004); as well as a Stormwater Management Plan (SMP);
- Best practice erosion and sedimentation controls should be put in place to limit offsite movement of materials into the adjacent vegetation to the north; and
- Erosion and sedimentation controls should be checked daily and maintained in working order especially after rain events.

2.4 Fencing, Services and Vehicular Access

Fauna movement is most likely along the north eastern and eastern boundaries where larger patches of remnant vegetation still occur in the area. Barbed-wire fencing should not be used throughout the site to avoid any possible fauna injury.

Hydrants are available along Appin Road for the replenishment of attending fire services. The hydrant system will be extended along the new internal roads to service the proposed residential allotments. The sizing, spacing and pressures of this system must comply with AS2419.1-2021. Recommendations will be included within the SEE to ensure compliance with the electricity and gas services requirements.

Furthermore, speed limits of up to 20km/h are expected to be enforced throughout the development, thus limiting the risk of collision with fauna.

2.5 General Construction & Operation

Site specific avoid and minimise measures (in accordance with Section 8 of the BAM) are discussed in **Tables 18** and **19** while **Tables 22** to **25** assess the direct, prescribed, indirect and residual impacts associated with the development and how they are to be mitigated.

- For the clearing phase, retained vegetation will be delineated by safety bunting flags, fencing and signage indicating environmental protection zone, which will still allow fauna to egress the development area as needed. Following the completion of clearing works, permanent delineation features such as logs should be installed to protect the retained vegetation during operational phase of the development;
- Plantings incorporated in the landscape design of the proposed development site to provide future resources for native fauna in the area.
- Vegetation clearing is to be timed to avoid cold weather periods where overnight temperatures are forecast to be less than 12°C. Cold weather is likely to make it difficult for resident hollow dependent fauna to successfully relocate. This is particularly relevant for low body-weight species such as microbats;
- Prior to clearing of any vegetation, an Ecologist is to inspect the area for any signs of resident fauna requiring attention, and in particular nesting birds. Where such is identified, appropriate strategies are to be developed and instigated to minimise impacts. Pre-clearance surveys to include diurnal surveys, stagwatching and nocturnal surveys;
- A staged approach to clearing is to be undertaken to provide fauna the opportunity to disperse outside the area of impact. Staging to include;
 - Phase 1 Clearing: Underscrubbing;
 - Phase 2 Clearing: Removal of non-habitat trees; and
 - Phase 3 Clearing: Removal of habitat and connecting trees;
- All clearing works comprising Phase 1, 2 and 3 are to be undertaken under the supervision of the Project Ecologist;
- Clearing should occur in a direction from previously disturbed lands towards retained lands;
- Implement clearing protocols, including pre-clearance surveys to identify habitat and vegetation to be retained;
- All clearing works to be attended by a suitable equipped and experienced ecologist to deal appropriately with any displaced fauna species;
- All hollow bearing features will be sectionally lowered by tree climbers (where safe to do so);
- Any fauna rescued during vegetation clearing is to be assessed for injuries, and subsequently released to a suitable nearby location; this may require holding fauna until dusk for release in accordance with relevant animal ethics licencing and standards;

- If any fauna is injured during vegetation clearing, they are to be taken promptly to a nearby veterinarian or suitable wildlife carer contact;
- Civil Construction staff to be inducted into pre-clearing and clearing protocols, and to identify environmental features for protection;
- Installation of nest boxes within the BMP lands prior to clearing of HBTs to mitigate the removal of HBTs within the development footprint and provide supplementary roosting / nesting habitat for resident fauna species that utilise such features. Retained lands has the capacity to accept a 1:2 ratio of removed hollows on the development lands to nest boxes in the retained lands for a variety of fauna guilds;
- Any suitable hollows recovered during clearing works should be reconditioned into suitable hollows and installed in retained lands in addition to the manufactured nest boxes;
- All manufactured boxes are to be industry best practice including either marine or hardwood plywood with a minimum thickness of 15mm. Boxes will not have hinged lids to ensure longevity of the boxes and installation methods will not inhibit growth of the host tree;
- All cleared vegetation is to be mulched on site and spread to help stabilise any exposed soil and minimise offsite movement of biomass. Fallen timber and hollow logs identified to be retained to be relocated into the retained lands;
- Live mulch and topsoil of local provenance is an ideal resource to assist rehabilitation of conservation lands;
- Implement hygiene protocols for machinery to prevent the spread of weeds outside the development site;
- Protocols within the Construction Environmental Management Plan (CEMP) that incorporates pre, during and post construction mitigation measure to reduce both direct and indirect impacts, such as lighting, vehicle strike, runoff etc.; and
- Incorporation of Water Sensitive Urban Design (WSUD) principles within stormwater infrastructure is to occur to minimise downstream hydrology changes.

No further site-specific avoidance measures (as listed within Section 8.1 and 9.3 of the BAM) are proposed for the project.

2.5.1.1 Management of Vegetation for Bush Fire Protection

APZs are within the boundary of the Subject Site abounding the applicable rainforest and forest vegetation and grassland to the south. Cleared grassland areas outside the Subject Site within the wider Study Area will continue to be grazed by stock / periodic slashing.

2.5.1.2 Landscaping

- Where possible, landscaping is to occur in conjunction with the proposed development and provide some future resources for native fauna in the area, particularly along the western boundary;
- Landscaping areas are to incorporate plantings with species that occur within the vegetation communities that have been ground-truthed during site surveys of PCTs 1600 and 1525. A comprehensive list of species available for the planting palette to be considered within the Landscape Plan has been recommended to the client which provides a more comprehensive list of associated species within the plant communities via the NSW State Vegetation Type Mapping (SVTM). This utilised PCT 1600 equivalent SVTM PCT 3433: *Hunter Coast Foothills Spotted Gum-Ironbark Grassy Forest* and PCT 1525 equivalent SVTM PCT 3086: *Lower North Hinterland Riparian Dry Rainforest*.

Table 18 – Avoid and Minimise Impacts on Biodiversity Values

Objectives/Requirements	Evidence of compliance
Locating a Project to Avoid and Minimise Impacts on Native Vegetation and Habitat	
<p><i>Knowledge of biodiversity values should inform decisions about the location of the proposal. The initial assessment of biodiversity values from Stage 1 may be used to inform the early planning of the route or location of a proposal.</i></p>	<p>The Subject Site is located in a developing rural landscape which comprises fragmented patches of remnant vegetation. Within the Maitland LEP 201 lands within the Subject Site are predominately zoned R1- General Residential as are lots adjoining the Subject Site with some already undergone development into residential properties and other areas with further residential development planned.</p> <p>Detailed surveys comprising flora and fauna assessment identified that native vegetation within the Subject Site occurs in a poor to severely degraded condition.</p> <p>Two (2) PCTs were identified within the Subject Site, being;</p> <ul style="list-style-type: none"> • Degraded - 0.30ha of PCT 1600 <i>Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter</i> that is associated with State Listed TEC; <i>Lower Hunter Spotted Gum Ironbark Forest in the Sydney Basin and NSW North Coast Bioregions</i>; • Poor - 0.10ha PCT 1525 <i>Sandpaper Fig - Whalebone Tree warm temperate rainforest</i> that is associated with State Listed TEC <i>Lower Hunter Valley Dry Rainforest in the Sydney Basin and NSW North Coast Bioregions</i> <p>The two listed PCTs above were assessed in the BAM under the Small Area Streamlined Assessment Module.</p> <p>Further to this;</p> <ul style="list-style-type: none"> • Severely degraded - 0.53ha of planted native vegetation that has not been assigned a PCT was identified on site. This vegetation has been assessed under the Planted Native Vegetation module of the BAM. <p>The remaining portion of the Subject Site comprises;</p> <ul style="list-style-type: none"> • 31.93ha of Exotic / Cleared / Existing Infrastructure; and • 0.17ha of Dam / Waterbody.

Objectives/Requirements	Evidence of compliance
	<p>A total of 3.56ha is being retained and avoided consisting of 3.28ha of PCT 1525 and 0.28ha of PCT 1600, demonstrating that the project has avoided areas of higher biodiversity value land and will manage this area under a BMP.</p> <p>As such, Avoid & Minimise principles have been adhered to and applied throughout the process of determining the location of subdivision.</p> <p>Considering the above, the location of the development is proposed in areas of low biodiversity value, and is suitable for development in the context of the land zoning and surrounding existing development and urbanisation.</p>
<p><i>Selecting a final proposal location may be an iterative process. Decisions may need to be revisited after all field surveys have been completed.</i></p>	<p>The final proposal is the result of an iterative design process undertaken in consultation with bushfire consultants and project ecologists to determine the optimal location of the footprint while considering potential biodiversity values and bushfire risk management requirements. As a result, impacts to native vegetation are limited to the partial clearing of 0.93ha of poor to severely degraded vegetation deemed to be commensurate with two (2) PCTs and planted native vegetation as described in Section 1.4 of the present report.</p>
<p><i>Impacts from clearing native vegetation and threatened species habitat can be avoided or minimised by locating the proposal in areas:</i></p> <ul style="list-style-type: none"> <i>a. lacking biodiversity values</i> <i>b. where the native vegetation or threatened species, habitat is in the poorest condition (i.e., areas that have a low vegetation integrity score)</i> <i>c. that avoid habitat for species with a high biodiversity risk weighting or land mapped on the important habitat map, or native vegetation that is a TEC or a highly cleared PCT.</i> <i>d. outside of the buffer area around breeding habitat features such as nest trees or caves.</i> 	<ul style="list-style-type: none"> a. The Subject Site contains minimal to no biodiversity values. Due to the highly managed nature of the site and limited broader connectivity. It is considered that the project has selected an appropriate location for development that will limit impact to biodiversity in the area. As described above 3.56ha of PCT 1525 & 1600 will be avoided and managed under a BMP within the Study Area. Thus, demonstrating the project has taken appropriate steps to avoid areas of higher biodiversity value land and maintain connectivity for local flora and fauna in the area. b. Vegetation proposed for removal that has been assessed for credits within the BAM-C comprise a VIS of 28.5 PCT 1600 degraded condition and a VIS of 45.6 PCT 1525 poor condition. The planted native vegetation component although not being assessed in the BAM-C had a vegetation condition ranging from highly to severely degraded. It is noted that the poor vegetation condition of PCT 1525 has been adopted from the vegetation plot undertaken within the retained portion of PCT 1525 within the Study Area. The actual condition of this vegetation within the Subject Site would be considerably less as there were only scattered trees associated with this PCT identified within the Subject Site. As such it is considered that the proposed development has been located within areas of lowest quality vegetation and has avoided areas of higher biodiversity value. c. While PCTs on site were considered, under the precautionary principle, to be associated with TECs as described in Section 1.4.4 of the present report, the vegetation on site is highly degraded and managed and unlikely to truly represent TECs in the area. Further to this, the highly degraded and fragmented condition of native vegetation on site means that biodiversity values are limited. No threatened species or potential SAIL species have been

Objectives/Requirements	Evidence of compliance
	<p>identified on site and a total of 3.56ha of PCT 1525 & 1600 (and its associated TEC) will be managed and conserved under a BMP for a period of 5 years. The majority of the development footprint is located within disturbed, exotics-dominated and cleared lands, with only 0.93ha of native vegetation somewhat associated with PCTs is proposed to be cleared. Actual potential TEC coverage on site is thus limited to approx. 0.40ha in a highly to severely degraded condition. Therefore, avoidance of TECs is considered acceptable in the context of the highly disturbed and fragmented nature of the site, and its location within an urban landscape.</p> <p>d. No breeding habitat features such as nest trees, used hollows or caves were identified on site or in the immediate surrounds.</p>
<p><i>When selecting a proposal's location, all of the following should be analysed. Justification for the decisions in determining the final location must be based on consideration of:</i></p> <p>a. <i>alternative modes or technologies that would avoid or minimise impacts on biodiversity values</i></p> <p>b. <i>alternative routes that would avoid or minimise impacts on biodiversity values</i></p> <p>c. <i>alternative locations that would avoid or minimise impacts on biodiversity values</i></p> <p>d. <i>alternative sites within a property on which the proposal is located that would avoid or minimise impacts on biodiversity values.</i></p>	<p>a. The development footprint is predominantly located within a highly managed paddock and is avoiding areas of higher biodiversity value (notably remnant PCT 1525) within the Study Area to the east of the site. Further to this the site is located along a main road and is part of a recent rezoning that has permitted the use of the land for residential development. Considering that the proposal is for residential development and will not be impacting high biodiversity value land to the east of the Subject Site, no considerations of alternative modes and technologies were deemed necessary or relevant in this instance.</p> <p>b. The proposed development will utilise the existing road network and internal roads to facilitate movement of vehicles in the area. No vehicle access is proposed to intersect or impact the areas of higher biodiversity value to the east. As such, no alternative modes are to be considered and impacts will be limited as a result of servicing of the proposed extension.</p> <p>c. As discussed above, an iterative design process undertaken in consultation with bushfire consultants and project ecologist resulted in the proposed footprint being the optimal option to limit direct and indirect impacts to remnant native vegetation. As a result, only 0.93ha of native vegetation is proposed to be removed and the majority of the development will occur on lands that are either dominated by exotics or already subject to clearing and other disturbance.</p> <p>d. The current location has been recently rezoned for residential development and has considered and adopted the principles of avoidance and minimisation of impacts to higher biodiversity value land.</p>
<p><i>The proposal may also list and map site constraints, such as:</i></p> <p>a. <i>bushfire protection requirements, including clearing for asset protection zones</i></p> <p>b. <i>flood planning levels</i></p> <p>c. <i>servicing constraints.</i></p>	<p>The impacts to native vegetation expected as a result of the proposed works consisting in the clearing of 0.93ha. All mitigation measures for fire, floods and services have been factored into the impact area while meeting the required standards.</p> <p>a) Asset Protection Zones (APZs) have been recommended for the site and have been incorporated into the design process and included within the Subject Site.</p>

Objectives/Requirements	Evidence of compliance
	<p>b) Storm water management and Water Sensitive Urban Design has been considered and incorporated as part of the development. Refer to the Storm Water Management Plan (Appendix L) for flood planning levels and associated works; Detention basins have also been incorporated within the site design, a Controlled Activity Approval will be required and Vegetated Riparian Zones (VRZs) for the identified first order stream in the northern allotment, have all been offset into the BMP lands within the Study Area along the relevant streams as required as part of the riparian corridor management'</p> <p>c) Servicing has been considered and will be provided to the properties.</p>
<p><i>In the BDAR or BCAR, the assessor must document and justify any actions taken to avoid or minimise impacts through careful location of the proposal.</i></p>	<p>As detailed above the Subject Site's location is the most feasible option to enable the project to progress and is located within land recently rezoned for residential development. Considering the location of the project in the context of the locality, the proposed DA footprint has the least impact to biodiversity values, native vegetation, connectivity routes and fauna movements whilst still being located in an appropriate location with regards to access.</p>
<p>Designing a Project to Avoid and Minimise Impacts on Native Vegetation and Habitat</p>	
<p><i>The BDAR or BCAR must document the reasonable measures taken by the proponent to avoid or minimise clearing of native vegetation and threatened species habitat during proposal design, including placement of temporary and permanent ancillary construction and maintenance facilities. The types of measures that can be used to demonstrate this include:</i></p> <p>a. <i>reducing the proposal's clearing footprint by minimising the number and type of facilities</i></p> <p>b. <i>locating ancillary facilities in areas that have no biodiversity values</i></p> <p>c. <i>locating ancillary facilities in areas where the native vegetation or threatened species habitat is in the poorest condition (i.e., areas with the lowest vegetation integrity scores)</i></p> <p>d. <i>locating ancillary facilities in areas that avoid habitat for species and vegetation that has a high threat status (e.g., an endangered ecological community (EEC) or critically endangered ecological community (CEEC) or is an entity at risk of a serious and irreversible impact (SAIL))</i></p>	<p>a-d. The proposed design of the development is such that it maximises use of existing cleared land and minimises impact to native vegetation retaining 3.28ha of remnant PCT 1525 that will be managed under a BMP along with 0.28ha of PCT 1600. Further to this 7.36ha of Exotic / Cleared / Existing Infrastructure land will also be avoided and retained.</p> <p>The Subject Site contains minimal to no biodiversity values. Due to the highly managed nature of the site and limited broader connectivity. It is considered that the project has selected an appropriate location for development that will limit impact to biodiversity in the area. As described above, 3.56ha of PCT 1525 & 1600 will be avoided and managed under a BMP. Thus, demonstrating the project has taken appropriate steps to avoid areas of higher biodiversity value land and maintain connectivity for local flora and fauna in the area.</p> <p>Vegetation proposed for removal that has been assessed for credits within the BAM-C comprise a VIS of 28.5 PCT 1600 degraded condition and a VIS of 45.6 PCT 1525 poor condition. The planted native vegetation component although not being assessed in the BAM-C had a vegetation condition ranging from highly degraded to severely degraded. It is noted that the poor vegetation condition of PCT 1525 has been adopted from the vegetation plot undertaken within the retained portion of PCT 1525 within the Study Area. The actual condition of this vegetation within the Subject Site would be considerably less as there were only scattered trees associated with this PCT identified within the Subject Site. As such it is considered that the proposed development has been located within areas of lowest quality vegetation and has avoided areas of higher biodiversity value.</p>

Objectives/Requirements	Evidence of compliance
<p>e. <i>actions and activities that provide for rehabilitation, ecological restoration and/or ongoing maintenance of retained areas of native vegetation, threatened species, threatened ecological communities and their habitat on the subject land.</i></p>	<p>While PCTs on site were considered, under the precautionary principle, to be associated with TECs as described in Section 1.4.4 of the present report, the vegetation on site is highly degraded and managed and unlikely to truly represent TECs in the area. Further to this, the highly degraded and fragmented condition of native vegetation on site means that biodiversity values are limited. No threatened species or potential SAll species have been identified on site and a total of 3.56ha of PCT 1525 (and its primarily associated TEC) will be managed and conserved under a BMP for a period of 5 years. The majority of the development footprint is located within disturbed, exotic dominated and cleared lands, with only 0.93ha of vegetation somewhat associated with PCTs proposed to be cleared. Actual potential TEC coverage on site is thus limited to approx. 0.40ha in a poor to degraded condition. Therefore, avoidance of TECs is considered acceptable in the context of the highly disturbed and fragmented nature of the site, and its location within an urban landscape.</p> <p>No breeding habitat features such as nest trees or caves were identified on site or in the immediate surrounds.</p> <p>e. The proposed impacts will not affect larger ecosystem connectivity and have a relatively minor impact on local connectivity as the majority of the development adjoins existing cleared areas. Consideration should be given to utilising endemic native species in any landscaping associated with the development, to provide future supplementary resources and connectivity for mobile fauna.</p>
<p><i>The BDAR or BCAR must document and justify efforts to avoid or minimise impacts through design.</i></p>	<p>As discussed above, the development and its subsequent impacts were deemed unavoidable to meet the development standards. Section 2 of the SBDAR explains in detail how the 'avoid and minimise principles' have been implemented as part of the biodiversity impact assessment for the project. Measures include fencing, undergrounding power and erosion and sedimentation controls to limit indirect impacts on adjacent lands, and clearing under the supervision of a Project Ecologist, conducted in such a way as to reduce harm to fauna and facilitate dispersal into retained vegetation zones.</p>

Table 19 - Prescribed Impact Avoidance and Minimisation

Objectives/Requirements	Evidence of compliance
Avoiding and Minimising Prescribed Biodiversity Impacts during Project Planning	
<p><i>The timing and extent of a prescribed impact on the habitat of threatened entities can be difficult to assess and adequately offset through the provision of biodiversity credits. Prescribed impacts may occur on habitat features that are not native vegetation, e.g., caves, rocky outcrops and flyways. Because these types of features cannot be readily replaced or offset, it is important that measures to avoid or minimise impacts are undertaken and are clearly documented in the BDAR or BCAR.</i></p>	<p>The proposed removal of exotic trees on site may be considered as resulting in a prescribed impact. However, field survey did not reveal that they provided significant biodiversity values and as such, their removal was not considered as being of notable consequence to the biodiversity in the locality.</p> <p>No other prescribed impacts, as detailed below in this table, were identified as likely to occur as a result of the proposal.</p>
Locating a Project to Avoid and Minimise Prescribed Biodiversity Impacts	
<p><i>To avoid or minimise prescribed biodiversity impacts, the proponent must consider how to:</i></p> <ul style="list-style-type: none"> a. <i>locate surface works to avoid direct impacts on the habitat features identified in Chapter 6</i> b. <i>locate subsurface works, in both the horizontal and vertical planes, to avoid and minimise operations beneath the habitat features identified in Chapter 6. For example, locating longwall panels away from geological features of significance, groundwater-dependent plant communities and their supporting aquifers</i> c. <i>locate the proposal to avoid severing or interfering with corridors connecting different areas of habitat and migratory flight paths, to important habitat or local movement pathways</i> d. <i>optimise the proposal layout to minimise interactions with threatened entities; for example, design a wind farm that has:</i> <ul style="list-style-type: none"> i. <i>100 m turbine-free buffers around features that attract and support aerial species, such as forest edges, riparian corridors, wetlands, ridgetops and gullies</i> ii. <i>turbine-free corridors in zones of regular movement for species of concern, to avoid a barrier effect</i> e. <i>locates the proposal to avoid impacts on water bodies or hydrological processes</i> 	<ul style="list-style-type: none"> a) The Subject Site: <ul style="list-style-type: none"> i. Does not contain karsts, caves, crevices, cliffs. No other features of geological significance supporting threatened species and ecological communities are present; ii. Does not contain rocks etc, which may support habitat for threatened species; iii. Contains some human made structures. However, no evidence of use by microbats was found on site.; iv. Does not contain non-native vegetation supporting threatened species but threatened ecological communities present; v. Wind turbines are not a feature of the development proposed. vi. Given that the development will be for local roads with a maximum speed limit of 50km/hr, the likelihood of vehicle strike is considered much lower than higher speed roads. <p>Surface works are predominantly located within areas of existing paddocks and impacts to native vegetation are considered to be negligible.</p> b) As discussed previously the developmental and subdivision has been designed to be contained primarily within paddocks avoiding large areas of native vegetation. Further to this appropriate VRZ management will be utilised to prevent impacts to waterways on site. c) The land on which the development is proposed would only provide connectivity between different areas of habitat for highly mobile species as the site is fragmented from other areas

Objectives/Requirements	Evidence of compliance
	<p>of vegetation. The significant area of retention within the Study Area will continue to provide habitat and connectivity to highly mobile species.</p> <p>d) Discussed above.</p> <p>e) A first order watercourse is mapped within the Subject Site and located in the northern allotment. Any further impacts to TEC's and incorporation of flood planning modelling for the site have been considered.</p> <p>The Stormwater Management Plan prepared by Enspire, June 2023 (refer Appendix L), indicates that the proposed development will achieve a significant reduction in pollutant loads hence improving the water quality throughout the catchment area.</p> <p>The MUSIC modelling in the Water Management Plan shows pollutant loads at the discharge location as:</p> <ul style="list-style-type: none"> • “Gross pollutants will achieve 96.0% in Basin A & C and 99.0% in Basin B (exceeds Maitland Councils target of 70%); • Total Suspended Solids will achieve 80.7% in Basin A & C and 82.2% in Basin B (exceeds Maitland Councils target of 80%); • Total Phosphorus will achieve 59.1% in Basin A & C and 62.1% in Basin B (exceeds Maitland Councils target of 45%); and • Total Nitrogen will achieve 50.0% in Basin A & C and 50.7% in Basin B (exceeds Maitland Councils target of 45%). <p>The Stormwater Management Plan prepared by Enspire, June 2023, concludes:</p> <p><i>This Civil Engineering and Stormwater Management Report has been prepared to provide an understanding of the design assumptions, inputs and guide to the stormwater quantity and quality management techniques for the proposed development.</i></p> <p><i>This report demonstrates that the stormwater drainage objectives as outlined in the Maitland City Council Manual of Engineering Standards are achieved.</i></p> <p><i>The included stormwater quantity calculations demonstrate how peak flows from the proposed development site in post-development conditions are attenuated to no greater than the existing peak flows for all design storms up to and including the 1%AEP event.</i></p> <p><i>The stormwater quality assessment demonstrates that a specifically tailored treatment system will be required in order to meet the pollutant removal targets as defined in the Maitland City Council Manual of Engineering Standards during the operational phase of the proposed development..</i></p> <p>It is noted that areas outside of the Subject Site but within the Study Area is prone to flooding.</p>
<p><i>When locating a proposal, the following need to be analysed and justification should be provided for each alternative selected:</i></p>	<p>As described above, the potential for prescribed impacts as a result of the proposal is limited to the removal of 0.93ha of native and planted native vegetation, exotic trees / paddocks and potential human-made structures. No other feature of note was identified which would justify</p>

Objectives/Requirements	Evidence of compliance
<ul style="list-style-type: none"> a. alternative modes or technologies that would avoid or minimise prescribed impacts b. alternative routes that would avoid or minimise prescribed impacts c. alternative locations that would avoid or minimise prescribed impacts d. alternative sites within a property on which the proposal is located that would avoid or minimise prescribed impacts. 	<p>considering alternative modes, technologies, routes, locations or sites within the property. The area of higher biodiversity value to the east of the Subject Site is being retained and as such the proposal is avoiding areas of higher biodiversity value that provide higher quality habitat for local flora and fauna in the area.</p> <p>Overall, the proposed plan, being the result of an iterative design process undertaken in consultation with bushfire consultants and project ecologists, seeks to limit impacts to habitat values within the site, by locating the proposal within land zoned for residential development and within cleared and exotic-dominated lands.</p>
<p>Justifications for a proposal's location should identify any other site constraints that the proponent has considered in determining the location and design of the proposal, such as:</p> <ul style="list-style-type: none"> a. bushfire protection requirements, including clearing for asset protection zones b. flood planning levels c. servicing constraints. 	<p>No prescribed impacts other than the potential ones listed above are considered as likely to be incurred by the implementation of an APZ. Other considerations of flood planning levels and servicing constraints have been incorporated in the design of the project.</p>
<p>The assessor must document and justify in the BDAR or BCAR all efforts to avoid, or the reasonable measures proposed to minimise, prescribed impacts when choosing the proposal's location.</p>	<p>As discussed above, the potential for prescribed impacts to be incurred by the proposal has been considered. It was deemed that there is limited to no such impact to be expected, with only small impacts to native vegetation presenting some potential to provide habitat values and therefore potentially being subjected to prescribed impacts. Further field assessment concluded that the removal of native vegetation will not reduce biodiversity values on site to any notable degree.</p>
Designing a Project to Avoid and Minimise Prescribed Biodiversity Impacts	
<p>Design measures that can avoid or minimise prescribed impacts include:</p> <ul style="list-style-type: none"> a. Engineering solutions, such as proven techniques to <ul style="list-style-type: none"> i. minimise fracturing of bedrock underlying features of geological significance, or groundwater-dependent communities and their supporting aquifers ii. restore connectivity and movement corridors b. Design elements that minimise interactions with threatened entities, such as: <ul style="list-style-type: none"> i. designing turbines to dissuade perching and minimise the diameter of the rotor swept area ii. designing fencing to prevent animal entry to transport corridors iii. providing vegetated buffers rehabilitated with native species 	<ul style="list-style-type: none"> a) <ul style="list-style-type: none"> i. It is not envisaged that any works will impact on features of geological significance, groundwater dependent communities or supporting aquifers. ii. Connectivity within the Subject Site is limited to predominantly scattered trees within cleared and managed paddocks and the proposal is unlikely to further reduce connectivity. A large portion of PCT 1525 will be retained as a result of the proposal and managed under a BMP for a period of 5 years. The retention of this vegetation will ensure areas of higher biodiversity value, fauna refuge and connectivity are maintained. Mitigation measures in the form of landscaping trees commensurate with PCTs on site is proposed to minimise impacts resulting from the proposal. b) It is recommended that powerlines be buried rather than overhead so that flight paths for threatened fauna in the locality are maintained and avoid impacts such as powerline strike. A rural style 'post and rail' fence placed at the edge of the proposed development is recommended along with a low-speed limit within the development will mean that even if animals enter the Subject Site, they are unlikely to be struck by vehicles. Native endemic

Objectives/Requirements	Evidence of compliance
<p>c. <i>Maintaining environmental processes that are critical to the formation and persistence of habitat features not associated with native vegetation</i></p> <p>d. <i>Maintaining hydrological processes that sustain threatened entities</i></p> <p>e. <i>Controlling the quality of water released from the site, to avoid or minimise downstream impacts on threatened entities.</i></p>	<p>species have been recommended to be incorporated into the landscape design process. However, this will be limited to what is acceptable whilst ensuring compliance with bushfire risk management requirements. While non-native vegetation occurs on site, it was concluded its habitat values are very limited. As such, it was not considered necessary to preserve such vegetation.</p> <p>c-d) The Stormwater Management Plan prepared by Enspire, June 2023 (refer Appendix L), indicates that the proposed development will achieve a significant reduction in pollutant loads hence improving the water quality throughout the catchment area.</p> <p>The MUSIC modelling in the Water Management Plan shows pollutant loads at the discharge location as:</p> <ul style="list-style-type: none"> • <i>“Gross pollutants will achieve 96.0% in Basin A & C and 99.0% in Basin B (exceeds Maitland Councils target of 70%);</i> • <i>Total Suspended Solids will achieve 80.7% in Basin A & C and 82.2% in Basin B (exceeds Maitland Councils target of 80%);</i> • <i>Total Phosphorus will achieve 59.1% in Basin A & C and 62.1% in Basin B (exceeds Maitland Councils target of 45%); and</i> • <i>Total Nitrogen will achieve 50.0% in Basin A & C and 50.7% in Basin B (exceeds Maitland Councils target of 45%).</i> <p>The Stormwater Management Plan prepared by Enspire, June 2023, concludes: <i>This Civil Engineering and Stormwater Management Report has been prepared to provide an understanding of the design assumptions, inputs and guide to the stormwater quantity and quality management techniques for the proposed development.</i> <i>This report demonstrates that the stormwater drainage objectives as outlined in the Maitland City Council Manual of Engineering Standards are achieved.</i> <i>The included stormwater quantity calculations demonstrate how peak flows from the proposed development site in post-development conditions are attenuated to no greater than the existing peak flows for all design storms up to and including the 1%AEP event.</i> <i>The stormwater quality assessment demonstrates that a specifically tailored treatment system will be required in order to meet the pollutant removal targets as defined in the Maitland City Council Manual of Engineering Standards during the operational phase of the proposed development.</i></p> <p>.-e. The project design process incorporates MUSIC (Model for Urban Stormwater Improvement Conceptualisation) water quality modelling to determine stormwater treatments to ensure post-development water quality at least maintains pre-development conditions.</p>
<p><i>The proposed measures must be evidence-based and directed towards the threatened entities identified in Chapter 6. The BDAR or BCAR must document the designs that are proposed to avoid or minimise prescribed impacts</i></p>	<p>Refer to Section 2.0 of the SBDAR.</p>

2.6 Assessment of Impacts

Section 8 of the BAM states that the BDAR “*must assess the impacts of the project on native vegetation and habitat*”. In addition to this, Sections 9.1.4 and 9.2 require that further assessment be produced for any impact, including biodiversity impacts, expected in land surrounding the Subject Site. **Tables 22 to 25** provide a summary of measures proposed to avoid and minimise direct, indirect and residual impacts on biodiversity.

Table 20 – Risk Matrix

		Probability						
		A	B	C	D	E		
Maximum reasonable consequence	1	CR	CR	HR	HR	MR	CRITICAL	CR
	2	CR	HR	HR	MR	LR	HIGH RISK	HR
	3	HR	HR	MR	LR	LR	MEDIUM RISK	MR
	4	HR	MR	LR	LR	LR	LOW RISK	LR
	5	MR	LR	LR	LR	LR		

Table 21 – Assessment Criteria

Consequence criteria: Impacts on threatened species and/or threatened species habitat
1. CRITICAL
Impact – Severe; Spatial scale – Widespread; Time scale – Long-term.
Requires consideration of whether impacts may result in a Serious and Irreversible Impact that may lead to local extinction.
2. MAJOR
Impact – Moderate; Spatial scale – Moderate to widespread; Time scale – Mid- to long-term.
May result in temporary or long-term damage.
3. MODERATE
Impact – Moderate; Spatial scale – Local to moderate; Time scale – Short- to mid-term.
May result in a moderate, temporary impact. However, it may be difficult to rehabilitate impact and may have negative implications on the ecosystem
4. MINOR
Impact – Minor; Spatial scale – Local; Time scale – Short-term.
May result in minor impacts that are relatively easily rehabilitated. Not likely to have negative implications on the ecosystem.
5. NEGLIGIBLE
Impact – Minor; Time scale – Short-term with no lasting effect.
Likelihood criteria
A. ALMOST CERTAIN
Very high or certain probability that impact will occur, or event is of a continuous nature.
B. LIKELY
Likely probability that impact will occur, or event is frequent (frequency 1-5 years).
C. MODERATE
Moderate probability that impact will occur, or event is infrequent (frequency 5-20 years).
D. UNLIKELY
Low probability that impact will occur, or event is very infrequent (frequency 100 years).
E. REMOTE
Very low probability that impact will occur or may occur under extenuating circumstances. Event is very rare or stochastic in nature (frequency 1000 years)

Table 22 – Direct Impact Assessment

Aspect	Project Phase	Potential Impact	Mitigation	Timing	Responsibility	Risk before mitigation	Risk after mitigation
Native vegetation	Construction and Operation	Removal of approx. 0.93ha of native and planted native vegetation.	Landscaping within the development will utilise endemic native species suitable for future fauna use. Development will primarily occur on cleared and exotic-dominated land.	Post-development	Council Project coordinator Ecologists	MR	LR
Threatened native vegetation	Pre-Construction and Construction	No threatened flora species have been identified on site, hence no impact.	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable
Habitat in the form of tree hollows	Pre-construction and Construction	Three (3) trees containing hollows are proposed to be removed.	Compensatory habitat in the form of nest boxes are proposed to be installed at a ratio of two nest boxes for every hollow removed, in retained BMP vegetation to the east of the Subject Site within the Study Area. Nest boxes are to be installed by qualified ecologists and according to the Habisure system (Franks & Franks 2006) or similar.	Not applicable	Project coordinator Ecologists	Not applicable	Not applicable
Fauna home range and connectivity	Pre-Construction and Construction	Disturbance to fauna habitat during clearing and construction operations	Presence of a project ecologist before and during clearing works to ensure any fauna present on site is safely relocated. Protective fencing to be installed to reduce likelihood of fauna incursion into construction site. Staff induction to raise awareness of potential fauna presence.	Pre-, during and post-development	Project coordinator Construction staff Site manager Project Ecologist	MR	LR
Fauna home range and connectivity	Operation	Reduction in connectivity by removal of 0.93ha of native and planted native vegetation.	Landscape tree planting commensurate with PCTs on site will provide compensatory resource where practicable.	Post-development	Council Project coordinator Ecologists	LR	LR

Aspect	Project Phase	Potential Impact	Mitigation	Timing	Responsibility	Risk before mitigation	Risk after mitigation
Reduction of biodiversity values	Operation and Post Operation	Removal of remnant vegetation present on site	0.40ha of native remnant vegetation and 0.53ha of planted native is proposed to be removed, most of which has been assessed as being in a poor to degraded condition. 3.56ha of PCT 1525 & 1600 has been avoided and is proposed to be placed under a BMP to enhance and preserve this area of native vegetation.	Pre-, construction and during-development	Project coordinator Construction staff Site manager Project Ecologist	HR	LR
	Construction	Sediment run-off into retained vegetation area	Best practice erosion and sedimentation (ERSED) control methods to be adopted, enforced and maintained throughout vegetation works, so as to avoid any movement of sediment resulting from clearing and construction into the retained vegetation lands.	During development	Project coordinator Construction staff Site manager Project Ecologist	HR	LR
		Changes to stormwater evacuation	Incorporation of Water Sensitive Urban Design (WSUD) principles within stormwater infrastructure is to occur to minimise hydrology changes.	During development and Operational	Project coordinator Construction staff Site manager Project Ecologist	HR	LR

Table 23 – Prescribed Impact Assessment

Subject of Prescribed Impact	Project Phase	Mitigation	Timing	Responsibility	Risk before mitigation	Risk after mitigation
Habitat of threatened species or ecological communities associated with: (i) Karst, caves, crevices, cliffs and other geological features of significance or (ii) rocks, or (iii) human made structures, or (iv) non-native vegetation	Not applicable	No such impacts are expected on site other than the clearing of a 31.93ha of land identified as exotic / cleared / existing infrastructure and 0.17ha of Dam / Waterbodies.	Not applicable	Not applicable	Not applicable	Not applicable
Connectivity of different areas of habitat of threatened species that facilitates the movement of those species across their range	Construction and operation	Reduction in connectivity will be negligible as only 0.93ha of native and planted native vegetation in poor to severely degraded condition will be impacted. Vegetation on site is already fragmented and heavily managed. This will not impact the viability of the 3.56ha of predominantly PCT 1525 rainforest corridor located to the east of the Subject Site and extends north.	Not applicable	Not applicable	Not applicable	Not applicable
Movement of threatened species that maintains their lifecycle	Pre-operational	No threatened species were identified within the proposed impact area and it is not anticipated that the proposed development will impact native species due to the highly managed and degraded nature of the site.	Not applicable	Not applicable	Not applicable	Not applicable
Water quality, water bodies and hydrological processes that sustain threatened species and threatened ecological communities	Not applicable	No threatened species were identified to be using the waterbodies on site and no further consideration is required.	Not applicable	Not applicable	Not applicable	Not applicable
Wind turbine strikes on protected animals	Not applicable	No wind turbines will be installed on site.	Not applicable	Not applicable	Not applicable	Not applicable
Vehicle strikes on threatened species or on animals that are part of a TEC	Construction, operation	Civil Construction staff to be inducted into pre-clearing and clearing protocols, and to identify environmental features for protection. During operation, such impacts will be mitigated through the introduction of low-speed	Pre- and during development	Project coordinator Construction staff Site manager	HR	MR

Subject of Prescribed Impact	Project Phase	Mitigation	Timing	Responsibility	Risk before mitigation	Risk after mitigation
		limits as well as speed limiting devices on the facilities' roads.		Project Ecologist		

Table 24 – Indirect Impact Assessment

Aspect	Project Phase	Potential Impact	Mitigation	Timing	Responsibility	Risk before mitigation	Risk after mitigation
Noise	Construction	Noise during construction due to construction works and construction traffic. Potential disturbance to threatened species or reduced viability of adjacent retained habitat zone.	Timing of construction operations will be optimised as per an approved Construction Environmental Management Plan (CEMP) which will include a Noise Mitigation Plan. Tree protection and site fencing to prevent incursions into adjacent lands.	During development	Project coordinator Construction staff Site manager	HR	MR
	Operation	Noise due to traffic. Potential disturbance to threatened species within the surrounding area.	The proposal is unlikely to significantly increase the noise currently present at the Subject Site, which is already located on Cessnock Road with adjoining urban development projects.	During operations and Operational	Civil Contractor	MR	MR
Vibration	Construction	Disturbance to fauna which may lead to displacement to adjacent areas.	Conditions of construction operations will be optimised as per an approved Construction Environmental Management Plan (CEMP).	During construction	Project coordinator Site manager Construction staff	HR	MR
Dust	Construction	Dust deposits on native flora and fauna habitat, resulting in disturbance to and reduced viability of adjacent habitat.	Dust levels during operations managed according to an approved CEMP: <ul style="list-style-type: none"> • Daily monitoring of dust generated by construction activities; and • Dust suppression measures (setting maximum speed limits and application of dust suppressants) will be 	During construction	Project coordinator Site manager Construction staff	LR	LR

Aspect	Project Phase	Potential Impact	Mitigation	Timing	Responsibility	Risk before mitigation	Risk after mitigation
			implemented during construction works to limit dust on site.				
Light spill	Construction	Disturbance to nocturnal fauna, thus reducing viability of the adjacent habitat.	Optimal construction methods as per an approved CEMP will reduce instances of light spill. Such measures will include limiting use of lights where necessary and directing lights in such a way as to limit impact on adjacent vegetated lands.	During construction	Project coordinator Site manager Construction staff	LR	LR
	Operation	Disturbance to nocturnal fauna, thus reducing viability of adjacent retained habitat zone.	Provision of lighting will be in accordance with an approved CEMP. Permanent lighting shall be designed to minimise light spill into surrounding vegetation.	During operations	Civil Contractor	LR	LR
Non-native vegetation	Construction	Soil disturbance may lead to proliferation of exotic flora (including invasive weeds) through seeds and vegetation fragments.	As per an approved CEMP including a Biodiversity Management Plan: <ul style="list-style-type: none"> • Appropriate handling of mulch created from the removal of exotic vegetation; • Appropriate cleaning of all construction equipment to limit the risk of weed seed and fragments to adjacent retained areas; and • Chemical and manual treatment of weeds where applicable. • Appropriate management of weeds within landscaping areas. 	During construction	Project coordinator Site manager Construction staff	MR	LR
Visual amenity	Construction	Rubbish and waste retained onsite attracting native fauna.	Activities on the Site will be managed in accordance with an approved CEMP and designed to limit the amount of rubbish and waste onsite through good housekeeping practices.	During construction	Project coordinator Site manager Construction staff	LR	LR
	Operation	Rubbish and waste retained onsite attracting native fauna.	Suitable fencing to be installed and maintained between development and surrounding natural areas to prevent	During operations	Civil Contractor	LR	LR

Aspect	Project Phase	Potential Impact	Mitigation	Timing	Responsibility	Risk before mitigation	Risk after mitigation
			access and degradation of surrounding vegetation.				

Table 25 – Residual Impact Assessment

Aspect	Project Phase	Potential Impact	Mitigation / Minimisation	Residual Impact Description	Impact to be offset (see Section 2.3.2)
Reduction of biodiversity values	Construction Operation	As the Subject Site has predominantly degraded vegetation with a VIS of 28.5 it has been determined that the site has very low biodiversity values, hence the impact is not deemed significant.	Reduction in connectivity and habitat values extent will be negligible as only 0.93ha of native and planted native vegetation in poor to severely disturbed condition will be impacted. Vegetation on site is already fragmented and heavily managed. Areas of higher biodiversity value (3.56ha of retained predominantly PCT 1525) are located to the east of the Subject Site and will be retained and managed under a BMP which will maintain habitat and connectivity for local flora and fauna in the area. Therefore, the proposal is unlikely to impact upon any existing corridors and areas of higher biodiversity value.	Clearing of 0.93ha of native and planted native vegetation consisting PCT 1600 (0.30ha), PCT 1525 (0.10ha) and 0.53ha of planted native vegetation	0.30 ha of PCT 1600 0.10ha of PCT 1525 0.53ha of planted native vegetation not subject to offsetting
Noise, dust, light spill	Construction	Disturbance to local fauna	Application of CEMP as mentioned above	Noise, dust and light spill will still occur but at a low magnitude, thus keeping the impact on local fauna to a low level	Not applicable

2.7 Impact Summary

Biodiversity Offsets Credits are required for the removal of 0.40ha of native vegetation comprising of;

- 0.30ha of PCT 1600 – *Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter*
- 0.10ha of PCT 1525 – *Sandpaper Fig - Whalebone Tree warm temperate rainforest*

To reiterate, 0.53ha of vegetation present within the Subject Site was classified as 'planted native vegetation' and BAM 2020 Appendix D applied (Table 2). This vegetation type is not required to be further assessed using the BAM, and was thus excluded from any credit or offset calculations.

2.7.1 Serious and Irreversible Impacts (SAIIs)

Species at risk of SAI as a result of development are determined by decision makers (i.e., Council) for each particular threatened species / community based upon four (4) principles listed within the Guidance and criteria to assist a decision maker to determine a serious and irreversible impact (DPIE 2019).

The following flora and fauna SAI candidate species were predicted as potentially occurring within the Subject Site. The potential for these species to occur within the Subject Site was based on both the candidate species predicted by the BAM-C for the PCTs present on site as well as BioNet Atlas records from the locality and where potential habitat was present within or near the Subject Site.

Singleton Mallee (*Eucalyptus castrensis*), Pokolbin Mallee (*Eucalyptus pumila*) and Scrub Turpentine (*Rhodamnia rubescens*) were identified as Candidate Species within the BAM-Calculator that required surveys. Surveys were undertaken for these species and they were not detected on site. As such it is not expected that these species would occur on site nor would they be at risk of a potential SAI.

Regent Honeyeater (*Anthochaera Phrygia*) and Swift Parrot (*Lathamus discolor*) were also identified within the BAM-Calculator as Candidate Species; however, these species were removed from the candidate species list as the site was not mapped as important habitat and no further assessment for these species was required. As above these species were not considered to be at risk of a potential SAI.

Large Bent-winged Bat (*Miniopterus orianae oceanensis*), Little Bent-winged Bat (*Miniopterus australis*), and Large-eared Pied Bat (*Chalinolobus dwyeri*) were identified on the Candidate Species list and within the 1500m BioNet search area and North Rothbury Persoonia (*Persoonia pauciflora*), Brush-tailed Rock-Wallaby (*Petrogale penicillata*), Eastern Cave Bat (*Vespadelus troughtoni*) were also identified as Candidate Species on the BAM-Calculator, however, these species were removed for further assessment due to various habitat constraints and / or geographic restrictions. As above these species were not considered to be at risk of a potential SAI.

2.7.2 Impacts requiring offset

2.7.2.1 Ecosystem Credits

As per Section 10.3 of the BAM, the removal of native vegetation within the site will require offsetting to achieve the ‘no net loss standard’ detailed within Section 11 of the BAM. To calculate the required offsets in the form of ecosystem credits, the BAM Calculator has taken into consideration the impact area and the projected loss in vegetation integrity score along with the biodiversity risk weighting of the PCT. Details of the required ecosystem credit outputs is provided in **Table 26**. A total of six (6) Ecosystem Credits are required to offset the proposed development.

Table 26 – Ecosystem Credit Requirements

Remnant Vegetation (PCT)	Impact Area (ha)	Future VIS	Vegetation Integrity Score Loss	Biodiversity Risk Weighting	Credit Requirements
1600	0.30	0	28.5	2	4
1525	0.10	0	45.6	1.75	2
Total					6

2.7.2.2 Species Credit

If a Species Credit species is either identified on the site during survey, assumed to be present, or confirmed present within an expert report, a ‘species polygon’ is required to be produced for the area of suitable habitat within the site for the species. No threatened species were identified on site or assumed to be present on site. As such no species credits have been incurred as part of this proposal.

2.7.3 Areas not requiring assessment

The total Subject Site is 33.03ha, of which 32.10ha is deemed Exotic / Cleared / Existing Infrastructure or Dams / Waterbodies and requires no assessment. In addition, as per Section 9.3 of the BAM, areas outside of the proposed impact area do not require assessment for credits. These are indicated in **Figure 7** (Subject Site/Impact Area).





A total of, 0.53ha of vegetation present within the Subject Site was classified as ‘planted native vegetation’ and BAM 2020 Appendix D applied (Table 2). This vegetation type is not required to be further assessed using the BAM, and was thus excluded from any credit or offset calculations.

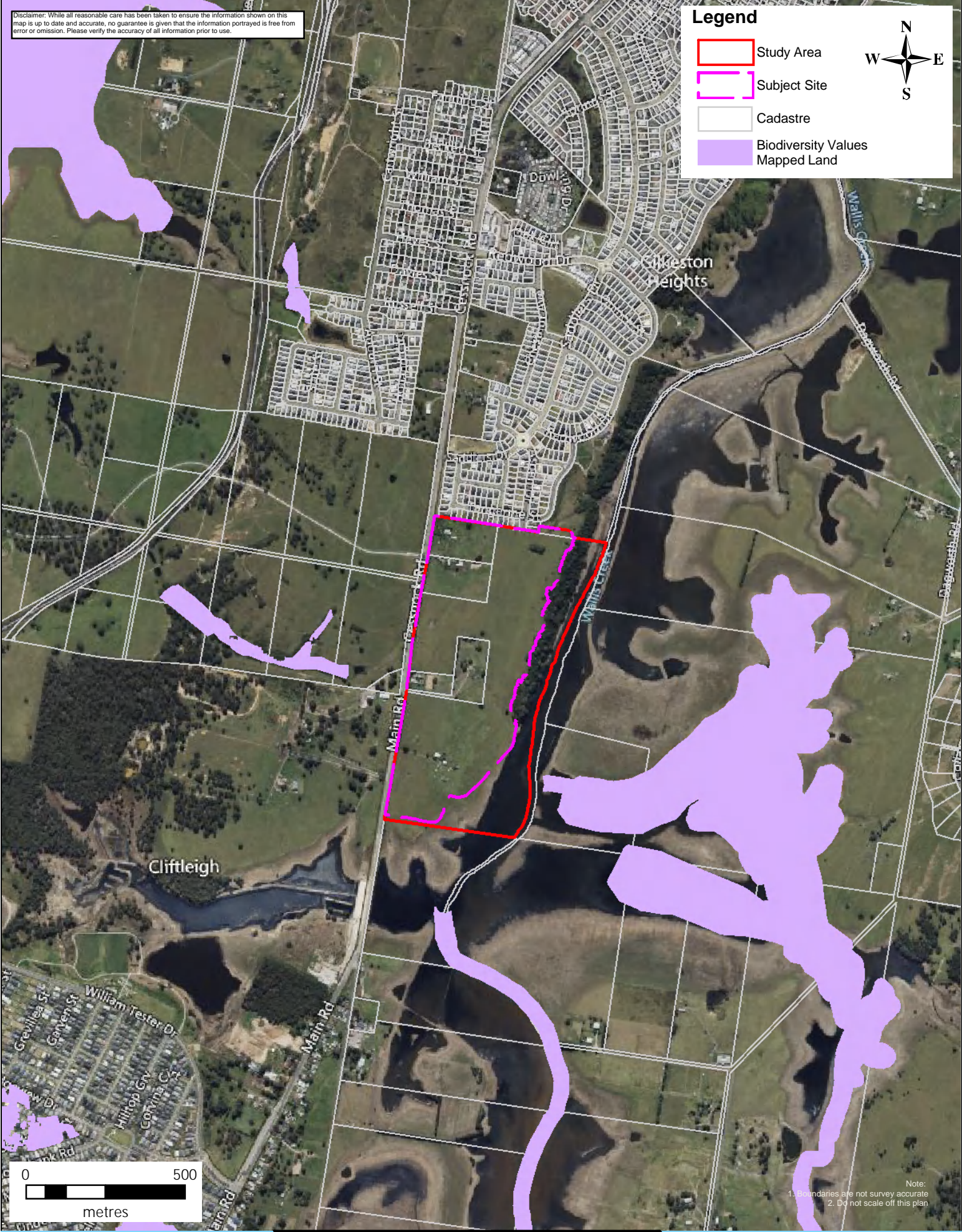
2.8 Biodiversity Credit Report

The Biodiversity Credit Report generated within the BAM Calculator is provided in **Appendix F** and includes potential offset variations that are applicable to the proposal.

Disclaimer: While all reasonable care has been taken to ensure the information shown on this map is up to date and accurate, no guarantee is given that the information portrayed is free from error or omission. Please verify the accuracy of all information prior to use.

Legend

-  Study Area
-  Subject Site
-  Cadastre
-  Biodiversity Values Mapped Land



Note:
1. Boundaries are not survey accurate
2. Do not scale off this plan



Figure 9: Biodiversity Values Map

Date: June 2023







Location: 527 Cessnock Rd, Gilliestons Heights NSW 2321

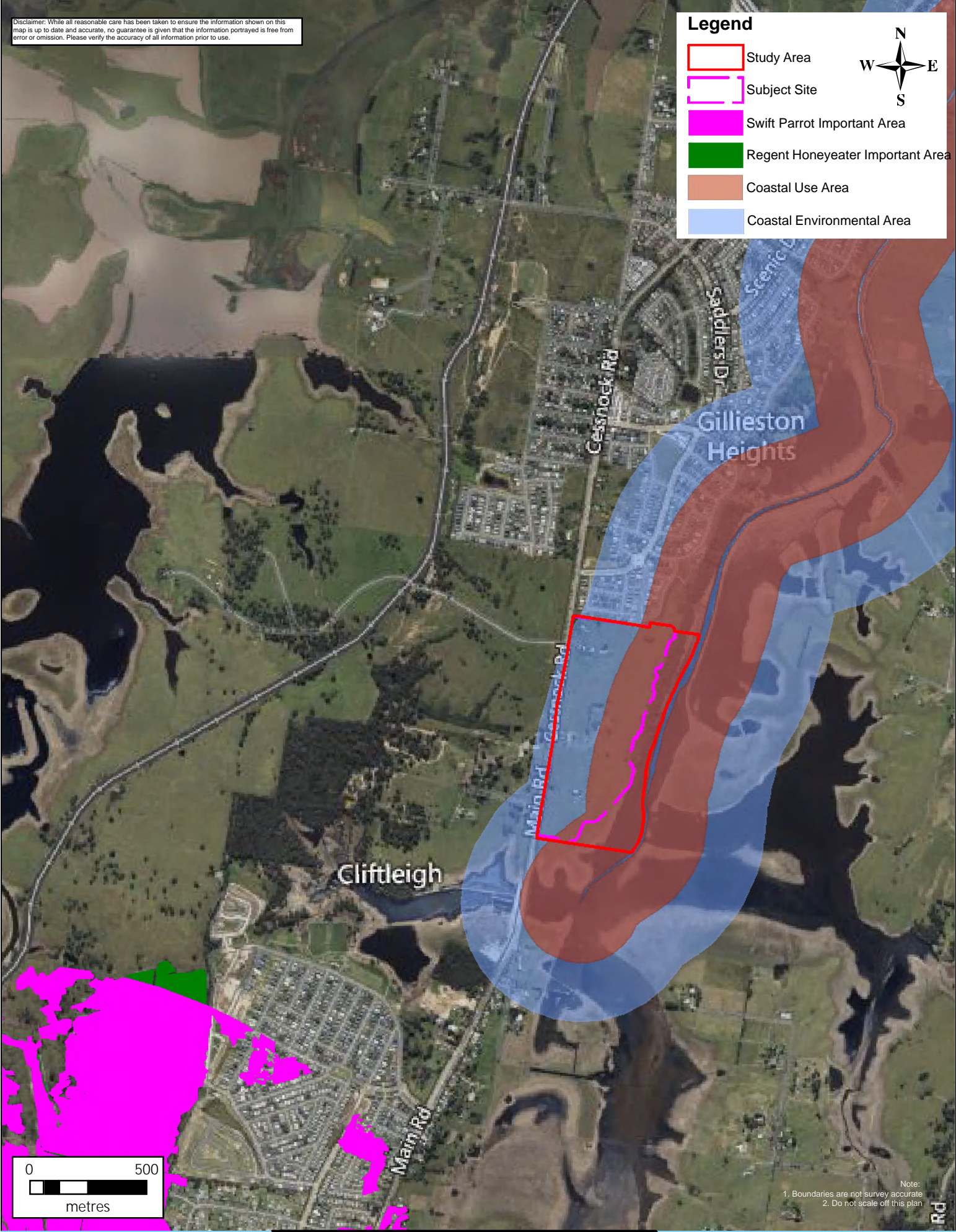
Client: Walker Gillieston Heights Pty Ltd

AEP Ref: 2665.02

Disclaimer: While all reasonable care has been taken to ensure the information shown on this map is up to date and accurate, no guarantee is given that the information portrayed is free from error or omission. Please verify the accuracy of all information prior to use.

Legend

-  Study Area
-  Subject Site
-  Swift Parrot Important Area
-  Regent Honeyeater Important Area
-  Coastal Use Area
-  Coastal Environmental Area



Note:
1. Boundaries are not survey accurate
2. Do not scale off this plan



Figure 9: Important Areas & Coastal Management Date: June 2023
Location: 527 Cessnock Rd, Gilliestons Heights NSW 2321
Client: Walker Gillieston Heights Pty Ltd AEP Ref: 2665.02

3.0 Conclusion

Application of the BAM against the proposal has quantified current biodiversity values within the site and calculated offset requirements for residual impacts following avoid and mitigation efforts.

The native vegetation within the proposed impact area was found to be commensurate with PCT 1600 and 1525. The remainder of the Subject Site is predominantly Exotic / Cleared / Existing Infrastructure areas. For the purposes of the Streamlined Assessment Module for Small Area of the BAM, PCTs 1600 and 1525 were retained and assessed in the BAM-C.

The proposal will require impact to 0.53ha of native vegetation not identified as PCTs 1600 and 1525. As a result, the following credit requirements were calculated within the BAM Calculator to offset the residual impacts and achieve a no net loss standard (refer **Table 27**).

Table 27 – Credit Requirements

Remnant Vegetation (PCT)	Impact Area (ha)	Credit Requirements
Ecosystem Credits		
PCT 1600	0.30	4
PCT 1525	0.10	2

The full biodiversity credit report is attached as **Appendix F**.

4.0 References

Anderson Environment and Planning (2017) *Ecological Assessment Report for rezoning proposal of 527 Cessnock Road Gillieston Heights, NSW. Unpublished report for Mr Graham Warby C/- PCB.*

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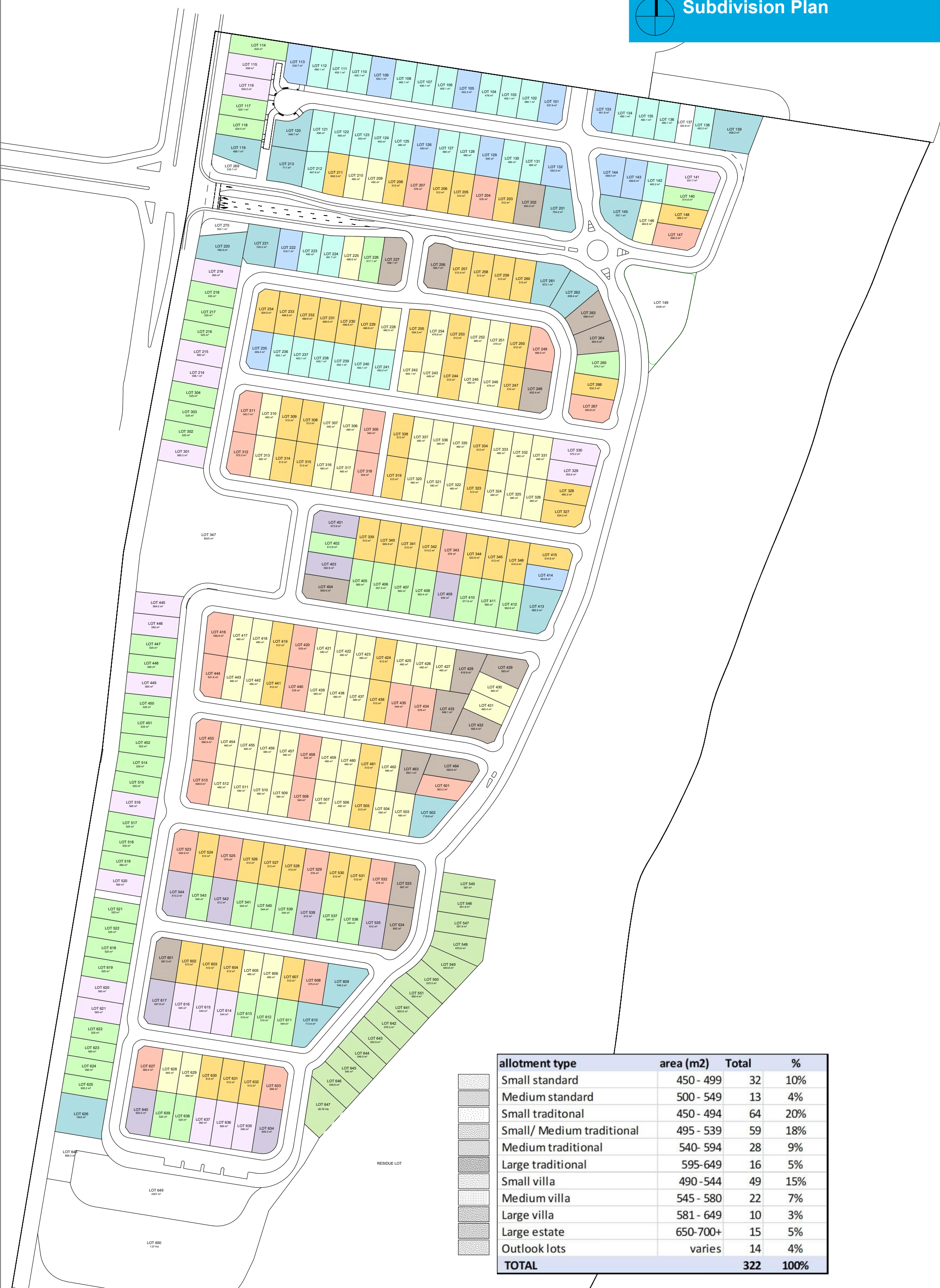
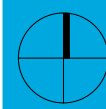
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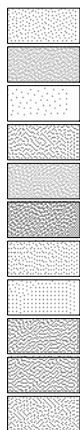
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Appendix A – Development Plan



allotment type	area (m2)	Total	%
Small standard	450 - 499	32	10%
Medium standard	500 - 549	13	4%
Small traditonal	450 - 494	64	20%
Small/ Medium traditional	495 - 539	59	18%
Medium traditional	540 - 594	28	9%
Large traditional	595-649	16	5%
Small villa	490 - 544	49	15%
Medium villa	545 - 580	22	7%
Large villa	581 - 649	10	3%
Large estate	650-700+	15	5%
Outlook lots	varies	14	4%
TOTAL		322	100%

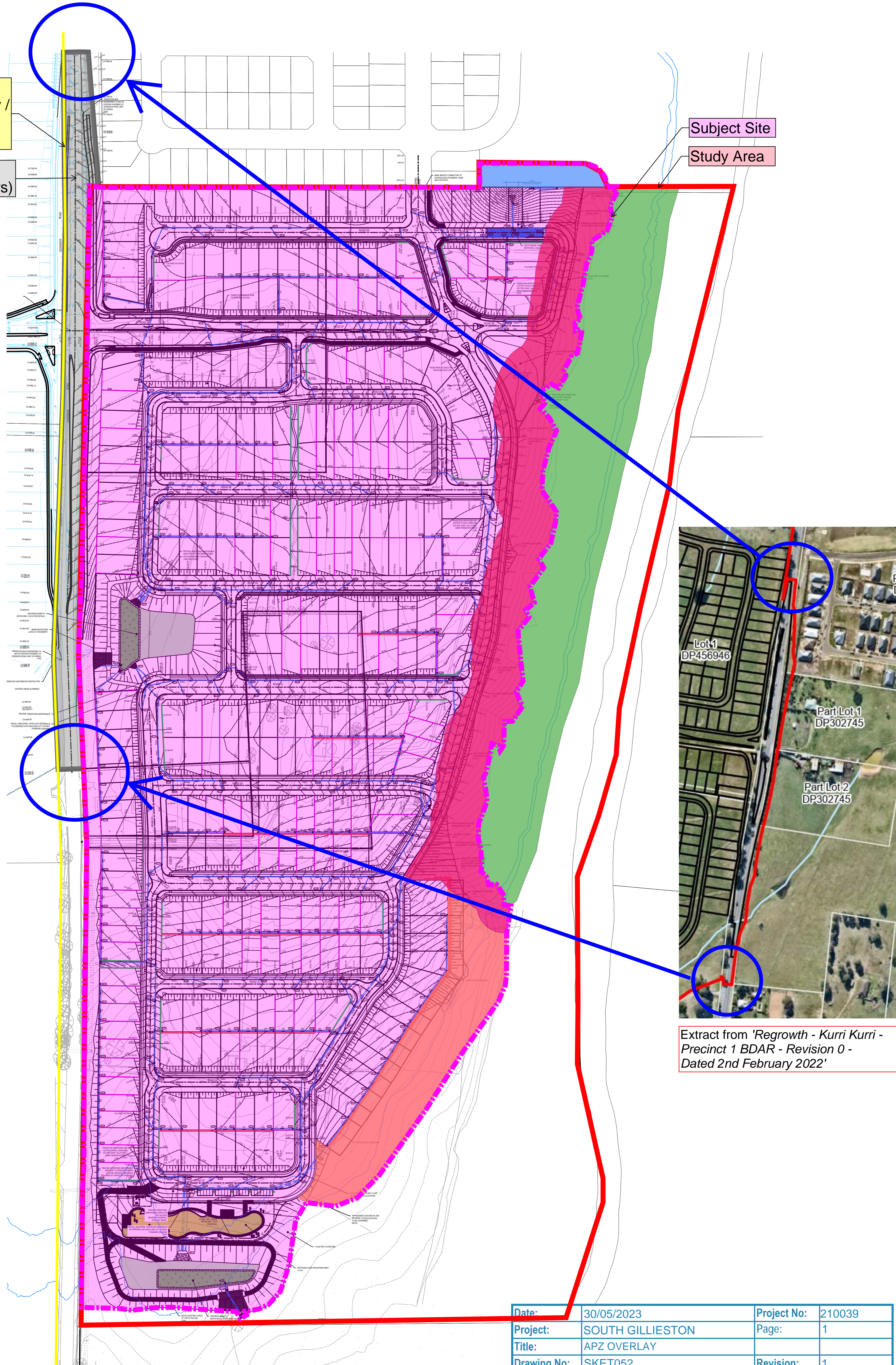


Existing Eastern Property Boundary / Cessnock Road Reserve Boundary

Cessnock Road Widening (By Others)

Subject Site

Study Area



Extract from 'Regrowth - Kurri Kurri - Precinct 1 BDAR - Revision 0 - Dated 2nd February 2022'

Date:	30/05/2023	Project No:	210039
Project:	SOUTH GILLIESTON	Page:	1
Title:	APZ OVERLAY	Revision:	1
Drawing No:	SKET052	Scale:	1:1500
Drawn:	ML		



Appendix B – Flora Species List

FLORA SPECIES LIST

The following list includes all species of vascular plants observed on site during fieldwork. 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.

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

Introduced species are indicated by an asterisk “*”.

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

Family	Scientific Name	Common Name
Agavaceae	<i>Yucca aloifolia</i> *	Dagger Plant
Alliaceae	<i>Agapanthus sp.</i> *	
Anacardiaceae	<i>Schinus areira</i> *	Pepper Tree
Poaceae	<i>Cynodon sp.</i> *	
Fabaceae	<i>Acacia falcata</i>	Sickle Wattle
Arecaceae	<i>Archontophoenix cunninghamiana</i>	Bangalow Palm
Poaceae	<i>Cenchrus clandestinum</i> *	Kikuyu
Poaceae	<i>Axonopus fissifolius</i> *	Narrow-leaved Carpet Grass
Poaceae	<i>Briza subaristata</i> *	
Poaceae	<i>Ehrharta erecta</i> *	Panic Veldtgrass
Myrtaceae	<i>Callistemon salignus</i>	Willow Bottlebrush
Myrtaceae	<i>Callistemon sp.</i>	
Poaceae	<i>Chloris gayana</i> *	Rhodes Grass
Carophyllaceae	<i>Cerastium glomeratum</i> *	Mouse-ear Chickweed
Asteraceae	<i>Hypochaeris sp.</i> *	A Catsear
Poaceae	<i>Paspalum dilatatum</i> *	Paspalum
Asteraceae	<i>Onopordum acanthium subsp. Acanthium</i> *	Scotch Thistle
Poaceae	<i>Setaria pumila</i> *	Pale Pigeon Grass
Rutaceae	<i>Citrus limon</i> *	Lemon Tree
Asteraceae	<i>Soliva sessilis</i> *	Bindyi
Poaceae	<i>Sporobolus africanus</i> *	Parramatta Grass
Commelinaceae	<i>Commelina cyanea</i>	Scurvy Weed, Native Wandering Jew
Asteraceae	<i>Taraxacum officinale</i> *	Dandelion
Bignoniaceae	<i>Jacaranda mimosifolia</i> *	Jacaranda
Bignoniaceae	<i>Pyrostegia venusta</i> *	Golden Shower
Verbenaceae	<i>Verbena bonariensis</i> *	Purpletop
Cactaceae	<i>Opuntia stricta</i> *	Prickly Pear
Asteraceae	<i>Conyza sp.</i> *	A Fleabane
Asteraceae	<i>Conyza sumatrensis</i> *	Tall Fleabane
Myrtaceae	<i>Corymbia maculata</i>	Spotted Gum
Casuarinaceae	<i>Allocasuarina torulosa</i>	Forest Oak
Casuarinaceae	<i>Casuarina cunninghamiana subsp. cunninghamiana</i>	River Oak
Casuarinaceae	<i>Casuarina glauca</i>	Swamp Oak
Celastraceae	<i>Celastrus subspicata</i>	Large-leaf Staff-Vine
Asteraceae	<i>Bidens pilosa</i> *	Cobbler's Pegs
Convolvulaceae	<i>Dichondra repens</i>	Kidney Weed
Cupressaceae	<i>Juniperus sp.</i> *	Juniper
Sapindaceae	<i>Cupaniopsis anacardioides</i>	Tuckeroo
Elaeocarpaceae	<i>Elaeocarpus reticulatus</i>	Blueberry Ash
Euphorbiaceae	<i>Breynia oblongifolia</i>	Coffee Bush
Asteraceae	<i>Senecio madagascariensis</i> *	Fireweed
Fabaceae	<i>Acacia mearnsii</i>	Black Wattle
Fabaceae	<i>Acacia parvipinnula</i>	Silver-stemmed Wattle
Fabaceae	<i>Acacia sp.</i>	Wattle
Fabaceae	<i>Acacia ulicifolia</i>	Prickly Moses
Fabaceae	<i>Daviesia ulicifolia</i>	Gorse Bitter Pea
Fabaceae	<i>Glycine clandestina</i>	Twining Glycine
Fabaceae	<i>Glycine tabacina</i>	Twining Glycine
Fabaceae	<i>Hardenbergia violacea</i>	False Sarsaparilla
Fabaceae	<i>Indigofera australis</i>	Native Indigo
Polygonaceae	<i>Rumex crispus</i> *	Curled Dock
Cyperaceae	<i>Cyperus sp.</i>	
Fabaceae	<i>Pultenaea spinosa</i>	Spiny Bush-pea

Family	Scientific Name	Common Name
Asteraceae	<i>Hypochaeris glabra</i> *	Smooth Catsear
Myrtaceae	<i>Eucalyptus crebra</i>	Narrow-leaved Ironbark
Myrtaceae	<i>Eucalyptus microcorys</i>	Tallowwood
Myrtaceae	<i>Eucalyptus robusta</i>	Swamp Mahogany
Lamiaceae	<i>Clerodendrum tomentosum</i>	Hairy Clerodendrum
Lamiaceae	<i>Plectranthus parviflorus</i>	Cockspur Flower
Lindsaeaceae	<i>Lindsaea linearis</i>	Screw Fern
Lobeliaceae	<i>Lobelia purpurascens</i>	Whiteroot
Lomandraceae	<i>Lomandra filiformis</i>	Wattle Matt-rush
Luzuriagaceae	<i>Eustrephus latifolius</i>	Wombat Berry
Luzuriagaceae	<i>Geitonoplesium cymosum</i>	Scrambling Lily
Asteraceae	<i>Gamochaeta sp.</i> *	
Asteraceae	<i>Hypochaeris radicata</i> *	Flatweed
Asteraceae	<i>Gnaphalium sp.</i>	Cudweed
Menispermaceae	<i>Sarcopetalum harveyanum</i>	Pearl Vine
Moraceae	<i>Maclura cochinchinensis</i>	Cockspur Thorn
Proteaceae	<i>Grevillea robusta</i>	Silky Oak
Moraceae	<i>Streblus brunonianus</i>	Whalebone Tree
Myrsinaceae	<i>Myrsine variabilis</i>	Muttonwood
Myrtaceae	<i>Acmena smithii</i>	Lillypilly
Myrtaceae	<i>Angophora costata</i>	Smooth-barked Apple
Myrtaceae	<i>Angophora floribunda</i>	Rough-barked Apple
Myrtaceae	<i>Backhousia myrtifolia</i>	Grey Myrtle
Myrtaceae	<i>Callistemon linearifolius</i>	Netted Bottle Brush
Cactaceae	<i>Opuntia aurantiaca</i> *	Tiger Pear
Asteraceae	<i>Cirsium vulgare</i> *	Spear Thistle
Myrtaceae	<i>Callistemon viminalis</i>	Weeping Bottlebrush
Myrtaceae	<i>Corymbia citriodora</i>	Lemon-scented Gum
Juncaceae	<i>Juncus cognatus</i> *	
Verbenaceae	<i>Lantana camara</i> *	Lantana
Myrtaceae	<i>Corymbia torelliana</i> *	Cadaghi
Myrtaceae	<i>Eucalyptus acmenoides</i>	White Mahogany
Myrtaceae	<i>Eucalyptus camaldulensis</i>	River Red Gum
Malvaceae	<i>Sida rhombifolia</i> *	Paddy's Lucerne
Myrtaceae	<i>Eucalyptus fibrosa</i>	Broad Leaved Ironbark
Myrtaceae	<i>Eucalyptus globulus</i>	
Fabaceae	<i>Medicago truncatula</i> *	Barrel Medic
Myrtaceae	<i>Eucalyptus moluccana</i>	Grey Box
Myrtaceae	<i>Eucalyptus paniculata</i>	Grey Ironbark
Malvaceae	<i>Modiola caroliniana</i> *	Red-flowered Mallow
Myrtaceae	<i>Eucalyptus siderophloia</i>	Northern Grey Ironbark
Myrtaceae	<i>Eucalyptus sideroxylon</i>	Red Ironbark
Myrtaceae	<i>Eucalyptus tereticornis</i>	Forest Red Gum
Myrtaceae	<i>Kunzea ambigua</i>	Tick Bush
Myrtaceae	<i>Leptospermum sp.</i>	Tea-tree
Myrtaceae	<i>Melaleuca bracteata</i>	Black Tea-tree
Myrtaceae	<i>Melaleuca decora</i>	White Feather Honey Myrtle
Myrtaceae	<i>Melaleuca linariifolia</i>	Snow in Summer
Myrtaceae	<i>Melaleuca nodosa</i>	Ball Honey Myrtle
Myrtaceae	<i>Melaleuca quinquenervia</i>	Broad-leaved Paperbark
Myrtaceae	<i>Melaleuca stypheloides</i>	Prickly-leaved Tea Tree
Myrtaceae	<i>Syzygium sp.</i> *	A Lilly Pilly
Oleaceae	<i>Ligustrum sinense</i> *	Small-leaved Privet
Moraceae	<i>Morus nigra</i> *	Black Mulberry
Oleaceae	<i>Notelaea longifolia</i>	Mock Olive, Large Mock-olive
Oleaceae	<i>Olea europaea subsp. cuspidata</i> *	African Olive

Family	Scientific Name	Common Name
Oxalidaceae	<i>Oxalis perrenans</i>	Yellow-flowered Wood Sorrel
Piperaceae	<i>Peperomia blanda</i> var. <i>floribunda</i>	
Phormiaceae	<i>Dianella longifolia</i>	Blue Flax Lily
Oxalidaceae	<i>Oxalis</i> sp.	
Pinaceae	<i>Pinus</i> sp.*	
Pittosporaceae	<i>Pittosporum revolutum</i>	Yellow Pittosporum
Asteraceae	<i>Ozothamnus diosmifolius</i>	Ball Everlasting
Poaceae	<i>Aristida lignosa</i>	
Poaceae	<i>Paspalum</i> sp.*	
Poaceae	<i>Briza maxima</i> *	Quaking Grass
Apiaceae	<i>Cyclospermum leptophyllum</i> *	Slender Celery
Phytolaccaceae	<i>Phytolacca octandra</i> *	Inkweed
Asteraceae	<i>Facelis retusa</i> *	Annual Trampweed
Plantaginaceae	<i>Plantago lanceolata</i> *	Ribwort
Asteraceae	<i>Lactuca</i> sp.*	
Ranunculaceae	<i>Ranunculus</i> sp.	
Poaceae	<i>Dichelachne rara</i>	
Asteraceae	<i>Sonchus oleraceus</i> *	Common Sow-thistle
Poaceae	<i>Lachnagrostis</i> sp.	
Chenopodiaceae	<i>Chenopodium album</i> *	Fat Hen
Poaceae	<i>Microlaena stipoides</i>	Weeping Grass
Poaceae	<i>Oplismenus aemulus</i>	Basket Grass
Fabaceae	<i>Medicago</i> sp.*	A Medic
Poaceae	<i>Paspalum mandiocanum</i> *	Broadleaf Paspalum
Malvaceae	<i>Modiola</i> sp.*	
Poaceae	<i>Setaria sphacelata</i> *	South African Pigeon Grass
Primulaceae	<i>Lysimachia arvensis</i> *	Scarlet Pimpernel
Poaceae	<i>Briza minor</i> *	Shivery Grass
Poaceae	<i>Bromus catharticus</i> *	Prairie Grass
Poaceae	<i>Stenotaphrum secundatum</i> *	Buffalo Grass
Poaceae	<i>Lolium perenne</i> *	Perennial Ryegrass
Poaceae	<i>Panicum maximum</i> var. <i>maximum</i>	
Polygonaceae	<i>Rumex brownii</i>	Swamp Dock
Solanaceae	<i>Solanum mauritianum</i> *	Wild Tobacco
Pontederiaceae	<i>Eichornia crassipes</i> *	Water Hyacinth
Poaceae	<i>Sporobolus fertilis</i> *	Giant Parramatta Grass
Proteaceae	<i>Banksia</i> sp.	
Caryophyllaceae	<i>Stellaria media</i> *	Common Chickweed
Pteridaceae	<i>Cheilanthes sieberi</i>	Rock Fern
Asteraceae	<i>Tagetes minuta</i> *	Stinking Roger
Rhamnaceae	<i>Alphitonia excelsa</i>	Red Ash
Rosaceae	<i>Rosa</i> sp.*	Rose
Poaceae	<i>Themeda triandra</i>	Kangaroo Grass
Fabaceae	<i>Trifolium repens</i> *	White Clover
Urticaceae	<i>Urtica incisa</i>	Stinging Nettle
Solanaceae	<i>Solanum nigrum</i> *	Black Nightshade, Black-berry Nightshade
Solanaceae	<i>Solanum seaforthianum</i> *	Climbing Nightshade
Theaceae	<i>Camellia japonica</i> *	Camellia
Ulmaceae	<i>Ulmus parvifolia</i> *	Chinese Elm
Verbenaceae	<i>Verbena rigida</i> var. <i>rigida</i> *	Veined Verbena
Fabaceae	<i>Vicia</i> sp.*	Vetch
Fabaceae	<i>Vicia villosa</i> *	Russian Vetch
Araceae	<i>Zantedeschia aethiopica</i> *	White Arum Lily
Vitaceae	<i>Cayratia clematidea</i>	Native Grape

Appendix C – Fauna Species List

EXPECTED FAUNA SPECIES LIST

The following list includes fauna species that could be reasonably expected to occur on or over the study site 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 (2022 & 2023).

* - Introduced species

? - Unconfirmed record, anecdotal records, etc.

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

Surveyed Observations; Observed (O), Heard (W), Scat (P), Miscellaneous (M), Track/scratchings (F), Nest (E), Burrow (FB)

Bat Records; Observed (O), Definitely (D) Possible or within Species Group (P) Likely (L)

Survey Equipment; Anabat (U), Songmeter (AR), Camera Trap (Q)

Threatened species listed under the *Biodiversity Conservation Act 2016* (BC Act) or the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) are as indicated; V: Vulnerable; E: Endangered; CE: Critically Endangered.

Scientific Name	Common Name	NSW status	Comm. status	BioNet Atlas Records	Surveyed Observations	Survey Equipment
Amphibia						
<i>Crinia signifera</i>	Common Eastern Froglet	P		42	O	
<i>Pseudophryne bibronii</i>	Bibron's Toadlet	P		1		
<i>Uperoleia fusca</i>	Dusky Toadlet	P		2		
<i>Uperoleia laevigata</i>	Smooth Toadlet	P		12		
<i>Litoria caerulea</i>	Green Tree Frog	P		50		
<i>Litoria dentata</i>	Bleating Tree Frog	P		4		
<i>Litoria fallax</i>	Eastern Dwarf Tree Frog	P		95	O	
<i>Litoria latopalmata</i>	Broad-palmed Frog	P		27		
<i>Litoria lesueuri</i>	Lesueur's Frog	P		1		
<i>Litoria nasuta</i>	Rocket Frog	P		1		
<i>Litoria peronii</i>	Peron's Tree Frog	P		46		
<i>Litoria tyleri</i>	Tyler's Tree Frog	P		18		
<i>Litoria verreauxii</i>	Verreaux's Frog	P		25		
<i>Limnodynastes dumerilii</i>	Eastern Banjo Frog	P		1		
<i>Limnodynastes peronii</i>	Brown-striped Frog	P		22		
<i>Limnodynastes tasmaniensis</i>	Spotted Grass Frog	P		24		
<i>Platyplectrum ornatum</i>	Ornate Burrowing Frog	P		3		
Reptilia						
<i>Nebulifera robusta</i>	Robust Velvet Gecko	P		1		
<i>Bellatorias major</i>	Land Mullet	P		1		
<i>Carlia tetradactyla</i>	Southern Rainbow-skink	P		5		
<i>Concinnia tenuis</i>	Barred-sided Skink	P		2		
<i>Ctenotus robustus</i>	Robust Ctenotus	P		4		
<i>Eulamprus quoyii</i>	Eastern Water-skink	P		5		

Scientific Name	Common Name	NSW status	Comm. status	BioNet Atlas Records	Surveyed Observations	Survey Equipment
<i>Lampropholis delicata</i>	Dark-flecked Garden Sunskink	P		11		
<i>Lampropholis guichenoti</i>	Pale-flecked Garden Sunskink	P		1		
<i>Tiliqua scincoides</i>	Eastern Blue-tongue	P		46		
<i>Amphibolurus muricatus</i>	Jacky Lizard	P		4		
<i>Intellagama lesueurii</i>	Eastern Water Dragon	P		5	O	
<i>Pogona barbata</i>	Bearded Dragon	P		15		
<i>Dendrelaphis punctulatus</i>	Common Tree Snake	P		2		
<i>Cacophis squamulosus</i>	Golden-crowned Snake	P		2		
<i>Furina diadema</i>	Red-naped Snake	P		1		
<i>Pseudechis porphyriacus</i>	Red-bellied Black Snake	P		31	O	
<i>Pseudonaja textilis</i>	Eastern Brown Snake	P		8		
Aves						
<i>Anas castanea</i>	Chestnut Teal	P		68		
<i>Anas gracilis</i>	Grey Teal	P		78		
<i>Anas superciliosa</i>	Pacific Black Duck	P		141		
<i>Aythya australis</i>	Hardhead	P		27		
<i>Chenonetta jubata</i>	Australian Wood Duck	P		159		
<i>Dendrocygna arcuata</i>	Wandering Whistling-Duck	P		3		
<i>Dendrocygna eytoni</i>	Plumed Whistling-Duck	P		6		
<i>Tachybaptus novaehollandiae</i>	Australasian Grebe	P		64		
<i>Columba livia</i>	Rock Dove			20		
<i>Geopelia humeralis</i>	Bar-shouldered Dove	P		15		
<i>Geopelia striata</i>	Peaceful Dove	P		2		
<i>Leucosarcia melanoleuca</i>	Wonga Pigeon	P		1		
<i>Lopholaimus antarcticus</i>	Topknot Pigeon	P		1		
<i>Macropygia phasianella</i>	Brown Cuckoo-Dove	P		1		

Scientific Name	Common Name	NSW status	Comm. status	BioNet Atlas Records	Surveyed Observations	Survey Equipment
<i>Ocyphaps lophotes</i>	Crested Pigeon	P		68		
<i>Phaps chalcoptera</i>	Common Bronzewing	P		2		
<i>Spilopelia chinensis</i>	Spotted Turtle-Dove			87		
<i>Podargus strigoides</i>	Tawny Frogmouth	P		58		
<i>Aegotheles cristatus</i>	Australian Owlet-nightjar	P		6		
<i>Ardea intermedia</i>	Intermediate Egret	P		12		
<i>Ardea pacifica</i>	White-necked Heron	P		13		
<i>Bubulcus ibis</i>	Cattle Egret	P		71		
<i>Casmerodius modesta</i>	Eastern Great Egret	P		33		
<i>Egretta garzetta</i>	Little Egret	P		8		
<i>Egretta novaehollandiae</i>	White-faced Heron	P		70	O	
<i>Plegadis falcinellus</i>	Glossy Ibis	P		1		
<i>Threskiornis moluccus</i>	Australian White Ibis	P		47	O	
<i>Threskiornis spinicollis</i>	Straw-necked Ibis	P		49		
<i>Accipiter cirrocephalus</i>	Collared Sparrowhawk	P		6		
<i>Accipiter fasciatus</i>	Brown Goshawk	P		4		
<i>Aviceda subcristata</i>	Pacific Baza	P		3		
<i>Circus approximans</i>	Swamp Harrier	P		6		
<i>Elanus axillaris</i>	Black-shouldered Kite	P		9		
<i>Haliaeetus leucogaster</i>	White-bellied Sea-Eagle	V,P		11	O	
<i>Haliastur sphenurus</i>	Whistling Kite	P		32		
<i>Lophoictinia isura</i>	Square-tailed Kite	V,P,3		4	O	
<i>Milvus migrans</i>	Black Kite	P		4		
<i>Falco berigora</i>	Brown Falcon	P		4		
<i>Falco cenchroides cenchroides</i>	Nankeen Kestrel	P		15	O	
<i>Falco longipennis</i>	Australian Hobby	P		14		

Scientific Name	Common Name	NSW status	Comm. status	BioNet Atlas Records	Surveyed Observations	Survey Equipment
<i>Falco peregrinus</i>	Peregrine Falcon	P		1		
<i>Fulica atra</i>	Eurasian Coot	P		62		
<i>Gallinula tenebrosa</i>	Dusky Moorhen	P		48		
<i>Vanellus miles</i>	Masked Lapwing	P		148	O	
<i>Cacatua galerita</i>	Sulphur-crested Cockatoo	P		37		
<i>Cacatua sanguinea</i>	Little Corella	P		35		
<i>Cacatua tenuirostris</i>	Long-billed Corella	P		8		
<i>Eolophus roseicapilla</i>	Galah	P		102		
<i>Zanda funereus</i>	Yellow-tailed Black-Cockatoo	P		31	O	
<i>Alisterus scapularis</i>	Australian King-Parrot	P		23		
<i>Glossopsitta concinna</i>	Musk Lorikeet	P		18		
<i>Platycercus elegans</i>	Crimson Rosella	P		2		
<i>Platycercus eximius</i>	Eastern Rosella	P		87		
<i>Psephotus haematonotus</i>	Red-rumped Parrot	P		22		
<i>Trichoglossus chlorolepidotus</i>	Scaly-breasted Lorikeet	P		10		
<i>Trichoglossus haematodus</i>	Rainbow Lorikeet	P		121		
<i>Cacomantis flabelliformis</i>	Fan-tailed Cuckoo	P		13		
<i>Cacomantis variolosus</i>	Brush Cuckoo	P		1		
<i>Centropus phasianinus</i>	Pheasant Coucal	P		1		
<i>Chalcites basalis</i>	Horsfield's Bronze-Cuckoo	P		1		
<i>Chalcites lucidus</i>	Shining Bronze-Cuckoo	P		2		
<i>Eudynamys orientalis</i>	Eastern Koel	P		24		
<i>Heteroscenes pallidus</i>	Pallid Cuckoo	P		2		
<i>Scythrops novaehollandiae</i>	Channel-billed Cuckoo	P		8		
<i>Ninox novaeseelandiae</i>	Southern Boobook	P		7		
<i>Ceyx azureus</i>	Azure Kingfisher	P		4		

Scientific Name	Common Name	NSW status	Comm. status	BioNet Atlas Records	Surveyed Observations	Survey Equipment
<i>Dacelo novaeguineae</i>	Laughing Kookaburra	P		116		
<i>Todiramphus sanctus</i>	Sacred Kingfisher	P		28		
<i>Merops ornatus</i>	Rainbow Bee-eater	P		13		
<i>Eurystomus orientalis</i>	Dollarbird	P		31		
<i>Cormobates leucophaea</i>	White-throated Treecreeper	P		35		
<i>Ptilonorhynchus violaceus</i>	Satin Bowerbird	P		22		
<i>Malurus cyaneus</i>	Superb Fairy-wren	P		124		
<i>Malurus lamberti</i>	Variiegated Fairy-wren	P		27		
<i>Acanthiza chrysorrhoa</i>	Yellow-rumped Thornbill	P		5		
<i>Acanthiza lineata</i>	Striated Thornbill	P		26		
<i>Acanthiza nana</i>	Yellow Thornbill	P		36		
<i>Acanthiza pusilla</i>	Brown Thornbill	P		31		
<i>Acanthiza reguloides</i>	Buff-rumped Thornbill	P		5		
<i>Gerygone mouki</i>	Brown Gerygone	P		4		
<i>Gerygone olivacea</i>	White-throated Gerygone	P		15		
<i>Sericornis frontalis</i>	White-browed Scrubwren	P		22		
<i>Smicronis brevirostris</i>	Weebill	P		7		
<i>Pardalotus punctatus</i>	Spotted Pardalote	P		58		
<i>Pardalotus striatus</i>	Striated Pardalote	P		12		
<i>Acanthorhynchus tenuirostris</i>	Eastern Spinebill	P		53		
<i>Anthochaera carunculata</i>	Red Wattlebird	P		66	OW	
<i>Anthochaera chrysoptera</i>	Little Wattlebird	P		4		
<i>Caligavis chrysops</i>	Yellow-faced Honeyeater	P		100		
<i>Entomyzon cyanotis</i>	Blue-faced Honeyeater	P		20		
<i>Lichmera indistincta</i>	Brown Honeyeater	P		1		
<i>Manorina melanocephala</i>	Noisy Miner	P		106		

Scientific Name	Common Name	NSW status	Comm. status	BioNet Atlas Records	Surveyed Observations	Survey Equipment
<i>Manorina melanophrys</i>	Bell Miner	P		35		
<i>Meliphaga lewinii</i>	Lewin's Honeyeater	P		20		
<i>Melithreptus brevirostris</i>	Brown-headed Honeyeater	P		10		
<i>Melithreptus lunatus</i>	White-naped Honeyeater	P		24		
<i>Myzomela sanguinolenta</i>	Scarlet Honeyeater	P		23		
<i>Philemon corniculatus</i>	Noisy Friarbird	P		35		
<i>Phylidonyris niger</i>	White-cheeked Honeyeater	P		16		
<i>Phylidonyris novaehollandiae</i>	New Holland Honeyeater	P		2		
<i>Plectorhyncha lanceolata</i>	Striped Honeyeater	P		3		
<i>Ptilotula fusca</i>	Fuscous Honeyeater	P		8		
<i>Ptilotula penicillata</i>	White-plumed Honeyeater	P		29		
<i>Falcunculus frontatus frontatus</i>	Eastern Shrike-tit	P		2		
<i>Psophodes olivaceus</i>	Eastern Whipbird	P		28		
<i>Coracina novaehollandiae</i>	Black-faced Cuckoo-shrike	P		75	OW	
<i>Coracina papuensis</i>	White-bellied Cuckoo-shrike	P		2		
<i>Lalage sueurii</i>	White-winged Triller	P		3		
<i>Colluricincla harmonica</i>	Grey Shrike-thrush	P		23		
<i>Pachycephala pectoralis</i>	Golden Whistler	P		44		
<i>Pachycephala rufiventris</i>	Rufous Whistler	P		18		
<i>Oriolus sagittatus</i>	Olive-backed Oriole	P		16		
<i>Sphecotheres vieilloti</i>	Australasian Figbird	P		24		
<i>Artamus leucorhynchus</i>	White-breasted Woodswallow	P		11		
<i>Artamus personatus</i>	Masked Woodswallow	P		2		
<i>Artamus superciliosus</i>	White-browed Woodswallow	P		4		
<i>Cracticus nigrogularis</i>	Pied Butcherbird	P		70		
<i>Cracticus torquatus</i>	Grey Butcherbird	P		60		

Scientific Name	Common Name	NSW status	Comm. status	BioNet Atlas Records	Surveyed Observations	Survey Equipment
<i>Gymnorhina tibicen</i>	Australian Magpie	P		297	O	
<i>Strepera graculina</i>	Pied Currawong	P		31		
<i>Dicrurus bracteatus</i>	Spangled Drongo	P		2		
<i>Rhipidura albiscapa</i>	Grey Fantail	P		93		
<i>Rhipidura leucophrys</i>	Willie Wagtail	P		163	OW	
<i>Rhipidura rufifrons</i>	Rufous Fantail	P		1		
<i>Corvus coronoides</i>	Australian Raven	P		143	OW	
<i>Corvus orru</i>	Torresian Crow	P		4		
<i>Grallina cyanoleuca</i>	Magpie-lark	P		202	O	
<i>Monarcha melanopsis</i>	Black-faced Monarch	P		1		
<i>Myiagra rubecula</i>	Leaden Flycatcher	P		3		
<i>Corcorax melanorhamphos</i>	White-winged Chough	P		10		
<i>Eopsaltria australis</i>	Eastern Yellow Robin	P		26		
<i>Microeca fascinans</i>	Jacky Winter	P		1		
<i>Petroica rosea</i>	Rose Robin	P		14		
<i>Cisticola exilis</i>	Golden-headed Cisticola	P		11		
<i>Acrocephalus australis</i>	Australian Reed-Warbler	P		23		
<i>Cincloramphus cruralis</i>	Brown Songlark	P		1		
<i>Cincloramphus mathewsi</i>	Rufous Songlark	P		2		
<i>Cincloramphus timoriensis</i>	Tawny Grassbird	P		3		
<i>Poodytes gramineus</i>	Little Grassbird	P		8		
<i>Hirundo neoxena</i>	Welcome Swallow	P		106	O	
<i>Petrochelidon ariel</i>	Fairy Martin	P		10		
<i>Petrochelidon nigricans</i>	Tree Martin	P		8		
<i>Turdus merula</i>	Eurasian Blackbird			2		
<i>Acridotheres tristis</i>	Common Myna			85		

Scientific Name	Common Name	NSW status	Comm. status	BioNet Atlas Records	Surveyed Observations	Survey Equipment
<i>Sturnus vulgaris</i>	Common Starling			56		
<i>Zosterops lateralis</i>	Silvereeye	P		51		
<i>Dicaeum hirundinaceum</i>	Mistletoebird	P		17		
<i>Neochmia temporalis</i>	Red-browed Finch	P		62		
<i>Stizoptera bichenovii</i>	Double-barred Finch	P		16		
<i>Taeniopygia guttata</i>	Zebra Finch	P		1		
<i>Passer domesticus</i>	House Sparrow			33		
<i>Anthus novaeseelandiae</i>	Australian Pipit	P		17		
Mammalia						
<i>Antechinus flavipes</i>	Yellow-footed Antechinus	P		10		
<i>Antechinus stuartii</i>	Brown Antechinus	P		18		
<i>Sminthopsis murina</i>	Common Dunnart	P		2		
<i>Petaurus breviceps</i>	Sugar Glider	P		9		
<i>Pseudocheirus peregrinus</i>	Common Ringtail Possum	P		13		
<i>Trichosurus vulpecula</i>	Common Brushtail Possum	P		46		
<i>Macropus giganteus</i>	Eastern Grey Kangaroo	P		84	O	
<i>Notamacropus rufogriseus</i>	Red-necked Wallaby	P		18		
<i>Osphranter robustus</i>	Common Wallaroo	P		2		
<i>Wallabia bicolor</i>	Swamp Wallaby	P		37		
<i>Pteropus alecto</i>	Black Flying-fox	P		2		
<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox	V		35		
<i>Pteropus scapulatus</i>	Little Red Flying-fox	P		7		
<i>Rhinolophus megaphyllus</i>	Eastern Horseshoe-bat	P		1		
<i>Austronomus australis</i>	White-striped Freetail-bat	P		22		
<i>Ozimops planiceps</i>	South-eastern Free-tailed Bat	P		3		
<i>Ozimops ridei</i>	Eastern Free-tailed Bat	P		11		

Scientific Name	Common Name	NSW status	Comm. status	BioNet Atlas Records	Surveyed Observations	Survey Equipment
<i>Chalinolobus gouldii</i>	Gould's Wattled Bat	P		31		
<i>Chalinolobus morio</i>	Chocolate Wattled Bat	P		17		
<i>Nyctophilus geoffroyi</i>	Lesser Long-eared Bat	P		5		
<i>Nyctophilus gouldi</i>	Gould's Long-eared Bat	P		1		
<i>Scotorepens orion</i>	Eastern Broad-nosed Bat	P		5		
<i>Vespadelus darlingtoni</i>	Large Forest Bat	P		1		
<i>Vespadelus pumilus</i>	Eastern Forest Bat	P		2		
<i>Vespadelus regulus</i>	Southern Forest Bat	P		1		
<i>Vespadelus vulturinus</i>	Little Forest Bat	P		24		
<i>Pseudomys novaehollandiae</i>	New Holland Mouse	P	V	2		
<i>Rattus rattus</i>	Black Rat			10		
<i>Canis lupus</i>	Dingo, domestic dog			4	O	
<i>Vulpes vulpes</i>	Fox			67		
<i>Lepus capensis occidentalis</i>	Brown Hare			7		
<i>Oryctolagus cuniculus</i>	Rabbit			17	F	
<i>Bos taurus</i>	European cattle			4	OW	

Appendix D – BAM Field Sheets and Tabulated Data

Family	Scientific Name	Common Name	BAM Growth Form	HTE	Present on Site	Plot 1	Plot 2	Plot 3	Plot 4	Plot 5	Plot 6	Plot 7	Plot 8	Plot 9	Plot 10	Plot 11	Other
Agavaceae	<i>Yucca aloifolia</i> *	Dagger Plant	nil - non-native		1												1
Alliaceae	<i>Agapanthus sp.</i> *		nil - non-native		1												1
Anacardiaceae	<i>Schinus areira</i> *	Pepper Tree	nil - non-native		1												
Apiaceae	<i>Cyclosporum leptophyllum</i> *	Slender Celery	nil - non-native		1							0.1					
Araceae	<i>Zantedeschia aethiopica</i> *	White Arum Lily	nil - non-native		1												0.1
Arecaceae	<i>Archontophoenix cunninghamiana</i>	Bangalow Palm	Palm & palmlike		1												1
Asteraceae	<i>Hypochaeris sp.</i> *	A Catsear	nil - non-native		1								0.3				
Asteraceae	<i>Onopordum acanthium subsp. Acanthium</i> *	Scotch Thistle	nil - non-native		1										0.1		
Asteraceae	<i>Soliva sessilis</i> *	Bindyi	nil - non-native		1								0.1				
Asteraceae	<i>Taraxacum officinale</i> *	Dandelion	nil - non-native		1								0.1				
Asteraceae	<i>Conyza sp.</i> *	A Fleabane	nil - non-native		1	0.1			0.1		0.1						
Asteraceae	<i>Conyza sumatrensis</i> *	Tall Fleabane	nil - non-native		1		0.1										
Asteraceae	<i>Bidens pilosa</i> *	Cobbler's Pegs	nil - non-native	Y	1							0.5			0.1		
Asteraceae	<i>Senecio madagascariensis</i> *	Fireweed	nil - non-native	Y	1	1	0.2	0.5	1	2	0.5	0.5	0.4			0.2	
Asteraceae	<i>Hypochaeris glabra</i> *	Smooth Catsear	nil - non-native		1	0.2			0.1	1		0.4					
Asteraceae	<i>Gamochaeta sp.</i> *		nil - non-native		1			0.1	0.1				0.1				
Asteraceae	<i>Hypochaeris radicata</i> *	Flatweed	nil - non-native		1	2	1	0.5	1		0.1	0.4	0.1		0.5	0.1	
Asteraceae	<i>Gnaphalium sp.</i>	Cudweed	Forb		1					0.1							
Asteraceae	<i>Cirsium vulgare</i> *	Spear Thistle	nil - non-native		1		0.1	0.1			0.5	0.2	0.1				
Asteraceae	<i>Ozothamnus diosmifolius</i>	Ball Everlasting	Shrub		1						0.1	0.5					
Asteraceae	<i>Facelis retusa</i> *	Annual Trampweed	nil - non-native		1							0.1	0.1				
Asteraceae	<i>Lactuca sp.</i> *		nil - non-native		1							0.1					
Asteraceae	<i>Sonchus oleraceus</i> *	Common Sow-thistle	nil - non-native		1							0.1	0.1		0.1		
Asteraceae	<i>Tagetes minuta</i> *	Stinking Roger	nil - non-native		1			0.1			0.1						
Bignoniaceae	<i>Jacaranda mimosifolia</i> *	Jacaranda	nil - non-native		1												1
Bignoniaceae	<i>Pyrostegia venusta</i> *	Golden Shower	nil - non-native		1												1
Cactaceae	<i>Opuntia stricta</i> *	Prickly Pear	nil - non-native	Y	1									2			
Cactaceae	<i>Opuntia aurantiaca</i> *	Tiger Pear	nil - non-native	Y	1							0.3	0.1				
Carophyllaceae	<i>Cerastium glomeratum</i> *	Mouse-ear Chickweed	nil - non-native		1			0.1					0.1				
Caryophyllaceae	<i>Stellaria media</i> *	Common Chickweed	nil - non-native		1			0.1									
Casuarinaceae	<i>Allocasuarina torulosa</i>	Forest Oak	Tree		1			0.6									
Casuarinaceae	<i>Casuarina cunninghamiana subsp. cunninghamiana</i>	River Oak	Tree		1												0.5
Casuarinaceae	<i>Casuarina glauca</i>	Swamp Oak	Tree		1												1
Celastraceae	<i>Celastrus subspicata</i>	Large-leaf Staff-Vine	Vine		1									19			
Chenopodiaceae	<i>Chenopodium album</i> *	Fat Hen	nil - non-native		1							0.1					
Commelinaceae	<i>Commelina cyanea</i>	Scurvy Weed, Native Wandering Jew	Forb		1			0.1									
Convolvulaceae	<i>Dichondra repens</i>	Kidney Weed	Forb		1							0.2		0.1			0.2
Cupressaceae	<i>Juniperus sp.</i> *	Juniper	nil - non-native		1												1
Cyperaceae	<i>Cyperus sp.</i>		Sedge		1	0.1	0.1	0.1						1			
Elaeocarpaceae	<i>Elaeocarpus reticulatus</i>	Blueberry Ash	Shrub		1												1
Euphorbiaceae	<i>Breynia oblongifolia</i>	Coffee Bush	Shrub		1								0.1				1
Fabaceae	<i>Acacia falcata</i>	Sickle Wattle	Shrub		1							3					0.1
Fabaceae	<i>Acacia mearnsii</i>	Black Wattle	Shrub		1												1
Fabaceae	<i>Acacia parvipinnula</i>	Silver-stemmed Wattle	Shrub		1												
Fabaceae	<i>Acacia sp.</i>	Wattle	Shrub		1												1
Fabaceae	<i>Acacia ulicifolia</i>	Prickly Moses	Shrub		1							0.5			0.1		
Fabaceae	<i>Daviesia ulicifolia</i>	Gorse Bitter Pea	Shrub		1										0.1		
Fabaceae	<i>Glycine clandestina</i>	Twining Glycine	Vine		1										0.1		0.3
Fabaceae	<i>Glycine tabacina</i>	Twining Glycine	Vine		1												0.3
Fabaceae	<i>Hardenbergia violacea</i>	False Sarsaparilla	Vine		1												0.4
Fabaceae	<i>Indigofera australis</i>	Native Indigo	Shrub		1												0.3
Fabaceae	<i>Pultenaea spinosa</i>	Spiny Bush-pea	Shrub		1												0.5
Fabaceae	<i>Medicago truncatula</i> *	Barrel Medic	nil - non-native		1	0.1											
Fabaceae	<i>Medicago sp.</i> *	A Medic	nil - non-native		1							0.1					
Fabaceae	<i>Trifolium repens</i> *	White Clover	nil - non-native		1	0.1	0.4				0.1				0.5		
Fabaceae	<i>Vicia sp.</i> *	Vetch	nil - non-native		1		0.1				0.1	0.1					
Ginkgoaceae	<i>Ginkgo biloba</i> *		nil - non-native		1												1
Fabaceae	<i>Vicia villosa</i> *	Russian Vetch	nil - non-native		1				0.1								
Juncaceae	<i>Juncus cognatus</i> *		nil - non-native		1	0.1										0.5	
Lamiaceae	<i>Clerodendrum tomentosum</i>	Hairy Clerodendrum	Tree		1									0.1			

Family	Scientific Name	Common Name	BAM Growth Form	HTE	Present on Site	Plot 1	Plot 2	Plot 3	Plot 4	Plot 5	Plot 6	Plot 7	Plot 8	Plot 9	Plot 10	Plot 11	Other
Lamiaceae	<i>Plectranthus parviflorus</i>	Cockspur Flower	Forb		1									0.1			
Lindsaeaceae	<i>Lindsaea linearis</i>	Screw Fern	Fern and fern allies		1									0.1			
Lobeliaceae	<i>Lobelia purpurascens</i>	Whiteroot	Forb		1												0.3
Lomandraceae	<i>Lomandra filiformis</i>	Wattle Matt-rush	Rush		1												0.2
Luzuriagaceae	<i>Eustrephus latifolius</i>	Wombat Berry	Vine		1									0.1			
Luzuriagaceae	<i>Geitonoplesium cymosum</i>	Scrambling Lily	Vine		1									0.1			
Malvaceae	<i>Sida rhombifolia*</i>	Paddy's Lucerne	nil - non-native		1			0.1			0.5	0.2	0.2		0.1		
Malvaceae	<i>Modiola caroliniana*</i>	Red-flowered Mallow	nil - non-native		1		0.1										
Malvaceae	<i>Modiola sp.*</i>		nil - non-native		1							0.1					
Menispermaceae	<i>Sarcopetalum harveyanum</i>	Pearl Vine	Vine		1									0.2			
Moraceae	<i>Maclura cochinchinensis</i>	Cockspur Thorn	Vine		1									19			
Moraceae	<i>Streblus brunonianus</i>	Whalebone Tree	Tree		1									0.2			
Moraceae	<i>Morus nigra*</i>	Black Mulberry	nil - non-native		1												0.1
Myrsinaceae	<i>Myrsine variabilis</i>	Muttonwood	Shrub		1									0.5			
Myrtaceae	<i>Callistemon salignus</i>	Willow Bottlebrush	Shrub		1			0.8									
Myrtaceae	<i>Callistemon sp.</i>		Shrub		1												0.1
Myrtaceae	<i>Corymbia maculata</i>	Spotted Gum	Tree		1			3				25	5				1
Myrtaceae	<i>Eucalyptus crebra</i>	Narrow-leaved Ironbark	Tree		1												1
Myrtaceae	<i>Eucalyptus microcorys</i>	Tallowwood	Tree		1			5					3				
Myrtaceae	<i>Eucalyptus robusta</i>	Swamp Mahogany	Tree		1										30		1
Myrtaceae	<i>Acmena smithii</i>	Lillypilly	Tree		1									75			
Myrtaceae	<i>Angophora costata</i>	Smooth-barked Apple	Tree		1												1
Myrtaceae	<i>Angophora floribunda</i>	Rough-barked Apple	Tree		1			1.5									
Myrtaceae	<i>Backhousia myrtifolia</i>	Grey Myrtle	Shrub		1												1
Myrtaceae	<i>Callistemon linearifolius</i>	Netted Bottle Brush	Shrub		1												1
Myrtaceae	<i>Callistemon viminalis</i>	Weeping Bottlebrush	Tree		1												
Myrtaceae	<i>Corymbia citriodora</i>	Lemon-scented Gum	Tree		1												
Myrtaceae	<i>Corymbia torelliana*</i>	Cadaghi	nil - non-native	Y	1												
Myrtaceae	<i>Eucalyptus acmenoides</i>	White Mahogany	Tree		1												
Myrtaceae	<i>Eucalyptus camaldulensis</i>	River Red Gum	Tree		1												
Myrtaceae	<i>Eucalyptus fibrosa</i>	Broad Leaved Ironbark	Tree		1			0.4					15				
Myrtaceae	<i>Eucalyptus globulus</i>		Tree		1												
Myrtaceae	<i>Eucalyptus moluccana</i>	Grey Box	Tree		1												
Myrtaceae	<i>Eucalyptus paniculata</i>	Grey Ironbark	Tree		1							8					
Myrtaceae	<i>Eucalyptus siderophloia</i>	Northern Grey Ironbark	Tree		1						4	6	4				
Myrtaceae	<i>Eucalyptus sideroxylon</i>	Red Ironbark	Tree		1												
Myrtaceae	<i>Eucalyptus tereticornis</i>	Forest Red Gum	Tree		1			1					20				
Myrtaceae	<i>Kunzea ambigua</i>	Tick Bush	Shrub		1												1
Myrtaceae	<i>Leptospermum sp.</i>	Tea-tree	Shrub		1												1
Myrtaceae	<i>Melaleuca bracteata</i>	Black Tea-tree	Shrub		1												1
Myrtaceae	<i>Melaleuca decora</i>	White Feather Honey Myrtle	Shrub		1												1
Myrtaceae	<i>Melaleuca linariifolia</i>	Snow in Summer	Shrub		1												
Myrtaceae	<i>Melaleuca nodosa</i>	Ball Honey Myrtle	Shrub		1												1
Myrtaceae	<i>Melaleuca quinquenervia</i>	Broad-leaved Paperbark	Tree		1												1
Myrtaceae	<i>Melaleuca stypheloides</i>	Prickly-leaved Tea Tree	Shrub		1												1
Myrtaceae	<i>Syzygium sp.*</i>	A Lilly Pilly	Shrub		1												1
Oleaceae	<i>Ligustrum sinense*</i>	Small-leaved Privet	nil - non-native	Y	1												1
Oleaceae	<i>Notelaea longifolia</i>	Mock Olive, Large Mock-olive	Tree		1			0.1						0.2	0.2		1
Oleaceae	<i>Olea europaea subsp. cuspidata*</i>	African Olive	nil - non-native	Y	1												0.1
Oxalidaceae	<i>Oxalis perrenans</i>	Yellow-flowered Wood Sorrel	Forb		1				0.1								
Oxalidaceae	<i>Oxalis sp.</i>		Forb		1			0.1			0.1	0.1	0.1				
Peperomiaceae	<i>Peperomia blanda var. floribunda</i>		Forb		1									1			
Phormiaceae	<i>Dianella longifolia</i>	Blue Flax Lily	Forb		1												0.3
Phytolaccaceae	<i>Phytolacca octandra*</i>	Inkweed	nil - non-native		1			0.1			0.2						
Pinaceae	<i>Pinus sp.*</i>		nil - non-native	Y	1												
Pittosporaceae	<i>Pittosporum revolutum</i>	Yellow Pittosporum	Shrub		1									0.1			
Plantaginaceae	<i>Plantago lanceolata*</i>	Ribwort	nil - non-native		1	2	0.2	0.5	0.3	2	0.7				0.5		
Poaceae	<i>Cynodon sp.*</i>		nil - non-native		1	3	10	40	70	30	30	40	70		5	70	
Poaceae	<i>Cenchrus clandestinum*</i>	Kikuyu	nil - non-native	Y	1		70	5			10	30	2		5		
Poaceae	<i>Axonopus fissifolius*</i>	Narrow-leaved Carpet Grass	nil - non-native	Y	1	0.4		1	1	20	5		0.2				

Family	Scientific Name	Common Name	BAM Growth Form	HTE	Present on Site	Plot 1	Plot 2	Plot 3	Plot 4	Plot 5	Plot 6	Plot 7	Plot 8	Plot 9	Plot 10	Plot 11	Other
Poaceae	<i>Briza subaristata</i> *		nil - non-native	Y	1				0.1								
Poaceae	<i>Ehrharta erecta</i> *	Panic Veldtgrass	nil - non-native	Y	1			40		0.5		3	2	4	0.2		
Poaceae	<i>Chloris gayana</i> *	Rhodes Grass	nil - non-native	Y	1							3			30		
Poaceae	<i>Paspalum dilatatum</i> *	Paspalum	nil - non-native	Y	1							2	0.2		3		
Poaceae	<i>Setaria pumila</i> *	Pale Pigeon Grass	nil - non-native		1					1		2				0.2	
Poaceae	<i>Sporobolus africanus</i> *	Parramatta Grass	nil - non-native		1	2	1	5				1					
Poaceae	<i>Aristida lignosa</i>	Tussock Grass			1										0.2		
Poaceae	<i>Paspalum sp.</i> *		nil - non-native		1	0.1		0.1									
Poaceae	<i>Briza maxima</i> *	Quaking Grass	nil - non-native		1										10		
Poaceae	<i>Dichelachne rara</i>	Tussock Grass			1											1	
Poaceae	<i>Lachnagrostis sp.</i>	Tussock Grass			1											0.1	
Poaceae	<i>Microlaena stipoides</i>	Weeping Grass	Other Grass		1							2		0.1			
Poaceae	<i>Oplismenus aemulus</i>	Basket Grass	Other Grass		1									10			
Poaceae	<i>Paspalum mandiocanum</i> *	Broadleaf Paspalum	nil - non-native		1											0.1	
Poaceae	<i>Setaria sphacelata</i> *	South African Pigeon Grass	nil - non-native		1	0.3			3	8	5						
Poaceae	<i>Briza minor</i> *	Shivery Grass	nil - non-native		1							0.1				0.1	
Poaceae	<i>Bromus catharticus</i> *	Prairie Grass	nil - non-native		1							0.1					
Poaceae	<i>Stenotaphrum secundatum</i> *	Buffalo Grass	nil - non-native	Y	1										0.2		
Poaceae	<i>Lolium perenne</i> *	Perennial Ryegrass	nil - non-native		1							0.1					
Poaceae	<i>Sporobolus fertilis</i> *	Giant Parramatta Grass	nil - non-native	Y	1	50	10		8	20	30						
Poaceae	<i>Themeda triandra</i>	Kangaroo Grass	Tussock Grass		1						5						
Poaceae	<i>Panicum maximum var. maximum</i>		Other Grass		1							15					
Polygonaceae	<i>Rumex crispus</i> *	Curled Dock	nil - non-native		1							0.5					
Polygonaceae	<i>Rumex brownii</i>	Swamp Dock	Forb		1											0.5	
Pontederiaceae	<i>Eichornia crassipes</i> *	Water Hyacinth	nil - non-native	Y	1												1
Primulaceae	<i>Lysimachia arvensis</i> *	Scarlet Pimpernel	nil - non-native		1		0.1	0.1			0.1	0.1	0.3				
Proteaceae	<i>Grevillea robusta</i>	Silky Oak	Tree		1												0.1
Proteaceae	<i>Banksia sp.</i>		Shrub		1												1
Pteridaceae	<i>Cheilanthes sieberi</i>	Rock Fern	Fern and fern allies		1							0.5					
Ranunculaceae	<i>Ranunculus sp.</i>		Forb		1		0.1										
Rhamnaceae	<i>Alphitonia excelsa</i>	Red Ash	Tree		1									0.1			1
Rosaceae	<i>Rosa sp.</i> *	Rose	nil - non-native		1												1
Rutaceae	<i>Citrus limon</i> *	Lemon Tree	nil - non-native		1												0.1
Sapindaceae	<i>Cupaniopsis anacardioides</i>	Tuckeroo	Tree		1						0.1			5			1
Solanaceae	<i>Solanum mauritianum</i> *	Wild Tobacco	nil - non-native		1			0.2			0.3	0.1		0.1			
Solanaceae	<i>Solanum nigrum</i> *	Black Nightshade, Black-berry Nightshade	nil - non-native		1						0.1	0.1					
Solanaceae	<i>Solanum seaforthianum</i> *	Climbing Nightshade	nil - non-native	Y	1									0.1			
Theaceae	<i>Camellia japonica</i> *	Camellia	nil - non-native		1												1
Ulmaceae	<i>Ulmus parvifolia</i> *	Chinese Elm	nil - non-native		1												1
Urticaceae	<i>Urtica incisa</i>	Stinging Nettle	Forb		1			0.1									
Verbenaceae	<i>Verbena bonariensis</i> *	Purpletop	nil - non-native		1	0.1	0.1	0.1	0.1	0.1	0.1	1			0.1	0.1	
Verbenaceae	<i>Lantana camara</i> *	Lantana	nil - non-native	Y	1			1						0.2	0.2		
Verbenaceae	<i>Verbena rigida var. rigida</i> *	Veined Verbena	nil - non-native		1	0.1	0.1				0.1						
Vitaceae	<i>Cayratia clematidea</i>	Native Grape	Vine		1									0.1			
* indicates non-native																	
^ indicates non-endemic native e.g. WA or SA species not naturally occurring																	

		Present on Site	Plot 1	Plot 2	Plot 3	Plot 4	Plot 5	Plot 6	Plot 7	Plot 8	Plot 9	Plot 10	Plot 11	Other
Overall Species Count	Non-native Species	164	17	17	32	14	11	25	42	24	27	22	11	52
	Non-native Cover %	77	16	15	20	13	10	20	30	18	5	16	8	15
	HTE %		51.4	80.2	47.5	10.1	42.5	45.5	39.3	4.9	6.3	38.7	0.2	
Composition Condition	Tree (TG)		0	0	7	0	0	2	3	5	6	2	0	
	Shrub (SG)		0	0	1	0	0	1	4	0	3	2	0	
	Grass & grasslike (GG)		1	1	1	0	0	1	2	0	3	1	2	
	Forb (FG)		0	1	3	1	1	1	2	1	3	0	1	
	Fern (EG)		0	0	0	0	0	0	1	0	1	0	0	
	Other (OG)		0	0	0	0	0	0	0	0	6	1	0	
Structure Condition	Tree (TG)		0	0	11.6	0	0	4.1	39	47	80.6	30.2	0	
	Shrub (SG)		0	0	0.8	0	0	0.1	7	0	0.7	0.2	0	
	Grass & grasslike (GG)		0.1	0.1	0.1	0	0	5	17	0	11.1	0.2	1.1	
	Forb (FG)		0	0.1	0.3	0.1	0.1	0.1	0.3	0.1	1.2	0	0.5	
	Fern (EG)		0	0	0	0	0	0	0.5	0	0.1	0	0	
	Other (OG)		0	0	0	0	0	0	0	0	38.5	0.1	0	
	High Threat Exotics		51.4	80.2	47.5	10.1	42.5	45.5	39.3	4.9	6.3	38.7	0.2	

Date: 22-07-27 Job number: 2665 Site: C: Ill/est n Merigh 1 > Plot ID: Plot 1 Bearing: 353°N Observers: CR
 Starting point Easting / Northing: 0361922 6372149 End point Easting / Northing: 0361940 6372202



Upper stratum	C	Ab	Mid stratum	C	Ab	Lower stratum	C	Ab	Lower stratum	C	Ab
						<i>Hypochaeris</i> ^{radica}	2				
						<i>Cynalon</i> sp	3	#			
						<i>Conyza</i> sp	0.1				
						<i>Plantagolanceola</i>	1	#			
						<i>Senecioioid</i>	1				
						<i>Paspalum</i> sp	0.1				
						<i>Verbena</i> bar	0.1				
						<i>Axonopus</i> sp	0.1				
						<i>Sporobolus</i> sp ^{fertilis} - head	1	50			
						<i>Hypochaeris</i> glabra	0.2				
						<i>Trifolium repens</i>	0.1				
						<i>Juncus</i> <i>Coghat</i> sp	0.1				
						<i>Medicago</i> sp ^{truncatula}	0.1				
						<i>Sideris</i> sp ^{sphaerata}	0.3				
						<i>Sporobolus</i> sp ^{africanus}	2				
						<i>Verbena</i> <i>nigida</i> ^{br incomple}	0.1				
						<i>Cyperoid</i> sp	0.1				
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.

Date: 22-07-27 Job number: 2665 Site: Gillieston Heights Plot ID: Plot 1 Bearing: 353°N Observers: CR
 Starting point Easting / Northing: 0361922 6372149 End point Easting / Northing: 0361940 6372202



Arrival time: 1000m² plot
 Departure time:
 Weather: Overcast
 Mapped Vegetation community:

TWO Transect photos (one landscape one Portrait) taken
 Transect GPS points taken

Tree Stem Size Class DBH (1.3m high)	Presence/Absence Count above 50 cm	Count of Hollow Bearing Trees	Leaf Litter Cover within 5 x 1m ² sub-plots						
			Leaf litter	Live vegetation	Bare ground	Rocks	Other	Total	
< 5 cm	P / (A)	0							
5 - 9 cm	P / (A)		1	60	35	5	0	0	100
10 - 19 cm	P / (A)		Total	2	40	30	25	0	5
20 - 29 cm	P / (A)	Length of logs (m) Note: >10cm diameter, >50cm length	3	55	20	20	0	5	100
30 - 49cm	P / (A)		4	35	30	15	0	0	100
50 - 79cm	#		5	60	35	5	0	0	100
>80cm	#	Total metres	Average	50	34	14	0	2	100

Plot Disturbance: (weediness, clearing, erosion, edge effects, grazing, fire, other)

Habitat features, comments and incidental fauna observations: Plot 1 contains active grazing from cattle. This is evidenced by foot prints in mud due to recent rains, as well as recent cow scat across paddock and plot

Note: Tree Stem Size Class <5cm refers to any regenerating stems and does not require a height of 1.3m.
 Note: Large Trees on the BAM Calculator vary dependant on PCT. We record number of all trees over 50cm, BAM Calculator may have large trees only over 80cm and 50 - 79cm as Present or Absent this is PCT dependant.

Yellow tailed blacks

Date:	Job number: 2665	Site: Lillieson Heights	Plot ID: Plot 2	Bearing: 184°S	Observers: CR
Starting point Easting / Northing: 0362043 6372446			End point Easting / Northing: 0362034 6372393		



Upper stratum	C	Ab	Mid stratum	C	Ab	Lower stratum	C	Ab	Lower stratum	C	Ab
						Kikuyu grass 70%			Sporobolus africanus 1		
						In: Tollen n. n. 50.4					
						Sporobolus sp. 10					
						Plantago lanceolata 0.2					
						Spear thistle 0.1 - Cirsium vulgare					
						Senecio mad 0.2					
						Verbena bonariensis 0.1					
						Conyza discolor 0.1					
						Verbena nigra incog 1 ^o 0.1					
						Sida rhombifolia 0.1					
						Vicia sp. 0.1					
						Conyza discolor 10					
						Cyperoid sp 0.1					
						Hypochaeris Rad. 1					
						Lythraea squarrosa 0.1					
						Modiola sp (Carolinian) 0.1					
						Geranium sp 1 0.1 Ranunculus sp					
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.

Date: 22-07-22 Job number: 2665 Site: Gill Weston Heights Plot ID: Plot 2 Bearing: 184°G Observers: CR
 Starting point Easting / Northing: 0362043 6372446 End point Easting / Northing: 0362034 6372393



Arrival time: 1000m² plot
 Departure time:
 Weather: Overcast showing
 Mapped Vegetation community:

TWO Transect photos (one landscape one Portrait) taken
 Transect GPS points taken

Tree Stem Size Class DBH (1.3m high)	Presence/Absence Count above 50 cm	Count of Hollow Bearing Trees	Leaf Litter Cover within 5 x 1m ² sub-plots						
			Leaf litter	Live vegetation	Bare ground	Rocks	Other	Total	
< 5 cm	P / (A)	0							
5 - 9 cm	P / (A)		1	55	50	5	0	0	100
10 - 19 cm	P / (A)	Total	2	20	50	20	0	10	100
20 - 29 cm	P / (A)	Length of logs (m) Note: >10cm diameter, >50cm length	3	10	60	30	0	0	100
30 - 49cm	P / (A)		4	60	35	5	0	0	100
50 - 79cm	# 0	0	5	5	55	30 35	0	5	100
>80cm	# 0	Total metres	Average	28	50	18	0	3	100

Plot Disturbance: (weediness, clearing, erosion, edge effects, grazing, fire, other) Active Cow grazing - cows in paddock and in sight. Cow scat abundant

Habitat features, comments and incidental fauna observations: Disturbed cleared paddock on minor hill only native species present
 Cow wandered into plot; Kikuyu dominant

Note: Tree Stem Size Class <5cm refers to any regenerating stems and does not require a height of 1.3m.
 Note: Large Trees on the BAM Calculator vary dependant on PCT. We record number of all trees over 50cm, BAM Calculator may have large trees only over 80cm and 50 - 79cm as Present or Absent this is PCT dependant.

Date: 22-01-22 Job number: 2665 Site: 2.11.10.10 - Nethers Plot ID: Plot 3 Bearing: 170.5 Observers: ch
 Starting point Easting / Northing: 0362296 End point Easting / Northing: 0362299
 0372928 6372878



Upper stratum		C	Ab	Mid stratum		C	Ab	Lower stratum		C	Ab	Lower stratum		C	Ab
Corymbia mac				Callistemon ^{salign}	0.8			Senecio mac	0.5			Upper stratum			
Corymbia ^{leucalipes}				Allocasuarina ^{sp}	0.6			Sporobolus ^{sp}	5			Can weed			
Mahoe ^{sp}				Landena ^{caner}	1			Hypochaeris ^{sp}	0.5			Cyperus ^{sp}			
Erebra ^{seedling}								Cyrtolobos ^{sp}	40			Plantago ^{lanceolata}			
								Ehrharta ^{erecta}	40			Comelina ^{erecta}			
								Kikuyu ^{grass}	5			Chickweed			
								Plantago				Verbenia ^{bar}			
								Tagetes ^{microcarpa}	1			Richardsonia ^{sp}			
								Sida ^{rhombifolia}	1			Raspalun ^{sp}			
								Uromyza ^{sp}	1			Sida			
								Stinging nettle	1			Axonopus			
								Solanum ^{sp}	0.2						
								Oxalis ^{sp}	1						
								Phytolacca ^{octandra}	1						Mouse ear
								Notolea ^{long}	0.1						Chickweed
								Spear Wattle	0.1						
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.

Date: 22-07-22 Job number: 2666 Site: Gillieston Heights Plot ID: 3 Bearing: 1770S Observers: Starting point Easting / Northing: 0362296 6372928 End point Easting / Northing: 0362289



Arrival time: 1000m² plot
 Departure time: Mapped Vegetation community:
 Weather:

TWO Transect photos (one landscape one Portrait) taken
 Transect GPS points taken

Tree Stem Size Class DBH (1.3m high)	Presence/Absence Count above 50 cm	Count of Hollow Bearing Trees	Leaf Litter Cover within 5 x 1m ² sub-plots						
			Leaf litter	Live vegetation	Bare ground	Rocks	Other	Total	
< 5 cm	(P) / A	0	1	10	30	60	0	0	100
5 - 9 cm	(P) / A		2	40	40	20	0	0	100
10 - 19 cm	(P) / A		3	50	35	15	0	0	100
20 - 29 cm	(P) / A		4	60	30	10	0	0	100
30 - 49cm	P / A		5	50	30	10	0	10	100
50 - 79cm	# 0		U L	Average	42	35	23	0	2
>80cm	# 0	Total metres							

Plot Disturbance: (weediness, clearing, erosion, edge effects, grazing, fire, other)

Habitat features, comments and incidental fauna observations: Pegnated Seneepines present - internal fence and boundary fence

Cow and calf nearby nesting. Vagrant dogs slow new housing estate booming around. Plot situated within original acreage block adjoins growing Gillieston Heights

Note: Tree Stem Size Class <5cm refers to any regenerating stems and does not require a height of 1.3m.

Note: Large Trees on the BAM Calculator vary dependant on PCT. We record number of all trees over 50cm, BAM Calculator may have large trees only over 80cm and 50 - 79cm as Present or Absent this is PCT dependant.

Subdivision:
 Plot contains canopy and midstory - these standing but planted given location on way. Areas underneath canopy worn and depressed from cattle nesting. Larkana graze

Date: 22-07-22	Job number: 2665	Site: Gullaston Heights	Plot ID: Plot 4	Bearing: 185°S	Observers: CR
Starting point Easting / Northing: 0362226		End point Easting / Northing: 0362206 6372690			



Upper stratum	C	Ab	Mid stratum	C	Ab	Lower stratum	C	Ab	Lower stratum	C	Ab
						Senecio ^{ma} 1					
						Sporobolus ^{fertilis} 5					
						Cynodon sp 70					
						Plantago ^{laevis} 0.3					
						Setaria ^{sp} 1					
						Hypochaeris ^{rad} 1					
						V grass ^{- Digitaria?} - Axonopus ^{subulatus} 1					
						Hypochaeris ^{rad} 0.1					
						Oxalis ^{sp} 0.1					
						Conyza ^{sp} 0.1					
						Vicia ^{sp} 0.1					
						Bromus sp? 0.1					
						Borz ^{subaristata} ^{sp} purple 0.1					
						Gnaphalium ^{sp} 0.1					
						Lentenis ^{sp} 0.1					
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.

Date: 22/7/22 Job number: 2665 Site: Ossnock Rd Gillieston Heights Plot ID: 4 Bearing: 185°S Observers: CR AH
 Starting point Easting / Northing: 0362226 6372736 End point Easting / Northing: 0362206 6372690



Arrival time: 1000m² plot Departure time: Mapped Vegetation community: Weather: TWO Transect photos (one landscape one Portrait) taken
 Transect GPS points taken

Tree Stem Size Class DBH (1.3m high)	Presence/Absence Count above 50 cm	Count of Hollow Bearing Trees	Leaf Litter Cover within 5 x 1m ² sub-plots						
			Leaf litter	Live vegetation	Bare ground	Rocks	Other	Total	
< 5 cm	P / (A)	NIL							
5 - 9 cm	P / (A)	Total — Length of logs (m) Note: >10cm diameter, >50cm length NIL	1	—	100	—	—	2% Comps	100
10 - 19 cm	P / (A)		2	—	100	—	—	11% 2%	100
20 - 29 cm	P / (A)		3	—	100	—	—	11% 2%	100
30 - 49cm	P / (A)		4	—	100	—	—	11% 2%	100
50 - 79cm	# —		5	—	100	—	—	11% 2%	100
>80cm	# —	Total metres —	Average	—	100	—	—	10%	100

Plot Disturbance: (weediness, clearing, erosion, edge effects, grazing, fire, other) No midstorey canopy
 Fireweed, rough tarbo tongue, Sparabobles - No canopy; Cattle grazing & compaction
 Habitat features, comments and incidental fauna observations: (single pair) WBSE, sq tail kite, nanken kestrel, ground saturated

Note: Tree Stem Size Class <5cm refers to any regenerating stems and does not require a height of 1.3m.

Note: Large Trees on the BAM Calculator vary dependant on PCT. We record number of all trees over 80cm and 50 - 79cm as Present or Absent this is PCT dependant.

Date: 22-07-22	Job number: 2665	Site: Lilliestone Heigh 25	Plot ID: plot 5	Bearing: 3° N	Observers: CR, AH
Starting point Easting / Northing: 0361995 6372563		End point Easting / Northing: 0362010 6372612		AEP ECOLOGY BIOBANKING OFFSETS BUSHFIRE	

Upper stratum	C	Ab	Mid stratum	C	Ab	Lower stratum	C	Ab	Lower stratum	C	Ab
						Axonopus serotinus 20					
						Plantago lanceolata 2					
						Sporobolus sp. 20					
						Hypochaeris glabra 1					
						Senecio mad 2					
						Selandia sp. 1					
						Richardsonia 0.5					
						Cynodon dactylon 50					
						Veronica borbonica 0.1					
						Cudweed - Anaphalium 0.1					
						* Other grass 3					
						Setaria pumila 1					
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.

Date: 22/7/22	Job number: 2665	Site: Cessnock Rd Gillieston Heights	Plot ID: 5	Bearing: 003°N	Observers: CR AH
Starting point Easting / Northing: 0361995 6372563			End point Easting / Northing: 0562010 6372612		



Arrival time: 1520 Departure time: Weather: 18°C Cloudy
 1000m² plot Mapped Vegetation community:

TWO Transect photos (one landscape one Portrait) taken
 Transect GPS points taken

Tree Stem Size Class DBH (1.3m high)	Presence/Absence Count above 50 cm	Count of Hollow Bearing Trees	Leaf Litter Cover within 5 x 1m ² sub-plots						
			Leaf litter	Live vegetation	Bare ground	Rocks	Other	Total	
< 5 cm	P / (A)	NIL							
5 - 9 cm	P / (A)	Total -	1	—	100	—	—	Cow pats 1%	100
10 - 19 cm	P / (A)		2	—	100	—	—	—	100
20 - 29 cm	P / (A)	Length of logs (m) Note: >10cm diameter, >50cm length	3	—	100 98% mud	2%	—	—	100
30 - 49cm	P / (A)		4	—	99%	1% mud	—	—	100
50 - 79cm	# -	Total metres -	5	—	98%	2% mud	—	—	100
>80cm	# -		Average	0	99	1	0	0.2	100

Plot Disturbance: (weediness, clearing, erosion, edge effects, grazing, fire, other)

100% cleared, pasture grasses & exotic weeds, ground ^{saturated} ~~flat~~, cattle grazing, ground compacted.

Habitat features, comments and incidental fauna observations:

Note: Tree Stem Size Class <5cm refers to any regenerating stems and does not require a height of 1.3m.

Note: Large Trees on the BAM Calculator vary dependant on PCT. We record number of all trees over 50cm, BAM Calculator may have large trees only over 80cm and 50 - 79cm as Present or Absent: this is PCT dependant.

Date: 22-07-21 Job number: 2665 Site: Gillieston Heights Plot 6 Bearing: 328° Observers: CR
 Starting point Easting / Northing: 0361879 6372307 End point Easting / Northing: 0361891 6372357



Upper stratum		C	Ab	Mid stratum		C	Ab	Lower stratum		C	Ab	Lower stratum		C	Ab
Encalyptus crebra	Ironbark		0.4	Antennaria	0.1			Senecionias	0.5			Cynodon	0.1		
				Geothamnus	0.1			Speargrass	0.5			Verhena	0.1		
								Selenia	5			Solanum	0.1		
								Plantago	0.7			Oxalis	0.1		
								Axonopus	0.5			Kibbush	0.1		
								Solanum	0.5			Sphenocladus	0.5		
								Phytolacca	0.2						
								Sporobolus	30						
								Sida	0.5						
								Tigetes	0.1						
								weed	0.1						
								tribolium	0.1						
								Lysimachia	0.1						
								Hypochaeris	0.7						
								Verhena	0.1						
								Conyza	0.1						
								Urtica	0.1						
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.)

Date: 22-07-22 Job number: 2665 Site: Gillieston Heights Plot ID: Plot 6 Bearing: 328°W Observers: CR, AH
 Starting point Easting / Northing: 0361819 6372307 End point Easting / Northing: 0361891 6372357



Arrival time: 1000m² plot Departure time: 1640 Weather: TWO Transect photos (one landscape one Portrait) taken
 Mapped Vegetation community: Transect GPS points taken

Tree Stem Size Class DBH (1.3m high)	Presence/Absence Count above 50 cm	Count of Hollow Bearing Trees	Leaf Litter Cover within 5 x 1m ² sub-plots						
			Leaf litter	Live vegetation	Bare ground	Rocks	Other	Total	
< 5 cm	P / (A)	1							
5 - 9 cm	P / (A)	Total 1	1	50	100	—	—	Very large branch	100
10 - 19 cm	P / (A)		2	0.1	100	—	—	—	100
20 - 29 cm	P / (A)	Length of logs (m) Note: >10cm diameter, >50cm length 1 x 15m (branch fell off grey iron bark HBT)	3	0.1	100	—	—	—	100
30 - 49cm	P / (A)		4	0.1	100	—	—	Compact 1%	100
50 - 79cm	# —		5	0.1	100	—	—	—	100
>80cm	# 1	Total metres	Average	10.08	20	0	0	0.2	100

Plot Disturbance: (weediness, clearing, erosion, edge effects, grazing, fire, other)

Habitat features, comments and incidental fauna observations:
 Site is cleared, ^{cattle} grazing, ground is compacted & saturated, pasture grasses & weeds

Note: Tree Stem Size Class <5cm refers to any regenerating stems and does not require a height of 1.3m.
 Note: Large Trees on the BAM Calculator vary dependant on PCT. We record number of all trees over 50cm, BAM Calculator may have large trees only over 80cm and 50 - 79cm as Present or Absent this is PCT dependant.

modified 5m x 80m



Date: 01-09-27	Job number: 2665	Site: Hillcrest Heights	Plot ID: Plot 7	Bearing: 172°05'	Observers: CR
Starting point Easting / Northing: 0361868 6372324			End point Easting / Northing: 0361880 6372400		

Upper stratum	C	Ab	Mid stratum	C	Ab	Lower stratum	C	Ab	Lower stratum	C	Ab
Encatyp + Dalneg too simple			Acacia salcata	3		Bidens pilosa	0.5		Guinea grass	15	
Ironbark			Dacrydium	0.5		Chelidonium	0.5		Hypochaeris glabra	0.4	
Corymbia			Ozothamnus	0.5		Cochlosyne	0.5		Verbena bonariensis	5	
E. Sideraphora	10		Solanum	0.1		Hypochaeris	0.4		wheat looking grass	0.1	
Assumed			Acacia	3		Senecio medag	0.4		Microseris	2	
Sideraphora	10					Plantago lanceolata	0.5		Rumea crispifolia	0.5	
						Paspalum	2		Chaenochorus clandestinus	30	
						Lysanachia	0.1		Lochnera	0.1	
						Sporobolus	1.5		Sideranthus	0.5	
						Facelium	0.1		Cirsium vulgare	0.2	
						Oxalis	0.1		Ehrharta erecta	3	
						Setaria	2		Chloris gayana	3	
						Sonchus	0.1		modified	0.1	
						Briza	0.1		weed? Palmetto	0.1	
						Opuntia	0.5		India	0.1	
			Solanum	0.1		Acacia			vicia	0.1	
			Clover	0.1		Apinn	0.1		Pichandra	0.2	
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.

Date:	Job number:	Site: <i>Gillesdon Heights</i>	Plot ID: <i>Plot 17</i>	Bearing:	Observers: <i>CR</i>
Starting point Easting / Northing:			End point Easting / Northing:		



Arrival time: 1000m² plot Departure time: Weather: *sunny - light wind* TWO Transect photos (one landscape one Portrait) taken

Mapped Vegetation community: *Potential PCT 1600* Transect GPS points taken

Tree Stem Size Class DBH (1.3m high)	Presence/Absence Count above 50 cm	Count of Hollow Bearing Trees	Leaf Litter Cover within 5 x 1m ² sub-plots					Total	
			Leaf litter	Live vegetation	Bare ground	Rocks	Other		
< 5 cm	<i>P</i> / A	Total <i>0</i>							
5 - 9 cm	P / A		1 <i>15</i>	<i>0</i>	<i>0</i>	<i>0</i>	<i>0</i>	<i>100</i>	
10 - 19 cm	<i>P</i> / A		2 <i>30</i>	<i>10</i>	<i>85</i>	<i>5</i>	<i>0</i>	<i>100</i>	
20 - 29 cm	<i>P</i> / A		Length of logs (m) Note: >10cm diameter, >50cm length	3 <i>45</i>	<i>0</i>	<i>0</i>	<i>0</i>	<i>100</i>	<i>100</i>
30 - 49cm	<i>P</i> / A			4 <i>60</i>	<i>20</i>	<i>75</i>	<i>5</i>	<i>0</i>	<i>100</i>
50 - 79cm	#		5 <i>75</i>	<i>0</i>	<i>0</i>	<i>0</i>	<i>0</i>	<i>100</i>	
>80cm	#		Total metres <i>0</i>	Average					<i>100</i>

Plot Disturbance: (weediness, clearing, erosion, edge effects, grazing, fire, other)

Road verge - Heavily disturbed - understory 95% eA of e

Habitat features, comments and incidental fauna observations:

*Stick next in canopy tree waypoint recorded. Tree species hard to identify id
needle spotted in plot. Tiger Bear also in plot*

Note: Tree Stem Size Class <5cm refers to any regenerating stems and does not require a height of 1.3m.

Note: Large Trees on the BAM Calculator vary dependant on PCT. We record number of all trees over 50cm, BAM Calculator may have large trees only over 80cm and 50 -79cm as Present or Absent this is PCT dependant.

modified
4x100m



Date:	Job number: 2065	Site: Willies to Heights	Plot ID: Plot 8	Bearing:	Observers: CR
Starting point Easting / Northing: From end to			End point Easting / Northing:		

Upper stratum		Mid stratum		Lower stratum		Lower stratum	
C	Ab	C	Ab	C	Ab	C	Ab
	5	5		0.5		2	
Ecnebrum?	5	tenet	5	Lymanchia ^{Alaensis}	0.5	Sida rhomb	2
unknown ^{Eucalypt}	0.5	tenet		catch	70	mouse earchick	2
poss tenet corn	5	coppicing	2	Hypochaeris sp	0.5	Taraxacum	0.1
EFibross?	5	Enc		heddy snail	5		
EFib same	5	coppicing Black	1	Black Gamochaete			
Ecnebr on side	5	Iron bark		Senecio mad	0.1		
EFib	5	tenet corn ^{- have}	5	Oxalis sp	0.1		
E tenet?	5	Corymbium maculata	5	Cirsium vulgare	0.1		
E tenet	5	- have fruit		K. ruga	2		
E tenet big	8			Paspalum dist	0.2		
- fruit in bag				Bind	0.1		
Fibross?	5			Erhadte	2		
Fibross	5			Axonogis	0.2		
St-very slightly	on falls			Facellismess	0.1		
ye 40m				Senecus oleaceus	0.1		
tenet 2	- got fruit 5			Hypochaeris mad	0.1		
tenet	- got fruit 0.1			Tiger Peck	0.1		
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.

Date:	Job number: 2665	Site: Gilleston Heights	Plot ID: Plot 8	Bearing:	Observers: CR
Starting point Easting / Northing:			End point Easting / Northing:		



Arrival time: 1000m² plot
 Departure time:
 Weather:
 Mapped Vegetation community:

TWO Transect photos (one landscape one Portrait) taken
 Transect GPS points taken

Tree Stem Size Class DBH (1.3m high)	Presence/Absence Count above 50 cm	Count of Hollow Bearing Trees	Leaf Litter Cover within 5 x 1m ² sub-plots					Total	
			Leaf litter	Live vegetation	Bare ground	Rocks	Other		
< 5 cm	P / A	Total 0 Length of logs (m) Note: >10cm diameter, >50cm length	1 20	35	0 50	15	0	0	100
5 - 9 cm	P / A		2 40	15	80	5	0	10	100
10 - 19 cm	P / A		3 60	15	65	20	0	0	100
20 - 29 cm	P / A		4 80	15	80	5	0	0	100
30 - 49cm	P / A		5 100	10	90	25	0	15	100
50 - 79cm	#		Average						100
>80cm	#	Total metres 0							

Plot Disturbance: (weediness, clearing, erosion, edge effects, grazing, fire, other)

Active horse grazing paddock - horses present

Habitat features, comments and incidental fauna observations:

Note: Tree Stem Size Class <5cm refers to any regenerating stems and does not require a height of 1.3m.

Note: Large Trees on the BAM Calculator vary dependant on PCT. We record number of all trees over 50cm, BAM Calculator may have large trees only over 80cm and 50 -79cm as Present or Absent this is PCT dependant.

Job: Gillieston heights		Job number:	2665.01	Date:	14.09.22	Observers:	NB DK TC	BAM Plot 9
Mapped Vegetation community:								
Upper stratum	C [1]	Ab [2]	Mid stratum	C [3]	Ab [4]	Lower stratum	C [5]	Ab [6]
Acmena smithii	75	60	celastrus subspicatus	19	25	Erhertha erecta	4	70
Tuckeroo	5	3	Maclura cochinchensis	19	30	Prickly pear	2	10
Alphitonia excelsa	0.1	3	Lantana camara	0.2	3	Oplismenus aemulus	10	500
Melaleuca styph (outside plot)			Notolea longifolia	0.2	3	Microlaena stipoides	0.1	50
Ficus macrophylla (outside plot)			Cayratia clematadia	0.1	2	Cyperus sp	1	20
			Myrsine variabilis	0.5	1	Lindsea linearis	0.1	15
			Eustrephus latifolius	0.1	5	Peperomia blanda	1	30
			Tobacco	0.1	1	Dichondria repens	0.1	20
			Sarcopetalum harveyanum	0.2	5	Plectranthus	0.1	10
			Geitnoplesium cynosum	0.1	1	Solanum cseaforthianiam	0.1	1
			Pittosporum rev	0.1	1			
			Streblus brunon	0.2	2			
			Hairy clary	0.1	1			
			Breynia oblongfolia	0.1	1			
Total Cover DO FIRST	80			40			20	
20mx20m plot = 400m ² Note: 0.1% = 63x63cm, 0.5% = 1.4x1.4m, 1% = 2x2m, 5% = 4x5m, 25% = 10x10m								

Arrival time:	11	Departure time:	BAM Plot 9	Weather:	Overcast 21degrees	TWO transect photos (one landscape, one portrait) taken	<input checked="" type="checkbox"/>	Transect GPS points taken	<input checked="" type="checkbox"/>
Start easting/northing:	362,268	6372468	End easting/northing:	362,281	6372518	Zone:		Bearing:	4
Tree Stem Size Class at DBH [7]	Presence/Absence	Count of Hollow Bearing Trees	Leaf Litter Cover within 5 x 1m2 sub-plots [8]						
< 5 cm [9]	<input checked="" type="checkbox"/>	#1		Leaf litter	Live vegetation	Bare ground	Rocks	Other	Total
5 - 9 cm	<input checked="" type="checkbox"/>		1	60		30	10		100
10 – 19 cm	<input checked="" type="checkbox"/>		2	20	60	10	10		100
20 – 29 cm	<input checked="" type="checkbox"/>	Length of logs (m) [10]	3	35		45	20		100
	<input type="checkbox"/>								
	<input type="checkbox"/>						..		
30 – 49cm	#1	#3,	4	60			40		100
50 -79cm	#1		5	30		20	50		100
>80cm	#		Average	41	60	26.25	26	#DIV/0!	#DIV/0!
Plot Disturbance: (weediness, clearing, erosion, edge effects, grazing, fire, other)									
Moderate disturbance, some lantana popping. Steep slope near water body									
Habitat features, comments and incidental fauna observations:									
This plot was undertaken as a reference for paddocks trees in the impact area									

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

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

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

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

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

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

[7] DBH = 1.3m high

[8] Note: - located at 5m, 15m, 25m, 35m and 45m along the transect - first plot located 5m on the left of the transect
Litter includes leaves, seeds, twigs and branches less than 10cm in diameter.
Also include dead material attached to living plants that is touching the ground.

[9] Note: Tree Stem Size Class <5cm refers to any regenerating stems and does not require a height of 1.3m.

[10] Note: >10cm diameter, >50cm length

Job: 2665 Gillieston		Job number:		Date:		Observers:		BAM Plot 10
Mapped Vegetation community:								
Upper stratum	C [1]	Ab [2]	Mid stratum	C [3]	Ab [4]	Lower stratum	C [5]	Ab [6]
Eucalyptus robusta	30		Notolea longifolia	0.2		Plantago Incelato	0.5	
			Glycine clandestina	0.1		Chloris gayana	30	
			Acacia ulicifolia	0.1		Hypochaeris radicata	0.5	
			Lantana camara	0.2		Buffalo	0.2	
			Divisea ulicifolia	0.1		Trifolium repens	0.5	
						Kikuyu	5	
						Couch	5	
						Verbena boniariesis	0.1	
						Paspalum dilatatum	3	
						Sida rhumbifolia	0.1	
						Sow thistle	0.1	
						Scotch thistle	0.1	
						Biden pilosa	0.1	
						Erharta erecta	0.2	
						Briza max	10	
						Aristida lignosa	0.2	
Total Cover DO FIRST								
20mx20m plot = 400m2 Note: 0.1% = 63x63cm, 0.5% = 1.4x1.4m, 1% = 2x2m, 5% = 4x5m, 25% = 10x10m								

Arrival time:		Departure time:		Weather:		TWO transect photos (one landscape, one portrait) taken	<input checked="" type="checkbox"/>	Transect GPS points taken	<input checked="" type="checkbox"/>
Start easting/northing:	361,874	6372297	End easting/northing:	361,898	6372676	Zone:		Bearing:	175
Tree Stem Size Class at DBH [7]	Presence/Absence	Count of Hollow Bearing Trees	Leaf Litter Cover within 5 x 1m2 sub-plots [8]						
< 5 cm [9]	<input type="checkbox"/>	#		Leaf litter	Live vegetation	Bare ground	Rocks	Other	Total
5 - 9 cm	<input type="checkbox"/>		15	10	70	20			100
10 – 19 cm	<input type="checkbox"/>		40	10	90				100
20 – 29 cm	<input type="checkbox"/>	Length of logs (m) [10]	65	10	70	20			100
30 – 49cm	#	#	80	20	80				100
50 -79cm	#		105	5	80	15			100
>80cm	#		Average	11	78	18.33333333	#DIV/0!	#DIV/0!	#DIV/0!
Plot Disturbance: (weediness, clearing, erosion, edge effects, grazing, fire, other)									
Habitat features, comments and incidental fauna observations:									

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

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

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

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

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

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

[7] DBH = 1.3m high

[8] Note: - located at 5m, 15m, 25m, 35m and 45m along the transect - first plot located 5m on the left of the transect
Litter includes leaves, seeds, twigs and branches less than 10cm in diameter.
Also include dead material attached to living plants that is touching the ground.

[9] Note: Tree Stem Size Class <5cm refers to any regenerating stems and does not require a height of 1.3m.

[10] Note: >10cm diameter, >50cm length

Arrival time:	09:30	Departure time:	10:15	Weather:	Fine, sunny	TWO transect photos (one landscape, one portrait) taken	<input checked="" type="checkbox"/>	Transect GPS points taken	<input checked="" type="checkbox"/>
Start easting/northing:		End easting/northing:		Zone:		Bearing:			
Tree Stem Size Class at DBH [1]	Presence/Absence	Count of Hollow Bearing Trees	Leaf Litter Cover within 5 x 1m2 sub-plots [2]						
< 5 cm [3]	<input type="checkbox"/>	#0		Leaf litter	Live vegetation	Bare ground	Rocks	Other	Total
5 - 9 cm	<input type="checkbox"/>		1						0
10 – 19 cm	<input type="checkbox"/>		2						0
20 – 29 cm	<input type="checkbox"/>	Length of logs (m) [4]	3						0
30 – 49cm	#	#0	4						0
50 -79cm	#		5						0
>80cm	#		Average	30	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Plot Disturbance: (weediness, clearing, erosion, edge effects, grazing, fire, other)									
Paddock plot, no shrub or canopy layer at all									
Habitat features, comments and incidental fauna observations:									
Ducks on dam									

[1] DBH = 1.3m high

[2] Note: - located at 5m, 15m, 25m, 35m and 45m along the transect - first plot located 5m on the left of the transect
Litter includes leaves, seeds, twigs and branches less than 10cm in diameter.
Also include dead material attached to living plants that is touching the ground.

[3] Note: Tree Stem Size Class <5cm refers to any regenerating stems and does not require a height of 1.3m.

[4] Note: >10cm diameter, >50cm length

Plot no:	11	Job:	Gilleston Heights	Job no:	2665.02	Date:	14/12/23	Observers:	DK, KD
Mapped Vegetation community:	Exotic								
Upper stratum	C [2]	Ab [1]	Mid stratum	C [3]	Ab [4]	Lower stratum	C [5]	Ab [6]	
						Cynodon spp	70	10000	
						Juncus cognatus	0.5	20	
						Senecio madgas	0.2	30	
						Setaria pumila	0.2	30	
						Rumex brownii	0.5	50	
						Lachnogrостis soo	0.1	10	
						Hypocharies radicata	0.1	20	
						Dichalacne rara	1	50	
						verbena bonariensis	0.1	1	
						Paspalum mandiocanum	0.1	10	
						Briza minor	0.1	10	
Total Cover	0			0			72.9		
20mx20m plot = 400m2 Note: 0.1% = 63x63cm, 0.5% = 1.4x1.4m, 1% = 2x2m, 5% = 4x5m, 25% = 10x10m									

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

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

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

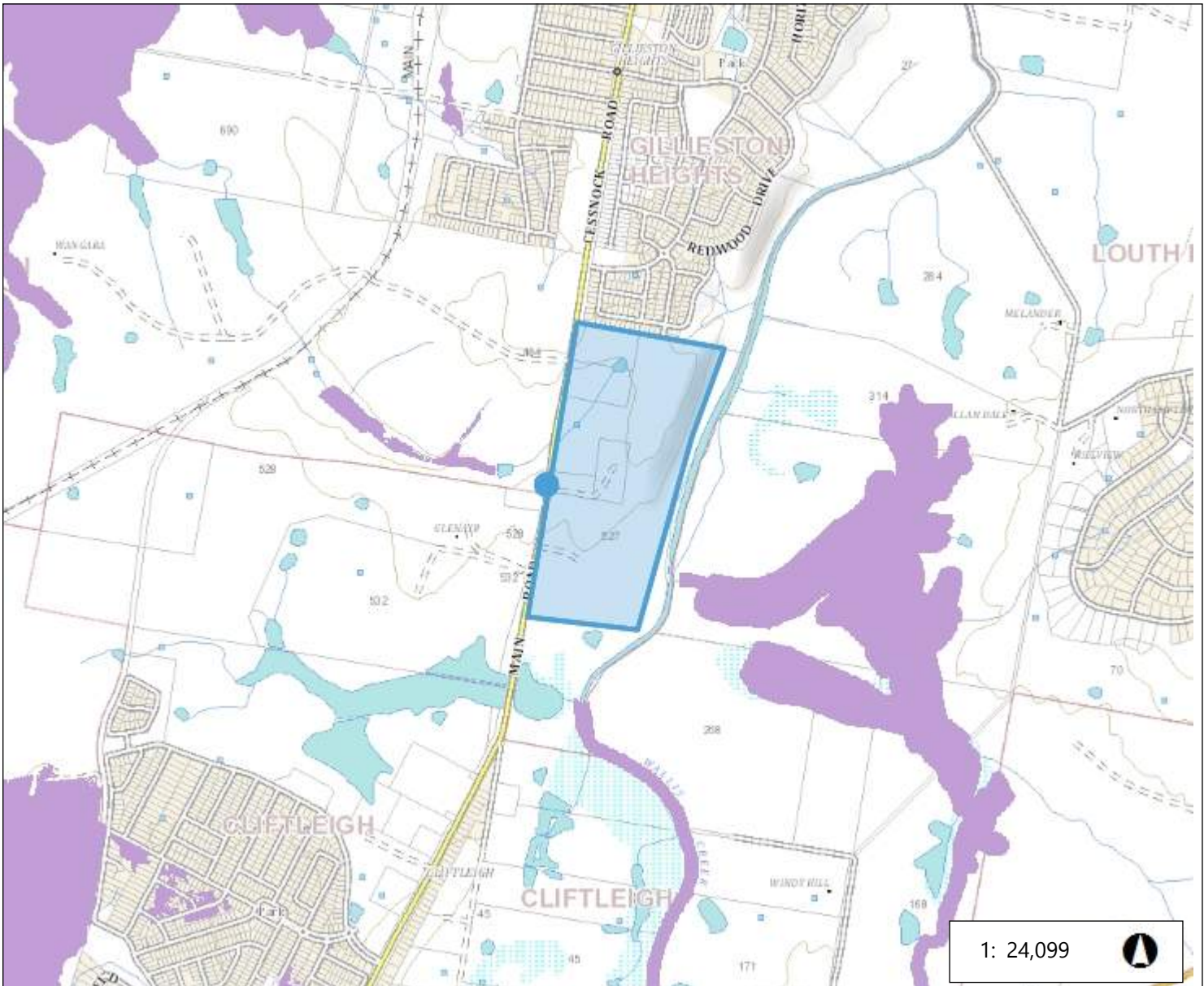
[4] Abundance: 1-20, 50, 100, 500, 1000 etc. (numbers >20 are estimates only. For overhanging plants, record abundance as 1.

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

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

Appendix E – BOSET Report

Biodiversity Values Map



1: 24,099



1,224.2 0 612.12 1,224.2 Metres

WGS_1984_Web_Mercator_Auxiliary_Sphere

This map is a user generated static output from an Internet mapping site and is for reference only. Data layers that appear on this map may or may not be accurate, current, or otherwise reliable.

THIS MAP IS NOT TO BE USED FOR NAVIGATION

Legend

- Biodiversity Values that have been mapped for more than 90 days
- Biodiversity Values added within last 90 days

Notes

© NSW Department of Planning and Environment

Biodiversity Values Map and Threshold Report

Results Summary

Date of Calculation	13/04/2023 12:04 PM	BDAR Required*
Total Digitised Area	407,806.6 sqm	
Minimum Lot Size Method	LEP	
Minimum Lot Size 10,000sqm = 1ha	450 sqm	
Area Clearing Threshold 10,000sqm = 1ha	2,500 sqm	
Area clearing trigger Area of native vegetation cleared	Unknown #	Unknown #
Biodiversity values map trigger Impact on biodiversity values map(not including values added within the last 90 days)?	no	no
Date of the 90 day Expiry	N/A	

*If BDAR required has:

- at least one 'Yes': you have exceeded the BOS threshold. You are now required to submit a Biodiversity Development Assessment Report with your development application. Go to <https://customer.lmbc.nsw.gov.au/assessment/AccreditedAssessor> to access a list of assessors who are accredited to apply the Biodiversity Assessment Method and write a Biodiversity Development Assessment Report
- 'No': you have not exceeded the BOS threshold. You may still require a permit from local council. Review the development control plan and consult with council. You may still be required to assess whether the development is "likely to significantly affect threatened species' as determined under the test in s. 7.3 of the Biodiversity Conservation Act 2016. You may still be required to review the area where no vegetation mapping is available.

Where the area of impact occurs on land with no vegetation mapping available, the tool cannot determine the area of native vegetation cleared and if this exceeds the Area Threshold. You will need to work out the area of native vegetation cleared - refer to the BMAT user guide for how to do this.

On and after the 90 day expiry date a BDAR will be required.

Disclaimer

This results summary and map can be used as guidance material only. This results summary and map is not guaranteed to be free from error or omission. The State of NSW and Department of Planning and Environment and its employees disclaim liability for any act done on the information in the results summary or map and any consequences of such acts or omissions. It remains the responsibility of the proponent to ensure that their development application complies will all aspects of the *Biodiversity Conservation Act 2016*.

The mapping provided in this tool has been done with the best available mapping and knowledge of species habitat requirements. This map is valid for a period of 30 days from the date of calculation (above).

Acknowledgement

I as the applicant for this development, submit that I have correctly depicted the area that will be impacted or likely to be impacted as a result of the proposed development.

Signature _____ Date: 13/04/2023 12:04 PM

Appendix F – Biodiversity Credit Report



BAM Biodiversity Credit Report (Like for like)

Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00034724/BAAS19076/22/00034725	2665-02 Cessnock Rd Gillieston Heights - SBDAR	14/04/2023
Assessor Name	Assessor Number	BAM Data version *
Ian Douglas Benson	BAAS18147	58
Proponent Names	Report Created	BAM Case Status
	22/06/2023	Finalised
Assessment Revision	Assessment Type	Date Finalised
2	Part 4 Developments (Small Area)	22/06/2023
BOS entry trigger	* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.	
BOS Threshold: Area clearing threshold		

Potential Serious and Irreversible Impacts

Name of threatened ecological community	Listing status	Name of Plant Community Type/ID
Nil		
Species		
Nil		

Additional Information for Approval

Assessment Id	Proposal Name
00034724/BAAS19076/22/00034725	2665-02 Cessnock Rd Gillieston Heights - SBDAR



BAM Biodiversity Credit Report (Like for like)

PCT Outside Ibra Added

None added

PCTs With Customized Benchmarks

PCT

No Changes

Predicted Threatened Species Not On Site

Name

No Changes

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

Name of Plant Community Type/ID	Name of threatened ecological community	Area of impact	HBT Cr	No HBT Cr	Total credits to be retired
1600-Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter	Lower Hunter Spotted Gum Ironbark Forest in the Sydney Basin and NSW North Coast Bioregions	0.3	0	4	4
1525-Sandpaper Fig - Whalebone Tree warm temperate rainforest	Lower Hunter Valley Dry Rainforest in the Sydney Basin and NSW North Coast Bioregions	0.1	2	0	2

BAM Biodiversity Credit Report (Like for like)

1525-Sandpaper Fig - Whalebone Tree warm temperate rainforest	Like-for-like credit retirement options					
	Name of offset trading group	Trading group	Zone	HBT	Credits	IBRA region
	Lower Hunter Valley Dry Rainforest in the Sydney Basin and NSW North Coast Bioregions This includes PCT's: 1525, 1541, 1543, 3076, 3083	-	1525_Poor	Yes	2	Hunter, Ellerston, Karuah Manning, Kerrabee, Liverpool Range, Peel, Tomalla, Upper Hunter, Wyong and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
1600-Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter	Like-for-like credit retirement options					
	Name of offset trading group	Trading group	Zone	HBT	Credits	IBRA region



BAM Biodiversity Credit Report (Like for like)

	<p>Lower Hunter Spotted Gum Ironbark Forest in the Sydney Basin and NSW North Coast Bioregions This includes PCT's: 1590, 1592, 1593, 1600, 1602, 3433, 3442, 3443, 3444</p>	-	1600_Degraded	No	<p>4 Hunter, Ellerston, Karuah Manning, Kerrabee, Liverpool Range, Peel, Tomalla, Upper Hunter, Wyong and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.</p>
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Species Credit Summary

No Species Credit Data

Credit Retirement Options

Like-for-like credit retirement options

Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00034724/BAAS19076/22/00034725	2665-02 Cessnock Rd Gillieston Heights - SBDAR	14/04/2023
Assessor Name	Assessor Number	BAM Data version *
Ian Douglas Benson	BAAS18147	58
Proponent Name(s)	Report Created	BAM Case Status
	22/06/2023	Finalised
Assessment Revision	Assessment Type	Date Finalised
2	Part 4 Developments (Small Area)	22/06/2023
BOS entry trigger	* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.	
BOS Threshold: Area clearing threshold		

Potential Serious and Irreversible Impacts

Name of threatened ecological community	Listing status	Name of Plant Community Type/ID
Nil		
Species		
Nil		

Additional Information for Approval

PCT Outside Ibra Added

None added

PCTs With Customized Benchmarks

BAM Biodiversity Credit Report (Variations)

PCT

No Changes

Predicted Threatened Species Not On Site

Name

No Changes

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

Name of Plant Community Type/ID	Name of threatened ecological community	Area of impact	HBT Cr	No HBT Cr	Total credits to be retired
1600-Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter	Lower Hunter Spotted Gum Ironbark Forest in the Sydney Basin and NSW North Coast Bioregions	0.3	0	4	4.00
1525-Sandpaper Fig - Whalebone Tree warm temperate rainforest	Lower Hunter Valley Dry Rainforest in the Sydney Basin and NSW North Coast Bioregions	0.1	2	0	2.00

1525-Sandpaper Fig - Whalebone Tree warm temperate rainforest

Like-for-like credit retirement options

Class	Trading group	Zone	HBT	Credits	IBRA region
Lower Hunter Valley Dry Rainforest in the Sydney Basin and NSW North Coast Bioregions This includes PCT's: 1525, 1541, 1543, 3076, 3083	-	1525_Poor	Yes	2	Hunter, Ellerston, Karuah Manning, Kerrabee, Liverpool Range, Peel, Tomalla, Upper Hunter, Wyong and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

Variation options

Formation	Trading group	Zone	HBT	Credits	IBRA region
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BAM Biodiversity Credit Report (Variations)

	Rainforests	Tier 5 or higher threat status	1525_Poor	Yes (including artificial)	2	IBRA Region: Sydney Basin, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
1600-Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter	Like-for-like credit retirement options					
	Class	Trading group	Zone	HBT	Credits	IBRA region
	Lower Hunter Spotted Gum Ironbark Forest in the Sydney Basin and NSW North Coast Bioregions This includes PCT's: 1590, 1592, 1593, 1600, 1602, 3433, 3442, 3443, 3444	-	1600_Degraded	No	4	Hunter, Ellerston, Karuah Manning, Kerrabee, Liverpool Range, Peel, Tomalla, Upper Hunter, Wyong and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	Variation options					
Formation	Trading group	Zone	HBT	Credits	IBRA region	
Dry Sclerophyll Forests (Shrub/grass sub-formation)	Tier 3 or higher threat status	1600_Degraded	No	4	IBRA Region: Sydney Basin, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.	

Species Credit Summary

No Species Credit Data



BAM Biodiversity Credit Report (Variations)

Credit Retirement Options Like-for-like options

Appendix G – Site Photographs



Above: Subject Site consists primarily of pasture/exotic grassland

Below: Wallis Creek floodplains to the north east of the Subject Site





Above: White-bellied Sea Eagle pair observed over Study Area.

Below: BAM Plot One





Above: Riparian Assessment being completed on farm dam

Below: Planted native vegetation around homestead





Above: Mapped hydroline – degraded with no defined bed or bank
Below: Overland water flow across Subject Site





Above: View north east from Northern boundary
Below: Planted natives along Cessnock Road





Above: *Eucalyptus Robusta* along Cessnock Road

Below: View South from Northern boundary across Subject Site





Above: View North East from where mapped hydrolines exits property

Below: BAM plot 11, view north





Above: Northern mapped hydrolines exiting onto floodplain to drain into Wallace Crk outside of Study Area.

Below: View south between Wallace Crk and the eastern downhill edge of the BMP Lands within the Study Area.



Appendix H – Other Legislation

EPBC Act Assessment

A Protected Matters Search within a 5km radius of the Study Area was conducted in March 2023 for Matters of National Environmental Significance as relevant to the Environment Protection & Biodiversity Conservation Act 1999 (EPBC Act). The following Matters of National Significance are considered in this assessment.

World Heritage Properties:

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

National Heritage Places:

The 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):

The site is not a Wetlands of International Significance but is in close proximity being 10-20km upstream to the Hunter estuary wetlands.

Great Barrier Reef Marine Park:

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

Commonwealth Marine Areas:

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

Threatened Ecological Communities:

From the search of the EPBC Act Protected Matters, seven (7) listed Threatened Ecological Communities (TECs) were considered likely to occur within a 5km radius of the Study Area.

Two (2) Endangered Ecological Communities:

- *Coastal Swamp Oak (Casuarina glauca) Forest of New South Wales and South East Queensland ecological community; and*
- *Coastal Swamp Sclerophyll Forest of New South Wales and South East Queensland.*

Five (5) Critically Endangered Ecological Community

- *River-flat eucalypt forest on coastal floodplains of southern New South Wales and eastern Victoria;*
- *White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland;*
- *Lowland Rainforest of Subtropical Australia;*
- *Hunter Valley Weeping Myall (Acacia pendula) Woodland; and*
- *Central Hunter Valley eucalypt forest and woodland.*

A review of vegetation zones was undertaken against the Conservation Advices for:

Central Hunter Valley eucalypt forest and woodland.

Review of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) (s266B) Approved Conservation Advice (including listing advice) for the Central Hunter Valley eucalypt forest and woodland ecological community for the potential association with PCT 1600 within the Subject Site is assessed in **Table 28** As such, the provisions of the Conservation Advice do not apply and the PCT within the Subject Site does not qualify as Central Hunter Valley eucalypt forest and woodland.

Table 28 – 1.5.1 The Key diagnostic characteristics of this ecological community are as follows:

Diagnostic characteristics	Site comments
It occurs in the Hunter River catchment (typically called the Hunter Valley region);	Yes
It typically occurs on lower hillslopes and low ridges, or valley floors in undulating country; on soils derived from Permian sedimentary rocks;	Yes
It does not occur on alluvial flats, river terraces, aeolian sands Triassic sediments, or escarpments	Yes
It is woodland or forest, with a projected canopy cover of trees of 10% or more; or with a native tree density of at least 10 native tree stems per 0.5 ha (at least 20 native tree stems/ha) that are at least one metre in height	Yes
The canopy of the ecological community is dominated by one or more of the following four eucalypt species: <i>Eucalyptus crebra</i> (narrow-leaved ironbark), <i>Corymbia maculata</i> (syn. <i>E. maculata</i>) (spotted gum), <i>E. dawsonii</i> (slaty gum) and <i>E. moluccana</i> (grey box); OR a fifth species, <i>Allocasuarina luehmannii</i> (bulloak, buloke) dominates in combination with one or more of the above four eucalypt species, in sites previously dominated by one or more of the above four eucalypt species	Yes
<i>Allocasuarina torulosa</i> (forest oak/ she-oak, rose she-oak/oak), <i>Eucalyptus acmenoides</i> (white mahogany) and <i>E. fibrosa</i> (red/broad-leaved ironbark) are largely absent from the canopy of a patch	No. <i>Allocasuarina torulosa</i> and <i>E fibrosa</i> are present.
A ground layer is present (although it may vary in development and composition), as a sparse to thick layer of native grasses and other native herbs and/or native shrubs.	Ground layer of natives was sparse / predominantly managed comprising mostly exotic species across the site. Some native grasses were present.
Due to the presence of <i>Eucalyptus fibrosa</i> and <i>Allocasuarina torulosa</i> , vegetation on site is more accurately reflected by the BC listed Lower Hunter Spotted Gum Ironbark Forest in the Sydney Basin and NSW North Coast Bioregions. As such the community on site is not considered to be commensurate with the EPBC listed TEC and no further assessment is required.	

Threatened Species:

Threatened species listed under the EPBC Act considered likely to occur on site were assessed from field inspections, Bird Data and using the BioNet Atlas search tool within a 10km search radius to the Subject Site with most recent records assessed (refer **Table 29**). Habitat assessment and surveys did not identify suitable habitat for threatened species listed under the EPBC Act and it is not expected that impacts to EPBC listed species would occur as a result of this development.

Table 29 - EPBC – Threatened Species Assessment

Scientific Name	Common Name	EPBC Status	BioNet Records	Most Recent Record	Assessment
<i>Acacia bynoeana</i>	Bynoe's Wattle	Vulnerable	29	2007	Twenty-nine (29) records in the locality exist according to the NSW BioNet Atlas. This species was not observed on the Subject Site during field surveys and given the degraded and cleared nature of the site, is unlikely to occur. Therefore, no further assessment is required against the EPBC's significant impact criteria for vulnerable species as it is unlikely that the proposed subdivision is going to impact the species in the area and broader locality.
<i>Chalinolobus dwyeri</i>	Large-eared Pied Bat	Vulnerable	4	2013	Four (4) records in the locality exist according to the NSW BioNet Atlas. No suitable breeding habitat has been identified on site or within the immediate locality. Given the degraded and cleared nature of the site, is unlikely to occur. Therefore, no further assessment is required against the EPBC's significant impact criteria for vulnerable species as it is unlikely that the proposed subdivision is going to impact the species in the area and broader locality.
<i>Eucalyptus glaucina</i>	Slaty Red Gum	Vulnerable	1	2004	One (1) record in the locality exist according to the NSW BioNet Atlas. This species was not observed on the Subject Site during field surveys and given the degraded and cleared nature of the site, is unlikely to occur. Therefore, no further assessment is required against the EPBC's significant impact criteria for vulnerable species as it is unlikely that the proposed subdivision is going to impact the species in the area and broader locality.
<i>Eucalyptus parramattensis subsp. decadens</i>		Vulnerable	259	2021	Two hundred and fifty-nine (259) records in the locality exist according to the NSW BioNet Atlas. This species was not observed on the Subject Site during field surveys and given the degraded and cleared nature of the site, is unlikely to occur. Therefore, no further assessment is required against the EPBC's significant impact criteria for vulnerable species as it is unlikely that the proposed subdivision is going to impact the species in the area and broader locality.
<i>Grevillea parviflora subsp. parviflora</i>	Small-flower Grevillea	Vulnerable	61	2019	Sixty-one (61) records in the locality exist according to the NSW BioNet Atlas. This species was not observed on the Subject Site during field surveys and

Scientific Name	Common Name	EPBC Status	BioNet Records	Most Recent Record	Assessment
					given the degraded and cleared nature of the site, is unlikely to occur. Therefore, no further assessment is required against the EPBC's significant impact criteria for vulnerable species as it is unlikely that the proposed subdivision is going to impact the species in the area and broader locality.
<i>Hirundapus caudacutus</i>	White-throated Needletail	Vulnerable	1	2020	One (1) record in the locality exist according to the NSW BioNet Atlas. This species was not observed on the Subject Site during field surveys and given the degraded and cleared nature of the site, is unlikely to occur. Therefore, no further assessment is required against the EPBC's significant impact criteria for vulnerable species as it is unlikely that the proposed subdivision is going to impact the species in the area and broader locality.
<i>Lathamus discolor</i>	Swift Parrot	Critically Endangered	15	2020	Fifteen (15) records in the locality exist according to the NSW BioNet Atlas. This species was not observed on the Subject Site during field surveys and given the degraded and cleared nature of the site, is unlikely to occur. Further to this the site is not mapped as important areas for this species (Refer Figure 9). Therefore, no further assessment is required against the EPBC's significant impact criteria for Critically Endangered species as it is unlikely that the proposed subdivision is going to impact the species in the area and broader locality.
<i>Litoria aurea</i>	Green and Golden Bell Frog	Vulnerable	7	2008	Seven (7) records in the locality exist according to the NSW BioNet Atlas. This species was not observed on the Subject Site during field surveys and given the degraded and cleared nature of the site, is unlikely to occur. Therefore, no further assessment is required against the EPBC's significant impact criteria for vulnerable species as it is unlikely that the proposed subdivision is going to impact the species in the area and broader locality.
<i>Phascolarctos cinereus</i>	Koala	Endangered	2	2017	Two (2) records in the locality exist according to the NSW BioNet Atlas. This species was not observed on the Subject Site during field surveys and given the degraded and cleared nature of the site, is unlikely to occur. Therefore, no further assessment is required against the EPBC's significant impact

Scientific Name	Common Name	EPBC Status	BioNet Records	Most Recent Record	Assessment
					criteria for vulnerable species as it is unlikely that the proposed subdivision is going to impact the species in the area and broader locality (Refer Appendix H).
<i>Pseudomys novaehollandiae</i>	New Holland Mouse	Vulnerable	3	2004	Three (3) records in the locality exist according to the NSW BioNet Atlas. This species was not observed on the Subject Site during field surveys and given the degraded and cleared nature of the site, is unlikely to occur. Therefore, no further assessment is required against the EPBC's significant impact criteria for vulnerable species as it is unlikely that the proposed subdivision is going to impact the species in the area and broader locality.
<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox	Vulnerable	35	2020	Thirty-five (35) records within a 10km BioNet search over the last twenty years. The Grey-headed flying fox is a highly mobile species and although the site provides suitable foraging habitat, as no roosts or camps were identified on site, this development is unlikely to significantly impact this species.
<i>Rutidosis heterogama</i>	Heath Wrinklewort	Vulnerable	5	2008	Five (5) records in the locality exist according to the NSW BioNet Atlas. This species was not observed on the Subject Site during field surveys and given the degraded and cleared nature of the site, is unlikely to occur. Therefore, no further assessment is required against the EPBC's significant impact criteria for vulnerable species as it is unlikely that the proposed subdivision is going to impact the species in the area and broader locality.

Migratory Species:

A number of EPBC listed migratory species have the potential to utilise the site on an irregular basis. The limited number and sporadic nature of records close to the Subject Site appear to reflect opportunistic rather than regular use of any habitat considered of importance to any threatened species.

It is not considered that the development of this land is likely to significantly affect the availability of potential habitat for such mobile species, or disrupt migratory patterns.

EPBC Act Assessment Conclusion:

While PCT 1600 was identified on site as having the potential to be associated with EPBC Act listed TECs, further assessment confirmed that *Central Hunter Valley eucalypt forest and woodland* is not associated with this community.

Therefore, an EPBC Act Referral is not considered as necessary for this proposal.

State Environmental Planning Policy (Resilience and Hazards) 2021 - Chapter 2 Coastal Management

State Environmental Planning Policy (Resilience and Hazards) 2021 (hereafter the Resilience and Hazards SEPP) came into force on 1 March 2022, repealing several existing SEPPs including State Environmental Planning Policy (Coastal Management) 2018 and State Environmental Planning Policy 55 - Remediation of Land. This Policy aims to minimise risks and harm from environmental hazards.

Investigations in accordance with the 2021 (R&H SEPP) found that the Subject Site falls within the Coastal Use Area Map. As such, an assessment has been undertaken to determine if the proposed development is likely to impact the Coastal Environment Area Map (refer **Figure 9**).

Therefore, in accordance with Clause 2.10 & 2.11 of the R&H SEPP respectively, the following assessment has been undertaken (**Table 30**).

Table 30 – Coastal Environment and Coastal Use Area Assessment

Clause Number	Clause	Assessment
2.10 (1)	<p>Development consent must not be granted to development on land that is within the coastal environment area unless the consent authority has considered whether the proposed development is likely to cause an adverse impact on the following:</p> <p>(a) the integrity and resilience of the biophysical, hydrological (surface and groundwater) and ecological environment,</p>	<p>The proposed subdivision development or Subject Site would have a minimal impact on the biophysical, hydrological and ecological integrity of the coastal environmental area, providing best practices of erosion and sediment controls are used.</p> <p>The Subject Site of 33.03ha has been selected as an urban development corridor along Cessnock Road and has been zoned as such. The Subject Site has already been cleared with minimal impact of 0.93ha to remnant native and planted native vegetation. With the use of proper sediment and erosion controls, the proposed development would have minimal impacts on the biophysical integrity of the coastal environmental area or impact on the integrity of the adjacent flood plains.</p> <p>A stormwater management plan provided will be required to ensure that the management of water as part of the Development meets Maitland City Councils water quality targets and will not have an adverse impact on the coastal management areas.</p> <p>All hydrological infrastructure incorporating Water Sensitive Urban Design (WSUD) principles in regard to construction, will be utilised in order to mitigate any negative hydrological impacts. This indicates that this development will have an insignificant impact to the integrity of the Coastal Environmental Area.</p>
	<p>(b) coastal environmental values and natural coastal processes.</p>	<p>The proposed development will have minimal impact as small area of land that is mostly cleared and in a severely degraded condition on the coastal environmental values and is positioned away from any natural coastal processes. The Subject Site</p>

Clause Number	Clause	Assessment
		does not impact Wallis Creek or the floodplains to the east and south of the Study Area.
	(c) the water quality of the marine estate (within the meaning of the Marine Estate Management Act 2014), in particular, the cumulative impacts of the proposed development on any of the sensitive coastal lakes identified in Schedule 1.	The site is not located adjacently to a listed sensitive coastal lake.
	(d) marine vegetation, native vegetation and fauna and their habitats, undeveloped headlands and rock platforms,	<p>In order to minimise impacts within the Study Area of 43.94ha, PCT 1525 <i>Sandpaper Fig - Whalebone Tree warm temperate rainforest</i> and the southern areas within the allotment that are prone to flooding, have been actively avoided within the development plans. PCT 1525 is likely to be commensurate with the State listed Vulnerable <i>Ecological Community Lower Hunter Valley Dry Rainforest in the Sydney Basin and NSW North Coast Bioregions</i> and was avoided. The Subject Site of 33.03ha comprises of two (2) community types of PCT 1600 of 0.30ha and PCT 1525 of 0.10ha and minimal impact to native vegetation, fauna and their habitats are expected. No headlands or rock platforms are present within the Subject Site.</p> <p>No impacts to adjacent undeveloped lands are expected.</p>
	(e) existing public open space and safe access to and along the foreshore, beach, headland or rock platform for members of the public, including persons with a disability.	The proposed development is located on private land. No impact to accessibility of public land is expected.
	(f) Aboriginal cultural heritage, practices and places,	<p>No known Aboriginal cultural heritage, practices or places are known to this Lot and no adverse impacts are expected.</p> <p>No known cultural and built environment and heritage places are known to this Lot and no adverse impacts are expected.</p> <p>Searches were carried out on the NSW Public Aboriginal Heritage Map Website. For an extensive search consultation with a registered Heritage Assessor is required (Heritage NSW 2022).</p>
	(g) the use of the surf zone.	The proposed development area is not adjacent to the foreshore. The site will not impact or use the surf zone in the foreshore.
2.10 (2)	Development consent must not be granted to development on land to which this section	The development and its subsequent impacts are considered unavoidable, in order to meet the

Clause Number	Clause	Assessment
	<p>applies unless the consent authority is satisfied that:</p> <p>(a) the development is designed, sited and will be managed to avoid an adverse impact referred to in subsection (1), or</p> <p>(b) if that impact cannot be reasonably avoided—the development is designed, sited and will be managed to minimise that impact, or</p> <p>(c) if that impact cannot be minimised—the development will be managed to mitigate that impact.</p>	<p>development requirements of the proposed residential Subdivision. The development has been designed to follow the principles of avoid and minimise through the location of the proposed development which limits impacts to those areas that are disturbed and cleared. These areas have limited regeneration possibility, and as such the area is unlikely to support a high diversity of diagnostic species for with community due to past management practices.</p> <p>In order to minimise impacts within the Study Area of 43.94ha, PCT 1525 <i>Sandpaper Fig - Whalebone Tree warm temperate rainforest</i> and the southern areas within the allotment that are prone to flooding, have been actively avoided within the development plans. PCT 1525 is likely to be commensurate with the State listed Vulnerable <i>Ecological Community Lower Hunter Valley Dry Rainforest in the Sydney Basin and NSW North Coast Bioregions</i> and was avoided. The Subject Site of 33.03ha comprises of two (2) community types of PCT 1600 of 0.30ha and PCT 1525 of 0.10ha, along with 0.53ha of planted native not assigned to a PCT and minimal impact to native vegetation, fauna and their habitats are expected.</p>
2.11 (1)	<p>Development consent must not be granted to development on land that is within the coastal use area unless the consent authority:</p> <p>(a) has considered whether the proposed development is likely to cause an adverse impact on the following:</p> <p>(i) existing, safe access to and along the foreshore, beach, headland or rock platform for members of the public, including persons with a disability,</p> <p>(ii) overshadowing, wind funnelling and the loss of views from public places to foreshores,</p> <p>(iii) the visual amenity and scenic qualities of the coast, including coastal headlands,</p> <p>(iv) Aboriginal cultural heritage, practices and places,</p> <p>(v) cultural and built environment heritage, and</p> <p>(b) is satisfied that:</p>	<p>The proposed development presents no impact to public land in regard to; accessibility, overshadowing, wind funnelling, views or scenic quality.</p> <p>Furthermore, no known Aboriginal cultural heritage, practices or places are known to this Lot and no adverse impacts are expected. No known cultural and built environment heritage places are known to this Lot and no adverse impacts are expected. Searches were carried out on the NSW Public Aboriginal Heritage Map Website. For an extensive search consultation with a registered Heritage Assessor is required (Heritage NSW 2022).</p> <p>No impacts on matters referred to in Clause 2.11 (1) (a) are expected as a result of the proposed development.</p>

Clause Number	Clause	Assessment
	(i) the development is designed, sited and will be managed to avoid an adverse impact referred to in paragraph (a), or (ii) if that impact cannot be reasonably avoided—the development is designed, sited and will be managed to minimise that impact, or (iii) if that impact cannot be minimised—the development will be managed to mitigate that impact, and	
2.11 (2)	This section does not apply to land within the Foreshores and Waterways Area within the meaning of <i>Sydney Regional Environmental Plan (Sydney Harbour Catchment) 2005</i> .	Not applicable to this application.

As demonstrated in the above assessment, the proposed development will have minimal to no impact on the catchment area following the installation of appropriate sediment and erosion control and implementation of WSUD and Stormwater Management.

As demonstrated in the above assessment it is likely that the proposed development will have minimal to no impact on the catchment area following the use of appropriate Water Sensitive Urban Design.

Water Management Act 2000

The Department of Planning and Environment (Water) administers the WM Act and is required to assess activities carried out on waterfront land. Waterfront land includes the bed and bank of any river, lake or estuary and all land within 40 meters of the highest bank of the river, lake or estuary. Certain activities within this land are defined as a 'controlled activity' and requires approval from the Office of Water.

There are five farm dams located within the Subject Site and a mapped first order stream in the north western portion of the main allotment (Lot 2 DP 601226) and the beginning of another mapped first order stream at the northern boundary (Lot 2 DP1230739) (refer **Figure 1** and **2**).

Ground-truthing vegetation and habitat features on site within the main allotment, observed water overflow gullies that are heavily degraded due to cattle grazing and overgrown with pasture grasses. Watercourse features as defined by Appendix 6 of the Waterfront Land Tool were not identified and the mapped 1st order stream is not present within the Subject Site.

Ground-truthing of the northern allotment confirmed the NSW Hydroline spatial data which identified that the mapped 1st order stream is present within the Subject Site within Lot 2 DP1230739. The proposed Vegetated Riparian Zone (VRZ) for this first order stream is 10m and as works will occur within 40m of waterfront land, a Controlled Activity Approval (CAA) will be required to accompany this development application. Offsets will be incorporated into the VRZ within the BMP Lands.

Due to the proximity of Wallis Creek that runs along the eastern boundary of the Study Area (as a fifth order stream and therefore a 40m VRZ is applicable). As the VRZ for Wallis Creek intersects the BMP Lands it is anticipated that no offsets are required.

Refer **Appendix I** Riparian Assessment Report and **Appendix J** Biodiversity Management Plan.

The proposed subdivision will include ancillary infrastructure such as stormwater management adhering to state requirements. The Subject Site development proposes to decommission the dams and adjust the existing hydrolines that will be outlined in the Stormwater Management Report **Appendix L**.

Fisheries Management Act 1994

The Fisheries Management Act 1994 (FM Act), objectives are to conserve, develop and share the fishery resources of the State for the benefit of present and future generations. The proposal will encroach into the VRZ of the first order stream in the north eastern section of the Subject Site and no works are to be undertaken within Wallace Creek. Any VRZ encroachment will be offset within the proposed BMP lands. As such, the objectives of the FM Act are considered to be met.

Further to this, under the FM Act, a permit is required for dredging or reclamations works on water lands. No dredging or reclamation works will occur within the first order stream to the north of the site and as such the FM Act is unlikely to be triggered.

As there are no natural streams or waterways to be directly impacted by this development. No further assessment under the *Fisheries Management Act 1994* is required.

State Environmental Planning Policy (Biodiversity and Conservation) 2021

Chapter 4 Koala Habitat Protection 2021

The State Environmental Planning Policy (Biodiversity and Conservation) 2021 (BC SEPP) commenced on 1 March 2022. The State Environment Planning Policy (Koala Habitat Protection) 2021 was one SEPP that was consolidated within the BC SEPP 2021 under Chapter 4 Koala Habitat Protection. No policy changes were made as part of the consolidation nor did the legal effect of the existing SEPPs, with section 30A of the *Interpretation Act 1987* applying to the transferred provisions. The consolidation was undertaken in accordance with section 3.22 of the *Environmental Planning and Assessment Act 1979*.

The land which comprises the Study Area has no approved koala plan of management. According to the BC SEPP 2021, the policy applies if:

4.9 Development assessment process—no approved koala plan of management for land

(1) This section applies to land to which this Chapter applies if the land—

(a) has an area of at least 1 hectare (including adjoining land within the same ownership), and

(b) does not have an approved koala plan of management applying to the land.

The Subject Site has an area of at least 1ha and does not have an approved koala plan of management.

(5) However, despite subclauses (3) and (4), the council may grant development consent if the applicant provides to the council –

a. information, prepared by a suitably qualified and experienced person, the council is satisfied demonstrates that the land subject of the development application –

i. does not include any trees belonging to the koala use tree species listed in Schedule 3 for the relevant koala management area, or

ii. is not core koala habitat,

Site inspections confirmed that some koala use trees listed in Schedule 3 are present within the Subject Site. Therefore, it is classified as core koala habitat and further investigations are required.

Tier 2 Assessment

Part A: Presence of highly suitable Koala Habitat

Determine the PCT (using suitable methods) and if PCT have Schedule 3 listed trees an assessment must be undertaken to determine koala presence.

The Subject site does contain Schedule 3 listed trees therefore, a Tier 2 Assessment is required.

Assess BioNet for records - All records within set distance (2.5km OR 5km) in the last 18 years apply = Core Habitat. Requiring a Part B Assessment to determine koala presence.

An assessment of BioNet showed two (2) records, both as road kills, a 2016 record 5kms south west from the Subject Site in Kurri township and the other from 2017 on the outskirts of Maitland ~4.5kms north east from the Subject Site approx. 3km to the south-south-west from the Study Area.

Part B Assessment

i) Koala Presence – Spot Assessment Technique, Nocturnal Survey and Call Playback

The Subject Site contains Schedule 3 listed trees therefore, a Tier 2 Assessment is required.

Two SAT surveys, numerous koala call playbacks and nocturnal surveys were undertaken on 31/08/2022 and 01/09/2022 and did not result in the identification of evidence of site use by Koala. This was considered sufficient survey for the Subject Site.

ii) Koala Records

As stated above, BioNet records exist in the area from within the last 18 years. but are not within 2.5kms from the Subject Site.

Records within these maximum distances must only be considered after a careful examination of the broader landscape. That is, within areas of contiguous habitat or between areas of habitat with connectivity. For example, a record from 2.5km from the subject site must not be used if natural or artificial landscape features would prevent koalas from the area with the record ever moving to the site (e.g., due to large rivers, roads, fences or built-up areas).

Table 31 – Koala Assessment

Principles	Criteria	Assessment
Introduction	Describe the nature of the proposed development.	Proposal for residential subdivision, including associated civil works and infrastructure.
	Define how the SEPP applies to the proposed development.	Parent lot >1ha in size and two (2) Koala records identified within 5km from Subject Site within the last 18 years.
Koala habitat values – addressing criteria 1 and 2	Describe the site area, including the general environment and condition, location and extent of the development area and any other areas that may be directly or indirectly impacted by the proposed development.	<p>The Subject Site is predominately cleared pasture lands with five small farm dams as well as existing dwellings and associated gardens and out buildings.</p> <p>It is located within a rural landscape that is becoming increasingly urbanised and adjoins Cessnock Road to the west and urban development to the north. A strip of remnant vegetation exists to the east that has some connectivity further to the north, that forms part of the Study Area that will be retained and placed under a BMP. To the south is mapped as flood lands and the development footprint has avoided this area. Adjacent lands in other directions are either cleared of native vegetation or developed.</p> <p>The development will incur the clearing on 0.93ha of remnant and planted native vegetation identified as being in a highly to severely disturbed condition and as such, holding limited biodiversity value.</p> <p>Koala use tree species identified include; <i>Corymbia maculata</i>,</p>

Principles	Criteria	Assessment
		<p><i>Eucalyptus robusta</i>, <i>Eucalyptus crebra</i>, <i>Eucalyptus anacardioides</i>, <i>Eucalyptus acmenoides</i>, <i>Eucalyptus camaldulensis</i>, <i>Eucalyptus moluccana</i>, and <i>Eucalyptus sideroxylon</i>.</p> <p><i>Eucalyptus globulus</i> and <i>Eucalyptus anacardioides</i> were identified within the Study area but are not listed as potential feed trees within the Central Coast koala management area.</p> <p>No indirect impacts other than potential increase in light spill and noise as a result of the subdivision, are expected.</p>
Measures taken to avoid impacts to koalas – addressing criteria 3, 4, 5, 6, 7 and 8	Describe the site selection process, including how koala habitat was taken into account and any avoidance outcomes achieved through this process.	<p>A survey using the Spot Assessment Technique and two consecutive nocturnal surveys using spotlights and call playback were undertaken on 31/08/2022 & 01/09/2022. As per the SAT, no evidence of use by Koala was found. Details of the survey are provided on Figure 6. Furthermore, a search for records of Koala in the BioNet Atlas revealed only two records of Koala in the last 18 years, both more than 4.5kms from the Subject Site.</p> <p>Native vegetation on site occurs in a highly to severely degraded and fragmented condition, with the majority of the Subject Site as cleared exotic dominant paddock pasture.</p> <p>Connectivity to remnant vegetation is limited to the strip of trees located along the eastern boundary within the Study Area which connects marginally to the north with the total fragmented patch being approx. 12.5ha. On the western side of Cessnock Road reserve is some connection along the mapped hydrolines that further connects to larger vegetated patches to the west.</p> <p>The high level of disturbance combined with paucity of records in the locality would infer that the site is unlikely to have any importance for any Koala population.</p> <p>As described above, habitat values for Koala within the Subject Site and broader Study Area are negligible. The iterative design process undertaken in consultation with bushfire consultants and project ecologists led to the formulation of a proposed plan that seeks to avoid areas with potentially better habitat (such as to the west of the site) and locates the footprint within</p>

Principles	Criteria	Assessment
		areas of high disturbance, cleared land and exotic-dominated vegetation.
	Describe how the proposed development avoids or minimises direct impacts to koala habitat and habitat function within the site area.	As above.
Analysis of potential impacts – addressing criteria 9	Identify the residual direct impacts to koalas and koala habitat within the site area, including the nature and extent of impacts and the likely implications for the viability of a local koala population.	No residual impacts to Koala are expected. More broadly, residual impacts to biodiversity have been quantified as per the BAM, resulting in the incurring of six (6) Ecosystem Credits as a result of the clearing of 0.93ha of highly to severely disturbed native vegetation on site.
	Identify the relevant potential indirect impacts to koalas and koala habitat within the site area and adjacent habitat areas, including the nature and extent of potential indirect impacts and the likely implications for the viability of a local koala population.	As discussed above, the absence of evidence of site use by Koala, the paucity of records in the locality and the fragmentation of bushland in the near surrounds means that direct or indirect impacts to Koala as a result of the proposal are considered highly unlikely.
Plan to manage and protect koalas and their habitat – addressing criteria 10, 11, 12 and 13	Describe the management measures that will be implemented as part of proposed construction and operations to manage the direct and indirect impacts identified. These measures should be outcomes focussed and include performance targets.	<p>Whilst impacts to Koala, whether direct or indirect, are not expected as a result of the proposal, the application of Avoid & Minimise principles through the design and construction process will lead to the implementation of impact mitigation measures on site, as follows:</p> <ul style="list-style-type: none"> • Protective fencing to prevent incursions of fauna from the eastern BMP lands into the site; • Use of fauna-friendly protective fencing (i.e., no barbed-wire); • Implementation of CEMP to control potential indirect impacts resulting from construction works; • Implementation of low-speed limits throughout the subdivision to reduce the risk of vehicle strikes.
	Describe any compensatory measures that will be delivered, including an analysis of the suitability of these measures against criteria 9 and 10.	No Koala were observed on site, nor was any evidence of site use found. As such, compensatory measures were not deemed necessary in this instance.
	Outline a plan for monitoring, adaptive management and reporting against the key outcomes and performance targets.	Not applicable.

Conclusion

The Subject Site does contain Schedule 3 trees as per the BC SEPP, however, despite the recent records of Koala from within in the locality, no evidence of site use was found. Impacts to potential habitat will be limited to the removal of 0.40ha of highly to severely degraded remnant native vegetation and 0.53ha of planted native trees. Therefore, it was considered that the proposal will not incur any significant impacts on Koala.

Gillieston Heights Cessnock/Maitland LEP and DCP tables

Maitland Local Environmental Plan 2011

The Maitland Local Environmental Plan, 2011, (LEP) commenced on 16 December 2011. The aim of the LEP

The particular aims of this plan are as follows:

- *to protect and promote the use and development of land for arts and cultural activity,*
- *including music and other performance arts,*
- *to facilitate ecologically sustainable development of land and natural assets,*
- *to protect and maintain the extent, condition, connectivity and resilience of natural ecosystems, native vegetation, wetlands and landscapes, including those aspects of the environment that are matters of national environmental significance within Maitland in the long term,*
- *to properly plan and protect human-made resources of Maitland including buildings, structures and sites of recognised significance which are part of the heritage of Maitland,*
- *to protect, enhance or conserve the natural resources of Maitland including the following—*
 - *areas of high scenic rural quality,*
 - *productive agricultural land,*
 - *habitat for listed threatened species and endangered ecological communities,*
 - *minerals of regional significance,*
- *to create liveable communities which are well connected, accessible and sustainable,*
- *to provide a diversity of affordable housing with a range of housing choices throughout Maitland*
- *to allow for future urban development on land within urban release areas and ensure that development on such land occurs in a co-ordinated and cost-effective manner,*
- *to concentrate intensive urban land uses and trip-generating activities in locations most accessible to transport and centres, strengthening activity centre and precinct hierarchies and employment opportunities,*
- *to ensure that land uses are organised to minimise risks from hazards including flooding, bushfire, subsidence, acid sulphate soils and climate change,*
- *to encourage orderly, feasible and equitable development whilst safeguarding the community's interests, environmentally sensitive areas and residential amenity.*

The assessment in **Table 32** assesses relevant ecological clauses within the LEP to ensure the aims of the LEP can be achieved.

Table 32 - LEP Assessment

Clause Number	Clause	AEP Assessment
Land Use Table		
Objectives of zone	Zone RU2 Rural Landscape	
	To encourage sustainable primary industry production by maintaining and enhancing the natural resource base.	N/A – Subject Site rezoned to R1
	To maintain the rural landscape character of the land.	N/A – Subject Site rezoned to R1
	To provide for a range of compatible land uses, including extensive agriculture.	N/A – Subject Site rezoned to R1
	To provide for a range of non-agricultural uses where infrastructure is adequate to support the uses and conflict between different land uses is minimised.	N/A – Subject Site rezoned to R1
Permitted without consent	Extensive agriculture; Home occupations; Intensive plant agriculture	N/A – Subject Site rezoned to R1
Permitted with consent	Agriculture; Airstrips; Animal boarding or training establishments; Aquaculture; Bed and breakfast accommodation; Boat launching ramps; Boat sheds; Camping grounds; Caravan parks; Cellar door premises; Cemeteries; Community facilities; Crematoria; Dual occupancies; Dwelling houses; Ecotourist facilities; Educational establishments; Environmental facilities; Environmental protection works; Farm buildings; Farm stay accommodation; Flood mitigation works; Forestry; Helipads; Home-based child care; Home businesses; Home industries; Information and education facilities; Jetties; Landscaping material supplies; Markets; Open cut mining; Places of public worship; Plant nurseries; Recreation areas; Recreation facilities (outdoor); Roads; Roadside stalls; Rural industries; Rural supplies; Signage; Turf farming; Veterinary hospitals; Water supply systems	N/A – Subject Site rezoned to R1
Prohibited	Intensive livestock agriculture; Livestock processing industries; Any other development not specified in item 2 or 3	N/A – Subject Site rezoned to R1
Objectives of zone	Zone R1 General Residential	
	To provide for the housing needs of the community.	Development proposal meets these objectives.
	To provide for a variety of housing types and densities.	

Clause Number	Clause	AEP Assessment
	To enable other land uses that provide facilities or services to meet the day to day needs of residents.	
Permitted without consent	Home occupations	Home occupations apart of the proposed work do not require consent.
Permitted with consent	Attached dwellings; Bed and breakfast accommodation; Boarding houses; Building identification signs; Business identification signs; Centre-based child care facilities; Community facilities; Dwelling houses; Group homes; Home-based child care; Home industries; Hostels; Hotel or motel accommodation; Multi dwelling housing; Neighbourhood shops; Oyster aquaculture; Places of public worship; Pond-based aquaculture; Residential flat buildings; Respite day care centres; Roads; Semi-detached dwellings; Seniors housing; Serviced apartments; Shop top housing; Tank-based aquaculture; Any other development not specified in item 2 or 4	Addressed in SEE.
Prohibited	Agriculture; Air transport facilities; Airstrips; Amusement centres; Animal boarding or training establishments; Biosolids treatment facilities; Boat building and repair facilities; Boat launching ramps; Boat sheds; Camping grounds; Car parks; Caravan parks; Cemeteries; Charter and tourism boating facilities; Commercial premises; Correctional centres; Crematoria; Depots; Eco-tourist facilities; Entertainment facilities; Extractive industries; Farm buildings; Forestry; Freight transport facilities; Function centres; Heavy industrial storage establishments; Helipads; Highway service centres; Home occupations (sex services); Industrial retail outlets; Industrial training facilities; Industries; Information and education facilities; Jetties; Marinas; Mooring pens; Moorings; Mortuaries; Open cut mining; Passenger transport facilities; Public administration buildings; Recreation facilities (indoor); Recreation facilities (major); Registered clubs; Research stations; Restricted premises; Rural industries; Rural workers' dwellings; Service stations; Sewage treatment plants; Sex services premises; Signage; Storage premises; Tourist and visitor accommodation; Transport depots; Truck depots; Vehicle body repair workshops; Vehicle repair stations; Veterinary hospitals; Warehouse or distribution centres; Waste or resource management facilities; Water recreation structures; Water recycling facilities; Wharf or boating facilities; Wholesale supplies	N/A
Part 3 – Exempt and Complying development		

Clause Number	Clause	AEP Assessment
3.3.1	<p align="center">3.3 Environmentally sensitive areas excluded</p>	
	Exempt or complying development must not be carried out on any environmentally sensitive area for exempt or complying development.	The development is not situated within any environmentally sensitive area.
3.3.2	<p>For the purposes of this clause—environmentally sensitive area for exempt or complying development means any of the following—</p> <ul style="list-style-type: none"> (a) the coastal waters of the State, (b) a coastal lake, (c) land within the coastal wetlands and littoral rainforests area (within the meaning of the Coastal Management Act 2016), (d) land reserved as an aquatic reserve under the Fisheries Management Act 1994 or as a marine park under the Marine Parks Act 1997, (e) land within a wetland of international significance declared under the Ramsar Convention on Wetlands or within a World heritage area declared under the World Heritage Convention, (f) land within 100 metres of land to which paragraph (c), (d) or (e) applies, (g) land identified in this or any other environmental planning instrument as being of high Aboriginal cultural significance or high biodiversity significance, (h) land reserved under the National Parks and Wildlife Act 1974 or land acquired under Part 11 of that Act, (i) land reserved or dedicated under the Crown Land Management Act 2016 for the preservation of flora, fauna, geological formations or for other environmental protection purposes, (j) land that is a declared area of outstanding biodiversity value under the Biodiversity Conservation Act 2016 or declared critical habitat under Part 7A of the Fisheries Management Act 1994. 	N/A
Part 7 – Additional Local Provisions		
7.4	7.4 Riparian Land and Watercourses	

Clause Number	Clause	AEP Assessment
	<p>1. The objective of this clause is to protect and maintain the following—</p> <ul style="list-style-type: none"> i) water quality within watercourses, ii) the stability of the bed and banks of watercourses, iii) aquatic riparian habitats, iv) ecological processes within watercourses and riparian areas. <p>2. This clause applies to—</p> <ul style="list-style-type: none"> 1. land identified as “Watercourse land” on the Watercourse Map, and 2. all land that is within 40 metres of the top of the bank of a watercourse identified as “Watercourse land” on the Watercourse Map. 	<p>There are five farm dams located within the Subject Site and a mapped First Order Stream in the north western portion of the main allotment and the beginning of another first order stream along the northern boundary (refer Figure 1 and 2). Ground-truthing vegetation and habitat features on site, observed stream banks that are heavily degraded due to cattle grazing and overgrown with pasture grasses and do not meet the definitions of a watercourse. Two additional drainage lines extend from the dams and appear to be surface flow gullies only. The Subject Site development proposes to decommission the dams and adjust the existing hydrolines. Due to a first order stream being impacted within the Subject Site and the proximity of Wallis Creek that runs along the eastern boundary of the Study Area, the proposed development will be considered an integrated development, and a Controlled Activity Approval will be required. The proposed subdivision will include ancillary infrastructure such as stormwater management adhering to state requirements.</p> <p>In accordance with Section 91 of the WM a Controlled Activities Approval is required to undertake the above works.</p> <p>It is noted that a BMP has been recommended to accompany this DA and could be considered to contribute to VRZ offsetting requirements as part of the CAA for works within 40m of Waterfront Land.</p>
	<p>3. Before determining a development application to carry out development on land to which this clause applies, the consent authority must consider whether or not the development—</p> <ul style="list-style-type: none"> (a) is likely to have any adverse impact on the following— <ul style="list-style-type: none"> (i) the water quality and flows within the watercourse, (ii) aquatic and riparian species, habitats and ecosystems of the watercourse, (iii) the stability of the bed, shore and banks of the watercourse, (iv) the free passage of fish and other aquatic organisms within or along the watercourse, (v) any future rehabilitation of the watercourse and its riparian areas, and (b) is likely to increase water extraction from the watercourse. 	<p>Riparian buffers and Vegetated Riparian Zones must be established according to the mapped stream order of Wallis creek and the unnamed mapped hydrolines within the Subject Site. This is addressed in SEE.</p>
	<p>4. Development consent must not be granted to development on land to</p>	<p>Addressed in SEE</p>

Clause Number	Clause	AEP Assessment
	<p>which this clause applies unless the consent authority is satisfied that—</p> <p>(a) the development is designed, sited and will be managed to avoid any significant adverse environmental impact, or</p> <p>(b) if that impact cannot be reasonably avoided by adopting feasible alternatives—the development is designed, sited and will be managed to minimise that impact, or</p> <p>(c) if that impact cannot be minimised—the development will be managed to mitigate that impact.</p>	

Maitland City Council Development Control Plan 2011

The Development Control Plan, (DCP) commenced in 2011. The aim of the DCP is to facilitate development in accordance with the LEP. **Table 33** assess the relevant ecological clauses within the DCP demonstrating compliance.

Table 33 - DCP Assessment

Maitland Development Control Plan 2011		
Clause Number	Clause	AEP Assessment
Part B – Environmental Guidelines		
	Riparian Watercourses and Flooding (B.7.5)	
B.7.5.1	Soil disturbance within riparian areas shall be limited to the purposes of providing critical infrastructure and remediation activities associated with improving flood mitigation and health of waterways. Disturbances within the VRZ should be avoided at all costs.	There are five farm dams located within the Subject Site and a mapped First Order Stream in the north western portion of the main allotment and the beginning of another first order stream along the northern boundary (refer Figure 1 and 2). Ground-truthing vegetation and habitat features on site, observed stream banks that are heavily degraded due to cattle grazing and overgrown with pasture grasses and do not meet the definitions of a watercourse. Two additional drainage lines extend from the dams and appear to be surface flow gullies only. The Subject Site development proposes to decommission the dams and adjust the existing hydrolines. Due to a first order stream being
B.7.5.2	Riparian vegetation should not to be removed from riparian corridors for the purposes of new development. Any proposal to consider offsets associated with development are to be assessed in accordance with the Guidelines for Riparian Corridors on Waterfront Land administered by NSW Office of Water. Where a proponent pursues an offset within the riparian corridor, the application will trigger integrated development, and the respective referral fees and charges will apply.	
B.7.5.3	Development shall not compromise connectivity, or opportunities for future connectivity, of riparian vegetation and habitat, or interfere with hydrological flows within waterways or riparian land.	

Maitland Development Control Plan 2011		
Clause Number	Clause	AEP Assessment
B.7.5.4	Any flood study to support a DA which could impact upon riparian land and/or waterways needs to include an assessment of improvements to the health and structure of riparian land. This is necessary in order to determine flood risk and identify possible natural mitigation measures against flooding, as opposed to alternative engineered mitigation measures that could have greater impacts upon the riparian corridor.	<p>impacted within the Subject Site and the proximity of Wallis Creek that runs along the eastern boundary of the Study Area and mapped hydrolines on site, the proposed development will be considered an integrated development, and a Controlled Activity Approval will be required. The proposed subdivision will include ancillary infrastructure such as stormwater management adhering to state requirements. In accordance with Section 91 of the WM a Controlled Activities Approval is required to undertake the above works. It is noted that a BMP has been recommended to accompany this DA and could be considered to contribute to VRZ offsetting requirements as part of the CAA for works within 40m of Waterfront Land. development</p> <p>In accordance with Section 91 of the WM a Controlled Activities Approval is required to undertake the above works.</p>
B.7.5.5	Improvements and remediation of riparian waterway banks should include only endemic native riparian species and complimentary soft engineering techniques.	
B.7.5.6	Stormwater detention areas and infrastructure shall maintain appropriate engineering design and mechanisms to ensure that all stormwater is treated prior to entering riparian waterways, whilst ensuring that such engineering and the location of stormwater devices does not compromise the connectivity and functioning of riparian vegetation, waterways and wildlife habitat.	
B.7.5.7	Works shall not be permitted in riparian areas that are likely to require excessive or incompatible piping, cause realignment of natural waterways, or alter the depth or width of natural waterways.	
B.7.5.8	The stability of waterway banks and channels shall be protected by minimising the removal of vegetation, natural riparian debris and natural stream structure, except where woody debris results in a flood hazard.	
B.7.5.9	Where there is no alternative but to locate infrastructure and services within riparian areas (i.e., all possible alternative options have been exhausted), the design of such services shall accommodate for the natural functions of the riparian area and waterway.	
	Other Environmental Considerations (B.7.6)	
B.7.6.1	Asset Protection Zones (APZs) proposed for bushfire management in association with a proposed development should ideally not be located within the VRZ (see Figure 1). No riparian vegetation should be removed from the VRZ for the purposes of providing an APZ or for bushfire management, unless the proponent pursues an APZ within the VRZ (in accordance with Guidelines for Riparian Corridors on Waterfront Land administered by NSW Office of Water). Any such application will trigger integrated development, and the respective referral fees and charges will apply.	Addressed in SEE.
B.7.6.2	Access points to riparian waterways shall be located so as to minimise disturbance to riparian vegetation, banks and wildlife habitat. Access shall be restricted within the VRZ.	Addressed in SEE
B.7.6.3	Where rehabilitation of riparian vegetation is proposed, only local native species shall be used to restore riparian areas, in order to ensure the natural ecological function is	Noted.

Maitland Development Control Plan 2011		
Clause Number	Clause	AEP Assessment
	maintained. No substitution for native endemic species will be permitted.	
B.7.6.4	If rehabilitation of riparian vegetation occurs within the VRZ, the density of plantings shall be consistent with the naturally occurring density of endemic species in the riparian area, and shall comprise 100% local native species, including groundcovers, shrubs and trees.	Noted.
Part C.10 – Subdivision Design Guidelines		
	Design Elements - Flora and Fauna (C.10.4.1)	
Objective	To protect remnant bushland, significant flora and fauna habitats and wildlife corridors from the impacts of subdivision and subsequent development, and to provide for the repair and enhancement of environmentally significant and/or degraded land.	A corridor of C2 – Environmental Conservation zoned land has been set aside on the Eastern side of the development and will be managed under a BMP to allow for protection of ecological processes and encourage the conservation and recovery of native flora and fauna within the locality.
C.10.4.1	<p>Design principals:</p> <ul style="list-style-type: none"> a) Subdivision design will minimise the impact on vegetation of likely future development on the lots created, including clearing for dwelling and building sites, roads, access, fire prevention, provision of services and the like. b) Subdivision design will include linkages to other areas of vegetation, such as existing or proposed buffer zones and corridors on the same land, or on adjacent or adjoining land. c) Subdivision design will consider the potential to enhance vegetation in natural drainage lines, creek and river banks and the like. d) Subdivision design will consider the potential to repair and/or enhance natural systems such as watercourses and drainage lines, and any part of the land that is already degraded through vegetation loss, soil erosion and the like. 	<p>The Biodiversity Assessment Report for this development took into consideration the condition, ecological value and significance of flora and fauna present within the site to determine the likely impact of works.</p> <p>Any development will incur impacts to threatened species, this development has undertaken to avoid and minimise impacts to threatened flora and fauna based on design iteration, location, type of habitat and retention of land in the west to act as both a sanctuary and corridor for biodiversity connectivity.</p> <p>Following these considerations, it is considered that the development as it stands is unlikely to cause significant impacts on any threatened species such that it would be placed at risk of extinction and further that offsets will be provided to compensate for the impacts that could not be avoided.</p>
C.10.4.1	<p>Performance criteria – General:</p> <ul style="list-style-type: none"> e) Areas of significant habitat must be protected. f) Design subdivision layout to avoid significant stands of vegetation. Where the subdivision proposal affects significant stands of vegetation, lot layout and lot size must take into account the 	<ul style="list-style-type: none"> e – f) No BV mapped land, significant habitat or significant stands of vegetation are present within the Subject Site. g - i) A corridor of C2 – Environmental Conservation zoned

Maitland Development Control Plan 2011		
Clause Number	Clause	AEP Assessment
	<p>need to retain the vegetation and the impact of likely future development on the lots, including building envelopes, parking, access and other development requirements such as Asset Protection Zones.</p> <p>g) Retain existing natural drainage lines and watercourses where practicable, revegetate where necessary and incorporate into open space areas (including pedestrian and/or cycleway corridors) or include in common property.</p> <p>h) Link existing vegetation corridors through open space provision and appropriate planting.</p> <p>i) Lot boundaries should be located to incorporate the whole of any significant stand of vegetation that is not included in common areas.</p> <p>j) Land title choices should reflect the need to protect and enhance vegetation. For example, Community Title may be appropriate where degraded areas need to be rehabilitated and maintained as part of the consent.</p>	<p>land has been set aside on the Eastern side of the development and will be managed under a BMP to allow for protection of ecological processes and encourage the conservation and recovery of native flora and fauna within the locality.</p> <p>j) Addressed in the SEE</p>
C.10.4.1	<p>Performance criteria – Rural and environmental zones (including land zoned R5 Large Lot Residential):</p> <p>k) New development is not to result in the removal of remnant vegetation. Subdivision design should incorporate native vegetation into the character of the development.</p> <p>l) Significant areas of vegetation, existing or proposed vegetation/wildlife corridors, riparian areas, habitat, major drainage lines and land use buffers should desirably be contained in separate environmental buffer allotments with satisfactory provision made for their ongoing maintenance and management.</p> <p>m) Environmental enhancement may be required in areas that have previously become degraded, or are near areas of special conservation value or significant areas of native vegetation.</p>	<p>k) Impacts to flora and fauna have been avoided and minimised where possible in accordance with the BAM 2020 avoid and minimise principle.</p> <p>l-m) An area of C2 zoned land has been set aside on the western side of the development and will be managed under a BMP to allow for protection of ecological processes and encourage the conservation and recovery of native flora and fauna within the locality.</p> <p>Further information on other environmental impacts are contained within the SEE.</p>
C.10.4.1	<p>Specific controls:</p> <p>n) The location of all natural drainage lines, wetland areas and significant stands of vegetation are to be mapped. Any vegetation to be removed must be identified and quantified. The subdivision application is required to address appropriate mechanisms for retention and protection of native vegetation.</p> <p>o) Where a subdivision proposal is likely to result in the loss of vegetation, or is likely to impact upon any environmentally sensitive area (such as a watercourse, wetland etc), it is to be accompanied by a flora and fauna assessment report prepared by a suitably qualified person. This report is to primarily address the 7 Part Test referred to in Section 5A of the Environmental Planning and Assessment Act, 1979, and the requirements of</p>	<p>n) Impacts to any hydrolines and native vegetation have been considered, avoided and minimised where possible in accordance with the BAM 2020 avoid and minimise principle. Water management has been addressed as part of the Stormwater Management Plan and appropriate management of streams on site will be undertaken in line with appropriate guidelines.</p> <p>o) Required documents have been prepared and are given in the SEE.</p> <p>p) An area of C2 zoned land has been set aside on the western side of the development and will be</p>

Maitland Development Control Plan 2011		
Clause Number	Clause	AEP Assessment
	<p>SEPP 44 – Koala Habitat Protection. As a result of this report a subsequent Species Impact Statement may be required.</p> <p>p) Where environmental enhancement is required, a planting and vegetation management scheme is to be prepared and implemented, indicating the reinstatement or enhancement of vegetation in riparian areas adjoining water courses, major drainage lines, significant areas of native vegetation, habitat, or proposed vegetation corridors and land use buffer areas.</p> <p>q) Planting should consist of species indigenous to the locality, and those which will enhance biodiversity and provide wildlife habitat. Suitable species can be sourced from local nurseries, or seed collected from plants already growing in the area. Species and planting guidelines are available from Council and/or Greening Australia.</p>	<p>managed under a BMP to allow for protection of ecological processes and encourage the conservation and recovery of native flora and fauna within the locality.</p> <p>q) Indigenous species have been incorporated into the BMP plan for the C2 zoned lands.</p>

Appendix I – Riparian Assessment Report



AEP

ECOLOGY | OFFSETS | BUSHFIRE | ARBORICULTURE

Riparian Assessment Report

Proposed residential subdivision at 527, 507, 501, 463 and 457
Cessnock Road, Gillieston Heights NSW 2321



Prepared for: **Walker Gillieston Heights Pty Ltd**

AEP Ref: 2665.02

Revision: 00

16 June 2023

Document Control

Document Name	Riparian Assessment Report for proposed residential subdivision at 527, 507, 501, 463 and 457 Cessnock Road, Gillieston Heights NSW 2321
Project Number	2665.02
Client Name	Walker Gillieston Heights Pty Ltd
AEP Project Team	Simon Purcell Kelly Drysdale Byron de Jager Brendon Young

Revision

Revision	Date	Author	Reviewed	Approved
00	16 June 2023	Byron de Jager and Brendon Young	Kelly Drysdale	Simon Purcell

Distribution

Revision	Date	Name	Organisation
00	16 June 2023	Dean Davies	Walker Gillieston Heights

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Appendix A – NRAR Hydroline Spatial Data

Appendix B – Author CVs

1.0 Introduction

Anderson Environment & Planning was commissioned by Walker Gillieston Heights (the client) to undertake a Riparian assessment Report (RAR) to inform a potential residential subdivision development at 501, 507, 527, 463, 464 and 457 Cessnock Road, Gillieston Heights, 2321 NSW, refer **Figure 1**.

For the purposes of referencing, this document should be referred to as:

Anderson Environment & Planning (2023). *Riparian Assessment Report for proposed residential subdivision at 501, 507, 527, 463, 464 and 457 Cessnock Road, Gillieston Heights, 2321 NSW, Rev 00*. Unpublished report for Walker Corporation Pty Ltd.

2.0 Site Particulars





Table 1 – Site Details


Detail	Comments
Client	Walker Corporation Pty Ltd
Address	527, 507, 501, 463 & 457 Cessnock Rd Gillieston Heights, NSW
Title(s)	Lot 2 DP 601226, Lot 1 DP 601226, Lot 1 DP 311179, Lot 2 DP 302745 and Lot 1 DP 302745 It is noted that an easement over a portion of 65 Redwood Drive Gillieston Height Part Lot 2 DP1230739 is applicable to this proposal and the portion where impact assessment has been applicable.
Study area	The Study Area consists of the proposed residential subdivision of 322 lots and a portion of the retained lands (3.56ha) is to be placed under a Biodiversity Management Plan (BMP). The Study Area totals 43.94ha (refer to Figure 1).
Subject Site	The Subject Site/development footprint covers 31.83ha, comprising approx. 0.27ha (PCT 1600) and 0.10ha (PCT 1525) of native remnant vegetation and 0.33ha of planted native vegetation. The majority of the Subject Site totalling 31.14ha consists of exotic / cleared / existing infrastructure and includes 0.17ha dam / waterbody (refer Figure 4).
LGA	Maitland City Council
Zoning	Under the <i>Maitland Local Environmental Plan 2011</i> (the LEP) (pub. 16-12-2011), the Study Area is currently zoned R1 – ‘General Residential’ and RU2 – ‘Rural Landscape’, C2 – ‘Environmental Conservation’ and C3 – ‘Environmental Management’.
Current Land Use	The Subject Site is currently used for cattle grazing with five residential homes and associated agricultural infrastructure. The Subject Site is highly managed with a few patches of remnant and planted native vegetation, and scattered trees which is in a highly degraded condition.
Surrounding Land Use	The site is bounded by: <ul style="list-style-type: none"> • Urban development to the north zoned R1 – General Residential and C3 – Environmental Management. • Wallis Creek to the east with floodplains/pastures. The zoning is a combination of RU2 – Rural Landscape and C2 – Environmental Conservation. • Testers Hollow to the south with floodplains/pasture. The zoning is a combination of RU2 – Rural Landscape and C2 – Environmental Conservation. • Cessnock Road to the west with rural properties zoned RU2 – Rural Landscape and R1 – General Residential.

Detail	Comments
Regional Vegetation	<p>Previous datasets consulted include <i>Lower Hunter Regional Vegetation Mapping 2013</i>. There was no regionally mapped land within the Subject Site with PCT 1525 and PCT 1736 identified within the Study Area refer Figure 2.</p> <p>Ground truthing of the Subject Site revealed that it consists predominately of exotic dominant grasslands cleared for pasture with non-endemic assemblages of native and exotic trees planted around the residential dwellings and roadways. There are patches of native vegetation which is associated with PCT1600 <i>Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter</i>.</p> <p>PCT 1525 <i>Sandpaper Fig - Whalebone Tree warm temperate rainforest</i> exists in the riparian zone of Wallis creek to the east of the Subject Site with some scattered tree species from this community within the Subject Site.</p>
Proposed Development	The proposal includes a residential subdivision and associated civil works.
Riparian areas	There are five farm dams located within the Subject Site and two state mapped hydrolines. One first Order Stream in the north western portion of the main allotment and the beginning of another first order stream along the northern boundary refer Figure 1 and 2 . It is noted that Wallis Creek runs along the eastern boundary of the Study Area and is partially Biodiversity Mapped Land (BV Map).

Disclaimer: While all reasonable care has been taken to ensure the information shown on this map is up to date and accurate, no guarantee is given that the information portrayed is free from error or omission. Please verify the accuracy of all information prior to use.

Legend

-  Study Area
-  Cadastre
-  Hydroline
-  Hydroarea



Note:
1. Boundaries are not survey accurate
2. Do not scale off the plan



AEP

Title: Figure 1 - Site Location

Date: June 2023

Location: 527 Cessnock Rd, Gilleston Heights NSW 2321

Client: Walker Gilleston Heights Pty Ltd

AEP ref: 2665.02

Disclaimer: While all reasonable care has been taken to ensure the information shown on this map is up to date and accurate, no guarantee is given that the information portrayed is free from error or omission. Please verify the accuracy of all information prior to use.

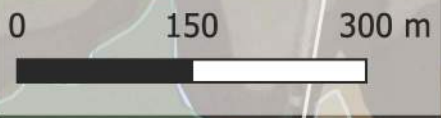


Legend

- Study Area
- Cadastre
- Hydroline
- Hydroarea

Lower Hunter Regional Vegetation

- Unidentified
- PCT 1525 Sandpaper Fig - Whalebone Tree warm temperate rainforest
- PCT 1591 Grey Gum - Rough-barked Apple shrubby open forest of the lower Hunter
- PCT 1598 Forest Red Gum grassy open forest on floodplains of the lower Hunter
- PCT 1600 Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter
- PCT 1736 Water Couch - Tall Spike Rush freshwater wetland of the Central Coast and lower Hunter



Note:
1. Boundaries are not survey accurate
2. Do not scale off the plan



AEP

Title: Figure 2 - Regional Vegetation

Date: June 2023

Location: 527 Cessnock Rd, Gilleston Heights NSW 2321

Client: Walker Gilleston Heights Pty Ltd

AEP ref: 2665.02

3.0 Methodology

Field surveys for determining the status of waterfront land occurring within the Subject Site have been prepared and performed as per the Natural Resources Access Regulator, 2020, *Waterfront Land Tool*. The tool identifies waterfront land based on three key factors:

- The presence of defined bed and banks;
- Evidence of flow and geomorphic features (whether water is present or not); and
- The presence of aquatic/riparian vegetation.

3.1 Information Sources

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

- Department of Planning, Industry and Environment (2020), Natural Resources Access Regulator Waterfront Land Tool;
- Aerial Photograph Interpretation (API) of the site using the latest Nearmap imagery (September 2022) and SixMaps and surrounding locality;
- NSW Government (2018) *Determining Stream Order* Fact Sheet;
- Water Management (General) Regulation 2018 Hydroline spatial data, accessed March 2022;
- Regional Vegetation Mapping assessed utilising Lower Hunter Vegetation Mapping 2013; and
- Collective knowledge gained from previous ecological survey and assessment in the area over the past 30 years.

3.2 Desktop Assessment

The following desktop analysis was conducted for the Subject Site:

- Stream orders were determined using the Strahler Order system via both API and *Water Management (General) Regulation 2018 Hydroline spatial data 1.0* refer **Figure 3** Desktop Stream Order;
- Regional Vegetation Mapping assessed utilising Lower Hunter Vegetation mapping 2013 was utilised to identify vegetation communities occurring within the Subject Site (refer **Figure 2**);
- Literature review of stream ordering assessment and field assessment criteria to determine accuracy of mapped hydrolines;
- Assignment of segment identification numbers to potential watercourses (Segment ID) (refer **Figure 4**); and
- Investigations for streams outside of the Subject Site will consist of roadside visual inspections and further desktop analysis.

3.3 Field Survey

Field surveys were completed in 2022 with the majority of the Riparians fieldwork undertaken in February 2023. The mapped hydrolines within the northern and western boundaries of the Subject Site were assessed in order to determine the presence of one or more of the following features: defined bed

and banks; evidence of flow and geomorphic features (whether water is present or not); and the presence of aquatic/riparian vegetation within the unnamed tributaries.

General observations outside of the Subject Site were undertaken to assess the hydrolines in the broader locality (refer **Figure 5** for survey effort).

The following data was collected to ground-truth desktop level assessments:

- Assessing each mapped hydroline to determine if defined bed and banks (including locating high bank) are present;
- Identifying what type of watercourse is present (in accordance with NRAR Guide – Watercourse types);
- Determine and notate watercourse features;
- Determine presence of any lakes or wetlands; and
- Determine and notate any changes in vegetation communities.

4.0 Riparian Assessment Results

Fieldwork was undertaken to ground-truth the stream order of the watercourses within the Subject Site and in the surrounding locality as is mapped in the New South Wales Hydroline Data Set. Desktop investigations revealed two (2) 1st order streams are mapped within the Study Area (refer **Figure 3**). Fieldwork was primarily conducted in February 2023 to ground-truth the stream order as mapped in the New South Wales Hydroline Data Set (refer **Appendix A**)

Table 2 – Assignment of survey identification numbers to potential watercourses

Task – Waterfront Land Tool (2020)	Assessment	Comments (provide evidence)	Figures
Preparation			
Prepare map allocating survey identification numbers	Yes	A desktop assessment indicated that the mapped hydrolines may have varying features representative of watercourses. Therefore, two segments were identified with eight individual targeted assessments.	4

Disclaimer: While all reasonable care has been taken to ensure the information shown on this map is up to date and accurate, no guarantee is given that the information portrayed is free from error or omission. Please verify the accuracy of all information prior to use.

Legend

-  Study Area
-  Cadastre
-  Hydroline
-  Hydroarea



Note:
1. Boundaries are not survey accurate
2. Do not scale off the plan



AEP

Title: Figure 3 - Desktop Stream Order

Date: June 2023


Location: 527 Cessnock Rd, Gilleston Heights NSW 2321

Client: Walker Gilleston Heights Pty Ltd


AEP ref: 2665.02


Disclaimer: While all reasonable care has been taken to ensure the information shown on this map is up to date and accurate, no guarantee is given that the information portrayed is free from error or omission. Please verify the accuracy of all information prior to use.

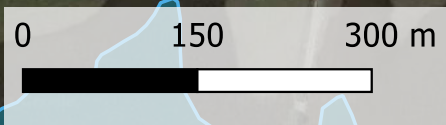
Legend

 Study Area

Study Segments

 1

 2



Note:
1. Boundaries are not survey accurate.
2. Do not scale off the plan



AEP

Title: Figure 4 - Survey Identification Number
Location: 527 Cessnock Rd Gilleston Heights 2321
Client: Walker Gilleston Heights Pty Ltd

Date: June 2023
AEP ref: 2665.02

Table 3 – Segment ID 1.1 Riparian Assessment

Task – Waterfront Land Tool (2020)	Assessment	Comments (provide evidence)	Figures
Desktop Assessment Segment ID – 1.1			
Is your property located on a watercourse, lake or estuary within the shaded area in any of the NRAR waterfront land maps? (Appendix 1- NRAR Guidelines, 2020)	No	No, the nearest mapped shaded waterfront land is the Hunter River, Newcastle, approximately 22.4km to the South East of the Subject Site.	-
Is your property within the shaded area on the <i>NRAR Map—Western land map local government area?</i> (Appendix 2- NRAR Guidelines, 2020)	No	No, the property is located in the Maitland LGA, which is excluded from the Western Land map.	-
Is there a watercourse visible on your property?	Yes	Yes, as per the desktop assessment there are two (2) mapped hydro-lines within the Study Area.	3
Is there a lake or wetland on your property or within 40 metres of the proposed work? (Appendix 3 - NRAR Guidelines, 2020—Lakes and Wetlands)	No	No wetland or lake are located on or within 40m from the site. The nearest large body of water is Louth Park wetland located 300m to the east of the Subject Site.	-
Using the <i>Determining Stream Order</i> fact sheet (Appendix 4 - NRAR Guidelines, 2020) and the NSW <i>Hydro Line Spatial Data Map</i> , what is the stream order of your watercourse?	1	Based on the desktop assessment, this hydroline is mapped as a 1 st order stream.	3
Field Assessment – Segment ID – 1.1			
Defined Bed and Banks (Yes / No)	No	-	-
Type of Watercourse: Type 1, Type 2, Type 3a, Type 3b, Type 3c, Type 4, Type 5, Type 6, Type 7, None (Refer Appendix 5 - NRAR Guidelines, 2020)	None	-	-
Watercourse Feature Present (Pool, Riffle, Erosion and Disposition, None)	No	-	-
Lakes or Wetlands (Appendix 3 - NRAR Guidelines, 2020)	No	-	-
Vegetation Present to Indicate Wetlands (Appendix 7 - NRAR Guidelines, 2020)	No	-	-
High Bank (Appendix 8 - NRAR Guidelines, 2020)	No	-	-
Ground-truthed Waterfront land Present (Y / N)	No	The inspection shows no defined bed and bank, or any watercourse features described in Appendix 6 of the Waterfront Land Tool. The 1st order stream as mapped was not observed and does not constitute waterfront land.	5
Ground-truthed Numbering to Determine VRZ	N/A	-	6
Controlled Activity Approval Required (Y / N)	No	-	-
Vegetated Riparian Zone Required (m)	N/A	-	-
Comments	No bed and banks were observed at field survey segment 1.1.		

Task – Waterfront Land Tool (2020)	Assessment	Comments (provide evidence)	Figures
		<p>Watercourse features as defined by Appendix 6 of the Waterfront Land Tool were not identified.</p> <p>It is likely this Survey Point represents an area of dam over flow during periods of heavy rain, and does not meet the definition for waterfront land.</p> <p>The mapped 1st order stream is not present within the Subject Site</p>	



late 1: Segment ID 1.1 Showing dam facing north.



Plate 2: Segment ID 1.1 Facing east across dam.

Table 4 – Segment ID 1.2 Riparian Assessment

Task – Waterfront Land Tool (2020)	Assessment	Comments (provide evidence)	Figures
Desktop Assessment Segment ID – 1.2			
Is your property located on a watercourse, lake or estuary within the shaded area in any of the NRAR waterfront land maps? (Appendix 1- NRAR Guidelines, 2020)	No	No, the nearest mapped shaded waterfront land is the Hunter River, Newcastle, approximately 22.4km to the South East of the Subject Site.	-
Is your property within the shaded area on the <i>NRAR Map—Western land map local government area?</i> (Appendix 2- NRAR Guidelines, 2020)	No	No, the property is located in the Maitland LGA, which is excluded from the Western Land map.	-
Is there a watercourse visible on your property?	Yes	Yes, as per the desktop assessment there are two (2) mapped hydro-lines within the Study Area.	3
Is there a lake or wetland on your property or within 40 metres of the proposed work? (Appendix 3 - NRAR Guidelines, 2020—Lakes and Wetlands)	No	No wetland or lake are located on or within 40m from the site.	-
Using the <i>Determining Stream Order</i> fact sheet (Appendix 4 - NRAR Guidelines, 2020) and the NSW <i>Hydro Line Spatial Data Map</i> , what is the stream order of your watercourse?	1	Based on the desktop assessment, this hydroline is mapped as a 1 st order stream.	3
Field Assessment – Segment ID – 1.2			
Defined Bed and Banks (Yes / No)	No	-	-
Type of Watercourse: Type 1, Type 2, Type 3a, Type 3b, Type 3c, Type 4, Type 5, Type 6, Type 7, None (Refer Appendix 5 - NRAR Guidelines, 2020)	None	-	-
Watercourse Feature Present (Pool, Riffle, Erosion and Disposition, None)	No	-	-
Lakes or Wetlands (Appendix 3 - NRAR Guidelines, 2020)	No	-	-
Vegetation Present to Indicate Wetlands (Appendix 7 - NRAR Guidelines, 2020)	No	-	-
High Bank (Appendix 8 - NRAR Guidelines, 2020)	No	-	-
Ground-truthed Waterfront land Present (Y / N)	No	The inspection shows no defined bed and bank, or any watercourse features described in Appendix 6 of the Waterfront Land Tool. The 1st order stream as mapped was not observed and does not constitute waterfront land.	5
Ground-truthed Numbering to Determine VRZ	N/A	-	6
Controlled Activity Approval Required (Y / N)	No	-	-
Vegetated Riparian Zone Required (m)	N/A-	-	-
Comments	Field survey segment 1.2 is located downhill (south-west) of segment 1.1 just below the farm dam. This wet area does not meet the criteria for a 1st order stream due to the lack of defined bed		

Task – Waterfront Land Tool (2020)	Assessment	Comments (provide evidence)	Figures
		<p>and banks, lack of riparian/ aquatic vegetation and no visible high bank. The vegetation is greener due to the convergence of overland flow in between landscape undulations.</p> <p>Watercourse features as defined by Appendix 6 of the Waterfront Land Tool were not identified.</p> <p>The mapped 1st order stream is not present within the Subject Site.</p>	



Plate 3 Segment ID 1.2 (left) facing SW



Plate 4: Segment ID 1.2 (right) facing NE. The dam wall can be seen.

Table 5 – Segment ID 1.3 Riparian Assessment

Task – Waterfront Land Tool (2020)	Assessment	Comments (provide evidence)	Figures
Desktop Assessment Segment ID – 1.3			
Is your property located on a watercourse, lake or estuary within the shaded area in any of the NRAR waterfront land maps? (Appendix 1- NRAR Guidelines, 2020)	No	No, the nearest mapped shaded waterfront land is the Hunter River, Newcastle, approximately 22.4km to the South East of the Subject Site.	-
Is your property within the shaded area on the <i>NRAR Map—Western land map local government area?</i> (Appendix 2- NRAR Guidelines, 2020)	No	No, the property is located in the Maitland LGA, which is excluded from the Western Land map.	-
Is there a watercourse visible on your property?	Yes	Yes, as per the desktop assessment there are two (2) mapped hydro-lines within the Study Area.	3
Is there a lake or wetland on your property or within 40 metres of the proposed work? (Appendix 3 - NRAR Guidelines, 2020—Lakes and Wetlands)	No	No wetland or lake are located on or within 40m from the site.	-
Using the <i>Determining Stream Order</i> fact sheet (Appendix 4 - NRAR Guidelines, 2020) and the NSW <i>Hydro Line Spatial Data Map</i> , what is the stream order of your watercourse?	1	Based on the desktop assessment, this hydroline is mapped as a 1 st order stream.	3
Field Assessment – Segment ID – 1.3			
Defined Bed and Banks (Yes / No)	No	-	-
Type of Watercourse: Type 1, Type 2, Type 3a, Type 3b, Type 3c, Type 4, Type 5, Type 6, Type 7, None (Refer Appendix 5 - NRAR Guidelines, 2020)	None	-	-
Watercourse Feature Present (Pool, Riffle, Erosion and Disposition, None)	No	-	-
Lakes or Wetlands (Appendix 3 - NRAR Guidelines, 2020)	No	-	-
Vegetation Present to Indicate Wetlands (Appendix 7 - NRAR Guidelines, 2020)	No	-	-
High Bank (Appendix 8 - NRAR Guidelines, 2020)	No	-	-
Ground-truthed Waterfront land Present (Y / N)	No	The inspection shows no defined bed and bank, or any watercourse features described in Appendix 6 of the Waterfront Land Tool. The 1st order stream as mapped was not observed and does not constitute waterfront land.	6
Ground-truthed Numbering to Determine VRZ	N/A	-	-
Controlled Activity Approval Required (Y / N)	No	-	-
Vegetated Riparian Zone Required (m)	No	-	-
Comments	Field survey segment 1.3 is located further downhill (south-west) along field survey segment 1. This wet area does not meet the		



Task – Waterfront Land Tool (2020)	Assessment	Comments (provide evidence)	Figures
		<p>criteria for a 1st order stream due to the lack of defined bed and banks, lack of riparian/ aquatic vegetation and lack of water.</p> <p>Watercourse features as defined by Appendix 6 of the Waterfront Land Tool were not identified.</p> <p>The mapped 1st order stream is not present within the Subject Site.</p>	
<div style="display: flex; justify-content: space-around;"> <div style="text-align: center;">  <p>Plate 5: Segment ID 1.3 facing NE.</p> </div> <div style="text-align: center;">  <p>Plate 6: Segment ID 1.3 facing NE.</p> </div> </div>			

Table 6– Segment ID 1.4 Riparian Assessment

Task – Waterfront Land Tool (2020)	Assessment	Comments (provide evidence)	Figures
Desktop Assessment– Segment ID – 1.4			
Is your property located on a watercourse, lake or estuary within the shaded area in any of the NRAR waterfront land maps? (Appendix 1- NRAR Guidelines, 2020)	No	No, the nearest mapped shaded waterfront land is the Hunter River, Newcastle, approximately 22.4km to the South East of the Subject Site.	-
Is your property within the shaded area on the <i>NRAR Map—Western land map local government area?</i> (Appendix 2 - NRAR Guidelines, 2020)	No	No, the property is located in the Maitland LGA, which is excluded from the Western Land map.	-
Is there a watercourse visible on your property?	Yes	Yes, as per the desktop assessment there are two (2) mapped hydro-lines within the Study Area.	3
Is there a lake or wetland on your property or within 40 metres of the proposed work? (Appendix 3 - NRAR - NRAR Guidelines, 2020)—Lakes and wetlands)	No	No wetland or lake are located on or within 40m from the site.	-
Using the <i>Determining Stream Order</i> fact sheet (Appendix 4 - NRAR Guidelines, 2020) and the <i>NSW Hydro Line Spatial Data Map</i> , what is the stream order of your watercourse?	1	Based on the desktop assessment, this hydroline is mapped as a 1 st order stream.	3
Field Assessment – Segment ID – 1.4			
Defined Bed and Banks (Yes / No)	No	-	-
Type of Watercourse: Type 1, Type 2, Type 3a, Type 3b, Type 3c, Type 4, Type 5, Type 6, Type 7, None (Refer Appendix 5 - NRAR Guidelines, 2020)	None	-	-
Watercourse Feature Present (Pool, Riffle, Erosion and Disposition, None)	No	-	-
Lakes or Wetlands (Appendix 3 - NRAR Guidelines, 2020)	No	-	-
Vegetation Present to Indicate Wetlands (Appendix 7 - NRAR Guidelines, 2020)	No	-	-
High Bank (Appendix 8 - NRAR Guidelines, 2020)	No	-	-
Ground-truthed Waterfront land Present (Y / N)	No	The inspection shows no defined bed and bank, or any watercourse features described in Appendix 6 of the Waterfront Land Tool. The 1st order stream as mapped was not observed and does not constitute waterfront land.	6
Ground-truthed Numbering to Determine VRZ	N/A	-	-
Controlled Activity Approval Required (Y / N)	No	-	-
Vegetated Riparian Zone Required (m)	No	-	-
Comments	Field survey segment 1.4, does not meet the criteria for a 1 st order stream due to the lack of defined bed and banks, lack of		

	<p>riparian vegetation and no water present in spite of recent rain before time of survey.</p> <p>Watercourse features as defined by Appendix 6 of the Waterfront Land Tool were not identified.</p> <p>The mapped 1st order stream is not present within the Subject Site.</p>
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Plate 7: Segment ID 1.4 facing NE.



Plate 8: Segment ID 1.4

Table 7 – Segment ID 1.5 Riparian Assessment

Desktop Assessment – Segment ID – 1.5			
Is your property located on a watercourse, lake or estuary within the shaded area in any of the NRAR waterfront land maps? (Appendix 1- NRAR Guidelines, 2020)	No	No, the nearest mapped shaded waterfront land is the Hunter River, Newcastle, approximately 22.4km to the South East of the Subject Site.	-
Is your property within the shaded area on the <i>NRAR Map—Western land map local government area?</i> (Appendix 2- NRAR Guidelines, 2020)	No	No, the property is located in the Maitland LGA, which is excluded from the Western Land map.	-
Is there a watercourse visible on your property?	Yes	Yes, as per the desktop assessment there are two (2) mapped hydro-lines within the Study Area.	3
Is there a lake or wetland on your property or within 40 metres of the proposed work? (Appendix 3 - NRAR Guidelines, 2020—Lakes and Wetlands)	No	No wetland or lake are located on or within 40m from the site.	-
Using the <i>Determining Stream Order</i> fact sheet (Appendix 4 - NRAR Guidelines, 2020) and the <i>NSW Hydro Line Spatial Data Map</i> , what is the stream order of your watercourse?	1	Based on the desktop assessment, this hydroline is mapped as a 1 st order stream.	3
Field Assessment – Segment ID – 1.5			
Define Bed and Banks (Yes / No)	No	-	-
Type of Watercourse: Type 1, Type 2, Type 3a, Type 3b, Type 3c, Type 4, Type 5, Type 6, Type 7, None (Appendix 5 - NRAR Guidelines, 2020)	None	-	-
Watercourse Feature Present (Pool, Riffle, Erosion and Disposition, None)	No	-	-
Lakes or Wetlands (Appendix 3 - NRAR Guidelines, 2020)	No	-	-
Vegetation Present to indicate Wetlands (Appendix 7 - NRAR Guidelines, 2020)	No	-	-
High Bank (Appendix 8 - NRAR Guidelines, 2020)	No	-	-
Ground-truthed Waterfront land Present (Y / N)	No	The inspection shows no defined bed and bank, or any watercourse features described in Appendix 6 of the Waterfront Land Tool. The 1st order stream as mapped was not observed and does not constitute waterfront land.	6
Ground-truthed Numbering to Determine VRZ	N/A	-	-
Controlled Activity Approval Required (Y / N)	No	-	-
Vegetated Riparian Zone Required (m)	No	-	-
Comments	<p>Field survey segment 1.5, does not meet the criteria for a 1st order stream due to the lack of defined bed and banks, lack of riparian/ aquatic vegetation and lack of water.</p> <p>Watercourse features as defined by Appendix 6 of the Waterfront Land Tool were not identified.</p> <p>The mapped 1st order stream is not present within the Subject Site.</p>		



Plate 9: Segment ID 1.5 facing NE, the lower dam can be seen.



Plate 10: Segment ID 1.5 facing SE.

Table 8 – Segment ID 1.6 Riparian Assessment

Desktop Assessment – Segment ID – 1.6			
Is your property located on a watercourse, lake or estuary within the shaded area in any of the NRAR waterfront land maps? (Appendix 1- NRAR Guidelines, 2020)	No	No, the nearest mapped shaded waterfront land is the Hunter River, Newcastle, approximately 22.4km to the South East of the Subject Site.	-
Is your property within the shaded area on the <i>NRAR Map—Western land map local government area?</i> (Appendix 2- NRAR Guidelines, 2020)	No	No, the property is located in the Maitland LGA, which is excluded from the Western Land map.	-
Is there a watercourse visible on your property?	Yes	Yes, as per the desktop assessment there are two (2) mapped hydro-lines within the Study Area.	3
Is there a lake or wetland on your property or within 40 metres of the proposed work? (Appendix 3 - NRAR Guidelines, 2020—Lakes and Wetlands)	No	No wetland or lake are located on or within 40m from the site.	-
Using the <i>Determining Stream Order</i> fact sheet (Appendix 4 - NRAR Guidelines, 2020) and the <i>NSW Hydro Line Spatial Data Map</i> , what is the stream order of your watercourse?	1	Based on the desktop assessment, this hydroline is mapped as a 1 st order stream.	3
Field Assessment – Segment ID – 1.6			
Define Bed and Banks (Yes / No)	No	-	-
Type of Watercourse: Type 1, Type 2, Type 3a, Type 3b, Type 3c, Type 4, Type 5, Type 6, Type 7, None (Appendix 5 - NRAR Guidelines, 2020)	None	-	-
Watercourse Feature Present (Pool, Riffle, Erosion and Disposition, None)	No	-	-
Lakes or Wetlands (Appendix 3 - NRAR Guidelines, 2020)	No	-	-
Vegetation Present to indicate Wetlands (Appendix 7 - NRAR Guidelines, 2020)	No	-	-
High Bank (Appendix 8 - NRAR Guidelines, 2020)	No	-	-
Ground-truthed Waterfront land Present (Y / N)	No	The inspection shows no defined bed and bank, or any watercourse features described in Appendix 6 of the Waterfront Land Tool. The 1st order stream as mapped was not observed and does not constitute waterfront land.	6
Ground-truthed Numbering to Determine VRZ	N/A	-	-
Controlled Activity Approval Required (Y / N)	No	-	-
Vegetated Riparian Zone Required (m)	No	-	-
Comments	A farm dam is located at field survey segment 1.6. A gully to the south east channels overland flow during heavy rainfall into the dam, however, no defined bad and banks are visible, or any		

	<p>watercourse features as defined by Appendix 6 of the Waterfront Land Tool.</p> <p>Watercourse features as defined by Appendix 6 of the Waterfront Land Tool were not identified.</p> <p>The mapped 1st order stream is not present within the Subject Site.</p>
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Plate 11: Segment ID 1.6 facing NE



Plate 12: Segment ID 1.6 facing SE

Table 9 – Segment ID 1.7 Riparian Assessment

Desktop Assessment – Segment ID – 1.7			
Is your property located on a watercourse, lake or estuary within the shaded area in any of the NRAR waterfront land maps? (Appendix 1- NRAR Guidelines, 2020)	No	No, the nearest mapped shaded waterfront land is the Hunter River, Newcastle, approximately 22.4km to the South East of the Subject Site.	-
Is your property within the shaded area on the <i>NRAR Map—Western land map local government area?</i> (Appendix 2- NRAR Guidelines, 2020)	No	No, the property is located in the Maitland LGA, which is excluded from the Western Land map.	-
Is there a watercourse visible on your property?	Yes	Yes, as per the desktop assessment there are two (2) mapped hydro-lines within the Study Area.	3
Is there a lake or wetland on your property or within 40 metres of the proposed work? (Appendix 3 - NRAR Guidelines, 2020—Lakes and Wetlands)	No	No wetland or lake are located on or within 40m from the site.	-
Using the <i>Determining Stream Order</i> fact sheet (Appendix 4 - NRAR Guidelines, 2020) and the NSW <i>Hydro Line Spatial Data Map</i> , what is the stream order of your watercourse?	1	Based on the desktop assessment, this hydroline is mapped as a 1 st order stream.	3
Field Assessment – Segment ID – 1.7			
Define Bed and Banks (Yes / No)	No	-	-
Type of Watercourse: Type 1, Type 2, Type 3a, Type 3b, Type 3c, Type 4, Type 5, Type 6, Type 7, None (Appendix 5 - NRAR Guidelines, 2020)	None	-	-
Watercourse Feature Present (Pool, Riffle, Erosion and Disposition, None)	No	-	-
Lakes or Wetlands (Appendix 3 - NRAR Guidelines, 2020)	No	-	-
Vegetation Present to indicate Wetlands (Appendix 7 - NRAR Guidelines, 2020)	No	-	-
High Bank (Appendix 8 - NRAR Guidelines, 2020)	No	-	-
Ground-truthed Waterfront land Present (Y / N)	No	Field survey segment 1.7 is associated with low depressions in the landscape formed to allow for the water movement through culverts under the road. The inspection shows no defined bed and bank, or any watercourse features described in Appendix 6 of the Waterfront Land Tool. The 1st order stream as mapped was not observed and does not constitute waterfront land.	6
Ground-truthed Numbering to Determine VRZ	N/A	-	-
Controlled Activity Approval Required (Y / N)	No	-	-
Vegetated Riparian Zone Required (m)	No	-	-

<p>Comments</p>	<p>Field survey segment 1.7, does not meet the criteria for a 1st order stream due to the lack of defined bed and banks, lack of riparian/aquatic vegetation. At the time of survey there was water present from recent rain but it was clear that it would diminish within a relatively short time frame.</p> <p>Watercourse features as defined by Appendix 6 of the Waterfront Land Tool were not identified.</p> <p>The mapped 1st order stream is not present within the Subject Site.</p>
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Plate 13: Left Segment ID 1.7 Culvert showing no defined bed or bank along eastern side of Cessnock Rd facing west.



Plate 14: Right Segment ID 1.7 (right) Culvert on western downstream side of Cessnock Rd.

Table 10 – Segment ID 2.1 Riparian Assessment

Task – Waterfront Land Tool (2020)	Assessment	Comments (provide evidence)	Figures
Desktop Assessment Segment ID – 2.1			
Is your property located on a watercourse, lake or estuary within the shaded area in any of the NRAR waterfront land maps? (Appendix 1- NRAR Guidelines, 2020)	No	No, the nearest mapped shaded waterfront land is the Hunter River, Newcastle, approximately 22.4km to the South East of the Subject Site.	-
Is your property within the shaded area on the <i>NRAR Map—Western land map local government area</i> ? (Appendix 2- NRAR Guidelines, 2020)	No	No, the property is located in the Maitland LGA, which is excluded from the Western Land map.	-
Is there a watercourse visible on your property?	Yes	Yes, as per the desktop assessment there are two (2) mapped hydro-lines within the Study Area.	3
Is there a lake or wetland on your property or within 40 metres of the proposed work? (Appendix 3 - NRAR Guidelines, 2020—Lakes and Wetlands)	No	No wetland or lake are located on or within 40m from the site.	-
Using the <i>Determining Stream Order</i> fact sheet (Appendix 4 - NRAR Guidelines, 2020) and the <i>NSW Hydro Line Spatial Data Map</i> , what is the stream order of your watercourse?	No	Based on the desktop assessment, this hydroline is mapped as a 1 st order stream.	3
Field Assessment – Segment ID – 2.1			
Defined Bed and Banks (Yes / No)	Yes	Bed and banks visible and present.	-
Type of Watercourse: Type 1, Type 2, Type 3a, Type 3b, Type 3c, Type 4, Type 5, Type 6, Type 7, None (Refer Appendix 5 - NRAR Guidelines, 2020)	None	Type 1 – Confined Valley Headwater	-
Watercourse Feature Present (Pool, Riffle, Erosion and Disposition, None)	No	Erosion	-
Lakes or Wetlands (Appendix 3 - NRAR Guidelines, 2020)	No	-	-
Vegetation Present to Indicate Wetlands (Appendix 7 - NRAR Guidelines, 2020)	No	-	-
High Bank (Appendix 8 - NRAR Guidelines, 2020)	Yes	-	5
Ground-truthed Waterfront land Present (Y / N)	Yes	This location represents the beginning of a 1 st order watercourse.	6
Ground-truthed Numbering to Determine VRZ	1	As per Appendix 4 of the Waterfront Land Tool, Segment ID 2 has been determined to be commensurate with a 1 st order stream for the purposes of defining the associated VRZ.	6
Controlled Activity Approval Required (Y / N)	Yes	The watercourse begins approx. 15m to the north of the boundary of Lot 2 DP 601226 and within Lot 2 DP1230739 and the proposed development will encroach and require a CAA.	-
Vegetated Riparian Zone Required (m)	Yes	10m from top of bank.	-

Task – Waterfront Land Tool (2020)	Assessment	Comments (provide evidence)	Figures
Comments		<p>Field survey segment 2.1 is located on the northern boundary of the Subject Site. From the south overland flow converges down steep paddock grassland transitioning to a thick patch of non-native shrubs. A defined bed and bank are visible within the vegetation approximately 15m to the north of the boundary of Lot 2 DP601226 and within Lot 2 DP1230739. Additionally, an outlet pipe discharges water at the boundary, artificially contributing to the watercourse.</p> <p>Watercourse features as defined by Appendix 6 of the Waterfront Land Tool were identified in this location.</p> <p>Ground-truthing of the NSW Hydroline spatial data identified the mapped 1st order stream is present within the Subject Site within Lot 2 DP1230739. The proposed VRZ for this first order stream is 10m and as works will occur within 40m of waterfront land, a Controlled Activity Approval will be required to accompany this development application.</p>	



Plate 15: Segment ID 2.1 downstream

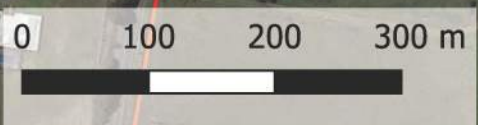



Plate 16: Segment ID 2.1 upstream

Disclaimer: While all reasonable care has been taken to ensure the information shown on this map is up to date and accurate, no guarantee is given that the information portrayed is free from error or omission. Please verify the accuracy of all information prior to use.

Legend

- Study Area
- NSW Hydroline Spatial Data
- Ground-truthed Hydroline
- Field Survey Segment



Note:
1. Boundaries are not survey accurate
2. Do not scale off the plan







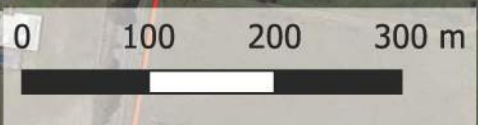
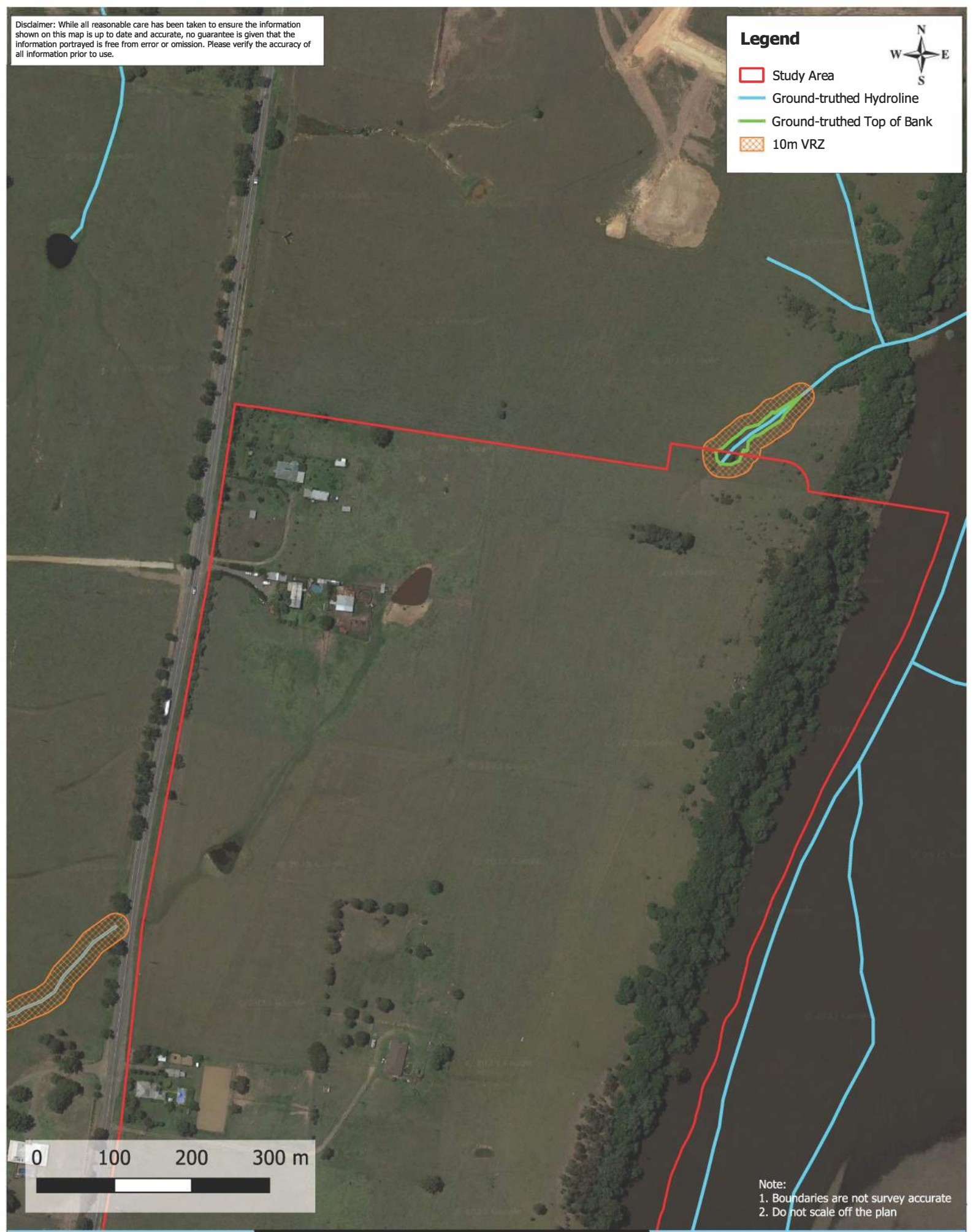
AEP

Figure 5 - Survey Effort Date: June 2023
Location: 527 Cessnock Rd, Gilleston Heights NSW 2321
Client: Walker Gilleston Heights Pty Ltd AEP ref: 2665.02

Disclaimer: While all reasonable care has been taken to ensure the information shown on this map is up to date and accurate, no guarantee is given that the information portrayed is free from error or omission. Please verify the accuracy of all information prior to use.

Legend

-  Study Area
-  Ground-truthed Hydroline
-  Ground-truthed Top of Bank
-  10m VRZ



Note:
1. Boundaries are not survey accurate
2. Do not scale off the plan



AEP

Title: Figure 5 - Ground-Truthed VRZ

Date: June 2023

Location: 527 Cessnock Rd, Gilleston Heights NSW 2321

Client: Walker Gilleston Heights Pty Ltd

AEP ref: 2665.02

5.0 Summary of Investigation

Desktop surveys indicated the presence of two (2) 1st order hydrolines across the Subject Site. However, field surveys identified a lack of watercourse features in Segment ID 1. This segment predominately represents minor gullies within the undulating landscape where a confluence of overland flow converges from surrounding flat paddocks and pastoral land. As a result, at the time of field surveys and ground-truthing of state mapped hydrolines there was no Watercourse features present as defined by Appendix 6 of the Waterfront Land Tool along Segment ID 1.

The desktop and field surveys have shown that Segment ID 2 constitutes a Type 1 – Confined Valley Headwater. At the time of field surveys no additional tributaries were identified connected to this segment. Therefore this segment was assigned ground-truthed numbering 1 for the purposes of defining the Vegetation Riparian Zone (VRZ). Segment ID 2 requires a VRZ of 10m either side of the ground truthed high banks, as defined in **Table 11**.

Table 11 – Riparian Corridor Matrix

Type	VRZ width (each side of WC)	Total RC width	Cycleways and pathways	Detention basins		Stormwater outlet structures and essential services	Stream realignment	Road crossings		
				Only within 50% outer VRZ	Online			Any	Culvert	Bridge
1 st order	10m	20m + channel width	Yes	Yes	Yes	Yes	Yes	-	-	
2 nd order	20m	40m + channel width	Yes	Yes	Yes	Yes	-	Yes	-	
3 rd order	30m	60m + channel width	Yes	Yes	-	Yes	-	-	Yes	Yes
4 th order or greater	40m	80m + channel width	Yes	Yes	-	Yes	-	-	Yes	Yes

Note: Where a watercourse (WC) does not exhibit the features of a defined channel with bed and banks, the NRAR may determine that the watercourse is not waterfront land for the purpose of the WM Act.

The DPE (Water) administers the 2000 WM Act and is required to assess activities carried out on waterfront land. Waterfront land includes the bed and bank of any river, lake or estuary and all land within 40 meters of the highest bank of the river, lake or estuary. Certain activities within this land is defined as a ‘controlled activity’ and requires approval from the Office of Water.

One (1) unnamed first order mapped hydroline is located within the Subject Site. Site investigations indicate that the closest top of bank stream measurement is **within 10m** of the Subject Site and as such a VRZ encroachment is applicable with offsets required that can be included within the BMP Lands within the Study Area. A Controlled Activity Approval (CAA) will be required to be submitted with the Development Application as works will occur within 40m of Waterfront Land.

It should be noted that the applicable 40m VRZ for Wallace Creek that is a 5th order stream encroaches the BMP Lands (refer **Table 12**), however as this area is not being impacted by the development no further consideration is required.

Table 12 - VRZ Wallace Creek

40m VRZ that encroaches BMP lands (indicated in brown) that lies outside of the Subject Site.



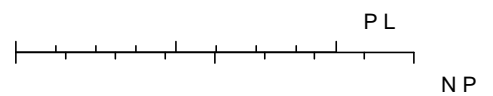
6.0 References

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- Department of Primary Industries Office of Water (2018) Guideline for Riparian Corridors on Waterfront Lands, https://www.industry.nsw.gov.au/_data/assets/pdf_file/0003/160464/licensing_approvals_controlled_activities_riparian_corridors.pdf, accessed April 2023.
- NSW Government (2018) Determining Stream Order Fact Sheet; https://www.industry.nsw.gov.au/_data/assets/pdf_file/0020/172091/Determining-Strahler-stream-order-fact-sheet.pdf accessed April 2023.
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- NSW Government (2022) SEED Portal Geocortex Viewer. Accessed April 2023.
- New South Wales Office of Water (2012) Controlled activities on waterfront land - Guidelines for riparian corridors on waterfront land. Department of Primary Industries.
- Strahler, A.N. (1952) Dynamic basis of geomorphology. Geological society of America bulletin, 63(9), pp.923-938.
- Water Management (General) Regulation 2018, NSW Government (2018), Current version for 29 April 2022, Schedule 2 Stream order of a watercourse <https://legislation.nsw.gov.au/view/html/inforce/current/sl-2018-0480#sch.2> accessed April 2023.

Appendix A – NRAR Hydroline Spatial Data



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Appendix B – Author CVs

Brendon Young

Curriculum Vitae

Brendon works with AEP in the role of Ecologist. He graduated with a Bachelor of Applied Science (Honours) and a Masters in Environmental Management, majoring in fish conservation and management. Brendon has previously worked in large retail operations in staff and budget/data management, reporting and quality assurance which adds to the experience that he currently contributes to the AEP team.

Qualifications

- CPR and First Aid (Completed on 30/11/21)
- White Card (Completed on 11/02/22)

Further Education & Training

- Master of Environmental Management (Natural Resources)
- Graduate Certificate of Fish Conservation and Management (Charles Sturt University)
- Bachelor of Applied Science (Fisheries) with Honours

Fields of Competence

- Training with aquatic sampling techniques such as seine nets, gill nets and fyke nets.
- Training in the use of mist netting, bat harp traps, Elliot traps, pitfall traps and camera traps.
- Experience identifying fish, reptiles, insects, and plants to species level through honours research and other projects while studying.

Relevant Employment History

2022 – Present

Ecologist

Anderson Environment & Planning, Newcastle

2013-2022

Department Manager

Woolworths Pty Ltd

Provision of leadership and coaching for a team of 5 to 20 members. Coach and guide daily activities to a high standard and achieve key performance indicators. Manage wage, sales, and wastage budgets. Plan for periodical events and long-term direction of the department.

March 2019-Oct 2019

Produce Quality Control Officer

Woolworths Pty Ltd

Inspection of produce as it arrives at the warehouse to ensure the required specifications for quality, size, weight and ripeness were met. Rejection of stock that did not meet company specification.

BYRON DE JAGER

Curriculum Vitae

Byron works with AEP in the role of Ecologist has a Bachelor of Science, majoring in Natural Resource Management. Byron has experience in a variety of environmental work, in a professional and volunteer capacity, including flora, and field surveys, reporting and mapping, habitat restoration and community volunteering.

Qualifications

- Certificate III Conservation and Land Management, Ryde TAFE 2017
- Bachelor of Science, Sustainable Resource Management (GPA 5.1)

University of Newcastle

Relevant courses: Australian Flora, Restoration Ecology, Land Management, Catchment and Water Resource Management, Environmental Legislation. 2011-2015

Further Education & Training

- Certificate II in Public Safety, through State Emergency Service (SES)
- Leadership fundamentals, SES
- Storm and Water Damage Operations, SES
- AQF3 Chemical user Certificate
- Chainsaw use statement of attainment: Feel small trees. Trim and cut felled trees
- First Aid Certificate, SES
- C-class Driver's License
- Cert IV Digital Media
- Cert II Office Applications for the Office TAFE Northern Sydney Institute

Relevant Employment History

October 2022- Present

Ecologist

Anderson Environmental & Planning, Newcastle

October 2019-present

Supervisor; Bush Regenerator

Toolijooa Hunter Valley Special Projects Division
Supervisor

Mar – May 2014

Bushcare, Blackwall Mountain Landcare

Relevant Ecological Experience

Oct- Dec 2015

Trees in Newcastle, Environmental Sector Placement

- Researched more water and power efficient irrigation specifically suitable to upgrading the nursery.
- Created a guide to help improve the existing system and installing the most efficient system possible in the new site including budget information
- Wrote a five-page report and presented findings to the Board

Jun – Sept 2014

Research assistant, Kooragang Island.

- Assisted PhD Student with collecting data on frogs at night.
- Collected and identified frog species with careful hygiene and consideration to prevent transfer of pathogens
- Marked location using GPS releasing the frogs in the same place after tagging.

Jun- Aug 2016

Hunter Water; Catchment Management department

- Database management including data entry, graphing and interpretation
- Imported Data from Lab Data program to Excel
- Explore and interpret data using Excel using graphs tables and formulas
- Updated procedures to latest format and information.
- WH & Safety induction including appropriate PPE, Take 5, incident reporting
- Water sample collecting from various sites around the catchment including drinking water in various locations in the catchment, supply test points and wastewater areas affected by high volumes of stormwater
- Introduction to water supply network including catchments, pumping stations, drinking treatment plants, reservoirs, wastewater treatment plants and recycling or disposal systems
- Learned to navigate and understand GIS data regarding the network

Kelly Drysdale

Curriculum Vitae

Kelly works with AEP in the role of Ecology Project Manager. She has extensive experience in various land management operations in several regions, with both small and large enterprises, in Australia and internationally. Her strong environmental stewardship knowledge, lateral thinking, project and change management, business development, strategic planning and human resource management skills are adding value to the AEP team.

Qualifications

- Certificate IV in Training and Assessment TAE40110, TAFE Hunter Institute, NSW 2016
- Graduate Certificate in Business Administration (with honours), Newcastle University, Newcastle, NSW 2013
- Associate Diploma of Applied Science (VITICULTURE), Charles Sturt University, Wagga Wagga, NSW 1992

Further Education & Training

- Australian Rural Leadership Foundation Program, Fellow 2011
- Class C NSW Drivers Licence Class, Defensive Driving, FL & experienced 4WD operator
- First Aid Certificate inc CPR 2021
- SafeWork NSW Construction White Card CGI1713214SEQ01
- Farm Chemical User Accreditation Certificate III (ChemCert Australia)
- Negotiation skills (Rogen International), Crucial conversations (ME Consulting)
- Media Training (Doyle Media Services)
- Various WHS management training, legislation and compliance courses, EEO, cultural competency and diversity in the workplace
- Workplace Trainer and Workplace Assessor
- Open Water PADI Dive Certificate

Fields of Competence

- Field assessment including: targeted fauna and flora surveys, BAM plots, Koala Spot Assessment Technique (SAT) surveys, tree surveys, HBT and nest box inspections.
- 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, State Environmental Planning Policy Biodiversity and Conservation) 2021 – Chapter 4 Koala Habitat Protection 2021, State Environmental Planning Policy (Resilience and Hazards) 2021 – Chapter 2 Coastal Management, Water Management Act 2000 and the Environment Protection and Biodiversity Conservation Act 1999
- Bushfire threat analysis and reporting
- Liaison with clients/site/company/government representatives

Relevant Employment History

Feb 2021- Current Ecology Project Manager- Anderson Environment & Planning, Newcastle, NSW

Assisting 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.

Aug 2019 - July 2021 Business Development Manager - RLF

Business development and strategic targeting of corporate and larger enterprises leveraging a vast network of contacts in the Australian Wine Industry and Agricultural sector to add value to farming systems with agronomic and fertiliser solutions.

Jul 2015 - Aug 2019 Viticultural & Trade Resource Manager- Hope Estate, Pokolbin, NSW

Operational and strategic management of five estate owned vineyards in NSW, WA & VIC. CRM & BDM of wine and beer portfolio of on/off premise sales on >1,800 customer base with PR responsibilities and hosting of events.

Jul 2017 - Aug 2019 Casual teacher in Viticulture & Wine - Kurri Kurri Tafe NSW

Revising, formulating and developing resources for and delivering all units of competency in the AHC51516 Diploma of Viticulture and strengthening relationships within the Hunter wine region.

Jul 2014 – July 2015 Sales Acquisition Agent – Wine Selectors & Choice, NSW

Wine appraisals, wine sales, developing staff training manuals, exceeding sales targets.

Jan 2004 - May 2010 Viticultural Manager – Casella Family Brands, Yenda NSW

Primarily responsible for the effective and efficient viticultural, land management operations and programs reporting to the company directors on 1,800ha with up to 160 staff. Primarily viticulture but also managed a large prune/plum orchard, broad acre cropping-dry and pivot, cattle, biodiversity tree planting program, compost making, winery waste water treatment plant and traded water.

June 2002 - Jan 2004 Viticulturist - Brown Brothers, Milawa VIC

Grower liaison for 84 growers and 5 diverse company owned vineyards; strategic plan development, asset assessments and evaluations.

June 2001 - June 2002 One-year overseas travel - study/work tour

Studied wine and agricultural markets in Asia and London, travelled through Italy, Switzerland and Spain's wine regions and worked vintage periods in Portugal, France and mostly in South Africa- Flagstone Wines, Cape Town, sourcing fruit from 48 vineyards across the Western Cape.

May 2000 - June 2001 Viticultural Projects Manager – Nepenthe, Adelaide Hills

Viticultural consultancy, contract management, development and management of investment projects, costing systems, reporting and management protocols.

Jan 1998 - May 2000
SA

General Manager – Pertaringa Wines, McLaren Vale,

Strategic operational and financial planning for company land portfolio and brand development, including contract management for clients and winery liaison with 15 customer wineries.

Dec 1992 - Jan 1998

Viticulturist –Southcorp Wines, SA

Grower Liaison in McLaren Vale, Technical Officer in Barossa/Clare/Adelaide Hills and Riverland, Greenfield Vineyard Development in Barooga and Robe, and Vine Propagation Manager for the group successively.

1993 - Vintages

Cellar hand - Murphy-Goode Estate Winery- Alexander Valley, California USA and Willamette Valley Vineyards- Willamette Valley, Oregon USA and CSUR, Wagga Wagga, NSW

SIMON PURCELL

Curriculum Vitae

Simon works with AEP in the role of Senior Ecologist. Simon has over 7 years of professional experience managing projects in the fields of terrestrial ecology, mining and mine rehabilitation and environmental management.

Qualifications

- Bachelor of Applied Science, Major Wildlife Science, University of Queensland Gatton 2013
- Certificate III in Animal Care and Management, Companion Animal Services (2008)

Further Education & Training

- NSW Class C Driver's Licence

Fields of Competence

- Terrestrial Ecology field survey, covering terrestrial flora and fauna
- Project Management

Relevant Employment History

2020 (November) -present Senior Ecologist

Anderson Environment & Planning, Newcastle

- Currently employed by Anderson Environment & Planning 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

Team Leader / Ecologist

Ecotone Flora Fauna Consultants, Weipa, QLD

- Conducted client liaison meetings, providing ecological advice and recommendations for flora, fauna and land management, complying with Queensland state and Commonwealth environmental legislation.
- Wrote proposal and executed surveys for Prefeasibility studies and EIS on Western Cape York for multi-national mining company complying with Commonwealth environmental legislation.
- Negotiated increases to budget and survey requirements with the client in relation to ongoing changes and project requirements
- Led high level discussions with the client to provide new services.
- Developed wide scale camera monitoring program to assess presence /absence of EVNT fauna within the survey site.
- Complex logistical planning for remote work
- Co-developed and implemented new safety system within the business

- Mentored project managers through training, and leadership guidance to ensure quality and standards of business were met
- Managed human relation matters within the business
- Digitally transformed infield data collection through roll out of ArcGIS Collector, leading to the reduction in the use of paper in the field.

2014-2018

Team Leader / Ecologist

Ecotone Flora Fauna Consultants, Weipa, QLD

- Lead project manager (6 years) for all aspects of mine / drill preclearing environmental surveys across three different mine sites and exploratory sites, including during the construction phase of a new mine in the Weipa region.
- Project managed and participated in numerous annual EVNT projects that led to cultural and process practices changing within a multinational mining company.
- Played a critical role in maintaining client and stakeholder relationships and built stability with onsite leadership to further grow business opportunities.
- Maintained client confidentiality on sensitive and impactful projects.
- Ensured all projects complied with Queensland state and Commonwealth environmental legislation and clients Environmental Authority.
- Assisted in the development of growth and innovation projects such as cloud-based document storage solution to support multi-site users.

2013-2014

Field Technician / Ecologist

Ecotone Flora Fauna Consultants, Weipa, QLD

- Pre-clear flora and fauna mining and drilling programs
- Baseline fauna surveys of future mining areas
- Sensitive vegetation ground truthing
- EVNT flora and fauna surveys
- Seed Processing (storing, drying management of inventory)
- Mixing of seed in preparation for annual rehabilitation season

2010-2012

Mine Operator and Trainer

Rio Tinto, Weipa, QLD

- Acted as Crew Leader to manage 30 mine operators, production targets and minimising environmental impacts
- Skilled Caterpillar 992G, 993K & Komatsu WA900 Loader and 776D, 777F and 785C Caterpillar haul truck operator
- Crew Trainer/Assessor - completed five certificate IV modules to Training and Assessing.

2009 - 2010

Parks and Garden Maintainer

Spotless Group, Weipa, QLD

- Attained six competencies towards Certificate III Forest Growing and Management.
- Maintained local green spaces and houses.

2009-2009

Vet Nurse

Tableland Veterinary Service, Weipa, QLD

- Prepared surgery for surgeries including use of autoclave to sterilise implements
- Administered sedation via injections in the muscle and intravenously
- Prepared and monitored animals before, during and after surgeries
- Monitored animal and anaesthetic during surgery focussing on breath rate, colour of gum and pupil movements
- Took blood samples from veins and prepared samples of foreign bodies for analysis
- Successfully directed and carried out on-call emergency cases with vet assistance over the phone

2003 – 2009

Manager

The Pet Centre, Sydney, NSW

2001 – 2003

Sales Assistant

The Pet Centre, Sydney, NSW

- Implemented standard procedures for staff to follow
- Focussed on achieving a high level of OHS standards within the store
- Responsible for daily takings up to five thousand dollars per day
- Accountable for people management including rosters, recruitment and managing employee issues
- Responsible for management of store inventory
- Developed skills in handling a range of domestic animals
- Maintained animal's health and welfare in store and complied with state laws and regulations
- Analysed store's and customer's aquarium water quality
- Developed sound knowledge of animals including their origin, identification and general requirements

Relevant Volunteer Experience

2012

Fauna Spotter / Field Assistant

Humble Bee Films

- Volunteered as a fauna spotter/field assistant with Dr Brad Purcell and Humble Bee Films in a ten day research camp, during the production of the natural history documentary "Dingo".

2012

Volunteer Ecological Field Assistant

Rio Tinto, Weipa, QLD

- Participated in an ethno-botanical workshop with Rio Tinto Alcan Land and Rehabilitation team.
- Participated as a field technician during pre-mining survey work. The work included assessing flora and the land formations to identify buffer zones for natural drainage systems and sensitive areas in the Andoom mine site Weipa.

2012

Fauna Technician

Brad Purcell PhD,

Greater Blue Mountains World Heritage Area

- Field technician for Brad Purcell during his doctoral research project on dingoes in the Greater Blue Mountains World Heritage Area. Developed skills in use of VHF radio tracking to retrieve collars, triangulation method to determine positioning of dingoes or deployed collars and traversing bushland.

Appendix J – Biodiversity Management Plan

Biodiversity Management Plan – 527, 507, 501, 463 and 457 Cessnock Road, Gillieston Heights, NSW, 2321

Prepared For: Walker Gillieston Heights Pty Ltd

Prepared By: Anderson Environment and Planning

Date: 16/06/2023

AEP Reference: 2665.03

Revision: 02



Plate 1 - Lower Hunter Valley Dry Rainforest present onsite in good condition



Plate 2 - Lower Hunter Valley Dry Rainforest present onsite in disturbed condition

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1.0 Introduction

At the request of Walker Gillieston Heights Pty Ltd (the client), Anderson Environment & Planning (AEP) have undertaken the necessary investigations to inform the production of a Biodiversity Management Plan (BMP) on land located at 457 Cessnock Road, Gillieston Heights NSW 2321 (refer **Figure 1**).

The proposed development is for a residential subdivision of 322 allotments located at 527, 507, 501, 463 and 457 Cessnock Road Gillieston Heights NSW, with drainage reserves, open space reserves, residue lot and construction of associated ancillary infrastructure. (refer **Figure 2**). The residue of the site primarily consists of native vegetation and paddocks that are subject to flooding within the riparian corridor of Wallis Creek.

This BMP has been developed in anticipation of Maitland City Council (MCC) Conditions of Consent for the Proposal relating to the management of the residue of the site, requiring approval of the following reports prior to the issue of any Subdivision Works Certificate:

- Vegetation Management Plan to schedule actions to mitigate impacts of the Development on the native vegetation to be retained;
- Wildlife Management Strategy to schedule actions to mitigate impacts from clearing on potentially occurring native fauna; and
- Weed and Hygiene Protocol to minimize the risk of incursion and spread of invasive species and pathogens onsite that may affect the welfare of local biota.

BMP works will commence immediately upon commencement of construction and will be actioned for a minimum of five (5) years from commencement of BMP works.

Annual reports will be submitted to Council's Ecologist within a month of the second biannual monitoring event each year for the duration of the BMP, detailing the progress of all works scheduled herein and recommended additional actions. A final report will be provided to Council certifying completion of the BMP at the end of the implementation period detailing specific conditions and objectives having been met.

The Client will appoint a Project Ecologist to undertake scheduled mitigation measures and certify compliance with ecological mitigation methods scheduled in this BMP.

1.1 Biodiversity Management Plan Objectives

This Biodiversity Management Plan (BMP) incorporates best practices in bushland restoration, management of invasive species and revegetation.

The overall BMP objectives are to:

- Enhance the physical and biological functions of the native rainforest vegetation community present;

- Enable natural and facilitated regeneration where appropriate, ensuring the structural and trophic complexity of the vegetation community is adequately represented;
- Ensure the site is maintained until vegetation in regenerating areas achieves a self-sustaining state;
- Implement erosion and sediment control measures to avoid or minimise the transfer of soil and sediments into the downslope receptors;
- Minimize risk to locally occurring fauna species through the implementation of Wildlife Management Strategy; and
- Implement a hygiene protocol to prevent the transfer of weeds and pathogens onto and off the site.

1.2 Previous Surveys and Literature Review

The production of this BMP has been informed by several rounds of surveys conducted onsite since 2022 and should be read in conjunction with the following reports:

- *Streamlined Biodiversity Development Assessment Report (Streamlined and Planted Native Vegetation) – Residential Subdivision at 527, 507, 501, 463 and 457 Cessnock Road, Gillieston Heights NSW 2321 (AEP 2023); and*
- *Riparian Assessment Report for proposed residential subdivision at 527, 507, 501, 463 and 457 Cessnock Road, Gillieston Heights NSW 2321 (AEP 2023);*

A final site inspection of the BMP Lands was conducted by AEP ecologists on 2 June 2023 to inform the development of this plan by assessing the native vegetation and paddocks to:

- Determine vegetation condition;
- Identify Management Zones;
- search for threatened species; and
- identify the causes of degradation and the physical and biological processes to regenerate.

1.3 BMP Lands description

The BMP lands are located on the eastern side of the Study area, between the proposed development and Wallis Creek and consist of 3.56 ha of retained native vegetation belonging to two separate Plant Community Types (PCTs).

1.3.1 PCT 1525 – Sandpaper Fig – Whalebone Tree warm temperate rainforest

Ground-truthing of the vegetation onsite has confirmed the presence of this PCT which is associated with the State Listed Threatened Ecological Community (TEC) – *Lower Hunter Valley Dry Rainforest in the Sydney Basin and NSW North Coast Bioregions*.

This vegetation community covers the vast majority of the BMP Lands (3.28ha) in the form of an east facing steep, rocky escarpment and is found onsite in a moderate to good condition.

The canopy layer is fairly intact and composed of large to very large *Ficus rubiginosa* (Port Jackson Fig), *Alphitonia Excelsa* (Red Ash), *Melia Azaderach* (White Cedar), *Melaleuca styphelioides* (Prickly Paperbark) with scattered emerging Eucalyptus including *Eucalyptus punctata* (Grey Gum) and *Eucalyptus tereticornis* (Forest Red Gum).

The midstory is quite dense, dominated by *Acmena smithii* (Common Lilly Pilly), *Mallotus philippensis* (Red Kamala), *Streblus brunonianus* (Whalebone Tree) and *Pittosporum undulatum* (Sweet Pittosporum). Large thickets of *Cissus antarctica* (Water Vine) are also present as well as other scramblers such as *Aphanopetalum resinolum* (Gum Vine) and *Jasminum volubile* (Stiff Jasmin).



Plate 3 - Parts of the site are in good condition with low incidence of exotic species

The understory and ground layer fluctuates from good condition areas dominated by native ferns and forbs including *Pellaea falcata* (Sickle Fern), *Adiantum hispidulum* (Rough Maidenhair), *Peperomia blanda* and *Oplismenus aemulus* (Basket Grass) to highly disturbed areas including thickets of *Lantana camara* and large areas colonized by *Ehrharta erecta* and *Opuntia spp.*

Due to the sporadic nature of weed incursion with varying densities of Lantana and other weeds throughout the escarpment, the segregation of this PCT into separate management zones was not practical.

Note that some rainforest trees and shrubs are regenerating within thickets of Lantana including pioneer species such as *Alphitonia excelsa* (Red Ash). As such, care should be taken during weed control activities. This is discussed further in **Section 3**.



Plate 4 - Thickets of Lantana are scattered throughout the site



Plate 5 - large areas of the ground layer have been colonized by Tiger Pear

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

This PCT covers a small area (0.26ha) in the southern section of the BMP Lands and is commensurate with the State listed TEC – *Lower Hunter Spotted Gum Ironbark Forest in the Sydney Basin and NSW North Coast Bioregions*. The upper stratum is almost entirely composed of *Eucalyptus tereticornis* (Forest Red Gum) regrowth.

The midstory is absent and the understory is composed of a mix of native grasses and forbs including as *Themeda triandra* (Kangaroo Grass), *Aristida vagans* (Three-awned Speargrass) and *Cheilanthes sieberi* (Poison Rock Fern) as well as scattered exotic grasses including *Sporobolus africanus* (Parramatta Grass), *Setaria parviflora* (Pigeon Grass) and *Axonopus fissifolius* (Narrow-leaved Carpet Grass).

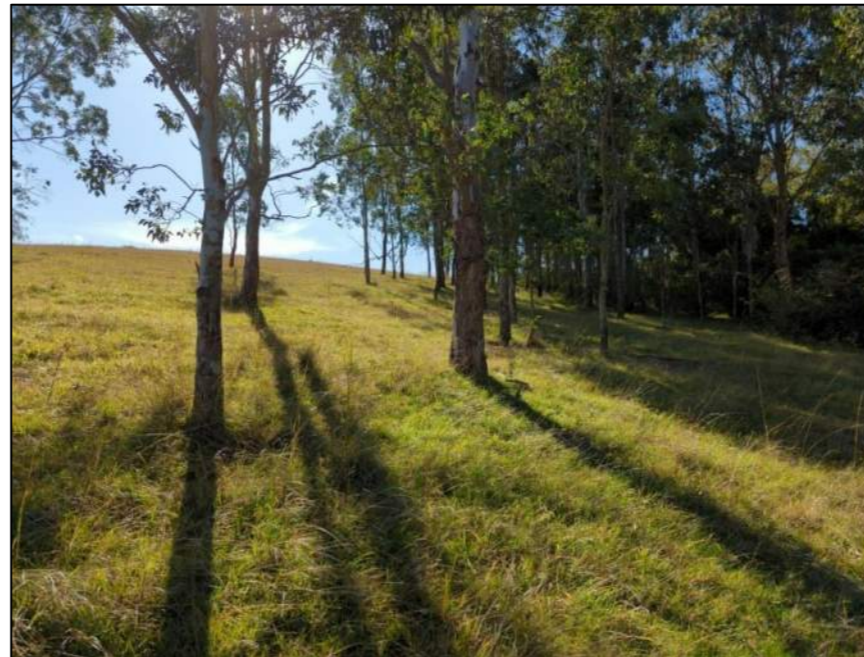


Plate 6 - PCT 1600 - Canopy only - present in the southern section of the BMP Lands

Note that this PCT was allocated to this patch due to its presence elsewhere on the Subject Site as well as scattered diagnostic species present within the rainforest such as emerging Eucalypt and dry sclerophyll shrubs species and grasses along the ecotone between the rainforest community and the exotic grassland to the west.

The alluvial flat of Wallis Creek at the bottom of the escarpment consists of an exotic grassland currently being grazed by cattle. This area is not proposed to be managed as part of this BMP.

Figure 3 outlines the present boundary of the vegetation communities



Plate 7 - Exotic Grassland along Wallis Creek (not subject of BMP)

Table 1 below provides a full list of vascular plants present within the BMP Lands.

Table 1 - Flora species list

Scientific Name	Common Name
Trees	
<i>Ficus rubiginosa</i>	Port Jackson Fig
<i>Melaleuca styphelioides</i>	White Cedar
<i>Melia azedarach</i>	White Cedar
<i>Corymbia maculata</i>	Prickly Paperbark
<i>Eucalyptus tereticornis</i>	Forest Red Gum
<i>Eucalyptus punctata</i>	Grey Gum
<i>Callistemon salignus</i>	Willow Bottlebrush
<i>Acmena smithii</i>	Common Lilly Pilly
<i>Alphitonia excelsa</i>	Red Ash
<i>Mallotus philippensis</i>	Red Kamala
<i>Streblus brunonianus</i>	Whalebone Tree
<i>Pittosporum undulatum</i>	Sweet Pittosporum
<i>Cupaniopsis anacardioides</i>	Tuckeroo
Shrubs	
<i>Pittosporum revolutum</i>	Yellow Pittosporum
<i>Pittosporum multiflorum</i>	Orange Thorn
<i>Maclura cochinchinensis</i>	Cockspur Thorn
<i>Elaeocarpus obovatus</i>	Hard Quandong
<i>Androcalva fraseri</i>	-

Scientific Name	Common Name
<i>Myrsine variabilis</i>	-
<i>Leucopogon juniperinus</i>	Prickly Beard-heath
Climbers and Epiphytes	
<i>Aphanopetalum resinosum</i>	Gum Vine
<i>Cissus antarctica</i>	Water Vine
<i>Geitonoplesium cymosum</i>	Scrambling Lily
<i>Clematis aristata</i>	Old Man's Beard
<i>Cayratia clematidea</i>	Native Grape
<i>Jasminum volubile</i>	Stiff Jasmine
<i>Platycerium bifurcatum</i>	Elk Horn Fern
Ground Layer	
<i>Pellaea falcata</i>	Sickle Fern
<i>Plectranthus parviflorus</i>	Cockspur Flower,
<i>Cyperus tetraphyllus</i>	-
<i>Peperomia blanda var. floribunda</i>	-
<i>Themeda triandra</i>	Kangaroo Grass
<i>Microlaena stipoides var. stipoides</i>	Weeping Grass
<i>Panicum effusum</i>	Hairy Panic
<i>Eragrostis brownii</i>	Brown's Lovegrass
<i>Aristida Vagans</i>	Three-awned Speargrass
<i>Dianella caerulea var. producta</i>	Blue Flax-lily
<i>Oplismenus aemulus</i>	Basket Grass
Exotics	
<i>Lantana camara</i>	Lantana
<i>Ligustrum lucidum</i>	Large-leaved Privet
<i>Ligustrum sinense</i>	Small-leaved Privet
<i>Cestrum parqui</i>	Green Cestrum
<i>Solanum mauritianum</i>	Wild Tobacco
<i>Pavonia hastata</i>	-
<i>Solanum seaforthianum</i>	Climbing Nightshade
<i>Olea europaea subsp. cuspidata</i>	African Olive
<i>Rubus anglocandicans</i>	Blackberry
<i>Solanum nigrum</i>	Blackberry Nightshade
<i>Verbena quadrangularis</i>	-
<i>Cynodon dactylon</i>	Common Couch
<i>Opuntia aurantiaca</i>	Tiger Pear
<i>Opuntia stricta</i>	Common Prickly Pear
<i>Ehrharta erecta</i>	Panic Veldtgrass
<i>Conyza bonariensis</i>	Fleabane

Scientific Name	Common Name
<i>Senecio madagascariensis</i>	Fireweed
<i>Setaria parviflora</i>	-
<i>Sporobolus africanus</i>	Parramatta Grass
<i>Axonopus fissifolius</i>	Narrow-leaved Carpet Grass

Species indicated in **bold** are listed Priority Weeds for the Hunter region.

2.0 Regeneration of BMP Lands

Regeneration of the BMP lands will be undertaken over a minimum period of five (5) years and management of the site will continue into perpetuity under the Biosecurity Act 2015.

However, it is expected that the BMP lands will achieve a self-sustaining state by the end of the five (5) year period and will only require sporadic minimal maintenance to address occasional incursion of weeds afterwards.

2.1 Integrated Regeneration Approach for BMP Lands

Regeneration of the BMP lands will be undertaken by utilising the principles of the Society for Ecological Restoration Australasia (2018) *National standards for the practice of ecological restoration in Australia*. This approach utilises three integrated regeneration techniques to achieve the goal of a naturally regenerating community.

- Reconstruction Approach;
- Facilitated Regeneration Approach; and
- Natural Regeneration Approach.

The approach to be utilized within this National Guideline; the Facilitated Regeneration Approach has been assigned to the BMP Land based on its history of disturbance and the present vegetation condition.

This approach is utilized where damage is relatively low, and pre-existing biota should be able to recover after cessation of degrading practices, mainly weed invasion.

The Natural Regeneration Approach requires limited intervention with weed management being the only task undertaken to encourage continual natural regeneration in order to achieve the structural complexity and floristic diversity typical of rainforest communities.

Being a rainforest community where seed dispersal agents are primarily birds and Flying-foxes, it is expected that native trees and shrubs species will be naturally regenerating as weed removal progresses and that planting will not be required. However, evidence of recruitment will be monitored throughout the 5 years duration of this BMP and the need to introduce additional species through revegetation will be assessed after 3 years at the discretion of the project's ecologist and bush regeneration contractor (a species list for revegetation is provided in **Appendix B**).

Note that if no regeneration occurs within 2 years of the clearing of *Lantana* thicket, planting of canopy and midstory species will be considered.

The Natural Regeneration Approach aims to be completed within the five (5) year duration of the BMP; at which point, it is expected that the vegetation present will be resilient and self-sustaining, only requiring sporadic maintenance to prevent re-incursion and establishment of wind and bird dispersed weeds.

2.2 Management Zones

The entirety of the BMP land has been assigned to two (2) Management Zones according to PCT and zone conditions. **Figure 4** shows the Management Zones within the Subject Site.

- Management Zone 1 (MZ1): PCT 1525 – good and moderate condition
- Management Zone 2 (MZ2): PCT 1600 – Canopy only

Site surveys identified the following weeds as being the main threat to the ecological integrity of the BMP Lands due to their high density onsite and level of invasiveness:

- *Lantana camara* (Lantana);
- *Ligustrum sinense* (Small-leaved Privet);
- *Solanum mauritianum* (Wild Tobacco Bush);
- *Solanum seaforthianum* (Climbing Nightshade);
- *Cestrum parqui* (Green cestrum);
- *Olea europaea subsp. Cuspidata* (African Olive);
- *Rubus anglocandicans* (Blackberry);
- *Opuntia aurantiaca* (Tiger Pear);
- *Opuntia stricta* (Common Prickly Pear); and
- *Senecio madagascariensis* (Fireweed).

The aforementioned exotic species will be the focus of weed management activities, based on legal requirement to control the species listed under the Biosecurity Act 2015, potential to further colonize the native community present and undermine the remnant vegetation.

2.2.1 MZ1: PCT 1525 Good and Moderate Condition – Facilitated Regeneration

This management zone is in moderate to good condition with a disturbed understorey. The site is quite steep, ruling out the use of mechanic aid.

It is proposed that this area is to have the Biosecurity Weeds and weeds negatively impacting the native vegetation values eradicated allowing for the regeneration of PCT 1525, providing foraging habitat, cover and connectivity for native fauna. The following is to be undertaken in this zone:

- Primary weeding;
- Secondary weeding; and

- Maintenance weeding.

With weed management, this community is anticipated to regenerate without the requirement for plantings. However, if after three (3) years ground covers and mid stratum are not regenerating adequately to reach target objectives, supplementary planting will be undertaken selecting from the recommended species list (Appendix A – Revegetation Species List).

To avoid unintended damage to native vegetation, suggested weed removal techniques to be used in this area should be restricted to manual removal of woody weeds such as the ‘cut and paint’ technique and spot spraying of herbicide, assessing the risk of damage to native plants by off-target spray. Any propagules found should be taken offsite.

Primary weeding should target all woody weeds present onsite as well as *Opuntia spp.* Thickets of Lantana can be carefully sprayed to avoid impacting emergent native midstory species.

2.2.2 Management Zone 2 (MZ2): PCT 1600 – Canopy only – Facilitated Regeneration

This management zone is composed almost entirely of *Eucalyptus tereticornis* (Forest Red Gum) with a grassy understory. Note that some eucalyptus saplings are regenerating. Scattered herbaceous weeds are present but the area is dominated by native grasses.

Weed control in this area should be restricted to hand weeding/deseeding of the exotic species present. Spot spraying of herbicide may be undertaken at the discretion of the bush regeneration contractor, assessing the risk of damage to native plants by off-target spray.

Revegetation may be considered after Year 3 if regeneration of native shrubs is limited. No planting of canopy species should be undertaken given that a canopy of *Eucalyptus tereticornis* is already established.

3.0 Implementation of BMP

3.1 Site Preparation

Prior to the commencement of regeneration, the BMP Lands must be prepared. The following works have been recommended to assist in site preparation.

3.1.1 Fencing

A temporary minimum 1.8-metre-high construction mesh fence must be installed prior to any work commencing:

- The fence must be installed along the entire western perimeter of the Biodiversity Management Zone identified in the approved Biodiversity Management Plan and cattle/stock excluded along the eastern perimeter with fencing sections along the northern boundary of the Study Area to Wallace Creek and along the southern end of the BMP Lands;
- All fenced conservation areas are to be clearly marked as a "No Go Area";

- No clearing of native vegetation, storage of vehicles or machinery, stockpiling, materials storage or unauthorised access is to occur within the fenced conservation area; and
- The fence must be maintained for the duration of all construction works. Construction impacts must be restricted to the development site and must not encroach into areas of retained native vegetation and habitat.

Upon completion of this BMP, any permanent security fencing along the boundary of the BMP Lands must be evaluated and considered.

- Lockable access gates could be provided for maintenance purposes;
- The fence type selected must not contain any barb wire material. The fence must be sign posted at intervals of no less than thirty (30) metres to identify the conservation value of the land and discourage uncontrolled access;
- Stock grazing along the Wallis Creek flats will need to be monitored as weed removal (i.e. Lantana and Blackberry thickets) could potentially increase access to the BMP Lands and therefore require a need for more permanent exclusion fencing of stock; and
- Evidence of compliance with these conditions must be provided to Council’s Ecologist.

3.1.2 Rubbish Removal

All extant of rubbish/waste is to be removed from BMP lands including farm fencing and structures. The need to remove such material should be assessed on a case-by-case basis as in some instances the material is inert, such as concrete, rocks and timber posts, etc. Such material may inadvertently provide geomorphic stability and suitable shelter and habitat for native fauna.



Plate 8 - Rubbish within the BMP Lands

3.1.3 Pathogens / Disease Control

Diseases and which could affect the BMP Lands include the root-rot fungus (*Phytophthora cinnamomi*) and Myrtle rust (*Puccinia psidii*), affecting Myrtaceous plants including the Eucalyptus species present onsite as well as Amphibian Chytrid fungus disease, Chytridiomycosis, caused by Chytrid fungus (*Batrachochytrium dendrobatidis*).

To minimise the potential for any such introductions, it is recommended that appropriate hygiene controls be employed and hygiene stations supplied:

Plant, Machinery, Tools and Boots Hygiene

- All plant/machinery is to be washed down upon entry to site and prior to exiting site;
- All tools being utilised on site should be sterilised and washed free of soil before use and at the end of each day;
- Boots should be clean and free of soil and seeds before entry to site and before exiting site; and
- Boots should be sterilised in a similar manner to tools after soil and seed removal.

Phytophthora cinnamomi

- Minimisation of work during excessively wet or muddy conditions;
- All personnel to be inducted on Phytophthora identification and management; and
- All plants and soils used/brought into site must be disease-free.

Amphibian Chytrid fungus

- Minimisation of work during excessively wet or muddy conditions.
- All personnel to be inducted on Chytrid management measures for the site.
- Handling of frogs only when necessary, with new gloves to be worn when handling each individual frog.

Myrtle Rust

- All personnel to be inducted into the identification and management of Myrtle rust.
- Should any areas on site be identified as areas contaminated by the above, additional exclusion measures including, work program directions, soil storage and waste disposal programs must be implemented.

3.1.4 Erosion and Sedimentation Control

Implement Erosion and Sediment control measures in accordance with specifications set out in the latest edition of the Landcom publication “Soils and Constructions – Volume 1 (The Blue Book)”.

3.2 Weed Management

Weed Control works within BMP lands are to be undertaken by a qualified bushland regeneration team using industry standards.

Any reproductive material of weeds, including weeds which can spread vegetatively, or seeds, must be taken off site to be disposed of at an appropriate local waste collection service. No weed material with the potential of spreading must be stockpiled within the Study Area, development footprint or the BMP Lands.

The *Biosecurity Act 2015* outlines several 'duties'; the general biosecurity duty, and additional duties under mandatory measures, regional measures, prohibited matter or biosecurity zone. Specific action for these measures may be required.

3.2.1 Sequential Weed Control

Weed control is required to occur in the following sequence:

1. **Primary Weeding** – this is where most problematic weeds are removed from Management Zones (primarily woody weeds and *Opuntia spp.*)
2. **Consolidation (Secondary weeding)** – over the next few months, the weed control zones will require monthly visits to remove weeds that are regenerating and / or have grown in response to the disturbance and are competing with regenerating native plants. These visits are essential, otherwise the weeds will recolonise, dominate and inhibit the regeneration of native species.
3. **Maintenance Weeding** – After six-month and will continue on a monthly basis for the first year, due to woody weeds, and other annual weeds being problematic within the locality. Maintenance will decrease overtime and only be biannually in the later years.

This interval will be evaluated based on-site condition during each monitoring period. Weed control works across the site are to be undertaken over the maintenance period of five (5) years, however, given the adaptive management approach, this time-frame is flexible, and may need to be extended based on changing site conditions and monitoring results indicating management zones have reached targets as set out in this BMP.

3.2.2 Herbicides

If herbicide usage is proposed, the following factors are to be taken into consideration when selecting the herbicide:

- The safety of the particular herbicide to users and use near waterways, desirable plants, soil micro-organisms, amphibians, birds and mammals; and
- The economics and time constraints of using herbicides over other methods of weed control.

Directions must be strictly followed and all precautions followed over time. For example, Glyphosate herbicides are systemic and non-selective.

3.3 Revegetation

If revegetation is required, it will be undertaken with local endemic species to reinstate PCT 1525 and PCT 1600:

- Species used for revegetation must be found in remnant vegetation on or adjoining the site;
- All plant stock must be provenance specific seed / material collected from locally endemic species, grown by suitably experienced and qualified nurseries, and hardened-off before planting. This will ensure the structure and composition of these communities will meet the targets set.
- Contingency measures must be included in the BMP if survival rates of tubestock fall below 80%;
- All plants provided must be of Maitland/Cessnock provenance with details of plant provenance recorded in annual monitoring reports;
- Timing for revegetation work should avoid the warmer months and should ideally be planned for spring and autumn;
- Soil preparation should include terraforming as well as the use of water crystals at the discretion of the bush regeneration contractor if deemed necessary;
- If monitoring indicates pest species pose notable impediments to achieving the aims of the BMP (i.e., through excessive browsing, etc.), then management actions will be reviewed to address these issues;
- Mulching will be necessary to help suppress weeds and conserve soil moisture around the planting. This will help with minimising the maintenance required for the planting to establish. Mulch should be sourced from a reputable source, from native trees only and be cured prior to utilising to avoid nitrogen draw down; and
- Watering may be necessary depending on the weather forecast during and in the weeks and month following planting events. As such the watering regime should be adapted to the conditions.

A detailed planting plan and schedule shall be prepared by the project ecologist in conjunction with the bush regeneration contractor using the data from the baseline monitoring should planting be required to aid facilitated regeneration.

4.0 Wildlife Management Strategy

4.1 Feral Animals

No significant evidence of feral animals was observed on site; however, it is likely that rabbits and foxes are present in the local area. Therefore, protection guards should be placed around any plantings so that revegetation efforts within BMP lands is not compromised by grazing. If

monitoring within management zones indicates pest species pose notable impediments to achieving the aims of the BMP (i.e., through excessive browsing, etc.), then management actions will be reviewed to address these issues.

4.2 Vegetation Clearing

As previously mentioned, no clearing of native vegetation, storage of vehicles or machinery, stockpiling, materials storage or unauthorised access is to occur within the fenced conservation area. However, within the Subject Site/Development footprint clearing of vegetation on site must adhere to the following procedure to ensure safety of utilising the site and best environmental outcomes:

- All clearing works are to be undertaken under the supervision of the Project Ecologist;
- For the clearing phase, retained vegetation will be delineated by safety bunting flags, fencing and signage indicating environmental protection zone, which will still allow fauna to egress the development area as needed;
- Following the completion of clearing works, permanent delineation features such as logs from the removed vegetation should be installed to protect the BMP Lands during operational phase of the development;
- Where practicable, vegetation clearing is to be timed to avoid cold weather periods where overnight temperatures are forecast to be less than 12°C. Cold weather is likely to make it difficult for resident hollow dependent fauna to successfully relocate. This is particularly relevant for low body-weight species;
- Hunter Wildlife Rescue (ph. 0418 628 483) must be contacted prior to clearing commencing to ensure they have capacity to care for any injured fauna;
- A staged approach to clearing is to be undertaken to provide fauna the opportunity to disperse outside the area of impact. Staging to include;
 - Phase 1 Clearing: Underscrubbing;
 - Phase 2 Clearing: Removal of non-habitat trees; and
 - Phase 3 Clearing: Removal of habitat and connecting trees;
- All clearing works (Phase 1, 2 and 3) to be undertaken under the supervision of the Project Ecologist;
- Clearing should occur in a direction from previously disturbed lands towards retained lands;
- Implement clearing protocols, including pre-clearance surveys to identify habitat and vegetation to be retained;
- All clearing works to be attended by a suitably equipped and experienced ecologist to deal appropriately with any displaced fauna species;

- All hollow bearing features will be sectionally lowered by tree climbers (where safe to do so);
- Any fauna rescued during vegetation clearing is to be assessed for injuries, and subsequently released to a suitable nearby location; this may require holding fauna until dusk for release in accordance with relevant animal ethics licencing and standards;
- If any fauna is injured during vegetation clearing, they are to be taken promptly to a nearby veterinarian or Hunter Wildlife Rescue;
- In addition, prior to clearing of any vegetation, an Ecologist is to inspect the area for any signs of resident fauna requiring attention. Where such is identified, appropriate strategies are to be developed and instigated to minimise impacts;
- Civil Construction staff to be inducted into pre-clearing and clearing protocols, and to identify environmental features for protection;
- Installation of nest boxes within the retained lands prior to construction to mitigate the removal of HBTs within the development footprint and provide supplementary roosting / nesting habitat for resident fauna species that utilise such features. Retained lands has the capacity to accept a 2:1 of removed hollow bearing trees on the development lands to nest boxes in the retained lands for a variety of fauna guilds;
- Any suitable hollows recovered during clearing works should be reconditioned into suitable hollows and installed in retained lands in addition to the manufactured nest boxes;
- All manufactured boxes are to be industry best practice including either marine or hardwood plywood with a minimum thickness of 18mm. Boxes will not have hinged lids to ensure longevity of the boxes and installation methods will not inhibit growth of the host tree;
- All cleared vegetation is to be mulched on site and spread to help stabilise any exposed soil and minimise offsite movement of biomass. Fallen timber and hollow logs identified to be retained to be relocated into the retained lands;
- Live mulch and topsoil that is free of weeds is an ideal way to begin rehabilitation of conservation lands;
- Protocols within the Construction Environmental Management Plan (CEMP) to manage Acid Sulphate Soils; and
- Incorporation of Water Sensitive Urban Design (WSUD) principles within stormwater infrastructure is to occur to minimise downstream hydrology changes.

4.3 Nest Box Installation

Nest boxes will be installed within the BMP Lands at a rate of 2:1 to offset the removal of hollow bearing trees present in the development footprint. The boxes installed will be providing similar roosting/nesting habitat as the hollows being removed. **Table 2** outlines the sizes for particular guilds.

Refer to the SBDAR prepared for the proposal for more information on the habitat trees being removed (AEP 2023).

To offset three (3) hollow bearing trees identified to be removed for the proposal in the SBDAR, six (6) nest boxes will be installed for hollow-dependant fauna recorded within the site including threatened species of microbats as well as mammals and birds that utilise such features.

A flexible schedule of nest boxes will include:

- Manufactured nest boxes; and
- Remanufactured hollows.

Nest boxes will be constructed of external grade plywood with a minimum thickness of 18mm utilising stainless steel or “highest grade” of galvanised fittings. Box bases will have three drainage holes no more than 10mm in diameter. Toxic substances are not to be used in the manufacture of nest boxes. The Nest Box Schedule in **Table 2** was developed from the SBDAR.

Table 2 - Nest Box Schedule

Species	General Size	No	Special Requirements
Little Lorikeet	Small < 10cm	2	External perch
Microbats	Extra Small	4	Bottom entry
Australian Wood Duck	Large >20 – 30cm	1	-
Common Brush-tail and Ringtail Possum	Med 10 – 20cm	1	Brush-tails and ringtails use the same size boxes, the smaller ringtails take branchlets into the nest hole.

Nest boxes must be installed prior to the removal of hollow-bearing trees to provide alternative nesting/roosting sites for potentially displaced fauna. Refer to **Figure 4** for indicative nest box locations within the BMP Lands.

5.0 Project Management

The client will be responsible for the engagement of a suitably qualified Bush Regeneration Contractor to undertake weed control and planting works outlined in this BMP.

Bush Regenerator(s) or company(s) shall have;

- Australian Association of Bush Regenerators (AABR) Accreditation. The Bush Regenerators shall hold a current AQF3 qualification;
- Site Supervisor must have demonstrated minimum of 2 years’ experience in the bush regeneration or related field and must have experience at a supervisory level in providing training, supervision and technical advice to staff, clients, volunteers and members of the public; and

- The Site Supervisor must hold a current AQF 3 qualification or higher and must have completed the Bush Regeneration Level IV Certificate or have a diploma or degree in a field related to natural resource management.

5.1 Regeneration Targets

The Integrated Regeneration Approach will be used across the entire BMP Lands and the following targets have been designed to be measurable, providing qualitative data on species abundance and cover for the vegetation communities within the BMP Lands.

Overall targets are outlined in **Table 3** and **Table 4** which provides a more detailed assessment of cover and density in-line with each year of management.

Table 3 – Targets for weed cover within MZ 1 and MZ 2.

Regeneration Targets	Cover of Woody Weeds (%)	Cover of Exotic Ground-cover Species (%)
Year 1	<30	<40
Year 2	<20	<30
Year 3	<5	<20
Year 4	<2	<10
Year 5	<1	<5

5.2 Monitoring and Reporting

The Project Ecologist will be responsible for the establishment of monitoring points within the BMP lands along with collection of baseline data that will be monitored against over the five-year period of this BMP with the overall targets and reporting on weed management, and regeneration approach success. Monitoring will occur at commencement and on a biannual basis during the duration of the BMP.

5.2.1 Baseline Data

Baseline monitoring and data collection to commence prior to site preparation. Four (4) indicative monitoring points have been identified within the BMP Lands (refer **Figure 4**). The final location of the monitoring points is to be determined when commencing works. The monitoring points will be established using a star picket and a GPS waypoint taken for easy identification. The star picket will be the centre of 20mx20m monitoring plot. Baseline data gathered will cover:

- Species diversity - both native and exotic;
- Projected Foliage Cover (PFC) - both native and exotic;
- Overall health of the BMP Lands;
- Photo records at monitoring points at each aspect;

- Nest Box Monitoring and Maintenance reporting; and
- Record incidental fauna.

5.2.2 Biannual Monitoring

This is to occur every 6 months from commencement, up to five (5) years and should include the same metrics as the baseline data but should also include:

- Effectiveness of weed control methods;
- Photo records at monitoring points at each aspect;
- General health of each Management Zone;
- Incidental fauna use of site; and
- Nestbox monitoring.

Biannual monitoring will inform the evaluation of management effectiveness, until the Regeneration Benchmark Targets are met.

5.2.3 Reporting

Progress reports are to be submitted to Council's Ecologist annually for a minimum of five (5) years following issue of the construction certificate. Reports are to detail the progress of the works and any recommended additional actions, with a final report certifying completion of the BMP at the end of the implementation period, or once the specific objectives of the plan have been met. Any recommended additional actions must be completed to the satisfaction of Council Ecologist prior to lodgement of the final report.

Once in a state of Natural Regeneration, management of the site will be undertaken in accordance with the *Biosecurity Act 2015* & *Biosecurity Regulations 2017*.

5.3 Regeneration Target Objectives

Table 4 - Targets for Cover and Diversity within BMP lands (MZ1) and management actions to achieve target

Timeframe	Works to be Undertaken	Targets	
		Cover of Woody Weeds (%)	Cover of Exotic Ground Cover (%)
Year 1	Installation of No-Go Zones, fencing and signs	<30	<40
	Installation of Nest boxes		
	Set up Photo monitoring points / Collection of Baseline data		
	Install appropriate sediment and erosion controls		
	Primary Weeding (Effectively control priority species and areas through appropriate methods to eliminate highly competitive weeds from an area. Include high disturbance activities that could negatively impact later regeneration such as high-volume herbicide application, and physical removal of large trees – focus is on Priority/Biosecurity weeds.		
	Secondary weeding - focus is on Biosecurity Weeds and regrowth of woody weeds		
	Maintenance weeding		
	Removal of inert waste		
	Biannual monitoring		
	Review of BMP success and failures and update where appropriate for submission with annual report to MCC		
At end of the first year the BMP land will remain in Facilitated Regeneration.			
Year 2	Biannual inspection of No-Go Zones, fencing, signs and sediment and erosion controls (or after rainfall events)	<20	<30
	Weed management as required to achieve annual targets (Maintenance)		
	Biannual monitoring		
	Review of BMP success and failures and update where appropriate for submission with annual report to MCC		
At end of the first year the BMP land will remain in Facilitated Regeneration.			
Year 3	Annual inspection of No-Go Zones, fencing and signs and sediment and erosion controls (or after rainfall events)	<5	<20
	Weed management as required to achieve annual targets (Maintenance)		
	Biannual monitoring		
	If no or minimal natural regeneration has occurred by the end of year 2 some planting will be undertaken in areas cleared of weeds		
	Replacing dead / dying plantings if applicable (every quarter)		
	Review of BMP success and failures and update where appropriate for submission with annual report to MCC		
At end of the third year the BMP land will remain in Facilitated Regeneration.			
Year 4	Annual inspection of No-Go Zones, fencing and signs and sediment and erosion controls (or after rainfall events)	<2	<10
	Replacing dead / dying plantings if applicable		
	Weed management as required to achieve annual targets (Maintenance)		
	Biannual monitoring		
	Biannual inspection or Installation of tree guards for pest control if required		

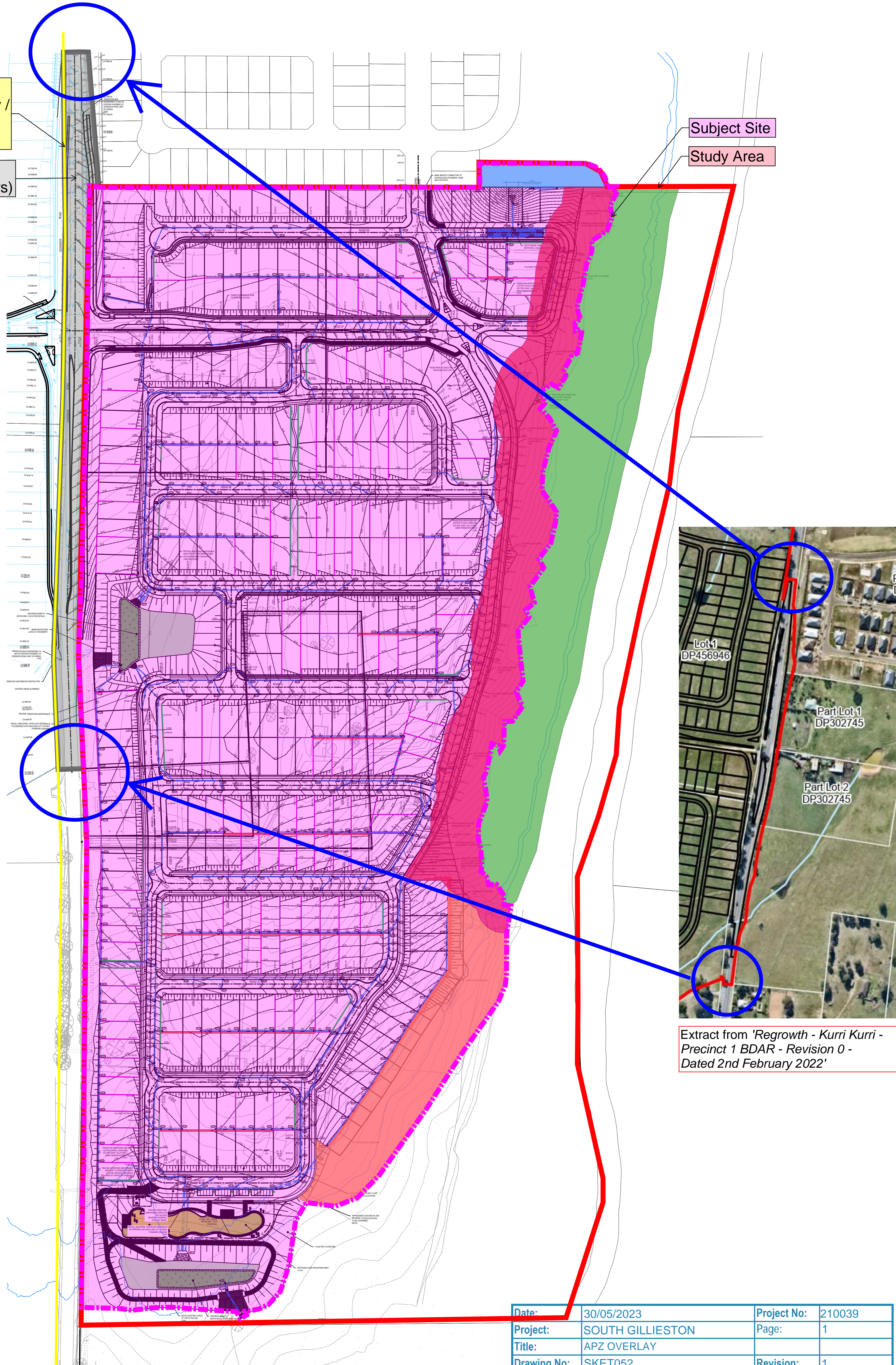
Timeframe	Works to be Undertaken	Targets	
		Cover of Woody Weeds (%)	Cover of Exotic Ground Cover (%)
	Annual Reporting to MCC		
At end of the fourth year the BMP land will remain in Facilitated Regeneration.			
Year 5	Annual inspection of No-Go Zones, fencing and signs and sediment and erosion controls (or after rainfall events)	<1	<5
	Replacing dead / dying plantings if applicable		
	Weed management as required to achieve annual targets (Maintenance)		
	Biannual monitoring		
	Biannual inspection or Installation of tree guards for pest control if required		
	Final report submitted to MCC with recommendation related to future maintenance if necessary		
At end of the fifth year the BMP land will be in a state of Natural Regeneration.			

Existing Eastern Property Boundary / Cessnock Road Reserve Boundary

Cessnock Road Widening (By Others)

Subject Site

Study Area



Extract from 'Regrowth - Kurri Kurri - Precinct 1 BDAR - Revision 0 - Dated 2nd February 2022'

Date:	30/05/2023	Project No:	210039
Project:	SOUTH GILLIESTON	Page:	1
Title:	APZ OVERLAY	Revision:	1
Drawing No:	SKET052	Scale:	1:1500
Drawn:	ML		



Disclaimer: While all reasonable care has been taken to ensure the information shown on this map is up to date and accurate, no guarantee is given that the information portrayed is free from error or omission. Please verify the accuracy of all information prior to use.

Legend

- Study Area
- Subject Site
- Cadastre
- BMP Land
- Hydroline

Ground-truthed Vegetation

- PCT 1525
- PCT 1600
- Planted Native
- Exotic/Cleared/Existing Infrastructure
- Waterbody

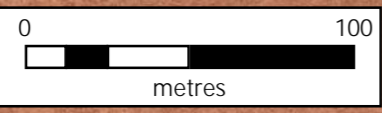
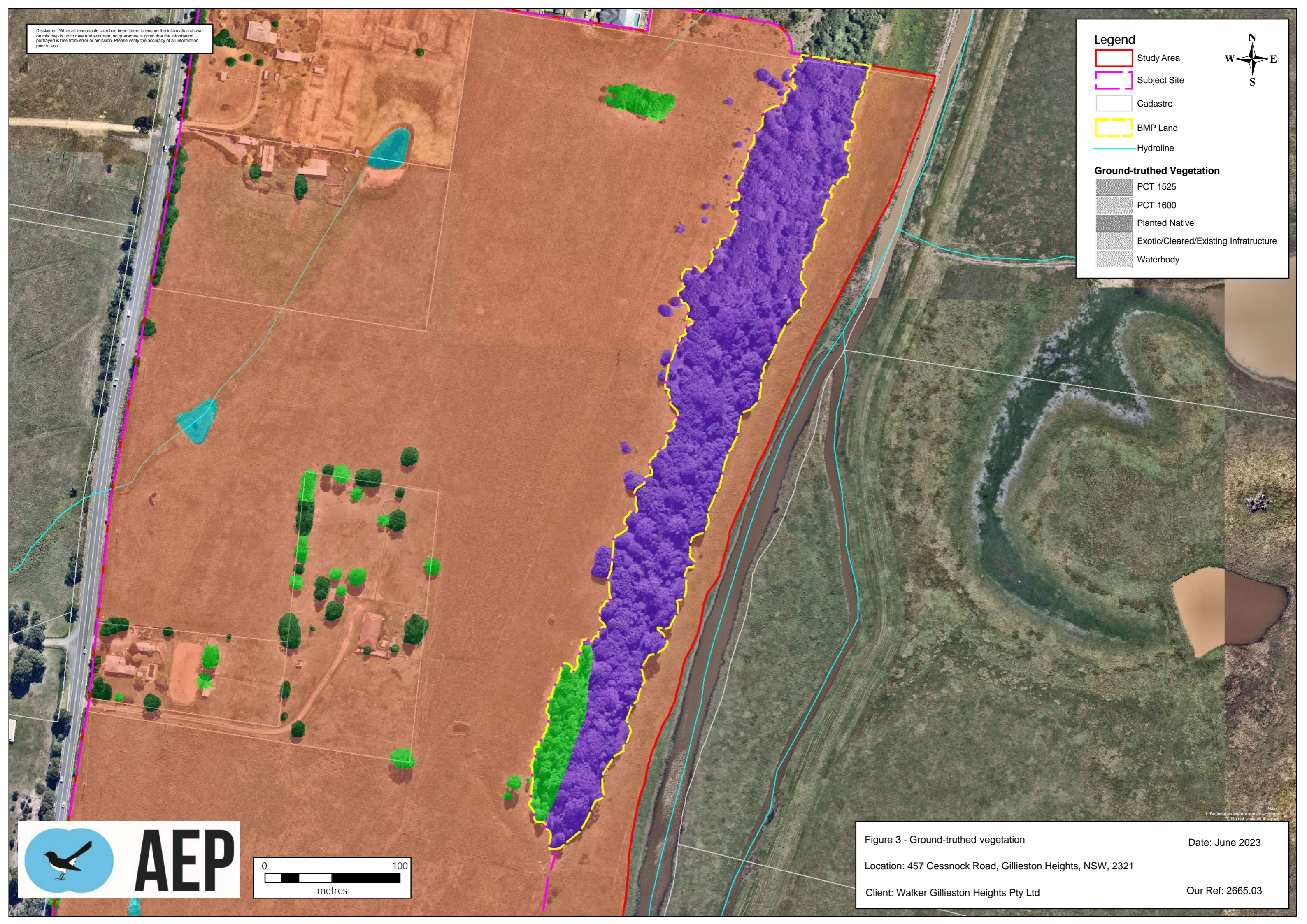



Figure 3 - Ground-truthed vegetation
Location: 457 Cessnock Road, Gillieston Heights, NSW, 2321
Client: Walker Gillieston Heights Pty Ltd
Date: June 2023
Our Ref: 2665.03

Notes:
1. Boundaries are not survey accurate.
2. Do not scale off this plan.

Disclaimer: While all reasonable care has been taken to ensure the information shown on this map is up to date and accurate, no guarantee is given that the information portrayed is free from error or omission. Please verify the accuracy of all information prior to use.

Legend

- Study Area
- Subject Site
- Cadastre
- BMP Land
- Hydroline

BMP Management Zones

- MZ1 - PCT 1525
- MZ2 - PCT 1600

- Indicative Monitoring Point
- Indicative Nest Box Locations

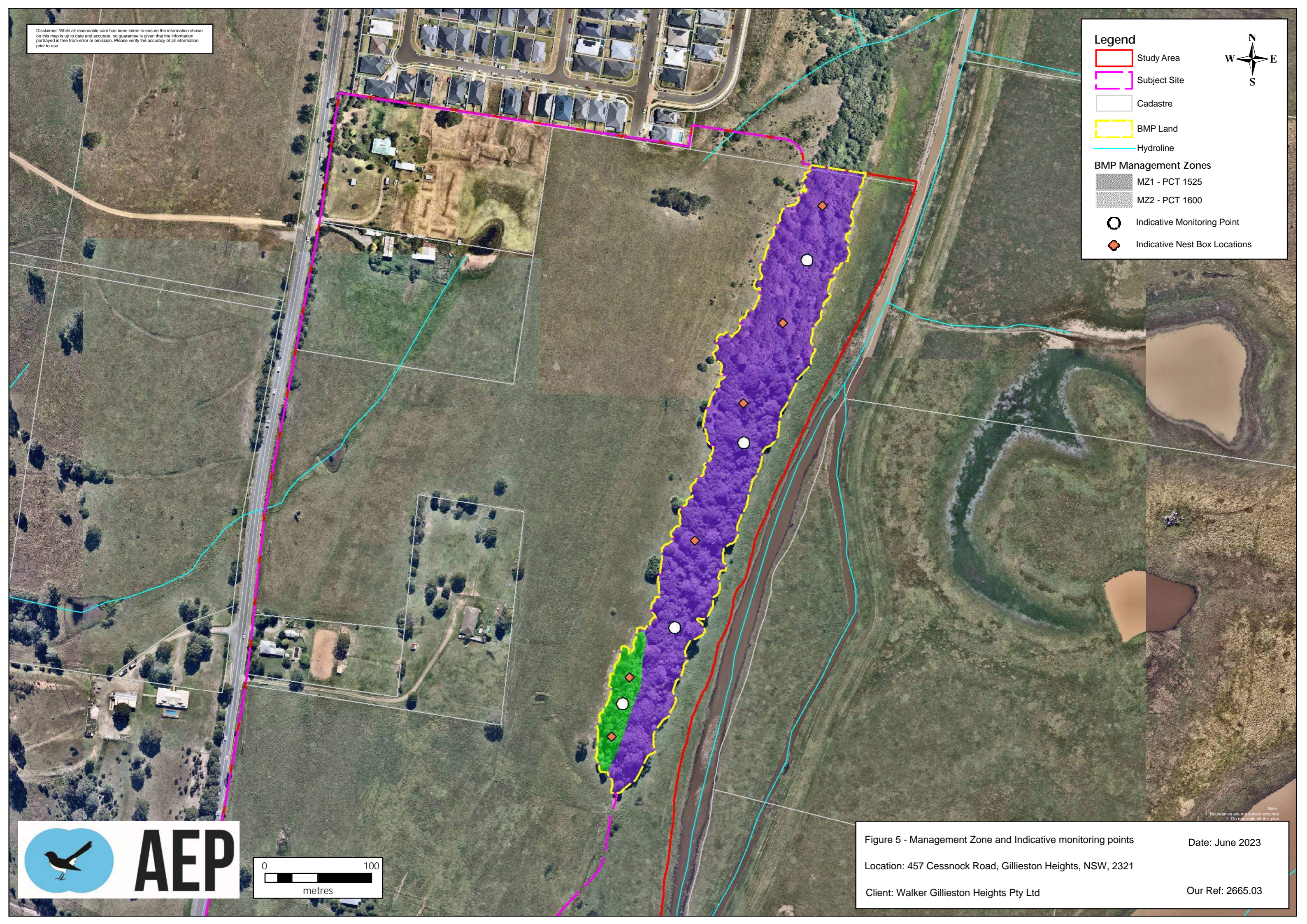


Figure 5 - Management Zone and Indicative monitoring points
Location: 457 Cessnock Road, Gillieston Heights, NSW, 2321
Client: Walker Gillieston Heights Pty Ltd
Date: June 2023
Our Ref: 2665.03

Note:
1. Boundaries are not survey accurate
2. Do not scale off this plan

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Appendix A – BMP Lands Signage

NO UNAUTHORISED ENTRY

**This is a Vegetation
Rehabilitation Area**

- **NO DUMPING or WASTE DISPOSAL**
- **NO ANIMALS, VEHICLES or MACHINERY**

For information – contact Site Manager

Appendix B – Revegetation Species List

Tree	Density	Shrubs	Density	Groundcovers	Density
PCT 1525 – Sandpaper Fig – Whalebone Tree warm temperate rainforest					
<i>Streblus brunonianus</i> <i>Acmena smithii</i> <i>Neolitsea dealbata</i> <i>Guioa semiglauca</i> <i>Cryptocarya microneura</i> <i>Toona ciliata</i> <i>Eucalyptus saligna</i> <i>Doryphora sassafras</i> <i>Daphnandra apatela</i> <i>Syncarpia glomulifera</i> <i>Mallotus philippensis</i> <i>Alphitonia excelsa</i>	1/30 m ²	<i>Pittosporum multiflorum</i> <i>Diospyros australis</i> <i>Claoxylon australe</i> <i>Hymenosporum flavum</i> <i>Ficus coronata</i> <i>Alectryon subcinereus</i> <i>Melicope micrococca</i> <i>Breynia oblongifolia</i> <i>Pittosporum revolutum</i> <i>Synoum glandulosum subsp. glandulosum</i> <i>Acronychia oblongifolia</i> <i>Wilkiea huegeliana</i>	1/10m ²	<i>Adiantum formosum</i> <i>Pellaea falcata</i> <i>Asplenium australasicum</i> <i>Adiantum aethiopicum</i> <i>Adiantum hispidulum</i> <i>Cyperus tetraphyllus</i> <i>Carex longebrachiata</i> <i>Microlaena stipoides</i> <i>Oplismenus aemulus</i> <i>Oplismenus imbecillis</i> <i>Lomandra longifolia</i> <i>Entolasia marginata</i> <i>Dichondra repens</i> <i>Viola hederacea</i> <i>Lobelia purpurascens</i>	4/m ²
PCT 1600 – Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter					
Not applicable due to the presence of an established of canopy stratum	-	<i>Bursaria spinosa</i> <i>Daviesia ulicifolia</i> <i>Acacia parvipinnula</i> <i>Acacia falcata</i> <i>Acacia implexa</i> <i>Breynia oblongifolia</i> <i>Leucopogon juniperinus</i>	1/10m ²	<i>Aristida vagans</i> <i>Themeda triandra</i> <i>Lomandra longifolia</i> <i>Lomandra filiformis</i> <i>Vernonia cinerea</i> <i>Brunoniella australis</i> <i>Lobelia purpurascens</i>	4/m ²

Appendix C – CVs

The fieldwork, data analysis and reporting for the BMP was undertaken by:

Staff	Title/Qualification	Tasks
Simon Purcell	Senior Ecologist/Works Coordinator BAppSc (Wildlife Science); Cert III Animal Care and Management	Report and Technical review
Yann Buisiere	Senior Ecologist BEnv&ResMgt, Dip Cons Land Mgt	Field survey, habitat and vegetation assessment and report preparation
Kelly Drysdale	Ecology Project Manager Ass Dip App. Sc, Grad Cert BA, TAE	Project lead, field survey, habitat and vegetation assessment and report review
Ben Graham	Ecologist BEnvSc&Man	GIS

Appendix K – Historical Imagery



Plate 1 – (Above) Historical Aerial Imagery from 1944 of the Subject Site (google).

Plate 2 – (Below) Historical Aerial Imagery from 1984 of the Subject Site (google).





Plate 3 – (Above) Historical Aerial Imagery from 1993 of the Subject Site (google).

Plate 4 – (Below) Historical Aerial Imagery from 2010 of the Subject Site (near maps.)





Plate 5 – (Above) Historical Aerial Imagery from 2023 of the Subject Site (near maps).

Appendix L – Stormwater Management Plan

South Gillieston Heights Development Application

Civil Engineering and Stormwater Report – Development Application



Prepared for Walker Gillieston Heights
Pty Ltd

16 June 2023



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Appendix A	Engineering Plans
Appendix B	Hunter River Branxton to Green Rocks Flood Study



1 Introduction

Enspire Solutions (**Enspire**) has been engaged by Walker Gillieston Heights Pty Ltd (**Client**) to prepare the Civil Engineering and stormwater management design and documentation in support of a Development Application (**DA**) submission to Maitland City Council for the proposed construction of roads and stormwater drainage infrastructure associated with the South Gillieston Heights development as shown in **Figure 1**.

Works associated with this application include:

1. Implementation of erosion and sediment controls
2. Bulk earthworks for proposed lots and roads
3. Stormwater management
4. Road construction
5. Retaining wall construction

This report intends to inform Council of the parameters and assumptions adopted in the design and documentation of the following civil engineering elements:

- Sediment and Erosion Control
- Bulk Earthworks
- Stormwater Quantity
- Stormwater Quality
- Roadworks
- Retaining walls



Figure 1 –Site Plan



2 Related Reports and Documents

This report is to be read in conjunction with the following reports and documents:

- 1) Development Application Documentation prepared by Enspire (refer Appendix A):

Table 1 – Enspire Development Application Drawing Reference

Drawing Number	Drawing Title
210039-DA-C01.01	COVER SHEET AND DRAWING SCHEDULE
210039-DA-C01.21	SPECIFICATION NOTES - SHEET 01
210039-DA-C01.22	SPECIFICATION NOTES - SHEET 02
210039-DA-C01.31	STAGING PLAN
210039-DA-C01.41	GENERAL ARRANGEMENT PLAN
210039-DA-C03.01	EROSION AND SEDIMENTATION CONTROL PLAN - SHEET 01
210039-DA-C03.02	EROSION AND SEDIMENTATION CONTROL PLAN - SHEET 02
210039-DA-C03.21	EROSION AND SEDIMENTATION CONTROL DETAILS
210039-DA-C03.31	SEDIMENT BASIN '01' PLAN AND SECTION
210039-DA-C03.32	SEDIMENT BASIN '02' PLAN AND SECTION
210039-DA-C03.33	SEDIMENT BASIN '03' PLAN AND SECTION
210039-DA-C04.01	CUT AND FILL PLAN
210039-DA-C04.21	CUT AND FILL SECTIONS - SHEET 01
210039-DA-C04.22	CUT AND FILL SECTIONS - SHEET 02
210039-DA-C04.23	CUT AND FILL SECTIONS - SHEET 03
210039-DA-C04.24	CUT AND FILL SECTIONS - SHEET 04
210039-DA-C04.25	CUT AND FILL SECTIONS - SHEET 05
210039-DA-C04.26	CUT AND FILL SECTIONS - SHEET 06
210039-DA-C04.27	CUT AND FILL SECTIONS - SHEET 07
210039-DA-C04.28	CUT AND FILL SECTIONS - SHEET 08
210039-DA-C04.29	CUT AND FILL SECTIONS - SHEET 09
210039-DA-C04.30	CUT AND FILL SECTIONS - SHEET 10
210039-DA-C04.31	CUT AND FILL SECTIONS - SHEET 11
210039-DA-C05.01	SITWORKS AND STORMWATER MANAGEMENT PLAN - SHEET 01
210039-DA-C05.02	SITWORKS AND STORMWATER MANAGEMENT PLAN - SHEET 02
210039-DA-C05.03	SITWORKS AND STORMWATER MANAGEMENT PLAN - SHEET 03
210039-DA-C05.04	SITWORKS AND STORMWATER MANAGEMENT PLAN - SHEET 04
210039-DA-C05.05	SITWORKS AND STORMWATER MANAGEMENT PLAN - SHEET 05
210039-DA-C05.06	SITWORKS AND STORMWATER MANAGEMENT PLAN - SHEET 06
210039-DA-C05.07	SITWORKS AND STORMWATER MANAGEMENT PLAN - SHEET 07
210039-DA-C06.01	ROAD TYPICAL CROSS SECTIONS - SHEET 01
210039-DA-C06.02	ROAD TYPICAL CROSS SECTIONS - SHEET 02
210039-DA-C06.03	ROAD TYPICAL CROSS SECTIONS - SHEET 03
210039-DA-C07.01	ROAD LONGITUDINAL SECTIONS - SHEET 01



210039-DA-C07.02	ROAD LONGITUDINAL SECTIONS - SHEET 02
210039-DA-C07.03	ROAD LONGITUDINAL SECTIONS - SHEET 03
210039-DA-C07.04	ROAD LONGITUDINAL SECTIONS - SHEET 04
210039-DA-C07.05	ROAD LONGITUDINAL SECTIONS - SHEET 05
210039-DA-C07.06	ROAD LONGITUDINAL SECTIONS - SHEET 06
210039-DA-C07.07	ROAD LONGITUDINAL SECTIONS - SHEET 07
210039-DA-C07.08	ROAD LONGITUDINAL SECTIONS - SHEET 08
210039-DA-C07.09	ROAD LONGITUDINAL SECTIONS - SHEET 09
210039-DA-C07.10	ROAD LONGITUDINAL SECTIONS - SHEET 10
210039-DA-C07.11	ROAD LONGITUDINAL SECTIONS - SHEET 11
210039-DA-C07.12	ROAD LONGITUDINAL SECTIONS - SHEET 12
210039-DA-C07.13	ROAD LONGITUDINAL SECTIONS - SHEET 13
210039-DA-C07.14	ROAD LONGITUDINAL SECTIONS - SHEET 14
210039-DA-C07.15	ROAD LONGITUDINAL SECTIONS - SHEET 15
210039-DA-C07.16	ROAD LONGITUDINAL SECTIONS - SHEET 16
210039-DA-C11.01	PAVEMENT, SIGNAGE AND LINEMARKING PLAN - SHEET 01
210039-DA-C11.02	PAVEMENT, SIGNAGE AND LINEMARKING PLAN - SHEET 02
210039-DA-C11.03	PAVEMENT, SIGNAGE AND LINEMARKING PLAN - SHEET 03
210039-DA-C11.04	PAVEMENT, SIGNAGE AND LINEMARKING PLAN - SHEET 04
210039-DA-C11.05	PAVEMENT, SIGNAGE AND LINEMARKING PLAN - SHEET 05
210039-DA-C11.06	PAVEMENT, SIGNAGE AND LINEMARKING PLAN - SHEET 06
210039-DA-C14.01	SITWORKS DETAILS - SHEET 01
210039-DA-C14.02	SITWORKS DETAILS - SHEET 02
210039-DA-C18.01	STORMWATER DETAILS
210039-DA-C18.51	STORMWATER BASIN 'A' PLAN
210039-DA-C18.52	STORMWATER BASIN 'A' SECTIONS
210039-DA-C18.53	STORMWATER BASIN 'B' PLAN
210039-DA-C18.54	STORMWATER BASIN 'B' SECTIONS
210039-DA-C18.55	STORMWATER OSD STORAGE TANK PLAN AND SECTION
210039-DA-C18.56	BIO-RETENTION BASIN DETAILS
210039-DA-C20.01	PRE-DEVELOPMENT CATCHMENT PLAN
210039-DA-C20.21	POST DEVELOPMENT CATCHMENT PLAN OVERALL
210039-DA-C20.22	POST DEVELOPMENT CATCHMENT PLAN INTERNAL - SHEET 01
210039-DA-C20.23	POST DEVELOPMENT CATCHMENT PLAN INTERNAL - SHEET 02
210039-DA-C22.01	TURNING PATH PLAN - SHEET 01
210039-DA-C22.02	TURNING PATH PLAN - SHEET 02
210039-DA-C22.03	TURNING PATH PLAN - SHEET 03
210039-DA-C22.04	TURNING PATH PLAN - SHEET 04
210039-DA-C22.05	TURNING PATH PLAN - SHEET 05
210039-DA-C22.06	TURNING PATH PLAN - SHEET 06



210039-DA-C22.07	TURNING PATH PLAN - SHEET 07
210039-DA-C22.08	TURNING PATH PLAN - SHEET 08
210039-DA-C22.09	TURNING PATH PLAN - SHEET 09

- 1) Maitland City Council Development Control Plan, 2011.
- 2) Maitland City Council Manual of Engineering Standards – Stormwater.
- 3) Maitland City Council Manual of Engineering Standards – Road Design.
- 4) Maitland City Council Pre DA Meeting Minutes
- 5) Cessnock Road, Gillieston Heights – Stage 11, SW17/2047
- 6) Cessnock Road, Gillieston Heights – Stage 12, SW/2019/0055
- 7) ADWJ MR195 Cessnock Road Plans, Regrowth Kurri Kurri Signalised Intersection Works, dated 03/22/2023
- 8) Hunter River Branxton to Green Rocks Flood Study – prepared by WMA Water, dated September 2010.
- 9) Using MUSIC in Sydney Drinking Water Catchment - A WaterNSW Standard, prepared by WaterNSW, 2019.



3 The Development

3.1 Proposed Development Works

The development site located within the Maitland City Council Local Government Area (LGA), is part of lots formally known as Lot 1 of DP311179, Lots 1 & 2 of DP601226 and Lots 1 & 2 of DP 302745. The site occupies approximately 43.57ha while the development footprint occupies a total area of approximately 31.0ha.

The development is generally bound by the following:

- Tangerine Street to the north.
- Cessnock Road to the west
- Existing rural land and Wallis Creek to the east and south.

The development, subject to this development application includes:

1. Establishment of roads and stormwater to facilitate subdivision for 322 residential lots;
2. Construction of three (3) on-site stormwater detention basins and two (2) water quality basins;
3. Connection to 4-way signalised Cessnock Road Intersection;
4. Construction of footpaths and shared paths;
5. Construction of public amenity spaces; and
6. Construction and commissioning of essential utilities.

3.2 Existing Site Conditions

The land to which this application applies is currently generally cleared grassed farmland with clusters of mature trees along the eastern boundary.

Five (5) existing dwellings are present on the site and front Cessnock Road. The site is located adjacent Wallis Creek along the eastern boundary of the site and a recently constructed development to the north.

The existing topography of the site includes numerous ridges throughout and an existing stormwater culvert below Cessnock Road. The site has three (3) main discharge points which coincide with the natural low points of the site. These are identified in **Figure 2**.

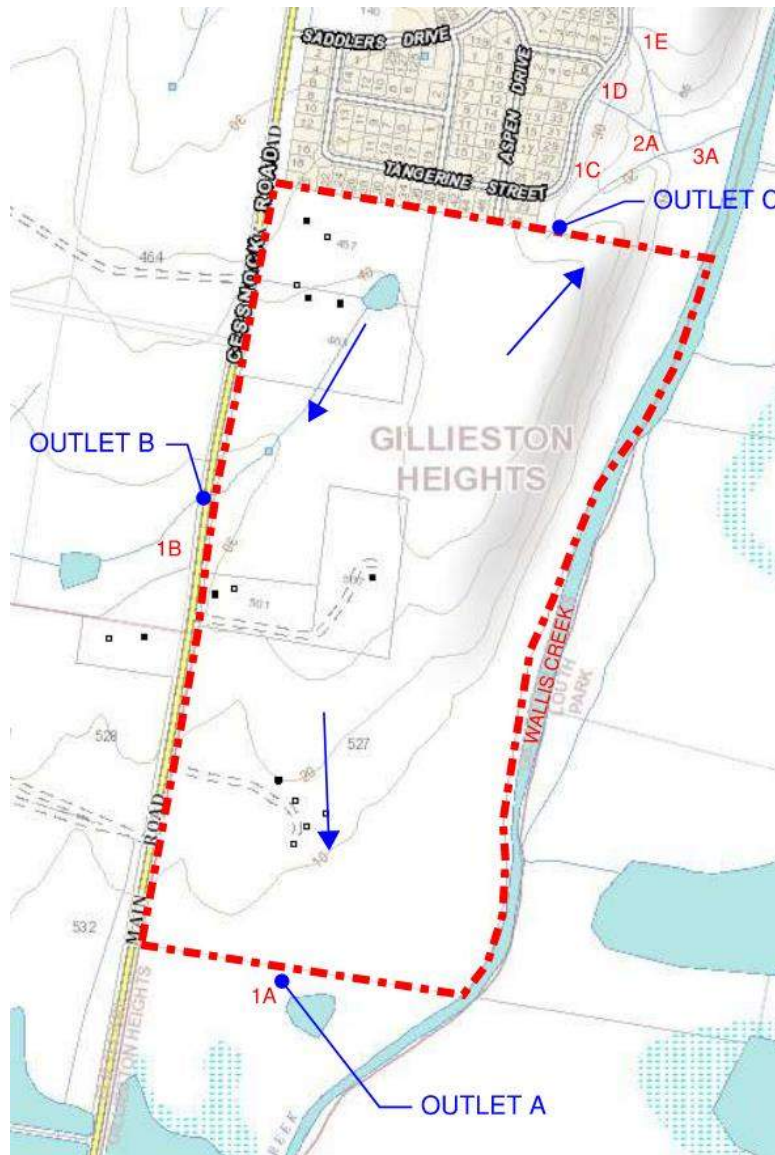


Figure 2 - Subject Site existing conditions



4 Erosion and Sediment Control

The objectives of the erosion and sediment control for the development site are to ensure:

- Adequate erosion and sediment control measures are applied prior to the commencement of construction and are maintained throughout construction; and
- Construction site runoff is appropriately treated in accordance with Maitland City Council requirements.

As part of the works, the erosion and sedimentation control will be constructed in accordance with Council requirements and the NSW Department of Housing Manual, “Managing Urban Stormwater Soil & Construction” 2004 (Blue Book) prior to any earthworks commencing on site.

4.1 Sediment Basin

Three (3) sediment basins are proposed to be utilised during construction and the sediment basins can be landscaped in line with relevant stage of works. Sediment basins have been located to coincide with the future permanent basin locations.

The sediment basins will be constructed as part of this subdivision development application and maintained through the construction of the subdivision. The sediment basins have been designed to capture site runoff during construction and have been located to coincide with the ultimate basin locations and low points of the site.

As per Appendix C of the Blue Book, the expected soil texture group for the proposed development is Type F. The proposed sediment basins are designed and sized to represent this soil texture classification.

To ensure the sediment basins are working effectively it will be maintained throughout the construction works. Maintenance includes ensuring adequate settlement times or flocculation and pumping of clean water to reach the minimum storage volume at the lower level of the settling zone. The settling zone will be identified by pegs to clearly show the level at which design storage capacity is available.

The pumped water from the sediment basins can be reused for dust control during construction.

An overflow weir is provided to each basin and will control overflows for rainfall events in excess of the design criteria.

4.2 Sediment and Erosion Control Measures

Prior to any earthworks commencing on site, sediment and erosion control measure shall be implemented generally in accordance with the Construction Certificate drawings and the “Blue Book”. The measures shown on the drawings are intended to be a minimum treatment only as the contractor will be required to modify and stage the erosion and sedimentation control measures to suit the construction program, sequencing, and techniques. These measures will include:

- A temporary site security/safety fence is to be constructed around the site
- Sediment fencing provided downstream of disturbed areas, including any topsoil stockpiles
- Dust control measures including covering stockpiles, installing fence hessian and watering exposed areas



- Placement of hay bales or mesh and gravel inlet filters around and along proposed catch drains and around stormwater inlets pits
- The construction of multiple temporary sediment basins
- Stabilised site access at the construction vehicle entry/exits.

Any stockpiled material, including topsoil, shall be located as far away as possible from any associated natural watercourses or temporary overland flow paths. Sediment fences shall be installed to the downstream side of stockpiles and any embankment formation. All stockpiles and embankment formations shall be stabilised by hydroseeding or hydro mulching on formation.

5 Stormwater Management Strategy

5.1 Objectives and Controls

The stormwater strategy has been developed in accordance with the Maitland City Council Precinct Development Control Plan 2011 (DCP) and Maitland City Council Manual of Engineering Standards Part 6 – Stormwater Drainage.

The proposed strategy seeks to achieve the following:

- a) To maximise safety of pedestrians and traffic during storm events through underground stormwater system and an overland major system.
- b) Ensure that post development flows from the total site do not generate stormwater discharges that exceed the existing pre-development flows.
- c) To minimise the erosion of existing waterways.
- d) To minimise the discharge of pollutants from operation of development sites.
- e) To minimise maintenance of stormwater management systems.
- f) To minimise nuisance flows of stormwater from one property to adjoining properties.

5.2 Proposed Stormwater Management Strategy

The stormwater management strategy has been designed to ensure site stormwater runoff is managed in the following key areas:

- Site catchments (internal and external)
- Stormwater Quantity
- Stormwater Quality.

The proposed civil engineering subdivision package documents site levels, grading, minor and major stormwater drainage components, and catchments for the site. The stormwater management strategy considers external upstream catchments as well as downstream external conditions.



5.3 Existing Catchments and External Conveyance

As part of the proposed stormwater management strategy the following items were assessed:

- Pre-developed catchments extents
- External catchments upstream of the site.

Under existing conditions, the catchments and impervious areas have been determined based on aerial photography and ground survey of the site, refer to **Figure 3** for existing catchment plan.



Figure 3 - Existing Catchments

5.4 Post Development Catchments

The proposed post-development catchments are generally consistent with the pre-developed catchments as discussed in Section 5.3.

Portions of existing Catchment 'B' have been incorporated into post-development Catchment 'A' as part of the proposed roads and lot grading strategy. The combined On-Site Detention (**OSD**)



and Water Sensitive Urban Design (**WSUD**) basins 'A' and 'B' have been sized to cater for the variation of catchment between pre and post-development scenarios. Catchment 'C' has a portion that is unable to drain into the OSD basin and Basin 'C' has been sized as to effectively attenuate the post developed flows back to that of the existing Catchment 'C' inclusive of the bypass catchment.

The post development catchments for the development are shown in **Figure 4**.



Figure 4 - Proposed Catchments

5.5 Stormwater Quantity

The Maitland City Council Manual of Engineering Standards Part 6 requires detention of stormwater flows for rainfall events up to and including the 1% Annual Exceedance Probability (AEP) event.



5.5.1 Stormwater Quantity Management Strategy

To comply with the objectives, set out in Maitland City Council's Manual of Engineering Standards Part 6, two permanent above ground OSD basins are proposed to the west and south of the site, as well as one below ground OSD culvert arrangement which is proposed to detain flows to the north.

Three (3) main discharge points have been identified for the works coinciding with the natural low points of the site. The proposed detention basins will be located upstream of the discharge location as identified in **Figure 5**.

Details of the proposed basins are provided in the Enspire drawing package.

5.5.1.1 Overall Catchments

Catchment 'A' – Discharges to the existing flood plain (Wallis Creek) to the south via a proposed OSD/WSUD Basin 'A'.

Catchment 'B' – Discharges through the proposed OSD/WSUD Basin 'B' and into the existing roadside swale. The flow is then conveyed under Cessnock Road by an existing 750mm RCP culvert.

Catchment 'C' – Discharges to the north via a below ground OSD culvert system. The flow is then conveyed to Wallis Creek through the existing low point.



Figure 5 – Basin Locations



5.5.2 Stormwater Modelling

Pre-Developed Catchment

The pre-development catchment runoff has been modelled using the RAFTS storage routing module of DRAINS software model using ARR 2019 rainfall inputs sourced from BoM and ARR Data Hub and catchment parameters as per Councils Engineering Design Specification.

The model includes the followings assumptions and key input parameters:

- Pre-development pervious fraction 95%
- Pervious Manning's roughness, $n = 0.05$
- Impervious Manning's roughness, $n = 0.015$
- Pervious area initial loss = 10mm
- Pervious area continuing loss = 3mm
- Impervious area initial loss = 1.5mm
- Impervious area continuing loss = 0mm
- Bx factor = 1

Post-Developed Catchment

The proposed subdivision will be drained by an in-ground pit and pipe network designed to convey the 10% AEP (minor) storm event. The surface drainage system has been designed to convey flow in excess of the minor event up to and including the 1% AEP (major) storm event.

The proposed drainage network has been designed to capture and convey 1% AEP (major) flows to the basin as to avoid any bypass of stormwater detention.

The on-site stormwater detention, pit and pipe network has been designed and modelled using the ILSAX module of DRAINS software (standard hydraulic model using ARR 2019 rainfall inputs sourced from BoM and ARR Data Hub).

The model includes the followings assumptions and key input parameters:

- Post developed impervious fraction 70%
- Depression storage:
 - o 1mm for paved area
 - o 5mm for grassed area
- Antecedence moisture condition 3
- Time of concentration 5mins for impervious areas, 8mins for pervious areas
- Ponding parameters 150mm max (minor event), 200mm max (major event)
- Velocity x depth product in gutter or overtopping roadway $< 0.4\text{m}^2/\text{s}$
- Minimum freeboard to HGL to ground level at each pit is 150mm (minor event).

The Enspire drawing package identifies the design parameters for each basin in the development and define the discharge relationship input into the DRAINS modelling.



5.6 Stormwater Drainage Modelling Results

The stormwater drainage network associated with the proposed development was analysed and results recorded. A pre-development and post-development flow analysis was conducted for each proposed on-site stormwater detention basin, outlined in Table 2, 3 and 4.

Table 2 –Basin A Pre/Post-Development Flow Assessment

AEP (%)	Pre-Development Flow (m ³ /s)	Post-Development Flow (m ³ /s)	Basin TWL (mAHD)	Basin Volume (m ³)
50	0.61	0.592	7.98	1042
20	1.2	0.757	8.32	2118
10	1.52	1.24	8.49	2708
5	2.05	1.94	8.65	3298
1	3.46	3.14	8.85	4079

Table 3 –Basin B Pre/Post-Development Flow Assessment

AEP (%)	Pre-Development Flow (m ³ /s)	Post-Development Flow (m ³ /s)	Basin TWL (mAHD)	Basin Volume (m ³)
50	0.544	0.54	28.86	1224
20	1.06	0.71	29.15	1855
10	1.39	1.17	29.3	2389
5	1.81	1.8	29.41	2763
1	3.07	2.98	29.6	3558

Table 4 –Basin C Pre/Post-Development Flow Assessment

AEP (%)	Pre-Development Flow (m ³ /s)	Post-Development Flow (m ³ /s)	Basin TWL (mAHD)	Basin Volume (m ³)
50	0.16	0.157	35.83	109
20	0.29	0.29	36.17	161
10	0.416	0.38	36.42	197
5	0.582	0.552	36.57	219
1	0.863	0.817	36.83	256

The above results indicate that the proposed basins have sufficient capacity to service the proposed development.



5.7 Stormwater Quality

5.7.1 Water Quality Strategy

Due to the complex level constraints present in the northeast corner of the site a WSUD basin for Catchment 'C' has been emitted in lieu of a GPT. It is proposed to over treat Catchment 'A' through an enlarged bio-retention area to satisfy Maitland City Council water quality targets.

5.7.2 Water Quality Objectives

The Maitland City Council Manual of Engineering Standards Part 6 provides water quality targets as presented in Table 5 below:

Table 5 - Water Quality Targets

Pollutant	% Reduction Post-Development Average Annual Load Reduction
Gross Pollutants	70
Total Suspended Solids (TSS)	80
Total Phosphorus (TP)	45
Total Nitrogen (TN)	45

The typical treatment strategy incorporates rainwater re-use tanks on every residential lot, gross pollutant traps (GPT) at each stormwater discharge point and tertiary treatment via vegetated bio-retention basins. To protect water quality infrastructure and minimise the size of proprietary treatment devices, it will be necessary to install splitter pits upstream of the treatment train to divert high flows directly to detention storages.

5.7.3 Bio-retention Areas

5.7.3.1 Bio-Retention Basins

The predominant means of suspended solids and nutrient removal is to be through the construction of bio-retention basins. Bio-retention basins are to incorporate an engineered filtration media that promotes nutrient removal when appropriately vegetated. Bio-retention basins have been modelled in MUSIC adopting the parameters detailed in Table 6. A typical bio-retention basin arrangement is presented in Figure 6.

Table 6 – Bio-Retention Basin Parameters

Parameter	Adopted Value
High Flow Bypass	3-month flow rate
Extended Detention Depth	300mm
Saturated Hydraulic Conductivity	100mm/hr
Filter Depth	500mm
TN Content of Filter Media	800mg/kg
Orthophosphate Content	40mg/kg
Exfiltration Rate	0mm/hr
Base liner	Yes
Vegetation	Effective nutrient removing plants assumed

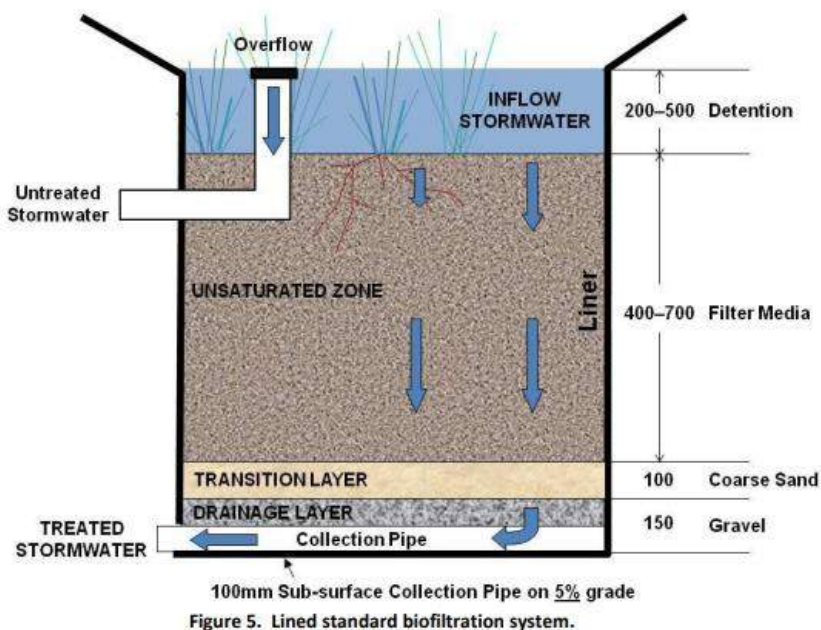


Figure 6 – Typical Bio-Retention Basin Arrangement

Source: *Stormwater Biofiltration systems Adoption Guidelines*, June 2009, FAWB.

5.7.4 Rainwater Tanks

Rainwater tanks have been modelled assuming the installation of a 3.0kL tank on each development lot but modelled in MUSIC with 2.5kL capacity taking into consideration storage inefficiencies.

It is noted rainwater tanks assist pollutant reduction through sedimentation and reuse. For this site the proposed tanks will typically be used for household non-potable water uses including toilet flushing, laundry, and garden irrigation.

5.7.4.1 Gross Pollutant Traps

Vortex type gross pollutant traps have been assumed to be adopted allowing for treatment up to the 3-month storm event. Larger storm events are assumed to bypass via splitter pit and be directed to detention basins. Given the range of proprietary products available this strategy has adopted the following treatment effectiveness for gross pollutant traps which is typical for industry leading units available in the market.

- 98% GP removal.
- 70% TSS removal for inflow concentrations greater than 75mg/L.
- 30% TP removal for inflow concentrations greater than 0.5mg/L.
- 0% TN removal.

It is part of this strategy that oil pillows will be installed in GPTs to capture hydrocarbon pollutants (oil and grease). Figure 7 shows a diagram of a typical vortex style GPT.

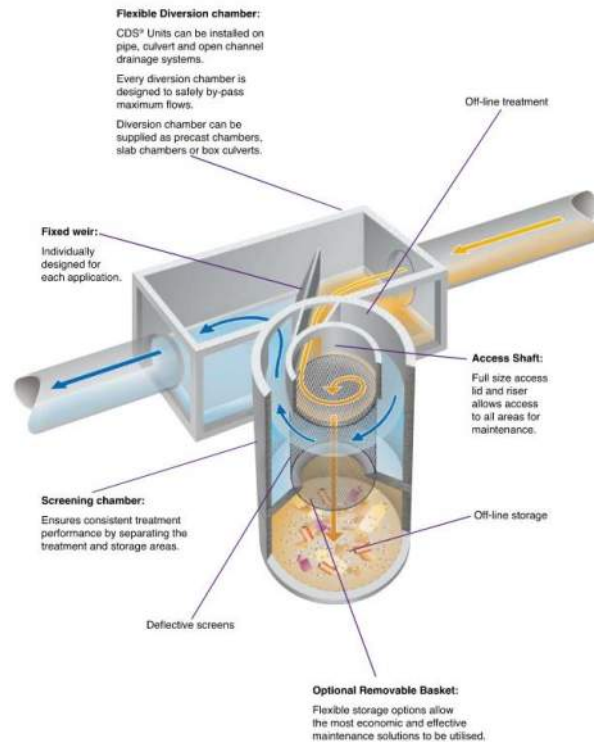


Figure 7 – Typical Vortex Type GPT Concept

Source: Rocla CDS Unit Technical Summary

5.7.5 MUSIC Modelling

A water quality analysis has been undertaken to assess the performance of the proposed WSUD strategy against the adopted stormwater quality targets. The stormwater quality analysis for this study was undertaken using the industry standard software model MUSIC (Model for Urban Stormwater Improvement Conceptualisation) Version 6.3.

Post-development catchment boundaries adopted for modelling are like those that have been adopted for stormwater quantity modelling but have been further broken down into land use categories to appropriately model pollutant quantities and the proposed treatment train. Catchment 'B' has been divided to illustrate the lots entering the basin via the GPT and those that discharge directly into the basin.

It is noted that Maitland City Council has not released a MUSIC modelling guideline or MUSIC Link file to standardise modelling in the LGA and a first principles approach to modelling has been adopted for this strategy. MUSIC modelling parameters and data have been specified in Section 5.7.6. Refer **Figure 8** for the proposed MUSIC Model layout.

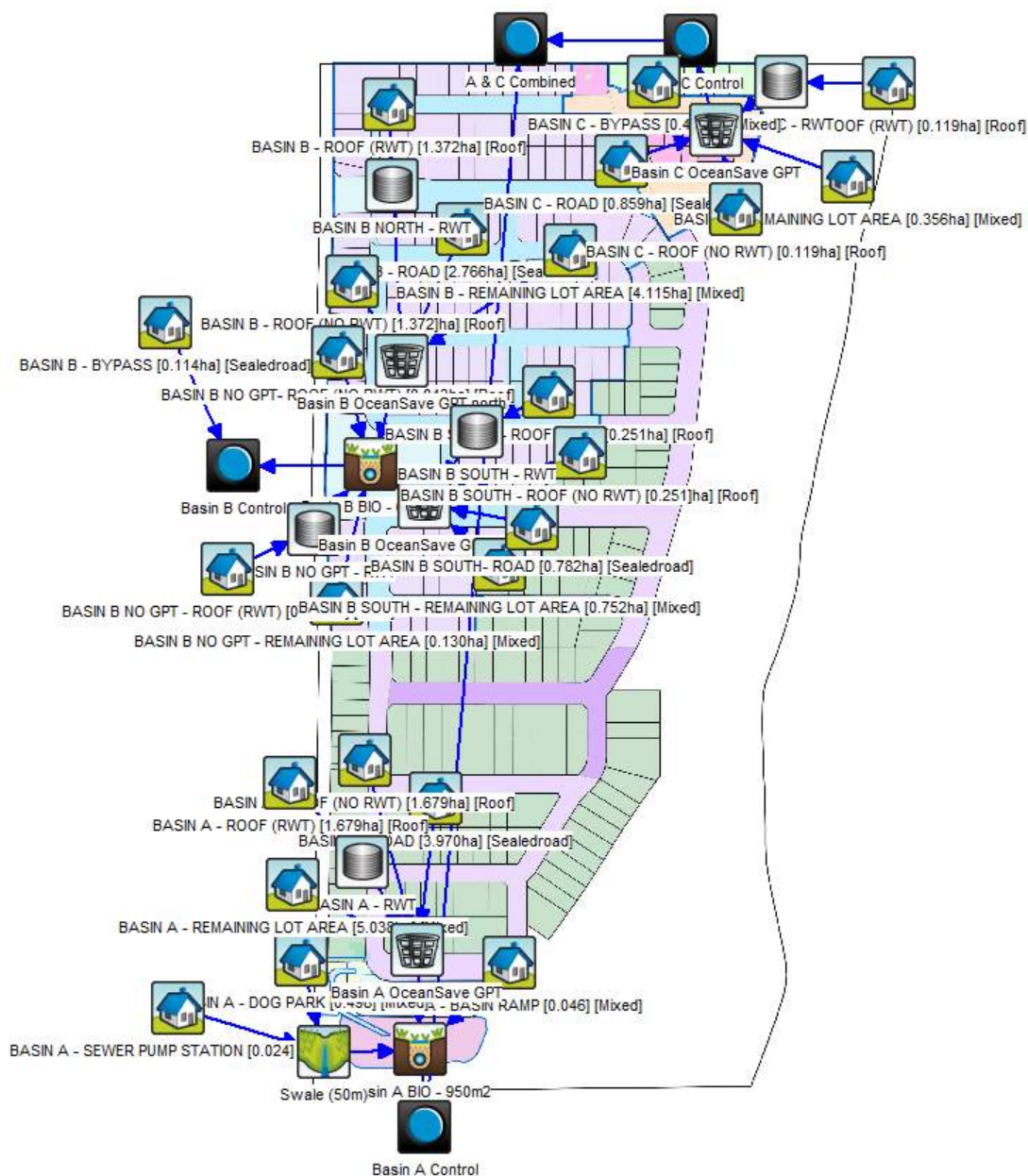


Figure 8 – Extract of MUSIC Modelling Layout

5.7.6 Catchment Hydrology

Rainfall data across numerous weather stations has been assessed with the rainfall data detailed in Table 7 and monthly Potential Evapotranspiration (PET) data in Table 8 adopted for modelling purposes. These rainfall parameters have been assessed based on:

- Proximity to the subject site (the closer the more relevant).
- Completeness of data (minimal to no data gaps)
- Period of data collection (ideally 40 years or more)
- Period appropriate for modelling typical climate conditions (generally a 10-year period with no extreme dry or wet conditions)
- Appropriate timestep for modelling evaporation and infiltration effects accurately (industry standard for water quality modelling is 6-minute).



Table 7 – MUSIC Model Rainfall Data

Variable	Adopted Value
Weather Station	61250 Paterson
Rainfall Period	1975-2005
Timestep	6-minute

Table 8 – MUSIC Model Monthly PET

Month	Protect PET (mm)
January	165
February	125
March	115
April	65
May	55
June	45
July	45
August	60
September	85
October	120
November	145
December	155

Catchment rainfall-runoff and groundwater properties for all catchment types has adopted the parameters in Table 9 which have taken into consideration to the typical soil profiles within The Site.

Table 9 – MUSIC Catchment Rainfall-Runoff Parameters

Parameter	Adopted Value
Impervious Areas	
Rainfall Threshold	1.0mm
Pervious Areas	
Soil Storage Capacity (mm)	120
Initial Storage (% of capacity)	25
Field Capacity (mm)	80
Infiltration Capacity Coefficient – a	200
Infiltration Capacity Coefficient – b	1
Groundwater	
Initial Depth (mm)	10
Daily Recharge Rate (%)	25
Daily Baseflow Rate (%)	10
Daily Deep Seepage Rate (%)	0



Table 10 - Key Parameters adopted for the proposed treatment measures

Proposed Measure	Key Parameter Values		
	Pollutant	Input (mg/L)	Output (mg/L)
Gross Pollutant Trap (GPT)	Total Suspended Solids	0 75 1000	0 75 350
	Total Phosphorus	0 0.5 1.0	0 0.5 0.85
	Total Nitrogen	0 0.5 5.0	0 0.5 4.3
	Gross Pollutants	0 15	0 1.5
Bio-retention Areas	Extended detention depth = 0.3 m. Filter depth = 0.5 m. Saturated hydraulic conductivity = 100 mm/hr. TN content of filter media = 800 mg/kg Orthophosphate content of filter media 40 mg/kg		
Rainwater Tanks	2.5KL Rainwater tank assumed for each lot Daily indoor demand = 0.1kL/day/lot Total demand calculated based on total number of lots.		

5.7.7 Catchment Representation

Post development catchments have been defined by the following general urban typologies:

- Roads
- Low Density
- Open Space areas

Table 11 details the land use breakdown adopted to generate nodes suitable for MUSIC modelling.

Table 11 – MUSIC Node Details Summary

Land Use	Sub Catchment	Adopted Impervious	Comments
Roads	N/A	70%	
Low Density	Roof (to rainwater tank)	100%	Roof assumed to represent 40% of total land use area. 50% of roof assumed to contribute to a rainwater tank.
	Roof (bypass)	100%	Roof assumed to represent 40% of total land use area. 50% of roof assumed to contribute to a rainwater tank.
	Remaining Lot Area	50%	Total percentage of low-density land use imperviousness equates to 60%
Open Space/Park	N/A	10%	



5.7.8 Catchment Pollutant Generation

Catchment pollutant generation estimates have been based on Table 12 base flow and storm flow parameters adopting stochastic generation.

Table 12 – MUSIC Catchment Pollutant Generation Parameters

Land Use	Mean / Standard Deviation	Total Suspended Solids (mg/L-log10)		Total Phosphorus (mg/L-log10)		Total Nitrogen (mg/L-log10)	
		Base Flow	Storm Flow	Base Flow	Storm Flow	Base Flow	Storm Flow
Road	Mean	1.20	2.43	-0.85	-0.30	0.11	0.34
	Standard Deviation	0.17	0.32	0.19	0.25	0.12	0.19
Roof	Mean	N/A	1.30	N/A	-0.89	N/A	0.30
	Standard Deviation	N/A	0.32	N/A	0.25	N/A	0.19
Residential	Mean	1.20	2.15	-0.85	-0.60	0.11	0.30
	Standard Deviation	0.17	0.32	0.19	0.25	0.12	0.19

5.7.9 MUSIC Model Results

Table 13 summarises the average annual pollutant loads and reductions at the receiving node, located directly downstream of the proposed bio-retention basins.

Table 13 - Estimated Average Annual Pollutant Load Reduction

Control Node	Gross Pollutants (GP) Removal (%)	Total Suspended Solids (TSS) Removal (%)	Total Phosphorous (TP) Removal (%)	Total Nitrogen (TN) Removal (%)
Performance Target	70.0	80.0	45.0	45.0
Basin A & C	96.0	80.7	59.1	50.0
Basin B	99.0	82.2	62.1	50.7

The results above demonstrate that the development meets Council's target reductions for pollutant loads at the discharge location.

6 Stream Erosion Index

To estimate potential impact on existing waterways due to changes in flow frequency behaviour, an assessment of Stream Erosion Index (**SEI**) has been undertaken. The following methodology has been adopted to calculate post-development SEI with a target SEI value of 3.5 or less (minimal impact).

- Critical stream forming flow has been estimated based on calculated pre-development 50% AEP flow rate multiplied by 50%. Critical stream forming flow indicates the threshold at which mobilisation of bed material and erosion of banks begins to occur.
- Mean pre-development annual runoff volume that exceeds the estimated critical flow has been determined through MUSIC software. With a SEI target of 3.5, the mean annual volume becomes the target in the post-development scenario.
- Mean post-development annual runoff volume that exceeds the estimated critical flow has been determined through MUSIC software. Detention and water quality



improvement infrastructure has been modelled as part of the post-development scenario.

- SEI has been determined by dividing post-development mean annual runoff volume by pre-development mean annual runoff volume from the above steps.

Table 14 – Stream Erosion Index Assessment with Detention

Waterway	Calculated 50%AEP Pre-Development Peak Flow Rate (m ³ /s)	Estimated Critical Stream Forming Flow Rate (m ³ /s)	Mean Annual Runoff Volume Above Critical Flow (ML/year)		SEI
			Pre-Development	Post-Development	
CP1/1A BASIN A	0.610	0.305	1.110	3.590	3.234
CP2/1B BASIN B	0.544	0.272	1.500	4.090	2.727
CP3/1C BASIN C	0.160	0.08	0.089	0.229	2.579

As demonstrated in Table 14 Table 1the implementation of the proposed stormwater management strategy will achieve an SEI of less than 3.5 for all existing watercourses indicating that it is very unlikely the proposed development will generate accelerated changes in the geomorphology of these watercourses where this strategy is in place.



7 Siteworks

7.1 General

The proposed development will comprise of one main entrance via a four-way intersection with Cessnock Road and the McCloys development to the west and a connection to Aspen Drive to the north. The Cessnock Road intersection will incorporate double diamond phasing, as to provide the best possible outcomes to future residents and road users. This intersection will form an integral connection between the development, Cessnock Road and the McCloys development to the west. Road 07 and Road 01, south of the proposed roundabout, will form the bus route to service the proposed development. The internal road network will consist of a combination of collector, local, perimeter and entry road types as demonstrated within Enspire's engineering drawing package. The road layout can be seen in **Figure 9**.

The development will incorporate multiple open space and public amenity areas including a pocket park and dog park, refer to the Enspire's engineering drawing package for further details.



Figure 9 – Proposed Road Layout



7.2 Road Types

It is proposed that internal roads will be designed as per the categorisation and road profile in Table 15 below:

Table 15 - Road Typical Sections

Road	Category	Road Reserve Width	Typical Road Carriageway	Comments
ROAD 01	Collector Road	21.0m	12.0m (3.5m Traffic lane, 2.5m parking bay)	4.5m verge both sides Variable footpaths, refer to Enspire Drawing Pack for details.
ROAD 01 (Perimeter)	Collector Road	22.0m	12.0m (3.5m Traffic lane, 2.5m parking bay)	4.5m verge one side 5.5m verge one side Variable footpath, refer to Enspire Drawing Pack for details.
ROAD 02	Local Road	17.0m, locally widened around dog park, refer to Enspire Drawing Pack for details.	8.0m, locally widened around dog park, refer to Enspire Drawing Pack for details.	Variable, refer to Enspire Drawing Pack for details.
ROAD 03 ROAD 04 ROAD 05 ROAD 06 ROAD 08 ROAD 09 ROAD 10 ROAD 11	Local Road	17.0m	8.0m	1.5m wide footpath on one side 4.5m wide verge on one side
ROAD 07	Sub – Arterial	25.5m	Variable, refer to Enspire Drawing Pack for details.	Variable, refer to Enspire Drawing Pack for details.

7.3 Design and Posted Speed

Internal roads of the development have a proposed posted speed limit of 50km/h. The design speed adopted throughout the development are as follows:

- Sub-Arterial/Collector Road - 60km/h
- Local Road – 50km/h

7.4 Parking and Signage

On-road parking is to be provide throughout the development with dedicated spaces on Road 01 and Road 07. A detailed signage and line marking plan can be found within Enspire’s engineering drawing package.

Signage, line marking, and road pavement surface treatments have been proposed in order to provide appropriate warning to vehicles, traffic calming at key intersections and improve driver awareness in critical locations.

The proposed development will include a new bus route and therefore appropriate signage, line marking, and bus stop measures have been implemented in accordance with Council’s



standards. Bus stops have been implemented on Road 01 as to ensure that no resident is generally located within a 400m walk from the nearest bus stop. Kerb blisters are also proposed along the perimeter portion of Road 01 to provide traffic calming and safe crossing locations for pedestrians. The kerb blister located behind the bus stop can be seen in **Figure 10** Below.

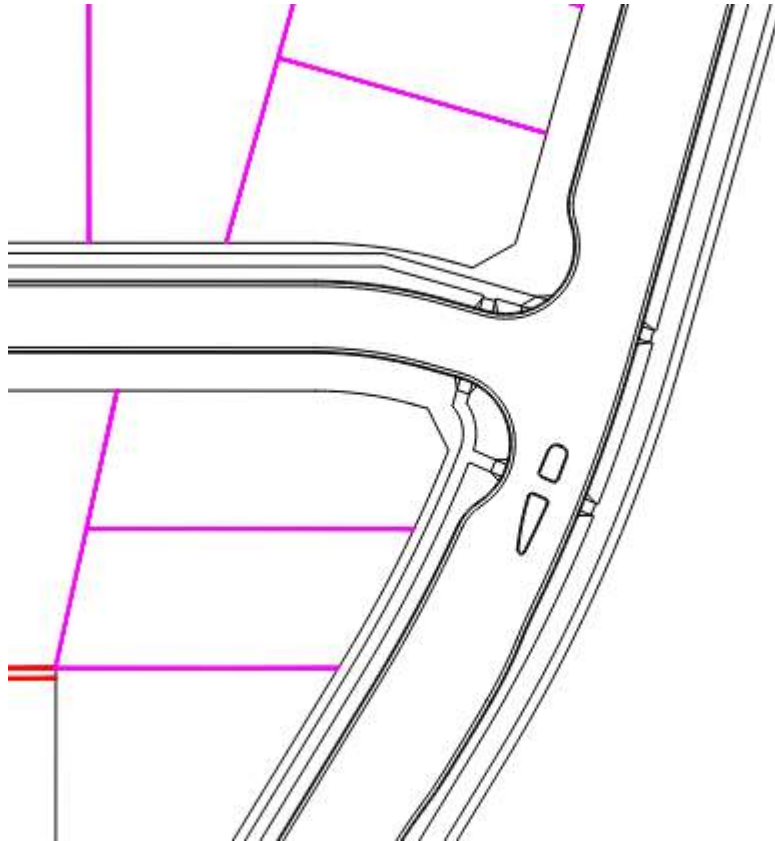


Figure 10 - Kerb Blisters

Reference shall be made to Enspire's Pavement, Signage and Linemarking Plans '210039-DA-C11.01' to 'C11.06' for details on proposed pavement treatments and signage.

7.5 Vertical and Horizontal Geometry

The road geometry has been designed in accordance with Maitland Council Engineering Standards Part 4 and generally in accordance with AUSTRROADS Guide to Road Design Part 3. The vertical and horizontal geometry has considered sight distance in accordance with AUSTRROADS Guide to Road Design Part 3.

Horizontal alignments, longitudinal gradients and vertical curves have been designed in accordance with Sections 2.3, 2.4 and section 2.5 in Councils Engineering Standards respectively.

7.6 Design Vehicles

Design vehicles for the development include a 5.2m passenger car, an 8.8m Medium Rigid Vehicle and a Bus in accordance with Part 4 of Council's Engineering Standards and a 12.5m bus for bus routes. A 19m semitrailer has been utilised for turning paths for the four-way intersection and access to the waste water pump station (WWPS). Swept path analysis has been



completed using AutoTURN software and in accordance with AUSTRROADS (2006) and Council's Guidelines.

Refer Enspire Turning Path Plans '210039-DA-C22.01' to 'C22.09' for details on turning paths assessments.

7.7 Pavement Design

Pavements for local roads have been designed generally in accordance with AUSTRROADS Guide to the Design of New Pavements for light Traffic, Councils Engineering Design Specification as well as advice from Stantec in their Geotechnical Investigation Report (ref: 304100964-001.2).

A design ESA traffic loading of 2×10^5 has been adopted for local roads, 1.5×10^6 for collector roads, 5×10^6 for bus route and 1×10^7 for sub-arterial roads. The proposed pavement designs have been developed in accordance with Maitland Council Engineering Standards Part 4.

The proposed design profile for each type of pavement in the development is demonstrated on Enspire's engineering drawings specifically '210039-DA-C11.01' to 'C11.07' and 'C14.01'.

7.8 Retaining Walls

It is proposed to construct retaining walls as part of this package.

Table 16 nominates the wall types used in the documentation.

Table 16 - Retaining Wall Types

Wall Type	Details
Concrete Sleeper Wall	To be constructed using a proprietary concrete sleeper retaining wall system. Refer Enspire's drawing 210039-DA-C14.02 for details.
Terrace Sleeper Retaining Wall	To be constructed using a proprietary concrete sleeper retaining wall system and in a terrace arrangement. Refer Enspire's drawing 210039-DA-C14.02 for details.
Blockwork Retaining Wall	Located at any retained locations adjacent roadways. Refer Enspire's drawing 210039-DA-C14.02 for details.

Figure 11 overleaf shows the retaining walls to be constructed as part of this package.

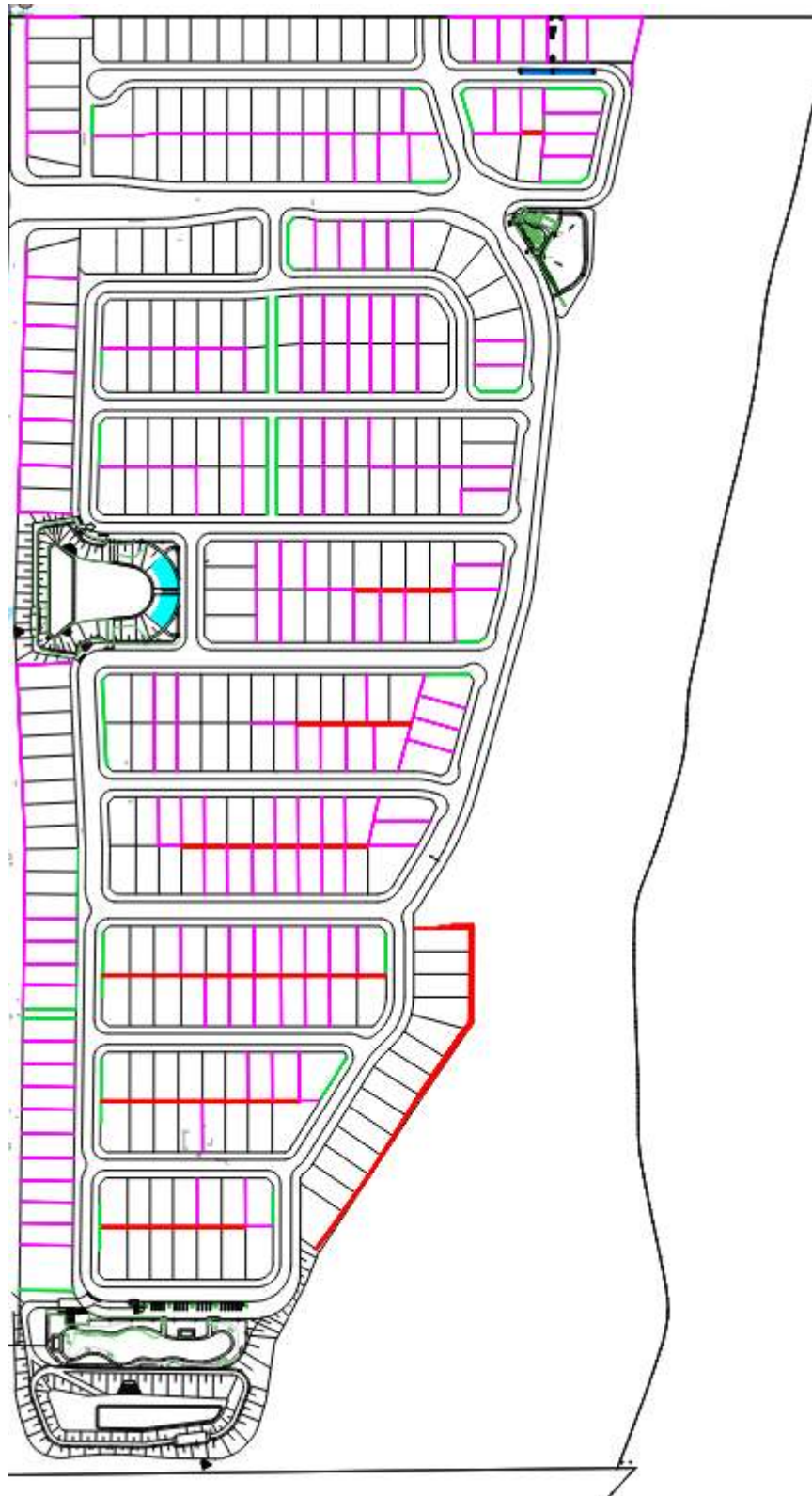


Figure 11 – Retaining wall plan



8 Conclusion

This Civil Engineering and Stormwater Management Report has been prepared to provide an understanding of the design assumptions, inputs and guide to the stormwater quantity and quality management techniques for the proposed development as depicted in **Figure 1**.

This report demonstrates that the stormwater drainage objectives as outlined in the Maitland City Council Manual of Engineering Standards are achieved.

The included stormwater quantity calculations demonstrate how peak flows from the proposed development site in post-development conditions are attenuated to no greater than the existing peak flows for all design storms up to and including the 1%AEP event.

The stormwater quality assessment demonstrates that a specifically tailored treatment system will be required in order to meet the pollutant removal targets as defined in the Maitland City Council Manual of Engineering Standards during the operational phase of the proposed development.

Proposed horizontal and vertical road alignments will meet the requirements of Council's Engineering Standards and Austroads Guidelines.

Appendix M – SBDAR Checklist

Biodiversity Development Assessment Report: Streamlined assessment module – Small area

BAM Reference	Information	SBDAR Section	Completed
Report			
Introduction - Chapters 2 and 3	Introduction to the biodiversity assessment including: <ul style="list-style-type: none"> brief description of proposed development identification of subject land boundary, including: operational footprint and construction footprint indicating clearing associated with temporary/ancillary construction facilities and infrastructure general description of the subject land 	1.1, 1.1.2, 1.1.3, Figure 1 Figure 2	Y
	Sources of information used in the assessment, including reports and spatial data	1.1.4	Y
	Identification of assessment method applied (i.e., linear or site-based)	1.1.2	Y
Landscape - Section 3.1, 3.2 and Appendix E	General description of subject land topographic and hydrological setting, geology and soils	1.1.1, 1.1.3, 1.2, 1.2.2	Y
	Percent native vegetation cover in the assessment area (as described in BAM Subsection 3.2(4.))	1.3.1	Y
	IBRA bioregions and subregions (as described in BAM Subsection 3.1.3(2.))	1.2.1	Y
	Rivers and streams classified according to stream order (as described in BAM Subsection 3.1.3(3–4.) and Appendix E)	1.2.2	Y
	Wetlands within, adjacent to and downstream of the site (as described in BAM Subsection 3.1.3(4.))	1.2.2	Y
	Connectivity of different areas of habitat (as described in BAM Subsection 3.1.3(5–6.))	1.2.2	Y
	Areas of geological significance and soil hazard features (as described in BAM Subsections 3.1.3(7.) and 3.1.3(10.))	1.2.2	Y
Native vegetation, TECs and vegetation integrity - Chapter 4	Patch size (in accordance with BAM Subsection 4.3.2)	1.4.2.1	Y
	Identification of the dominant PCT on the subject land and extent (ha) with justification of method used (existing information or plot-based survey data)	1.4.3 Tables 3 to 7	Y
	Identification of any TEC associated with the PCT (BAM Subsection 4.2.2)	1.4.3 Table 6, Table 7, Table 10	Y
	Estimate of percent cleared value of dominant PCT (BAM Subsection 4.2.1(5.))	1.4.4, Table 6, Table 7	Y
	Identification of any TEC on site that is not associated with the dominant PCT (Note: This TEC is required to be assessed and offset.)	N/A	
	Equivalence with mapping units of previous vegetation maps reviewed as part of the assessment (i.e., equivalent mapping units)	1.4.1, Table 3, Figure 3	Y
	Vegetation integrity of the PCT(s) on the subject land as individual vegetation zones	1.5.1, Table 11	Y
	Justification for how this was determined (i.e., qualitatively by observing values for the condition attributes set out in Table 2 of	1.4.3	Y

BAM Reference	Information	SBDAR Section	Completed
	the BAM or quantitatively by collecting field data for the condition attributes at a plot in accordance with BAM Subsection 4.3.4)		
	Use of relevant benchmark data from BioNet Vegetation Classification (as described in BAM Subsections 4.3.3(5.)) Where use of more appropriate local benchmark data is proposed (as described in BAM Subsection 1.4.2, BAM Subsection 4.3.3(5.) and BAM Appendix A): <ul style="list-style-type: none"> • identify the PCT or vegetation class for which local benchmark data will be applied • identify published sources of local benchmark data (if benchmarks obtained from published sources) • describe methods of local benchmark data collection (if reference plots used to determine local benchmark data) • provide justification for use of local data rather than BioNet Vegetation Classification benchmark values 	1.4.4, 1.4.5	Y
Chapter 5 and Section 9.1	Describe the review of existing information and any field survey undertaken to assess habitat constraints and microhabitats for threatened species within the subject land	1.6, 2.7.1, Table 15, Table 16	Y
	Determination of the suite of threatened species likely to occur on or use the proposed site according to Steps 1 and 2 in BAM Section 5.2 including species to be assessed for ecosystem credits and the list of species to be assessed for species credits	1.6 Table 12	Y
	List of ecosystem credit species derived from the TBDC (as described in BAM Subsections 5.2.1 and 5.2.2) with justification for the exclusion of any ecosystem credit species based on habitat constraints (as described in BAM Subsection 5.2.2)	1.6.1, Table 13, Table 14	Y
	Identification of candidate species credit species that are at risk of an SAll and therefore, must be further assessed (BAM Section 9.1). Note: Candidate species credit species that are not at risk of an SAll and not incidentally recorded on the subject land do not require further assessment.	1.6.1, Table 13, Table 14 Figure 5	Y
	For candidate species credit species that are at risk of an SAll, a description of the species, any habitat constraints or microhabitats associated with the species on the subject land and information used to create the species polygon/s in accordance with Steps 3 to 5 of BAM Section 5.2 including: <ul style="list-style-type: none"> • justification for determining that a candidate species credit species at risk of an SAll is unlikely to have suitable habitat on the subject land or specific vegetation zone (based on a field assessment of the subject land and published literature or an expert report prepared in accordance with Box 3 of the BAM) • determination of the presence of remaining candidate species credit species at risk of an SAll (by assuming presence, conducting a threatened species survey or an expert report). Note: If the subject land is mapped on an important habitat map for a species, or for a component of its habitat, the subject land is considered to have suitable habitat for the species to be present. <ul style="list-style-type: none"> • species polygons identifying the location and area of suitable habitat for each candidate threatened species 	1.6.5 2.7.1, Table 13, Table 14, Figure 5	Y

BAM Reference	Information	SBDAR Section	Completed
	<p>at risk of an SAIL that is recorded on the subject land and is measured by area, OR</p> <ul style="list-style-type: none"> species polygons identifying the area of suitable habitat and targeted surveys identifying the count and location of individuals on the subject land for each candidate threatened flora species at risk of an SAIL that is recorded on the subject land and is measured by count species polygons for each threatened species identified on the subject land that is not at risk of an SAIL (i.e., incidentally observed during site visit) 		
	Determination of habitat condition within species polygon/s for each threatened species (measured by area) at risk of an SAIL or incidentally observed during the site visit (Step 6 of BAM Section 5.2)	N/A	Y
	For flora species credit species at risk of an SAIL or incidentally observed during site visit, provide a count, or an estimation, of the number of individual plants present on the subject land (as described in BAM Subsection 5.2.5(4.))	N/A	Y
Prescribed impacts Chapter 6	Any prescribed impacts from the small area proposal must be set out in the BDAR consistent with Appendix K	2.1, Table 19	Y
Avoid and minimise impacts – Chapter 7	<p>Demonstration of efforts to avoid and minimise impacts on biodiversity values (including prescribed impacts) associated with the proposal location in accordance with Chapter 7, including an analysis of alternative:</p> <ul style="list-style-type: none"> modes or technologies that would avoid or minimise impacts on biodiversity values and justification for selecting the proposed mode or technology alternative locations that would avoid or minimise impacts on biodiversity values and justification for selecting the proposed location alternative sites within a property on which the proposal is located that would avoid or minimise impacts on biodiversity values and justification for selecting the proposed site 	2.1, 2.2 Table 18, Table 19	Y
	Describe efforts to avoid and minimise impacts (including prescribed impacts) to biodiversity values through proposal design (as described in BAM Subsections 7.1.2 and 7.2.2)	2.1, 2.2, Table 18, Table 19, Table 22, Table 23, Table 24, Table 25	Y
	Identification of any other site constraints that the proponent has considered in determining the location and design of the proposal (as described in BAM Subsection 7.2.1(3.))	Table 18, Table 19, Table 22, Table 23, Table 24, Table 25	Y
Assessment of Impacts - Chapter 8, Section 8.1 and 8.2	<p>Determine the impacts on native vegetation and threatened species habitat, including:</p> <ul style="list-style-type: none"> description of direct impacts of clearing of native vegetation, threatened ecological communities and threatened species habitat (as described in BAM Sections 8.1) description of the nature, extent, frequency, duration and timing of indirect impacts of the proposal (as described in BAM Subsection 8.2) 	2.2, 2.6, Table 22, Table 23, Table 24, Table 25	Y

BAM Reference	Information	SBDAR Section	Completed
Mitigation and Management of Impacts - Chapter 8, Section 8.4 and 8.5	Identification of measures to mitigate or manage impacts in accordance with the recommendations in BAM Subsections 8.4.1 and 8.4.2, including (as described in BAM Subsection 8.4.1(2.): <ul style="list-style-type: none"> • techniques, timing, frequency and responsibility • identify measures for which there is risk of failure • evaluate the risk and consequence of any residual impacts • document any adaptive management strategy proposed 	2.2, 2.6, Table 22, Table 23, Table 24, Table 25	Y
	Identification of measures for mitigating impacts related to: <ul style="list-style-type: none"> • displacement of resident fauna (as described in BAM Subsection 8.4.1) • indirect impacts on native vegetation and habitat (as described in BAM Subsection 8.4.1(3.)) • mitigating prescribed biodiversity impacts (as described in BAM Subsection 8.4.2) 	2.2, 2.6, Table 22, Table 23, Table 24, Table 25	Y
	Details of the adaptive management strategy proposed to monitor and respond to impacts on biodiversity values that are uncertain (BAM Section 8.5)	2.7	Y
Thresholds for assessing and offsetting the impacts of the proposal - Chapter 9	Information from the TBDC and/or other sources to report on the current status of threatened species, threatened populations at risk of an SAll and TEC/s for the proposal, and	2.7.1	Y
	Report on impacts of the proposal on TEC/s in accordance with BAM Subsection 9.2.1	2.7	Y
	Report on impacts of the proposal on threatened species and/or threatened populations at risk of an SAll in accordance with BAM Section 9.1	2.7.1	Y
	Identification of impacts requiring offset in accordance with BAM Section 9.2	2.7.2	Y
	Identification of impacts not requiring offset in accordance with BAM Subsection 9.2.1(3.)	2.7.3	
	Identification of areas not requiring assessment in accordance with BAM Section 9.3	2.7.3	Y
Applying the no net loss standard - Chapter 10	Description of the impact on PCTs/TECs	3.0 Table 27	Y
	Description of the impact on threatened species at risk of an SAll or incidentally observed via site visit	3.0	Y
	Number of ecosystem credits required for impacts on biodiversity values according to BAM Subsection 9	3.0 Table 27	Y
	Number of species credits required for impacts on biodiversity values according to BAM Subsection 10.1.3, including any species credit species that has been incidentally observed on the subject land Note: Species credits for any species at risk of an SAll are calculated in the event that the decision-maker forms the opinion that the proposed impact is unlikely to be serious and irreversible and therefore can be offset.	2.7.2.2	Y
	Identification of credit class for ecosystem credits and species credits according to BAM Section 10.2 (this can be generated from BAM-C)	Appendix F	
Maps			

BAM Reference	Information	SBDAR Section	Completed
Introduction - Chapters 2 and 3	Map of the subject land boundary showing the final proposal footprint, including the construction footprint for any clearing associated with temporary/ancillary construction facilities and infrastructure (if BDAR)	Appendix A	Y
Landscape - Section 3.1, 3.2 and Appendix E	Site Map <ul style="list-style-type: none"> • boundary of subject land • cadastre of subject land • landscape features identified in BAM Subsection 3.1.3 • areas of outstanding biodiversity value within the subject land 	Figure 1	Y
	Location Map - digital aerial photography at 1:1,000 scale or finer <ul style="list-style-type: none"> • boundary of subject land • 1500 m buffer area or 500 m buffer for linear development • landscape features identified in BAM Subsection 3.1.3 • additional detail (e.g., local government area boundaries) relevant at this scale • areas of outstanding biodiversity value within the assessment area 	Figure 2	Y
	Landscape features identified in BAM Subsection 3.1.3 and to be shown on the Site Map and/or <ul style="list-style-type: none"> • IBRA bioregions and subregions • rivers, streams and estuaries • wetlands and important wetlands • connectivity of different areas of habitat • areas of geological significance and soil hazard features 	Figure 2	Y
Native vegetation, TECs and vegetation integrity - Chapter 4	Map of native vegetation extent for the subject land (as described in BAM Section 3.1)	Figure 3	Y
	Map of PCT/vegetation zones within the subject land (as described in BAM Section 4.2(1.))	Figure 4	Y
	Map the location of floristic vegetation survey plots and vegetation integrity survey plots relative to PCT boundaries	Figure 6	Y
	Map of TEC distribution on the subject land	Figure 4	Y
	Patch size of native vegetation (as described in BAM Subsection 4.3.2)	Figure 2	Y
Chapter 5 and Section 9.1	Map of species credit species records within the subject land and species polygons for flora and fauna species at risk of an SAI or incidentally observed during the site visit (as described in BAM Subsection 5.2.5(1-7.))	Figure 5	Y
Prescribed impacts Chapter 6	If relevant, maps showing location of any prescribed impact features (i.e., karst, caves, crevices, cliffs, rocks, humanmade structures, etc.)	N/A	
Avoid and minimise impacts – Chapter 7	Map of final proposal footprint, including construction and operation	Appendix A	Y
	Maps demonstrating indirect impact zones where applicable	Appendix A	Y
Assessment of Impacts - Chapter 8,	No Maps		

BAM Reference	Information	SBDAR Section	Completed
Section 8.1 and 8.2			
Mitigation and Management of Impacts - Chapter 8, Section 8.4 and 8.5	No Maps		
Thresholds for assessing and offsetting the impacts of the proposal - Chapter 9	Map showing the extent of TECs at risk of an SAll within the subject land	N/A	
	Map showing the location of threatened species at risk of an SAll within the subject land	N/A	
	Map showing location of: <ul style="list-style-type: none"> • impacts requiring offset • impacts not requiring offset • areas not requiring assessment 	Figure 7	Y
Applying the no net loss standard - Chapter 10	No Maps		
Tables			
Native vegetation, TECs and vegetation integrity - Chapter 4	Table of current vegetation integrity scores for vegetation zone within the site including: <ul style="list-style-type: none"> • composition condition score • structure condition score • function condition score 	Table 10 Table 11	Y
	Report from BAM-C (Small area module) including vegetation integrity scores (BAM Section 4.4)	Table 11	Y
Chapter 5 and Section 9.1	Table showing ecosystem credit species in accordance with BAM Subsection 5.1.1, and: <ul style="list-style-type: none"> • identifying any ecosystem credit species removed from the list of species on the basis of further assessment in accordance with BAM Subsections 5.2.2 and 5.2.3 • identifying the sensitivity to gain class of each species (BAM Section 5.4) 	Table 12-14	Y
	Table detailing species credit species within the subject land at risk of an SAll (BAM Section 9.1) or incidentally observed during the site visit including any associated habitat feature/components and its abundance (flora)/extent of habitat (flora and fauna) and biodiversity risk weighting (BAM Sections 5.2–5.4)	N/A	
Prescribed impacts Chapter 6	Table showing the prescribed impacts.	Table 18 Table 19	Y
Avoid and minimise impacts – Chapter 7	Table of measures to be implemented before, during and after construction to avoid and minimise the impacts of the proposal, including action, outcome, timing and responsibility	Tables 22 - 25	Y
Assessment of	Table showing change in vegetation integrity score for each vegetation zone as a result of identified impacts	N/A	

BAM Reference	Information	SBDAR Section	Completed
Impacts - Chapter 8, Section 8.1 and 8.2			
Mitigation and Management of Impacts - Chapter 8, Section 8.4 and 8.5	Table of measures to be implemented before, during and after construction to mitigate and manage impacts of the proposal, including action, outcome, timing and responsibility	Table 22 to 25	Y
Thresholds for assessing and offsetting the impacts of the proposal - Chapter 9	No Tables	N/A	
Applying the no net loss standard - Chapter 10	Table showing biodiversity risk weightings	Table 9	Y
	Table of BC Act listing status for PCTs and threatened species requiring offset	N/A	
	Table of PCTs requiring offset and number of ecosystem credits required (Subsection 10.2.1)	Table 26	Y
	Table of species at risk of an SAIL or incidentally observed on site assessed for species credits and the number of credits required	N/A	
	BAM-C credit report	Appendix F	Y
Data			
Landscape - Section 3.1, 3.2 and Appendix E	All report maps as separate jpeg files / Individual digital shape files of: <ul style="list-style-type: none"> subject land boundary assessment area (i.e., buffer area) boundary cadastral boundary of subject land areas of native vegetation cover areas of habitat connectivity 	Attached Files	Y
Native vegetation, TECs and vegetation integrity - Chapter 4	All report maps as separate jpeg files <ul style="list-style-type: none"> Plot field data (MS Excel format) Digital shape files for all maps and spatial data Field data sheets (if relevant) for determining vegetation integrity (BAM Subsection 4.3.4) 		Y
Chapter 5 and Section 9.1	Digital shape files of species polygons <ul style="list-style-type: none"> Species polygon map in jpeg format Expert reports and any supporting data used to support conclusions of the expert report Field data sheets (if relevant) for threatened species surveys 		Y
Prescribed impacts Chapter 6	<ul style="list-style-type: none"> If relevant, digital shape files of prescribed impact feature locations Prescribed impact features map in jpeg format 		Y

BAM Reference	Information	SBDAR Section	Completed
Avoid and minimise impacts – Chapter 7	Digital shape files of: <ul style="list-style-type: none"> • final proposal footprint • direct and indirect impact zones • Maps in jpeg format 		Y
Assessment of Impacts - Chapter 8, Section 8.1 and 8.2			Y
Mitigation and Management of Impacts - Chapter 8, Section 8.4 and 8.5			Y
Thresholds for assessing and offsetting the impacts of the proposal - Chapter 9	Digital shape files of: extent of TECs at risk of an SAll within the subject land <ul style="list-style-type: none"> • threatened species at risk of an SAll within the subject land • boundary of impacts requiring offset • boundary of impacts not requiring offset • boundary of areas not requiring assessment Maps in jpeg format		Y
Applying the no net loss standard - Chapter 10			Y

Appendix N – CVs

Alana Guest

Curriculum Vitae

Alana works with AEP in the role of Ecologist. She graduated with a Bachelor of Science majoring in Biology and a Bachelor of Arts, majoring in History and minoring in Ancient History. She has worked in various roles unrelated to the science field over the past 5 years. Alana has worked at AEP since October 2022, and in addition to this has, experience in a variety of environmental work, from her university degree in, flora and fauna field surveys, reporting, and data management.

Qualifications

- Bachelor of Science, Biology major and Bachelor of Arts, History major and Ancient History minor – University of Newcastle (2022)

Further Education & Training

- Class C NSW Driver's Licence
- First Aid and CPR

Fields of Competence

- Field assessment including: targeted fauna and flora surveying, Koala Spot Assessment Technique (SAT) surveys, targeted fauna trapping
- High proficiency in written and verbal communication skills
- Gaining skill in botanical surveys
- Growing proficiency in Biodiversity Development Assessment report and Ecological Assessment report writing
- Data management and the use of Excel and Word

Relevant Employment History

2022 – Present

Ecologist

Anderson Environment & Planning, Newcastle

Currently employed by Anderson Environment & Planning to assist in the provision of consulting services to land, property, legal and government sectors. Covering ecological, project management, environmental, planning services, advices, strategy and representation. Expanding knowledge of field survey methodology, report writing, mapping and data manipulation

Andrew Harker

Curriculum Vitae

Andrew works with AEP in the role of Ecologist. He graduated with a Bachelor of Environmental Science and Management, majoring in Earth Systems. Whilst studying at the University of Newcastle he conducted tailored his degree to focus on conservation biology and environmental remediation. Andrew gained experience in a range of ecological field studies as a requirement of his degree courses. Working with Enviropacific Services he gained further experience in ecological field surveys as a graduate environmental scientist working on environmental remediation projects in the civil construction sector. He has experience in bushfire threat assessments, targeted fauna and flora surveys, Koala Spot Assessment Technique (SAT) surveys, fauna handling and tree surveys. Andrew also has extensive experience in the civil construction sector in large scale remediation projects, residential developments, excavation and trades.

Qualifications

- Bachelor of Environmental Science and Management – University of Newcastle (2017)
- Masters Degree in Disaster Resilience and Sustainable Development (2019 – current)
- Diploma of Public Safety (Royal Australian Air Force 2012)
- Diploma of Management (Royal Australian Air Force 2009)
- Cert IV in Training & Assessment (Royal Australian Air Force 2010)
- Cert II in Civil Construction
 - FPIFGM069A – Trim & Cross-cut Felled Tree
 - FPIFGM111A – Fall Trees Manually – Intermediate

Licences/Certificates

- Apply First Aid
- Class HC NSW Drivers Licence
- Light & Heavy 4WD, ATV
- Construction White Card
- PADI Open Water; Advanced Diver; Rescue Diver
- Backhoe/Loader & Forklift
- Bush Firefighter (BF 2003)

Field Survey Experience

- Aquatic & marine water quality surveys, sampling and analysis
- Terrestrial fauna survey, including koala SAT surveys and spotlighting
- Bushfire Treat Assessments

Volunteer Experience

- NSW Rural Fire Service

Employment History

Mar 2021 – Current

Ecologist

Anderson Environment & Planning, Newcastle

Sep 2018 – Mar 2021

Water Treatment Specialist

Water Treatment Services Australia

Nov 2017 – Apr 2019

Graduate Environmental Scientist / Engineer

Enviropacific Services

Oct 1995 – Sep 2012

Aircraft/Armament Technician/Manager

Royal Australian Air Force

Ben Graham

Curriculum Vitae

Ben works with AEP in the role of Ecologist. He is expected to graduate with a Bachelor of Environmental Science and Management (Ecology and Conservation) in November 2023. Ben's studies and past experience in a variety of roles developing data analysis, reporting, land rehabilitation, biodiversity offset management, leadership and WHS skills add to his growing ecological knowledge and experience.

Qualifications

- Currently undertaking a Bachelor of Environmental Science and Management (Ecology and Conservation) Charles Sturt University; to be completed November 2023
- Bachelor of Engineering (Chemical) University of Newcastle (2015)

Further Education & Training

- First Aid and CPR (HLTAID001, HLTAID002, HLTAID003) (Completed on 10/02/2021)
- C-Class Driver's License NSW

Fields of Competence

- Training in the use of mist netting, bat harp traps, Elliot traps, pitfall traps and camera traps.
- High proficiency in written and verbal communication skills
- Data management and analysis (Excel)
- Growing proficiency in GIS mapping
- Growing proficiency in floristic surveying

Relevant Employment History

Feb 2023 – Present

Ecologist

Anderson Environment & Planning, Newcastle

Oct 2022 – Jan 2023

Environment and Community Vacation Student

Glencore Coal Assets Australia

Undertook biodiversity offset management, land rehabilitation actions and rehabilitated land certification assessment.

Oct 2021 – Oct 2022

Store Manager

Frame today

Lead and coached a team of 3 to 6 members. Provided guidance for daily activities to a high standard to achieve key performance indicators. Managed rostering, sales, customer service, quality control, workplace safety, and training.

Ma7 2016 – Sep 2018

Junior Project Engineer

Granite Power

Worked independently and as part of a team to carry out commissioning operations on waste heat to energy systems, including data analysis, reporting, maintenance, process control, and safety while adhering to relevant standards/regulations/procedures.

Brendon Young

Curriculum Vitae

Brendon works with AEP in the role of Ecologist. He graduated with a Bachelor of Applied Science (Honours) and a Masters in Environmental Management, majoring in fish conservation and management. Brendon has previously worked in large retail operations in staff and budget/data management, reporting and quality assurance which adds to the experience that he currently contributes to the AEP team.

Qualifications

- CPR and First Aid (Completed on 30/11/21)
- White Card (Completed on 11/02/22)

Further Education & Training

- Master of Environmental Management (Natural Resources)
- Graduate Certificate of Fish Conservation and Management (Charles Sturt University)
- Bachelor of Applied Science (Fisheries) with Honours

Fields of Competence

- Training with aquatic sampling techniques such as seine nets, gill nets and fyke nets.
- Training in the use of mist netting, bat harp traps, Elliot traps, pitfall traps and camera traps.
- Experience identifying fish, reptiles, insects, and plants to species level through honours research and other projects while studying.

Relevant Employment History

2022 – Present

Ecologist

Anderson Environment & Planning, Newcastle

2013-2022

Department Manager

Woolworths Pty Ltd

Provision of leadership and coaching for a team of 5 to 20 members. Coach and guide daily activities to a high standard and achieve key performance indicators. Manage wage, sales, and wastage budgets. Plan for periodical events and long-term direction of the department.

March 2019-Oct 2019

Produce Quality Control Officer

Woolworths Pty Ltd

Inspection of produce as it arrives at the warehouse to ensure the required specifications for quality, size, weight and ripeness were met. Rejection of stock that did not meet company specification.

BYRON DE JAGER

Curriculum Vitae

Byron works with AEP in the role of Ecologist has a Bachelor of Science, majoring in Natural Resource Management. Byron has experience in a variety of environmental work, in a professional and volunteer capacity, including flora, and field surveys, reporting and mapping, habitat restoration and community volunteering.

Qualifications

- Certificate III Conservation and Land Management, Ryde TAFE 2017
- Bachelor of Science, Sustainable Resource Management (GPA 5.1)

University of Newcastle

Relevant courses: Australian Flora, Restoration Ecology, Land Management, Catchment and Water Resource Management, Environmental Legislation. 2011-2015

Further Education & Training

- Certificate II in Public Safety, through State Emergency Service (SES)
- Leadership fundamentals, SES
- Storm and Water Damage Operations, SES
- AQF3 Chemical user Certificate
- Chainsaw use statement of attainment: Feel small trees. Trim and cut felled trees
- First Aid Certificate, SES
- C-class Driver's License
- Cert IV Digital Media
- Cert II Office Applications for the Office TAFE Northern Sydney Institute

Relevant Employment History

October 2022- Present

Ecologist

Anderson Environmental & Planning, Newcastle

October 2019-present

Supervisor; Bush Regenerator

Toolijooa Hunter Valley Special Projects Division
Supervisor

Mar – May 2014

Bushcare, Blackwall Mountain Landcare

Relevant Ecological Experience

Oct- Dec 2015

Trees in Newcastle, Environmental Sector Placement

- Researched more water and power efficient irrigation specifically suitable to upgrading the nursery.
- Created a guide to help improve the existing system and installing the most efficient system possible in the new site including budget information
- Wrote a five-page report and presented findings to the Board

Jun – Sept 2014

Research assistant, Kooragang Island.

- Assisted PhD Student with collecting data on frogs at night.
- Collected and identified frog species with careful hygiene and consideration to prevent transfer of pathogens
- Marked location using GPS releasing the frogs in the same place after tagging.

Jun- Aug 2016

Hunter Water; Catchment Management department

- Database management including data entry, graphing and interpretation
- Imported Data from Lab Data program to Excel
- Explore and interpret data using Excel using graphs tables and formulas
- Updated procedures to latest format and information.
- WH & Safety induction including appropriate PPE, Take 5, incident reporting
- Water sample collecting from various sites around the catchment including drinking water in various locations in the catchment, supply test points and wastewater areas affected by high volumes of stormwater
- Introduction to water supply network including catchments, pumping stations, drinking treatment plants, reservoirs, wastewater treatment plants and recycling or disposal systems
- Learned to navigate and understand GIS data regarding the network

CALLUM REEDMAN

Curriculum Vitae

Callum works with AEP in the role of Ecologist. Callum has over 3 years of experience in the environmental industry, having previously worked in the Natural Area Restoration field as a Bush Regenerator, participating in a variety of restoration projects across multiple LGAs, coupled with a history of community environmental volunteering.

Qualifications

- Diploma of Conservation & Land Management - TAFE NSW (2022)
- Certificate III in Conservation & Land Management - Hunter TAFE (2016)

Further Education & Training

- NSW Class C Driver's Licence.
- WHS NSW Construction Induction White Card
- First Aid (Provide first aid HLTAID003)
- AQF3 CHEMCert Chemical Application Certificate
- Chainsaw Certificate Level 1 & 2 Crosscut & Fell Small Trees

Fields of Competence

- Competent in-field native Flora ID of the Sydney Basin Bioregion
- Competent in-field invasive Flora ID of the Sydney Basin Bioregion
- Competent in Hollow Bearing Tree Surveying
- Competent in Camera trapping set up and removal

Relevant Employment History

2021 – Present

Ecologist

Anderson Environment & Planning, Newcastle

Currently employed by Anderson Environment & Planning to assist in the provision of consulting services to land, property, legal and government sectors. Expanding my knowledge of field survey methodology, report writing, mapping and data manipulation. Undertaking Biodiversity Assessment Method (BAM) Plots across a variety of environments within the Sydney Basin Bioregion.

2020 - 2021

Bush Regenerator

Australian Facilities Landscapes

Undertaking weed management activities within diverse vegetation communities and EECs across the Singleton SMA. Collecting and breeding biocontrol of *Cactoblatis* sp. To control various *Opuntia* sp. Weed mapping within the SMA. Providing weed management advice and mentoring to junior staff.

2020 - Present

Casual Bushcare Supervisor
Lane Cove Municipal Council

Supervision of Bushcare volunteers undertaking Bush Regeneration activities. Conducting StreamWatch Monitoring in LCC LGA creek lines, Leading WaterBug Blitz events throughout LCC LGA creek lines, Working sensitively within diverse vegetation communities and EECs across the LCC LGA.

2017 - 2020

Bush Regenerator
Lake Macquarie City Council

Carrying out Natural Area Restoration field works, following designated Plans of Management, carrying out threatened species mapping for *Tetratheca juncea*, carrying out flora species monitoring plots for Council's BioBank monitoring requirements, working sensitively within diverse vegetation communities and EECs across the LMCC LGA and Nursery and Volunteer Supervision.

2014 - 2015

Green Army Participant
Conservation Volunteers Australia

Carrying out Natural Area Restoration activities under the directive of the CVA supervisor, and working alongside Council staff and Council volunteers.

Relevant Volunteer Experience

2018 - 2020

University of Newcastle Field Assistance

Volunteer participation in various PhD and Honours projects with the University of Newcastle, experience handling, trapping, spotlighting and monitoring for fauna such as Squirrel Gliders and the Green and Golden Bell Frog as well as flora, for *Diuris praecox*.

2016 - 2019

Hunter Intrepid Landcare

Participated in events across the Newcastle Region, as well as occasionally co-creating and coordinating

**2014 - Present
(CEM)**

Lake Macquarie City Council Community Ecosystem Monitoring

Participating in flora monitoring plots within a variety of ecosystems in the Lake Macquarie LGA

Darcy Kilvert

Curriculum Vitae

Darcy works with AEP in the role of Ecologist. He graduated with a Bachelor of Science majoring in Biology. Darcy has worked as a Bush Regenerator for over 5 years and undertaken numerous volunteering projects in the environmental sector. These experiences have given him experience in flora & fauna identification, surveying, reporting, mapping, and ecological restoration

Qualifications

- Bachelor of Science (Biology), The University of Newcastle, completed in September 2021

Further Education & Training

- Class C NSW Driver's Licence
- NSW Construction White Card
- Working at Heights
- Chemcert and EPA ground applicator licence
- Apply First Aid

Fields of Competence

- Flora & fauna surveying both terrestrial and aquatic
- Growing proficiency in botanical surveys
- Adept experience in operating 4x4 vehicles

Relevant Employment History

2021 – Present

Ecologist

Anderson Environment & Planning, Newcastle

Currently employed by Anderson Environment & Planning to assist in the provision of consulting services to land, property, legal and government sectors. Covering ecological, project management, environmental, planning services, advices, strategy and representation. Expanding knowledge of field survey methodology, report writing, mapping and data manipulation.

2018 - 2021

Senior Field Supervisor

Traditional Aussie Gardens, Newcastle

2015 - 2017

Field Worker

Newcastle City Council, Newcastle

Ian Benson

Curriculum Vitae

Ian works with AEP in the role of Director and 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

- Biodiversity Accredited Assessor System (BAAS 18147)
- Advanced Plant Identification (University of New South Wales)
- NSW Class C Driver's Licence. Experienced 4WD operator
- Occupational Health & Safety Training
- Remoted Piloted Aircraft Excluded Category Training with Aviassist Pty Ltd
- Rail Industry Worker
- ARTC Safety Induction for Contractors (NSW)
- ARTC Hunter Bulk Terminal Induction

Fields of 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

Relevant Employment History

2022 – Present

Director & Principal Ecologist

Anderson Environment & Planning, Newcastle

Ian is a Director of Anderson Environment & Planning whilst continuing in the role of Principal Ecologist overseeing a team of approx. 35 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.

2019 – 2022

Principal Ecologist

Anderson Environment & Planning, Newcastle

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 Ian 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. Ian was required to liaise with clients regarding project requirements, project goals and deadlines. He 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. Ian 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

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

Birddata Moderator

BirdLife Australia

Volunteer moderating and vetting bird surveys from Birddata 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.

Key Project Experience

- Targeted surveys for *Dichanthium setosum* in Glen Innes Region;
- Target surveys for *Eucalyptus cannonii*, Western Rail Coal Unloader, Pipers Flat;
- White-bellied Sea-Eagle nest locating and monitoring Glenning Valley and Chisholm;
- Powerful Owl nest locating and monitoring: Salamander Bay, Soldiers Point, Anna Bay North, Wallsend, Cameron Park and Edgeworth;
- Accredited Assessor for approved Biodiversity Development Assessment Reports:
 - Berkeley Vale Road, Glenning Valley;
 - Railway Road, Warnervale;
 - Barden Ridge Townhouses;
 - McFarlane's Road, Chisholm;
 - Fairlands Road, Medowie;
 - Rosella Rise, Warnervale;
 - Carr's Road, Neath;
 - Jack Grant Avenue, Warnervale;
 - Minnesota Road, Hamlyn Terrace;
 - Bellbird North;
 - Waterford, Chisholm;
- Ecological Assessment Report for Proposed Modification To Approved Western Rail Coal Unloader At Pipers Flat;
- Spot Analysis Techniques surveys: Nelsons Plains, Wallsend, Anna Bay, Boat Harbour, Salamander Bay, North Arm Cove, Warnervale, Hamlyn Terrace, Kincumber, Palmdale, Wyee, Charlestown, Chisholm, Gillieston Heights, Mount Vincent, Radford Park, Cessnock
- Infrastructure;
 - Gwandalan Recycled Water Main;
 - Lower Belford Water Main;
 - Raymond Terrace Rising Main;
 - Astra Street Landfill Rehabilitation Assessment;
- Cat Tracker Pilot Program Associated With The Hunter Estuary Wetlands for Hunter Local Land Services;
- Surveys for Squirrel Glider (*Petaurus norfolcensis*) Warnervale Area June 2020

- Biodiversity Stewardship Agreements including:
 - • Bobs Farm (approved);
 - • Cedar Brush Creek (ready for signing);
 - • Girvan (final assessment);
 - • Mardi (under assessment);
 - • Wallsend (report being drafted);
 - • Ellalong (report being drafted);
 - • Blueys Beach (surveys continuing);
 - • South-West Rocks (surveys continuing).

Kelly Drysdale

Curriculum Vitae

Kelly works with AEP in the role of Ecology Project Manager. She has extensive experience in various land management operations in several regions, with both small and large enterprises, in Australia and internationally. Her strong environmental stewardship knowledge, lateral thinking, project and change management, business development, strategic planning and human resource management skills are adding value to the AEP team.

Qualifications

- Certificate IV in Training and Assessment TAE40110, TAFE Hunter Institute, NSW 2016
- Graduate Certificate in Business Administration (with honours), Newcastle University, Newcastle, NSW 2013
- Associate Diploma of Applied Science (VITICULTURE), Charles Sturt University, Wagga Wagga, NSW 1992

Further Education & Training

- Australian Rural Leadership Foundation Program, Fellow 2011
- Class C NSW Drivers Licence Class, Defensive Driving, FL & experienced 4WD operator
- First Aid Certificate inc CPR 2021
- SafeWork NSW Construction White Card CGI1713214SEQ01
- Farm Chemical User Accreditation Certificate III (ChemCert Australia)
- Negotiation skills (Rogen International), Crucial conversations (ME Consulting)
- Media Training (Doyle Media Services)
- Various WHS management training, legislation and compliance courses, EEO, cultural competency and diversity in the workplace
- Workplace Trainer and Workplace Assessor
- Open Water PADI Dive Certificate

Fields of Competence

- Field assessment including: targeted fauna and flora surveys, BAM plots, Koala Spot Assessment Technique (SAT) surveys, tree surveys, HBT and nest box inspections.
- 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, State Environmental Planning Policy Biodiversity and Conservation) 2021 – Chapter 4 Koala Habitat Protection 2021, State Environmental Planning Policy (Resilience and Hazards) 2021 – Chapter 2 Coastal Management, Water Management Act 2000 and the Environment Protection and Biodiversity Conservation Act 1999
- Bushfire threat analysis and reporting
- Liaison with clients/site/company/government representatives

Relevant Employment History

Feb 2021- Current Ecology Project Manager- Anderson Environment & Planning, Newcastle, NSW

Assisting 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.

Aug 2019 - July 2021 Business Development Manager - RLF

Business development and strategic targeting of corporate and larger enterprises leveraging a vast network of contacts in the Australian Wine Industry and Agricultural sector to add value to farming systems with agronomic and fertiliser solutions.

Jul 2015 - Aug 2019 Viticultural & Trade Resource Manager- Hope Estate, Pokolbin, NSW

Operational and strategic management of five estate owned vineyards in NSW, WA & VIC. CRM & BDM of wine and beer portfolio of on/off premise sales on >1,800 customer base with PR responsibilities and hosting of events.

Jul 2017 - Aug 2019 Casual teacher in Viticulture & Wine - Kurri Kurri Tafe NSW

Revising, formulating and developing resources for and delivering all units of competency in the AHC51516 Diploma of Viticulture and strengthening relationships within the Hunter wine region.

Jul 2014 – July 2015 Sales Acquisition Agent – Wine Selectors & Choice, NSW

Wine appraisals, wine sales, developing staff training manuals, exceeding sales targets.

Jan 2004 - May 2010 Viticultural Manager – Casella Family Brands, Yenda NSW

Primarily responsible for the effective and efficient viticultural, land management operations and programs reporting to the company directors on 1,800ha with up to 160 staff. Primarily viticulture but also managed a large prune/plum orchard, broad acre cropping-dry and pivot, cattle, biodiversity tree planting program, compost making, winery waste water treatment plant and traded water.

June 2002 - Jan 2004 Viticulturist - Brown Brothers, Milawa VIC

Grower liaison for 84 growers and 5 diverse company owned vineyards; strategic plan development, asset assessments and evaluations.

June 2001 - June 2002 One-year overseas travel - study/work tour

Studied wine and agricultural markets in Asia and London, travelled through Italy, Switzerland and Spain's wine regions and worked vintage periods in Portugal, France and mostly in South Africa- Flagstone Wines, Cape Town, sourcing fruit from 48 vineyards across the Western Cape.

May 2000 - June 2001 Viticultural Projects Manager – Nepenthe, Adelaide Hills

Viticultural consultancy, contract management, development and management of investment projects, costing systems, reporting and management protocols.

Jan 1998 - May 2000
SA

General Manager – Pertaringa Wines, McLaren Vale,

Strategic operational and financial planning for company land portfolio and brand development, including contract management for clients and winery liaison with 15 customer wineries.

Dec 1992 - Jan 1998

Viticulturist –Southcorp Wines, SA

Grower Liaison in McLaren Vale, Technical Officer in Barossa/Clare/Adelaide Hills and Riverland, Greenfield Vineyard Development in Barooga and Robe, and Vine Propagation Manager for the group successively.

1993 - Vintages

Cellar hand - Murphy-Goode Estate Winery- Alexander Valley, California USA and Willamette Valley Vineyards- Willamette Valley, Oregon USA and CSUR, Wagga Wagga, NSW

SIMON PURCELL

Curriculum Vitae

Simon works with AEP in the role of Senior Ecologist. Simon has over 7 years of professional experience managing projects in the fields of terrestrial ecology, mining and mine rehabilitation and environmental management.

Qualifications

- Bachelor of Applied Science, Major Wildlife Science, University of Queensland Gatton 2013
- Certificate III in Animal Care and Management, Companion Animal Services (2008)

Further Education & Training

- NSW Class C Driver's Licence

Fields of Competence

- Terrestrial Ecology field survey, covering terrestrial flora and fauna
- Project Management

Relevant Employment History

2020 (November) -present Senior Ecologist

Anderson Environment & Planning, Newcastle

- Currently employed by Anderson Environment & Planning 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

Team Leader / Ecologist

Ecotone Flora Fauna Consultants, Weipa, QLD

- Conducted client liaison meetings, providing ecological advice and recommendations for flora, fauna and land management, complying with Queensland state and Commonwealth environmental legislation.
- Wrote proposal and executed surveys for Prefeasibility studies and EIS on Western Cape York for multi-national mining company complying with Commonwealth environmental legislation.
- Negotiated increases to budget and survey requirements with the client in relation to ongoing changes and project requirements
- Led high level discussions with the client to provide new services.
- Developed wide scale camera monitoring program to assess presence /absence of EVNT fauna within the survey site.
- Complex logistical planning for remote work
- Co-developed and implemented new safety system within the business

- Mentored project managers through training, and leadership guidance to ensure quality and standards of business were met
- Managed human relation matters within the business
- Digitally transformed infield data collection through roll out of ArcGIS Collector, leading to the reduction in the use of paper in the field.

2014-2018

Team Leader / Ecologist

Ecotone Flora Fauna Consultants, Weipa, QLD

- Lead project manager (6 years) for all aspects of mine / drill preclearing environmental surveys across three different mine sites and exploratory sites, including during the construction phase of a new mine in the Weipa region.
- Project managed and participated in numerous annual EVNT projects that led to cultural and process practices changing within a multinational mining company.
- Played a critical role in maintaining client and stakeholder relationships and built stability with onsite leadership to further grow business opportunities.
- Maintained client confidentiality on sensitive and impactful projects.
- Ensured all projects complied with Queensland state and Commonwealth environmental legislation and clients Environmental Authority.
- Assisted in the development of growth and innovation projects such as cloud-based document storage solution to support multi-site users.

2013-2014

Field Technician / Ecologist

Ecotone Flora Fauna Consultants, Weipa, QLD

- Pre-clear flora and fauna mining and drilling programs
- Baseline fauna surveys of future mining areas
- Sensitive vegetation ground truthing
- EVNT flora and fauna surveys
- Seed Processing (storing, drying management of inventory)
- Mixing of seed in preparation for annual rehabilitation season

2010-2012

Mine Operator and Trainer

Rio Tinto, Weipa, QLD

- Acted as Crew Leader to manage 30 mine operators, production targets and minimising environmental impacts
- Skilled Caterpillar 992G, 993K & Komatsu WA900 Loader and 776D, 777F and 785C Caterpillar haul truck operator
- Crew Trainer/Assessor - completed five certificate IV modules to Training and Assessing.

2009 - 2010

Parks and Garden Maintainer

Spotless Group, Weipa, QLD

- Attained six competencies towards Certificate III Forest Growing and Management.
- Maintained local green spaces and houses.

2009-2009

Vet Nurse

Tableland Veterinary Service, Weipa, QLD

- Prepared surgery for surgeries including use of autoclave to sterilise implements
- Administered sedation via injections in the muscle and intravenously
- Prepared and monitored animals before, during and after surgeries
- Monitored animal and anaesthetic during surgery focussing on breath rate, colour of gum and pupil movements
- Took blood samples from veins and prepared samples of foreign bodies for analysis
- Successfully directed and carried out on-call emergency cases with vet assistance over the phone

2003 – 2009

Manager

The Pet Centre, Sydney, NSW

2001 – 2003

Sales Assistant

The Pet Centre, Sydney, NSW

- Implemented standard procedures for staff to follow
- Focussed on achieving a high level of OHS standards within the store
- Responsible for daily takings up to five thousand dollars per day
- Accountable for people management including rosters, recruitment and managing employee issues
- Responsible for management of store inventory
- Developed skills in handling a range of domestic animals
- Maintained animal's health and welfare in store and complied with state laws and regulations
- Analysed store's and customer's aquarium water quality
- Developed sound knowledge of animals including their origin, identification and general requirements

Relevant Volunteer Experience

2012

Fauna Spotter / Field Assistant

Humble Bee Films

- Volunteered as a fauna spotter/field assistant with Dr Brad Purcell and Humble Bee Films in a ten day research camp, during the production of the natural history documentary "Dingo".

2012

Volunteer Ecological Field Assistant

Rio Tinto, Weipa, QLD

- Participated in an ethno-botanical workshop with Rio Tinto Alcan Land and Rehabilitation team.
- Participated as a field technician during pre-mining survey work. The work included assessing flora and the land formations to identify buffer zones for natural drainage systems and sensitive areas in the Andoom mine site Weipa.

2012

Fauna Technician

Brad Purcell PhD,

Greater Blue Mountains World Heritage Area

- Field technician for Brad Purcell during his doctoral research project on dingoes in the Greater Blue Mountains World Heritage Area. Developed skills in use of VHF radio tracking to retrieve collars, triangulation method to determine positioning of dingoes or deployed collars and traversing bushland.

Yann Buissiere

Curriculum Vitae

Yann works with AEP in the role of Senior Ecologist. Yann has over 15 years of professional experience managing projects in the field of ecology, natural area restoration, biodiversity conservation, community education, flora and fauna pest management and the development of environmental management systems.

Qualifications

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

Further Education & Training

- Commercial Drone Accreditation
- 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
- Chainsaw Operation and Maintenance
- 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, avifauna surveys and fauna trapping.
- Botanical surveys including vegetation monitoring, targeted threatened flora search and undertaking BAM plots.
- Project management and report writing
- Bush regeneration and habitat restoration
- Planning and undertaking fire hazard reduction work
- Feral animal control

Relevant Employment History

Since April - present

- | | |
|--------------------|---|
| 2021 – 2023 | Biodiversity and Resilience Officer
Maitland City Council |
| 2019 - 2020 | 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 |