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Streamlined Biodiversity Development Assessment Report

Proposed Residential Subdivision and Associated Infrastructure within 898 New England Hwy, 25 Wyndella Rd and 39 Wyndella Rd, Lochinvar, NSW

Prepared for: Lochinvar Developments Pty Ltd

C/- ADW Johnson Pty Ltd

July 2024

AEP Ref: 2699

BOAMS Ref: 00037152/BAAS19076/24/00048759

Revision: 00

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Document Control

Document Name	Streamlined Biodiversity Development Assessment Report for Proposed Residential Subdivision and Associated Infrastructure within 898 New England Hwy, 25 Wyndella Rd and 39 Wyndella Rd, Lochinvar, NSW
Project Number	2699
Client Name	Lochinvar Developments Pty Ltd C/- ADW Johnson Pty Ltd

Revision

Revision	Date	Author	BAAS No
01	26 June 2024	Natalie Black	19076
02	25 July 2024	Natalie Black	19076

Distribution

Revision	Date	Name	Organisation
01	26 June 2024	Mathew London	Lochinvar Developments Pty Ltd C/- ADW Johnson Pty Ltd
02	25 July 2024	Mathew London	Lochinvar Developments Pty Ltd C/- ADW Johnson Pty Ltd

EXECUTIVE SUMMARY

Anderson Environment & Planning (AEP) was commissioned by ADW Johnson Pty Ltd on behalf of Lochinvar Developments Pty Ltd (the proponent) to undertake a Streamlined Biodiversity Development Assessment Report (SBDAR) over land identified as 898 New England Hwy, 25 Wyndella Rd and 39 Wyndella Rd, Lochinvar, NSW, located within the Maitland Local Government Area (LGA) in the Hunter region of New South Wales.

Lochinvar Developments Pty Ltd is proposing a 258 Lot residential subdivision with internal roads, services, storm water facilities, recreational park lands, vegetated riparian creek line and Asset Protection Zones (APZs). The land is currently zoned for General Residential (R1) land use and forms part of the Lochinvar Urban Release Area. This report responds to the updated subdivision layout, developed as a result of comments provided by Maitland City Council in November 2023 on the development application.

This report has been prepared to meet the requirements of the *Biodiversity Assessment Method 2020* (BAM) established under Section 6.7 of the *Biodiversity Conservation Act 2016* (NSW). 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.

The Subject Site totals approx. 25.91ha, comprising approx. 0.94ha of degraded condition native vegetation, with the remainder of the Subject Site consisting of exotic / cleared lands.

The native vegetation within the Subject Site contains four (4) plant community types (PCT), which are present in varying condition:

- 3328 - *Lower Hunter Red Gum-Paperbark Riverflat Forest* (0.03ha).
- 3433 - *Hunter Coast Foothills Spotted Gum-Ironbark Grassy Forest* (0.07ha).
- 4042 - *Lower North Riverflat Eucalypt-Paperbark Forest* (0.13ha).
- 4044 - *Northern Creekflat Eucalypt-Paperbark Mesic Swamp Forest* (0.70ha).
- Planted Native *Cynodon dactylon* (23.94ha).

The proposal will require the removal or modification of approx. 0.94ha of native PCT vegetation.

As per the requirements of the BAM's Streamlined Assessment Module for Smal

The remainder of the Subject Site comprises 1.03ha of cleared vegetation, grazed pasture improved grassland, and non-vegetated areas including existing infrastructure and farm dams.

No threatened fauna or flora species were identified as utilising the site. Fauna species recorded were typical of those expected in this locality and in this type of remnant habitat with tenuous connections to larger patches of habitat offsite.

To offset residual impacts of the proposed native vegetation removal, the proposal would require retirement of a total of:

- 1 x PCT 3433 Ecosystem Credits (or equivalent).
- 10 x PCT 4044 Ecosystem Credits (or equivalent).

Avoid and minimise principles were considered during this assessment, whereby the location of the proposed works is designed to occur primarily within the degraded site that is zoned for R1 – General Residential. Further site specific avoid and minimised measures are provided within this report.

The proposed development involves works within 40m of a watercourse including a creek crossing, triggering *Section 91* of the *Water Management Act, 2000*, and *Section 201 and 219* of the *Fisheries Management Act, 1994*.

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* (BC SEPP)*, State Environmental Planning Policy (Resilience and Hazards) 2021 – Chapter 2 Coastal Management* (RH SEPP) (Coastal Management SEPP 2018) and the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) was undertaken and is included in **Appendix G**.

The Subject Site only provides potential seasonal foraging habitat for relevant species, it is not mapped as Important Areas for Regent Honeyeater or Swift Parrot, and no Grey-headed Flying-fox roost camps are present within the site. Therefore, referral under the EPBC Act is not likely to be necessary for this proposal.

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Study Certification and Licensing

This report was written and certified by Natalie Black (BAAS: 19076) of Anderson Environment & Planning.

The below table acknowledges the Contributing Ecologists who undertook, fieldwork, research or investigations, data analysis, and mapping that are relied on in preparing the report.

Staff	BAAS No.	Title/Qualification	Tasks
Natalie Black	19076	Senior Environmental Manager / Works Coordinator BSc (Hons), Master Planning, Cert IV (TA)	Scientific advice, Accredited person preparing and certifying the report.
Frances O'Brien	20013	Senior Ecologist/Lead Botanist BEnv LLB GDLP MEL	Contributor, conducting research or investigations that are relied on in preparing the report, PCT determination, due diligence assessment, RDPs, and Riparian assessment.
Darcy Kilvert		Senior Ecologist/Botanist B.Sc. (Bio)	Contributor, conducting research or investigations that are relied on in preparing the report, BAM plots, and Incidental flora and fauna.
Brendon Young		Project Ecologist M.Env.Mgt (Natural resources) B.Ap.Sc.(Fisheries) Grad Cert Fish Converation and Mgmt	Riparian assessment and Aquatic surveys.
Thomas Stephens		Project Ecologist B.EvnSc & Mmgt	Contributor, conducting research or investigations that are relied on in preparing the report, Project management, and GIS.
Angela Metcalfe		Ecologist B.Sc Eco/Con & Biodiversity Mgmt (Hons)	Contributor, conducting research or investigations that are relied on in preparing the report, Project management, GIS, Figures, BAM-C, Diurnal bird survey, BAM plots, and Nocturnal fauna surveys
Kathleen Bushell		Ecologist BSc. (Marine Biology)	Riparian assessment, RDPs, Incidental flora and fauna, and Harp netting
Dr Maria Jedensjo		Ecologist PhD (Natural Science), BSc (Marine biology), MSc (Ecology), Cert III Cons & Land Mgt	Contributor, conducting research or investigations that are relied on in preparing the report.
Oscar Anderson		Ecologist B.EvnSc & Mmgt	Contributor, conducting research or investigations that are relied on in preparing the report.

Staff	BAAS No.	Title/Qualification	Tasks
Samuel Rayfield		Ecologist Dip Conservation Land Mgt	Contributor, conducting research or investigations that are relied on in preparing the report, Habitat survey, Koala SATs, Nocturnal fauna survey, BAM plots, and Incidental flora and fauna.

Research was conducted under the following licences:

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

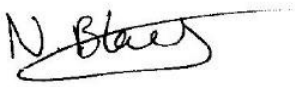
Certification:

As the principal author and certifier, I, Natalie Black (BAAS: 19076), 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;
- Anderson Environment and Planning have no actual, potential or perceived conflicts of interest with Lands Advisory Services. Anderson Environment and Planning has received commercial payment for consulting services and assessment by Lands Advisory Services for this project;
- 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, Biodiversity Conservation Act 2016 and the Australian Code of Practice for the Care and Use of Animals for Scientific Purposes; and
- This report has been written to comply with the requirements of the Biodiversity Conservation Act, 2016 and Biodiversity Conservation Regulation, 2017 as outlined in the below Table.

Biodiversity Conservation Act, 2016 (BC, Act) Section 6.15 Currency of biodiversity assessment report	
1. A biodiversity assessment report cannot be submitted in connection with a relevant application unless the accredited person certifies in the report that the report has been prepared on the basis of the requirements of (and information provided under) the biodiversity assessment method as at a specified date and that date is within 14 days of the date the report is so submitted.	I, Natalie Black (BAAS: 19076) declare that I prepared the BDAR and all BDAR amendments for the relevant application on the basis of the requirements within BAM 2020 as at the specified date (below).
2. A relevant application is an application for planning approval, for vegetation clearing approval, for biodiversity certification or in respect of a biodiversity stewardship agreement.	Not applicable to this application.
Biodiversity Conservation Regulation, 2017 (BC Regulations) Clause 6.8 Content of biodiversity development assessment reports (section 6.16)	
A biodiversity development assessment report must include—	
1. the number and classes of biodiversity credits required to be retired in accordance with the like-for-like requirements of the offset rules, and	Addressed within Section 2.7 of this BDAR
2. the number and classes of biodiversity credits that could be retired in accordance with the variation rules (in any case in which the proponent of the development proposes to use the variation rules), and	Addressed within Section 2.7 of this BDAR
3. details of any proposal to fund a biodiversity conservation action in accordance with the offset rules, and	Not applicable to this application.
4. details of any ecological rehabilitation of a site impacted by mining under a mining lease that is proposed as a measure to offset or compensate for those impacts, and	Not applicable to this application
5. the date of the report and the requisite certification under section 6.15 of the Act, and	As below.
6. details of the accreditation of the person preparing the report and of the qualifications and experience of any other person commissioned to conduct research or investigations that are relied on in preparing the report, and	As above and Appendix I
7. any other information required by the biodiversity assessment method or ancillary rules to be included in the report.	Refer Appendices for contributing investigations, results and contributing reports prepared by other Professional consultants
6.5 Ancillary rules of Environment Agency Head for purposes of biodiversity offset and variation rules	
(4) If the ancillary rules are changed, a biodiversity assessment report may, during the period of 90 days after the rules were changed, be prepared on the basis of the rules in force before the change, but only if the report states that it has been prepared on that basis.	This report has been prepared in accordance with all ancillary rules prior to 90 days from the date of certification. All ancillary rules after the 90 days have not been included in this assessment.

Principal Author and Certifier:



Natalie Black

Senior Environmental Manager

Anderson Environment & Planning

BAAS no. 19076

Calculator Ref: 00037152/BAAS19076/24/00048759

25 July 2024

Glossary of Terms

Assessment Area	Land occurring within a 1500m buffer around the Subject Site boundary.
BAM	Biodiversity Assessment Method Order (2020) that determines: • Methodology applicable to quantifying biodiversity values inherent within a development site; • Avoid and minimise efforts required to be employed as part of any development proposal; and • Number and class of credits required to offset residual impacts of the proposal upon the biodiversity values therein.
BC Act	Biodiversity Conservation Act 2016
Biodiversity Credit Report	Specifies the number and type of biodiversity credits required to offset the impacts of a development.
BAM Calculator (BAM-C)	The online tool used to interpret site survey data and regional location information to quantify ecosystem and species credits required / generated at a development / stewardship site.
Biodiversity credits	Ecosystem or Species Credits required to offset the loss of biodiversity values on a development site.
Biodiversity offsets	Specific measures that are put in place to compensate for impacts on biodiversity values.
Biodiversity values	The composition, structure and function of ecosystems, and threatened species, populations and ecological communities, and their habitats.
BRW	Biodiversity Risk Weighting
CEEC	Critically Endangered Ecological Community
Council	Maitland Council
DAWE	The former Commonwealth Department of Agricultural, Water and Environment
CDCCEEW	The Commonwealth Department of Climate Change, Energy, the Environment and Water
DCCEEW	The NSW Department of Climate Change, Energy, the Environment and Water
DoEE	The former Commonwealth Department of the Environment and Energy
DPI	The NSW Department of Primary Industries
DPE	The NSW Department of Planning and Environment
DPIE	The former NSW Department of Planning, Industry and Environment
Ecosystem credit	The class of biodiversity credits created or required for the impact on EECs, CEECs and threatened species habitat for species that can be reliably predicted to occur within a vegetation type.
EEC	Endangered Ecological Community
EPBC Act	The Commonwealth Environment Protection and Biodiversity Conservation Act 1999.
IBRA	Interim Biogeographic Regionalisation for Australia
OEH	The former NSW Office of Environment and Heritage
PFC	Projected Foliage Cover
Subject Site	The Subject Site consists of lands within 898 New England Hwy, 25 Wyndella Rd and 39 Wyndella Rd, Lochinvar, NSW (Lots 2-6 and 9 DP747391, Lots 12 and 13 DP1219648). Land upon which the

	development is proposed, and within which residual impacts upon biodiversity are required to be offset, as shown in **Figure 1**
Species credit	Class of biodiversity credits created or required for the impact on threatened species that cannot be reliably predicted to use an area based on habitat surrogates.
TBDC	Threatened Biodiversity Data Collection
TEC	Threatened Ecological Community
VIS	Vegetation Integrity Score
VRZ	Vegetated Riparian Zone

1.0 Stage 1 – Biodiversity Assessment

1.1 Introduction

A residential subdivision is proposed within land known as 898 New England Hwy, 25 Wyndella Rd and 39 Wyndella Rd (Lot 2 to 6 DP 747391, Lot 12 and 13 DP 1219648, and Lot 9 DP 747391), Lochinvar, NSW. At the request of Lochinvar Developments Pty Ltd (the Proponent), Anderson Environment & Planning (AEP) have undertaken the necessary investigations to inform the production of a Streamlined Biodiversity Development Assessment Report (SBDAR) addressing the proposed development.

This SBDAR undertaken adheres to the approach outlined in the Biodiversity Assessment Method (DPIE 2020a) (the BAM) and the BAM Calculator User Guide (DPIE 2020b).

1.1.1 Biodiversity Offsets Scheme Threshold Triggers

Biodiversity Values Map Threshold

The Biodiversity Values Map (BV Map) identifies land with high biodiversity value, as defined by the *Biodiversity Conservation Regulation 2017*. The Biodiversity Offsets Scheme (BOS) applies to all local developments, major projects or the clearing of native vegetation where the *SEPP (Vegetation in Non-Rural Areas) 2017* applies. Any of these will require entry into the BOS if they occur on land mapped on the BV Map. Exempt and complying development or private native forestry are not subject to the BOS.

The BV Map does not intersect with the Study Area; therefore, the proposal does not trigger the BOS or the requirement for a Biodiversity Development Assessment Report (BDAR) under this criterion (refer **Appendix A**).

Area Clearing Threshold

The Area Clearing threshold trigger is defined as follows: *"The area threshold varies depending on the minimum lot size (shown in the Lot Size Maps made under the relevant Local Environmental Plan (LEP)), or actual lot size (where there is no minimum lot size provided for the relevant land under the LEP). The area threshold applies to all proposed native vegetation clearing associated with a development proposal"*.

In this case, the minimum lot size has been specified in the LEP as 450m^2 (0.06ha), which falls within the minimum lot size category of **<1ha** and consequently the area clearing threshold of **>0.25ha** applies (refer **Table 1**). The removal of 0.94ha of native vegetation is under the 1.0ha area clearing limit, and as such the preparation of a BDAR using the Streamlined Assessment Module for Small Area Development of the BAM is required based on the clearing threshold.

Table 1 – Area Clearing Thresholds (BC Act)

Minimum lot size	Threshold for clearing, above which the BAM and offsets scheme apply
< 1ha	**>0.25ha**
1ha to <40ha	>0.5ha.
40ha to <1000ha	>1.0ha
>1000ha	>2ha

This SBDAR has been triggered as required by Clause 7.1 *Biodiversity Conservation Regulation 2017* by the following threshold:

- (a) the clearing of native vegetation of an area declared by clause 7.2 as exceeding the threshold.

Therefore, a SBDAR is required, with an assessment under Appendix C, Table 12 of the Biodiversity Assessment Method Order 2020 (BAM Order).

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 BAM Order, including threatened entities listed under the BC Act.

The proposed development has been assessed under the Streamlined Assessment Module for Small Area Development of the BAM as the minimum Lot size associated with the property falls within the Area Clearing Limits of the small area development module for sites that have a minimum lot size that is less than less than 1ha. As per Table 12 of the BAM, the maximum area clearing limit for application of the small area development module for this minimum lot size is less than 1ha. The proposed development is seeking to clear approximately 0.94ha of native vegetation, thus, the clearing threshold for the minimum lot size is not being exceeded and falls within the clearing limits prescribed in the BAM under the Streamlined Assessment Module for Small Area Development. This report includes:

- **Stage 1 – Biodiversity Assessment** – including the mapping of remnant vegetation communities including Endangered Ecological Communities (EECs) within the site, the location of previously identified threatened species and their habitats, and potential contemporary occurrence of threatened species identified within the BAM Calculator; and
- **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.

It is noted that under the Streamlined Assessment Module the dominant PCT associated with a Threatened Ecological Community (TEC) is required to be adopted for all vegetation zones. As such, the PCT and associated vegetation zones on site have been assessed under the BC Act Listed EEC *Lower Hunter Spotted Gum - Ironbark Forest in the Sydney Basin and NSW North Coast Bioregions*.

1.1.3 The Proposal

Lochinvar Developments Pty Ltd is proposing a 258-lot residential subdivision with internal road, services, and asset protection zones (APZs). The residential development will be situated within Development Boundary Lots 2-6 and 9 DP747391, Lots 12 and 13 DP1219648 (approx. 22.5ha) currently zoned for General Residential (R1) land use. The proposed development is a large residential subdivision planned under the Lochinvar Urban Release program with a realignment of an existing creek line proposed to be managed under a Biodiversity Management Plan (BMP).

The Assessment Area covers approximately 1061ha and the Study Area totals approx. 26.51ha, comprising approx. 1.14ha of poor and highly degraded condition native vegetation, with the remainder of the Study Area consisting of exotic / cleared lands.

The native vegetation within the Study Area contains four (4) plant community types (PCTs), which are present in varying conditions:

- PCT 3328 - *Lower Hunter Red Gum-Paperbark Riverflat Forest* (0.03ha*);*
- PCT 3433 - *Hunter Coast Foothills Spotted Gum-Ironbark Grassy Forest* (0.20ha*);*
- PCT 4042 - *Lower North Riverflat Eucalypt-Paperbark Forest* (0.13ha);
- PCT 4044 - *Northern Creekflat Eucalypt-Paperbark Mesic Swamp Forest (*0.78ha); and

- Planted Native - *Cynodon dactylon* (24.11ha).

The proposal will require the removal or modification of approx. 0.94ha of native vegetation. As part of this proposal to minimise impacts to PCT 3433, 0.10ha of vegetation will be retained and revegetated under a BMP. The current creek line and exotic riparian vegetation will be realigned and revegetated within the proposed BMP works. The realignment is proposed to improve the flooding in the local landscape and improve aquatic flora and fauna habitat for local species to utilise.

The remainder of the Study Area comprises 1.14ha of cleared vegetation, unmaintained grassland, farm dams and non-vegetated areas including existing infrastructure surrounding the current dwelling.

In summary, approx. 0.94ha of native vegetation, 23.94ha of planted native vegetation and 1.03ha of exotic / cleared / existing infrastructure and a farm dam within the Subject Site will be cleared for the development.

The proposed development plan is included in **Appendix B**.

1.1.4 General Description of the Subject Site and Site Particulars

The Subject Site is located within the Maitland Local Government Area (LGA) in the Hunter Region of NSW (**Figure 1** and **Table 2**). The Subject Site is currently a large lot under 1km from the Pacific Highway, within a semi-rural area released as a part of the Lochinvar Urban Release.

The Subject Site currently contains one farm shed with the majority of the allotment dominated by exotic/non-native planted vegetation and highly disturbed/managed paddock with scattered paddock trees and a small patch of native vegetation within the west of the first-order creek riparian zone bisecting the south of the site.

Table 2 – Site Particulars

Detail	Comments
Client	Lochinvar Developments Pty Ltd C/- ADW Johnson Pty Ltd
Address	898 New England Hwy, 25 Wyndella Rd and 39 Wyndella Rd, Lochinvar, NSW
Title(s)	Lot 2 to 6 DP 747391 Lot 12 and 13 DP 1219648 Lot 9/DP 747391
Study Area	The Study Area (approx. 26.51ha) consists of the proposed Development Lot Boundary, and buffer that considers impacts from associated Roads & Infrastructure batters.
Subject Site	The Subject Site (approx. 25.94ha) which includes Roads and Infrastructure Impacts consists of semi-rural land currently being grazed. The vegetation is dominated by pasture grasses, exotics and weeds with remnant native vegetation comprised of predominantly scattered paddock trees. A first order stream bisects the south of the south from west to east. Three farm dams are present in the northern portion of the Site. There are agricultural structures consisting of an open shed and scattered rubble piles throughout the paddock (refer to **Figure 1**).
Assessment Area	The Assessment Area is all areas within a 1500m buffer of the Study Area, totalling approx. 1061ha.
LGA	Maitland
Zoning	Under the Maitland Local Environmental Plan 2011 (the LEP) (pub. 16-12-2011), the Subject Site is zoned R1 – General Residential.

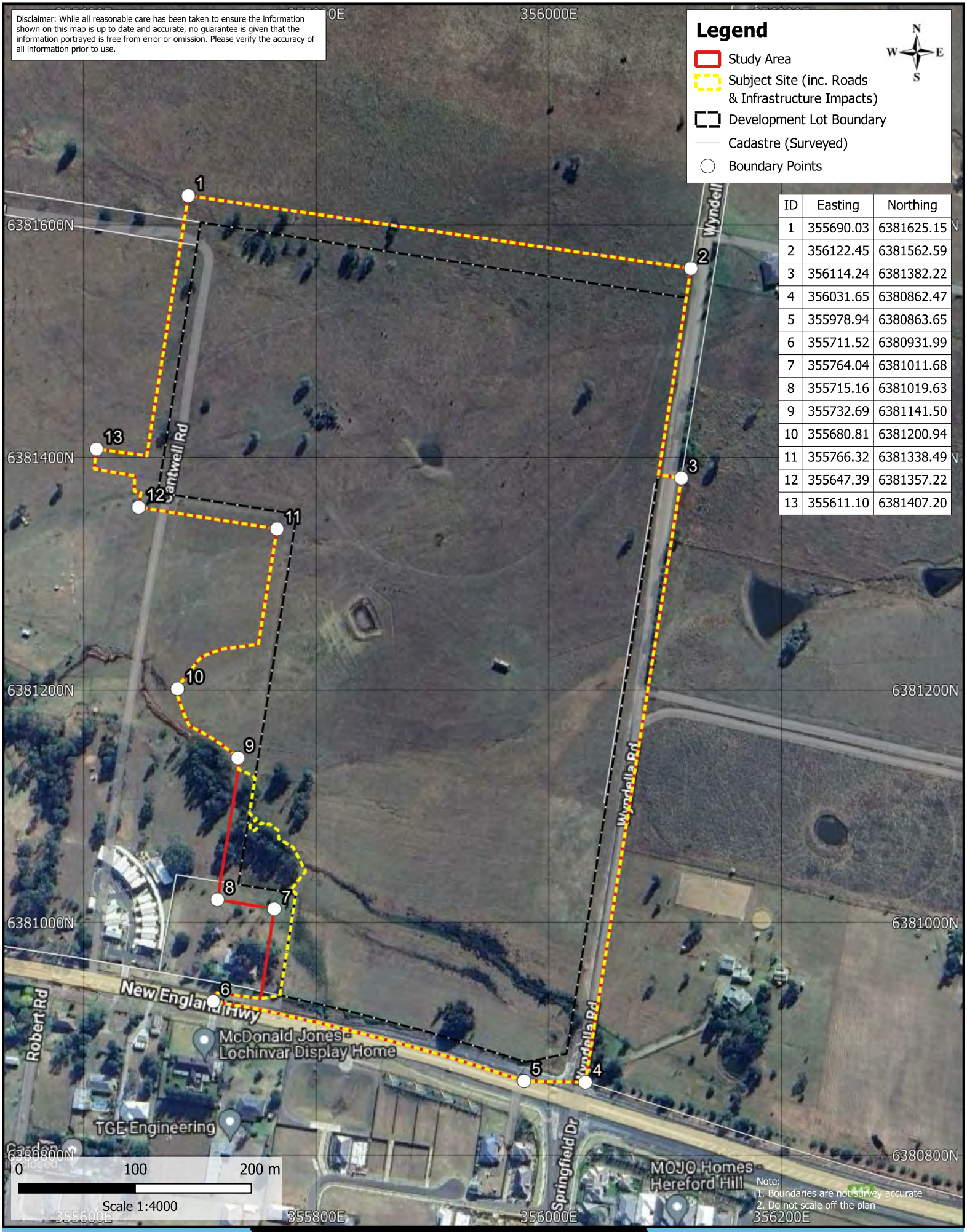
Detail	Comments
Current Land Use	The Study Area consists of rural land currently being grazed. The vegetation is dominated by pasture grasses, exotics and weeds with remnant native vegetation dominated by scattered paddock trees concentrated around the creekline in the south of the site. There are agricultural structures consisting of an open shed and scattered rubble piles throughout the paddock
Surrounding Land Use	Surrounding land uses including small and large lot residential, grazing lands, schools, recreation areas and the New England Highway (SP2 – Special Infrastructure). The Lochinvar Land Release promises further residential growth in the area.

Figure 1 depicts the extent of the Subject Site and Subject Site. **Figure 2** depicts native vegetation occurring within the Assessment Area along with other site location features.

1.1.5 Information Sources

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

- Field surveys conducted within the site and surrounding areas by AEP (2022, 2023, 2024);
- State survey guidelines (DEC 2004; OEH 2018; DPIE 2020b; DPE 2022).
- PlantNET NSW (https://plantnet.rbgsyd.nsw.gov.au/);
- Aerial Photograph Interpretation (API) of the site and surrounding locality (Google 2023; SIX Maps 2023; Nearmap 2024);
- DCCEEW Threatened Biodiversity Profiles (https://www.environment.nsw.gov.au/threatenedSpeciesApp/);
- Search and review of flora and fauna sighting records in the DCCEEW BioNet Atlas within a 100km^2 search area around the site (https://www.environment.nsw.gov.au/topics/animals-and-plants/biodiversity/nsw-bionet);
- Protected Matters Search within a 5km radius of the site held by CDCCEEW, summarising Matters of National Environmental Significance that may occur in, or may relate to the Subject Site;
- DCCEEW's *BAM – Important Areas Viewer* to determine whether the site is mapped as *Swift Parrot, Regent Honeyeater, Migratory Shorebird* and *Plains-wanderer Important Areas;*
- Collective knowledge gained from previous ecological survey and assessment in the Maitland City Council area over the past 30 years; and
- Anecdotal records.



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5	355978.94	6380863.65
6	355711.52	6380931.99
7	355764.04	6381011.68
8	355715.16	6381019.63
9	355732.69	6381141.50
10	355680.81	6381200.94
11	355766.32	6381338.49
12	355647.39	6381357.22
13	355611.10	6381407.20

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Figure 1 - Site Map

Date: July 2024

Location: 898 New England Hwy, 25 & 39 Wyndella Rd, Lochinvar NSW

Client: Lochinvar Developments Pty Ltd
C/- ADW Johnson Pty Ltd

AEP ref: 2699.04
BOAMS: 00048759

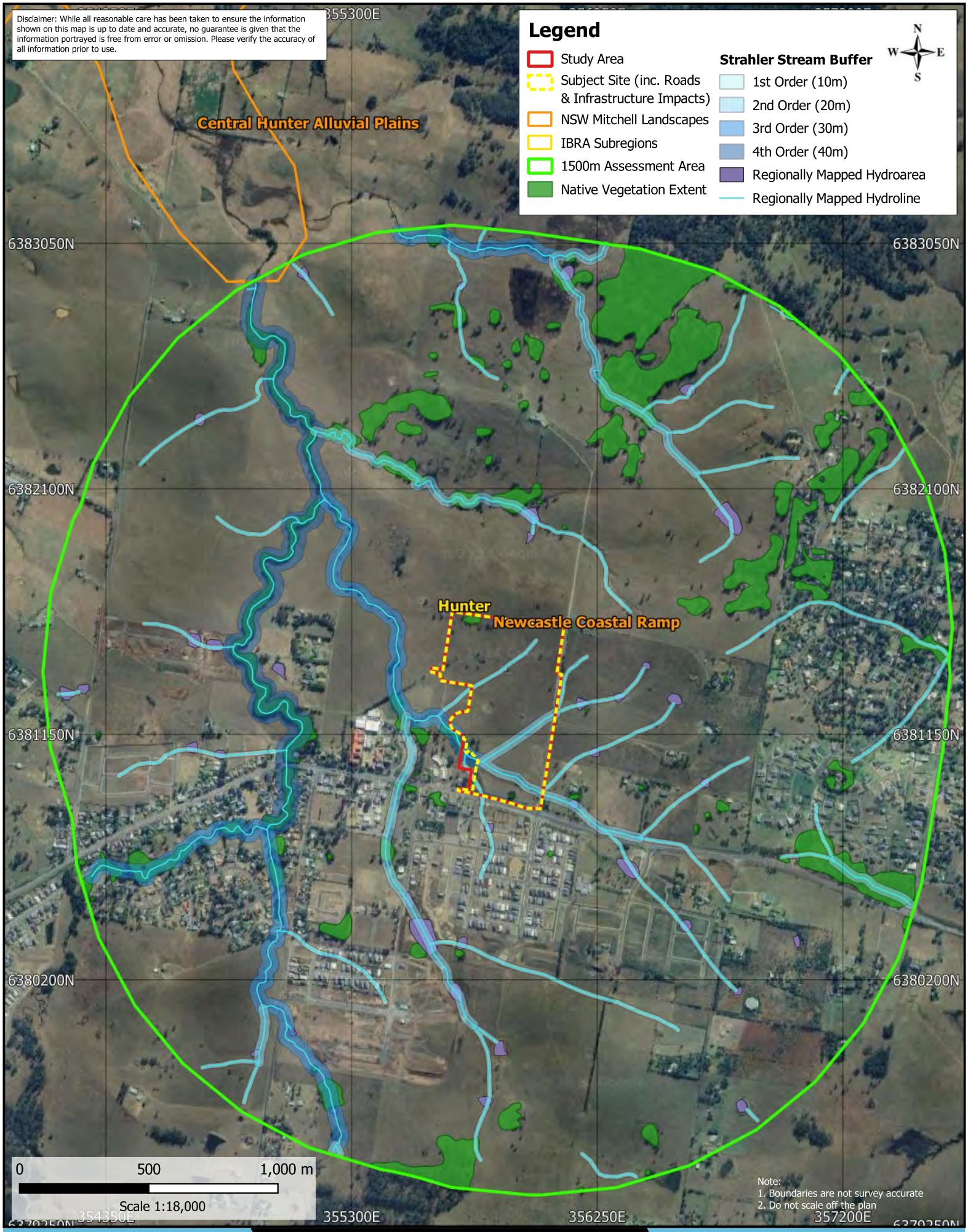

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Figure 2 - Site Location

Date: July 2024

Location: 898 New England Hwy, 25 & 39 Wyndella Rd, Lochinvar NSW

Client: Lochinvar Developments Pty Ltd
C/- ADW Johnson Pty Ltd

AEP ref: 2699.04
BOAMS: 00048759

1.2 Landscape Features

1.2.1 Regional Landscapes

The development site was identified as occurring within the following areas:

- IBRA Bioregion: Sydney Basin.
- IBRA Subregion: Hunter.
- NSW Landscape: The Subject Site occurs entirely on the 'Newcastle Coastal Ramp' landscape. This landscape was selected for use within the BAM calculator. Delineation of NSW Landscape area is shown in the Location Map (**Figure 2**).

1.2.2 Identified Landscape Features

The BAM identifies nine (9) landscape features that require assessment for their relevance to the Subject Site. These features are outlined in **Table 3**.

Table 3 – Landscape Feature Assessment

Landscape Feature	Assessment
Rivers and Streams	Several hydrological features are regionally mapped as occurring within the Study Area. These include a first-order hydroline running from the north to the southwest, and another first-order hydroline running from the southwest to the northwest. Upstream outside of the Study Area, a network of hydrological features leads to the convergence of two second-order streams within the Study Area, forming a third-order stream that exits the Study Area at its western boundary (**Figure 2**). Detailed riparian assessments determined that, for the purpose of applying the accurate Vegetation Riparian Zones for a Controlled Activity Approval (*Section* 91 of the *Water Management Act, 2020*), the unnamed watercourse within the Subject Site is a first-order watercourse (see **Appendix I**) Three farm dams are present within the site.
Wetlands	No mapped wetlands - *SEPP (Resilience and Hazards) 2021* or otherwise - occur within the site.
Native Vegetation Extent	Approximately 1.14ha of native vegetation occurs within the Study Area, of which 0.94ha is proposed to be cleared. The PCTs occurring within the Study Area are as follows: • 3328 - *Lower Hunter Red Gum-Paperbark Riverflat Forest*. It was determined as not commensurate with none of its associated TECs, namely BC Act Listed EEC – *Hunter Lowland Redgum Forest in the Sydney Basin and New South Wales North Coast Bioregions*; BC Act Listed EEC – *River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin, and South East Corner Bioregions* or EPBC Act Listed CEEC – *River-flat eucalypt forest on coastal floodplains of southern New South Wales and eastern Victoria*. • 3433 - *Hunter Coast Foothills Spotted Gum-Ironbark Grassy Forest*. It is commensurate with associated BC Act Listed EEC *Lower Hunter Spotted Gum Ironbark Forest in the Sydney Basin and NSW North Coast Bioregions*. • 4042 - *Lower North Riverflat Eucalypt-Paperbark Forest.* It was determined as not commensurate with associated BC Act Listed EEC – *Freshwater Wetlands on Coastal Floodplains of the New South Wales North Coast, Sydney Basin, and South East Corner Bioregions*.

Landscape Feature	Assessment
	• 4044 - *Northern Creekflat Eucalypt-Paperbark Mesic Swamp Forest.* It was determined as not commensurate with associated BC Act Listed EEC *Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions.* • Planted Native - *Cynodon dactylon*.
Connectivity Features	The site has limited connectivity throughout grazing lands to the northwest via sparsely vegetated riparian zones, to no vegetative connectivity to the south due to the surrounding land uses, being a school, grazing lands and the New England Highway (SP2 – Special Infrastructure).
Karst, Caves, Crevices, Cliffs, Rock and other Geological Features of Significance	There are no identified karst, caves, crevices, cliffs, rock and other geological features of significance within the Subject Site.
NSW Landscape	The Subject Site occurs within the Newcastle Coastal Ramp.
Soil hazard features	Class 5 Acid Sulphate Soils are present on site.
Features identified by the Secretary's Environmental Assessment Requirements (SEARs)	No SEARs apply to this proposal.
Areas of Outstanding Biodiversity Value (AOBV) under the BC Act:	No AOBV are present on the Subject Site or the adjacent lands.

1.2.3 Geology and Soils

Australian Soil Classification (ASC):

- Creekline: *KU - Kurosols*
- Remainder of Study Area: *CH - Chromosols*

Great Soil Group:

- Creekline: *GP - Gleyed Podzolic Soils*
- Remainder of Study Area: *NKB - Non-calcic Brown Soils*

Hydrologic Soil:

- Creekline: *D – Very Slow Infiltration*
- Remainder of Study Area: *C – Slow Infiltration*

1.3 Site Context Components and Native Vegetation

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

1.3.1 Landscape Native Vegetation Cover

The Assessment Area, consisting of a 1500m buffer placed around the Subject Site, covers approximately 1061ha. Approximately 72.24ha comprises native vegetation as per Section 4.3.2 of the BAM. This equates to approximately 6.81% native vegetation cover and an integer of 7% was entered into the BAM Calculator.

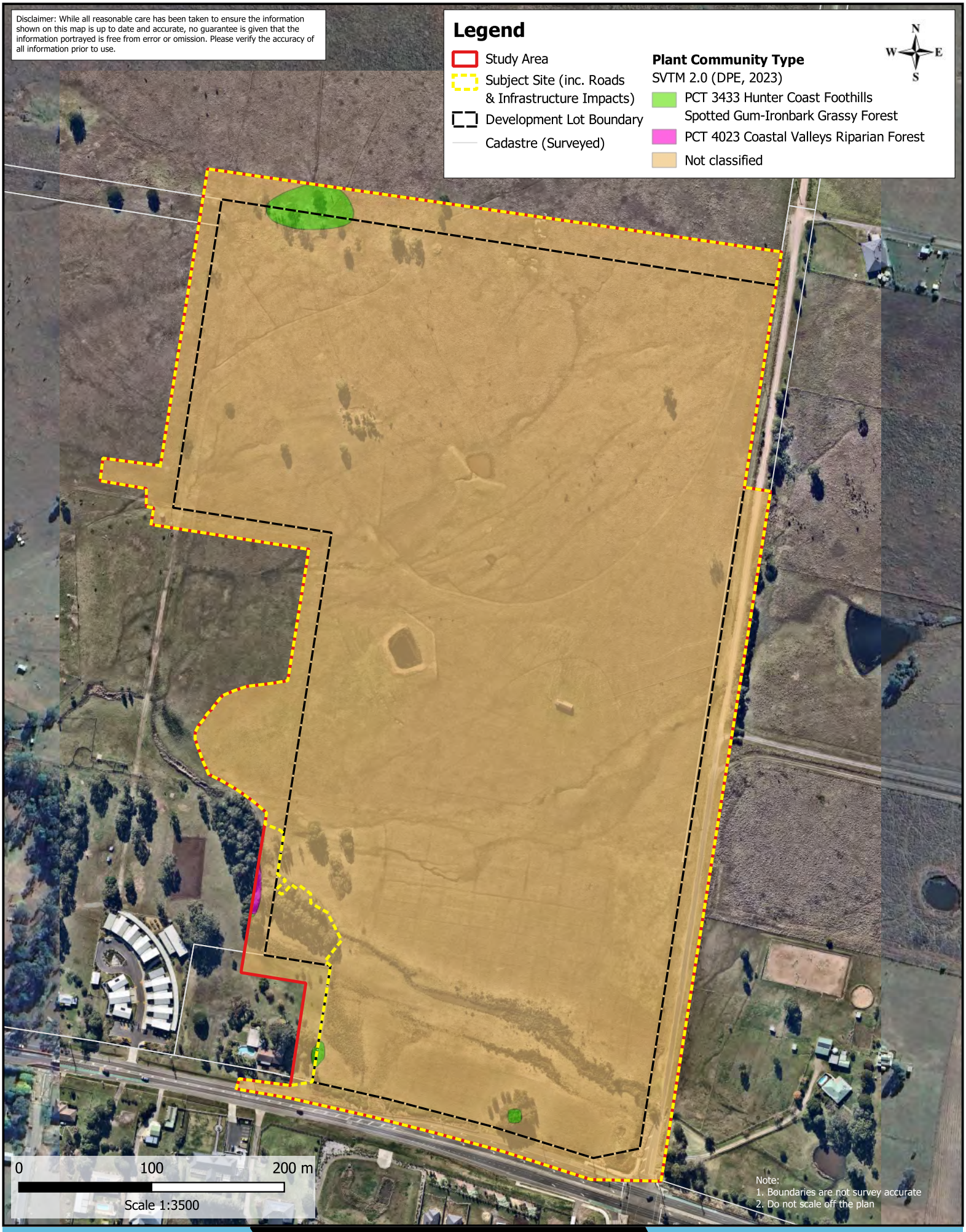
1.3.2 State Vegetation Type Mapping

The State Vegetation Type Map (SVTM) (DPE, 2023) indicates that the native vegetation present consists of PCT 3433 - *Hunter Coast Foothills Spotted Gum-Ironbark Grassy Forest* and PCT 4023 - *Coastal Valleys Riparian Forest*. The vegetation communities mapped within the area, and their extent, are provided in **Table 4** and **Figure 3.** Lower Hunter Vegetation Mapping (Parsons Brinkerhoff 2013) was also afforded consideration.

SVTM served as a basis for preliminary site assessment. Ground-truthing of vegetation by AEP (2022, 2023 and 2024) was the prime source of data to inform Plant Community Type determination in the present assessment.

Table 4 – State Vegetation Type Mapping Results

PCT ID	PCT Name	Area
3433	*Hunter Coast Foothills Spotted Gum-Ironbark Grassy Forest*	0.20
4023	*Coastal Valleys Riparian Forest*	0.02
	Not Native Vegetation	26.30
Total		**26.51**



AEP

Figure 3 - State Vegetation Type Mapping (DPE, 2023) Date: July 2024

Location: 898 New England Hwy, 25 & 39 Wyndella Rd, Lochinvar NSW

Client: Lochinvar Developments Pty Ltd
C/- ADW Johnson Pty Ltd

AEP ref: 2699.04
BOAMS: 00048759

1.3.3 Plot Based Floristics Surveys

Flora surveys were undertaken by AEP in August and December 2022, January 2023, and April 2024 to produce a flora species list for the Subject Site, to search specifically for threatened flora and fauna species known to occur within the wider area, and to gather data necessary to both derive vegetation community type(s) and to meet relevant survey guidelines. Such works included:

- 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;
- Systematic coverage of the site using the Random Meander Technique (Cropper 1993);
- A total of 11 BAM plots were undertaken by AEP within the Study Area to assess different vegetation zones. Plots were located randomly within each vegetation zone.
- Field sheets are provided in **Appendix D**. The location of BAM Plots is depicted in **Figure 4**. A summary of the plot data is provided in **Appendix D**.

1.3.3.1 Plant Community Types (PCTs) and Vegetation Zones

Where native vegetation occurs, four (4) Plant Community Types (PCTs) were determined to occur, as follows:

- PCT 3328 - *Lower Hunter Red Gum-Paperbark Riverflat Forest;*
- PCT 3433 - *Hunter Coast Foothills Spotted Gum-Ironbark Grassy Forest;*
- PCT 4042 - *Lower North Riverflat Eucalypt-Paperbark Forest*; and
- PCT 4044 - *Northern Creekflat Eucalypt-Paperbark Mesic Swamp Forest*.
- Vegetation determined as “Planted Native” due to the presence of *Cynodon dactylon* was also identified on site and is assessed thereafter.

PCT 3328 - Lower Hunter Red Gum-Paperbark Riverflat Forest

Vegetation present on site determined to be associated with PCT 3328 - *Lower Hunter Red Gum-Paperbark Riverflat Forest* is in a highly disturbed and fragmented condition. The determination to associate this vegetation to PCT 3328 was made due to the presence of the remnant canopy species *Eucalyptus tereticornis*, and the midstratum species, *Hakea sericea*, in conjunction with the Study Area’s position within the Hunter IBRA Subregion and Newcastle Coastal Ramp NSW Landscape. Both species were scattered across the northern portion of the site. No other species associated with this PCT was found to be present on site following a long history of agricultural land use. The ground stratum was dominated by a wide range of pasture grasses.

PCT 3328 - *Lower Hunter Red Gum-Paperbark Riverflat Forest* is associated with BC Act listed EEC and EPBC Act listed CEEC *River-flat eucalypt forest on coastal floodplains of southern New South Wales and eastern Victoria*. Associated vegetation within the Subject Site is limited to one (1) canopy tree species, *Eucalyptus tereticornis*, and one (1) midstratum species, *Hakea sericea*. Therefore, as detailed in **Appendix I**, the vegetation present was determined as not being commensurate with the BC Act listed and EPBC Act listed threatened ecological communities.

PCT 3433 - Hunter Coast Foothills Spotted Gum-Ironbark Grassy Forest

The Hunter Coast Foothills Spotted Gum-Ironbark Grassy Forest present on site is dominated by a canopy of Spotted Gum (*Corymbia maculata*) and Grey Gum (*Eucalyptus punctata*). This patch of vegetation is not remnant, having been planted in what appears to be parallel lines no longer than 20

years ago, which is evidenced by the age of the trees. The assignment to this PCT was justified by the characteristic species present including Spotted Gum (*Corymbia maculata*), Grey Gum (*Eucalyptus punctata*) and *Lobelia purpurascens*, and the PCT being present within the locality.

There is a mixture of Dry Sclerophyll Forests species and Forested Wetland species such as *Casuarina glauca, Carex appressa* and *Juncus usitatus* resulting from plantings being placed adjacent to the hydroline. Additional native species present include *Centella asiatica*, *Rumex brownii*, *Lachnagrostis aemula* and *Parsonsia straminea*.

PCT 3433 - *Hunter Coast Foothills Spotted Gum-Ironbark Grassy Forest* is associated with the BC Act listed EEC *Lower Hunter Spotted Gum - Ironbark Forest in the Sydney Basin Bioregion*. Given the absence of midstory, sparse native understorey and fragmented condition of the site, the Hunter Coast Foothills Spotted Gum-Ironbark Grassy Forest present in planted form is a highly disturbed variant of the EEC. This small patch of vegetation suffers from edge effects and disturbance form the grazing cattle. The entire Subject Site is currently grazed by cattle and therefore suppressing the shrub layer. The lower stratum, although highly disturbed and containing a large cover of exotics, also contains a regenerating native understorey.

PCT 4042 - Lower North Riverflat Eucalypt-Paperbark Forest

Vegetation in the southern low-lying areas of the Site were determined to be commensurate with PCT 4042 - Lower North Riverflat Eucalypt-Paperbark Forest. *Casuarina glauca* dominated the canopy with a ground stratum of *Carex appressa, Juncus usitatus*. Introduced species *Cyperus eragrostis* and *Juncus acutus* also dominated the low-lying areas of the site.

PCT 4042 - *Lower North Riverflat Eucalypt-Paperbark Forest* is associated with the BC Act listed EEC *Swamp oak floodplain forest of the NSW North Coast Sydney Basin and South East Corner bioregions*. Associated vegetation within the Subject site is limited to one (1) canopy tree species, *Casuarina glauca*, and two (2) ground stratum species, *Carex appressa* and *Juncus usitatus*. Given the limited diversity of native species, highly disturbed and fragmented condition of the site, the *Lower North Riverflat Eucalypt-Paperbark Forest* present was determined to be a highly disturbed variant of the EEC.

PCT 4044 - Northern Creekflat Eucalypt-Paperbark Mesic Swamp Forest

Vegetation was assessed in southern section of the allotment. This area is dominated by the tree species *Casuarina glauca*. Very sparse *Dichondra repens* is present in the midstorey and ground covers are dominated by exotic species including *Ehrharta erecta, Paspalum dilatatum*, *Plantago lanceolata*, and *Sida rhombifolia*. Paired with the PCT, BAM 4 was a modified plot undertaken in the north-western section of the allotment, being a small remnant patch of *Melaleuca ericifolia.* This area has some *Sporobolus elongatus* and *Euchiton* spp. present in the ground layer. However, this stratum is dominated by exotics including *Briza maxima* and *Hypochaeris radicata.*

PCT 4044 - *Northern Creekflat Eucalypt-Paperbark Mesic Swamp Forest* is associated with BC Act listed EEC *Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions*. Associated vegetation within the Subject Site is limited to two (2) canopy tree species, *Casuarina glauca* and *Melaleuca ericifolia*. Given the limited diversity of native species, highly disturbed and fragmented condition of the site, the *Northern Creekflat Eucalypt-Paperbark Mesic Swamp Forest* present was determined to be a highly disturbed variant of the EEC.

Native cover in grass-only BAM plots 2, 5, 7 and 8 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. Plots 2, 5, 7, and 8 were determined to occur in a vegetation zone described as “Planted Native *Cynodon dactylon*” with high exotic load.

High Threat Weeds present within the Study Area include *Andropogon virginicus* (Whisky Grass), *Araujia sericifera* (Mothvine), *Bidens pilosa* (Cobbler's Pegs), *Briza subaristata*, *Chloris gayana* (Rhodes Grass), *Cyperus eragrostis* (Umbrella Sedge), *Ehrharta erecta* (Panic Veldtgrass), *Galenia pubescens* (Galenia), *Juncus acutus*, *Megathyrsus maximus* (Guinea Grass), *Olea europaea* subsp. *cuspidata* (African Olive), *Paspalum dilatatum* (Paspalum), *Senecio madagascariensis* (Fireweed), *Solanum seaforthianum* (Climbing Nightshade), and *Stenotaphrum secundatum* (Buffalo Grass).

Ground-truthed PCT mapping for the Subject Site is shown in **Figure 4**. BAM plot photographs are included in the body of the report and additional site photographs are provided in **Appendix E**.

1.3.4 Selection Justification

The BAM requires the identification of the PCTs (or the most likely PCTs) and all TECs on the Subject Site. The identification must be in accordance with the NSW PCT classification as described in the BioNet Vegetation Classification system. The identification of TECs must be consistent with the NSW Threatened Species Scientific Committee Final Determination for the TEC.

1.3.4.1 PCT Determination and Vegetation Zones Process

AEP utilises the NSW Government BioNet Vegetation Classification, 2023 webpage including the PCT Data and Bulk Export data spreadsheet to determine the most likely PCTs. The following outlines the process:

1. Determine the State Vegetation Type Mapping Extent based on most recent mapping tools.
2. Determine the IBRA and IBRA Subregion zones – this step assists in discounting PCTs that are not located within Subject Site.
3. Determine the NSW Landscapes – a map needs to be generated for this step as there may be multiply landscapes within the Subject Site.
4. Use the floristic results from the BAM Plots, filtering from canopy species through to other ground-stratum species. Using the BioNet Vegetation Classification is critical in this stage where the frequency of the species present is the leading contributor to refining the PCT as confirmation of presence and absence is identified within this step.

The above steps allow the narrowing of the potential PCTs as shown in **Table 5** with further assessment required.

5. Using the BioNet Vegetation Classification and details collected in the field to assess both the Vegetation Formation and Class must be undertaken to ensure the species present are a representation of the community at the Subject Site. For example, some species such as *Eucalyptus robusta,* can be found in both Dry Sclerophyll Forests and Forested Wetlands, which will significantly alter the PCT if not assessed accurately.
6. Determination of LGA, as there are particular plant communities that are restricted to or excluded from LGAs.
7. Geographical Restrictions and elevation are researched – these factors play a significant role in soil types and climatic conditions which impacts the location of flora within NSW.
8. AEP uses E-Spade to determine the local soil types to assist with refining the PCTs.

9. Other habitat restrictions such as rainfall, tidal, riparian zones, etc are also researched against the BioNet Vegetation Classification results and data collected on site.

The above steps are generally undertaken in order to ensure the PCTs within the Subject Site are an accurate reflection of the vegetation communities occurring within the areas.

Tables 6, **8**, **10** and **12** provide a summary of each of the contributing factors used to determine the PCT present within the areas deemed native vegetation by the Accredited Assessor and Botanist.

Tables 7, **9**, **11** and **13** show the assessment of each condition of the vegetation PCTs within the Subject Site to assist with the determination of the Vegetation Zones. AEP utilises the data collected in the field and the Vegetation Integrity Scores to determine the conditions.

Table 5 – Species Data for Potential PCT Determination

Plot ID	Dominant Native Species	Diagnostic species present	Potential PCTs
1	*Eucalyptus punctata; Eucalyptus* spp.*; Casuarina glauca; Corymbia maculata; Callistemon salignus; Centella asiatica; Parsonsia straminea; Pittosporum revolutum; Rumex brownii; Carex appressa; Juncus usitatus; Lachnagrostis aemula; Lobelia purpurascens.*	*Corymbia maculata, Eucalyptus punctata; Callistemon salignus, Pittosporum revolutum, Pittosporum undulatum; Juncus usitatus, Carex appressa, Lachnagrostis aemula; Lobelia purpurascens, Dichondra repens, Centella asiatica; Parsonsia straminea.*	**3241** **3432** **3433** **3446**
2	*Euchiton* spp.*; Fimbristylis dichotoma; Lachnagrostis aemula; Sporobolus elongatus; Cheilanthes sieberi; Eragrostis brownii.*	*Cynodon dactylon*	**Planted Native Module**
3	*Casuarina glauca; Dichondra repens*	*Eucalyptus robusta, Casuarina glauca, Eucalyptus microcorys, Eucalyptus punctata, Eucalyptus tereticornis, Corymbia maculata,* *Callistemon salignus, Pittosporum revolutum, Pittosporum undulatum, Melaleuca ericifolia,* *Carex appressa, Juncus usitatus, Themeda triandra,* *Lobelia purpurascens, Dichondra repens, Centella asiatica, Parsonsia straminea*	**4020** **4023** **4042** **4044**
4	*Melaleuca ericifolia; Sporobolus elongatus; Euchiton* spp.*; Fimbristylis dichotoma; Austrostipa ramosissima; Bothriochloa macra; Cyperus* spp.	*Eucalyptus robusta, Casuarina glauca, Eucalyptus microcorys, Eucalyptus punctata, Eucalyptus tereticornis, Corymbia maculata,* *Callistemon salignus, Pittosporum revolutum, Pittosporum undulatum, Melaleuca ericifolia,* *Carex appressa, Juncus usitatus, Themeda triandra,* *Lobelia purpurascens, Dichondra repens, Centella asiatica, Parsonsia straminea*	**4020** **4023** **4042** **4044**
5	*Euchiton spp.; Sporobolus elongatus; Fimbristylis dichotoma; Eragrostis brownii*	*Cynodon dactylon*	**Planted Native Module**
6	*Eucalyptus* spp.*; Eucalyptus tereticornis; Sporobolus elongatus; Euchiton spp.; Eragrostis brownii; Cyperus* spp.	*Eucalyptus tereticornis Hakea sericea, Pittosporum undulatum,* *Themeda triandra, Fimbristylis dichotoma, Juncus usitatus, Lobelia purpurascens, Dichondra repens, Centella asiatica, Cheilanthes sieberi subsp. sieberi,*	**3328** **3446** **4042**
7	Non-native dominant	-	**Not Native**
8	*Austrostipa ramosissima; Sporobolus elongatus; Eragrostis brownii; Euchiton spp.; Rumex brownii; Fimbristylis dichotoma; Lachnagrostis aemula; Cheilanthes sieberi*	*Cynodon dactylon*	**Planted Native Module**
9	*Juncus usitatus; Ludwigia peploides subsp. montevidensis; Lachnagrostis aemula; Ranunculus inundatus*	*Eucalyptus tereticornis, Corymbia maculata, Eucalyptus microcorys, Casuarina glauca, Eucalyptus robusta,*	**3328** **3446**

Plot ID	Dominant Native Species	Diagnostic species present	Potential PCTs
		Callistemon salignus, Pittosporum revolutum, Pittosporum undulatum, Melaleuca ericifolia, *Carex appressa, Themeda triandra, Eragrostis brownii, Juncus usitatus, Fimbristylis dichotoma, Austrostipa ramosissima, Lachnagrostis filiformis, Sporobolus elongatus, Dichondra repens, Lobelia purpurascens, Centella asiatica, Ranunculus inundatus, Cheilanthes sieberi subsp. sieberi, Parsonsia straminea,*	**4042**
10	*Eucalyptus punctata; Melaleuca bracteata; Eucalyptus microcorys; Eucalyptus robusta; Hakea bakeriana; Hakea sericea; Themeda triandra; Juncus usitatus; Sporobolus elongatus; Rytidosperma pallidum; Rumex brownii; Pittosporum undulatum*	*Eucalyptus punctata, Eucalyptus microcorys, Eucalyptus robusta, Pittosporum undulatum, Hakea sericea;* *Themeda triandra, Rytidosperma pallidum, Juncus usitatus, Lachnagrostis filiformis, Sporobolus elongatus*	**3241** **3432** **3433** **3446**
11	*Fimbristylis dichotoma*	*Cynodon dactylon*	**Planted Native Module**

Review of floristic data concluded that plots and PCTs were associated as follows. Further justification is provided in **Tables 6 to 13**.

- PCT 3328: BAM plot 6;
- PCT 3433: BAM plots 1 & 10;
- PCT 4042: BAM plot 9; and
- PCT 4044: BAM plots 3 & 4.
- Planted native *Cynodon dactylon* BAM plot 2, 5, 8, and 11, no upper or mid stratum, native vegetation extent <15%.

Table 6 – PCT Determination for Plot 1 & 10

Potential PCTs	3241	3432	3433	3446
PCT Name	Lower North White Mahogany-Spotted Gum Moist Forest	Hunter Coast Foothills Apple-Ironbark Grassy Forest	Hunter Coast Foothills Spotted Gum-Ironbark Grassy Forest	Lower North Foothills Ironbark-Box-Gum Grassy Forest
SVTM 2023	No	No	No (PCT 1592 previously determined on site by AEP has strong lineage relationship to PCT 3433)	No
IBRA Region	NSW North Coast; **Sydney Basin;**	NSW North Coast; **Sydney Basin;**	NSW North Coast; **Sydney Basin;**	NSW North Coast; **Sydney Basin;**
IBRA Subregion	Ellerston; Karuah Manning; Macleay Hastings; Mummel Escarpment; Tomalla; Upper Hunter; **Hunter**; Wyong; Yengo;	Karuah Manning; Upper Hunter; **Hunter**; Wyong;	Karuah Manning; Macleay Hastings; Upper Hunter; **Hunter**; Wyong; Yengo;	Karuah Manning; Mummel Escarpment; Upper Hunter; **Hunter**; Wyong; Ellerston; Tomalla; Yengo;
LGA	Central Coast; Cessnock; Dungog; Lake Macquarie; **Maitland**; Mid-Coast; Muswellbrook; Port Macquarie-Hastings; Port Stephens; Singleton; Newcastle;	Central Coast; Cessnock; Dungog; Lake Macquarie; **Maitland**; Mid-Coast; Newcastle; Port Stephens;	Central Coast; Cessnock; Dungog; Lake Macquarie; **Maitland**; Mid-Coast; Newcastle; Port Stephens;	Cessnock; Dungog; **Maitland**; Mid-Coast; Newcastle; Port Stephens; Singleton; Muswellbrook;
Present Diagnostic Species within Subject Site	**Tree Form Group:** *Corymbia maculata, Eucalyptus punctata, Eucalyptus microcorys, Eucalyptus tereticornis,* **Shrub Form Group:** *Pittosporum revolutum, Pittosporum undulatum, Callistemon salignus,* **Grass & Grasslike Form Group:** *Themeda triandra, Carex appressa, Bothriochloa macra, Juncus usitatus, Austrostipa ramosissima, Fimbristylis dichotoma, Lachnagrostis filiformis,*	**Tree Form Group:** *Corymbia maculata, Eucalyptus punctata, Eucalyptus microcorys, Eucalyptus tereticornis,* **Shrub Form Group:** *Hakea sericea, Callistemon salignus, Pittosporum revolutum, Pittosporum undulatum,* **Grass & Grasslike Form Group:** *Themeda triandra, Rytidosperma pallidum, Eragrostis brownii, Fimbristylis dichotoma, Lachnagrostis aemula, Austrostipa*	**Tree Form Group:** *Corymbia maculata, Eucalyptus punctata, Eucalyptus tereticornis, Eucalyptus microcorys, Eucalyptus robusta,* **Shrub Form Group:** *Callistemon salignus, Pittosporum revolutum, Pittosporum undulatum, Hakea sericea* **Grass & Grasslike Form Group:** *Themeda triandra, Eragrostis brownii, Rytidosperma pallidum, Fimbristylis dichotoma, Juncus usitatus, Austrostipa ramosissima, Bothriochloa macra, Carex appressa, Lachnagrostis*	**Tree Form Group:** *Corymbia maculata, Eucalyptus tereticornis, Eucalyptus punctata, Casuarina glauca, Eucalyptus microcorys,* **Shrub Form Group:** *Pittosporum undulatum, Pittosporum revolutum, Callistemon salignus, Hakea sericea,* **Grass & Grasslike Form Group:** *Themeda triandra, Eragrostis brownii, Fimbristylis dichotoma, Juncus usitatus, Bothriochloa macra, Carex appressa, Sporobolus elongatus, Austrostipa ramosissima,*

Potential PCTs	3241	3432	3433	3446
	Forb Form Group: *Dichondra repens, Lobelia purpurascens, Centella asiatica, Rumex brownii,* **Fern Form Group:** *Cheilanthes sieberi subsp. sieberi,* **Other Form Group:** *Parsonsia straminea,*	*ramosissima, Juncus usitatus, Lachnagrostis filiformis,* **Forb Form Group:** *Lobelia purpurascens, Centella asiatica, Dichondra repens,* **Fern Form Group:** *Cheilanthes sieberi subsp. sieberi,* **Other Form Group:** *Parsonsia straminea,*	*aemula, Lachnagrostis filiformis, Sporobolus elongatus* **Forb Form Group:** *Lobelia purpurascens, Dichondra repens, Centella asiatica,* **Fern Form Group:** *Cheilanthes sieberi subsp. sieberi,* **Other Form Group:** *Parsonsia straminea,*	*Lachnagrostis aemula, Rytidosperma pallidum, Lachnagrostis filiformis,* **Forb Form Group:** *Lobelia purpurascens, Dichondra repens, Centella asiatica, Rumex brownii,* **Fern Form Group:** *Cheilanthes sieberi subsp. sieberi,* **Other Form Group:** *Parsonsia straminea,*
PCT Description	A tall to very tall sclerophyll open forest with a sparse mid-stratum of soft-leaved shrubs and a grassy ground layer on dry slopes of the hinterland ranges of the Central Coast, Hunter valley and lower north coast. The tree canopy very frequently includes a high cover of *Eucalyptus acmenoides* and *Corymbia maculata*. These may rarely be replaced or accompanied by a range of other species typically from the ironbark, grey gum or mahogany eucalypt groups of which *Eucalyptus siderophloia, Eucalyptus punctata* and *Eucalyptus umbra* are most frequent. The mid-stratum is layered, with a sparse cover of small trees that are very frequently dominated by *Allocasuarina torulosa* occasionally with *Acacia implexa* or rarely *Angophora floribunda* or low-growing eucalypts. The sparse lower shrub	A tall to very tall sclerophyll open forest with a sparse dry shrub layer and grassy ground cover found on coastal hills, rises and escarpment foot slopes between Wyong and The Branch on the Lower North and Hunter coasts. The tree canopy is diverse however collectively can be summarised into combinations of smooth-barked apple, bloodwood, ironbark, spotted gum, white mahoganies and stringybarks. A high cover of *Angophora costata* is very frequently recorded, commonly in association with *Corymbia gummifera*, *Corymbia maculata* or occasionally *Eucalyptus umbra*. Five species of ironbark have been recorded although only *Eucalyptus fibrosa* is common. Collectively stringybarks are also common, however no single species occurs more than occasionally. The mid-stratum	A tall to very tall sclerophyll open forest with dry and soft-leaved shrubs and a grassy ground cover on undulating foothills of the Hunter coast hinterland from Tuggerah to Stratford, and the lower Hunter valley around Cessnock. The canopy almost always includes *Corymbia maculata* accompanied by one or more ironbarks (*Eucalyptus fibrosa* or *Eucalyptus siderophloia*). Mahoganies (*Eucalyptus umbra* or *Eucalyptus acmenoides*) are also commonly present in the canopy. The sparse mid-stratum almost always includes one or more Acacia species, of which *Acacia falcata* and *Acacia ulicifolia* are the most frequent and abundant. The shrubs and small trees that complete the mid-stratum very frequently include *Daviesia ulicifolia*, commonly *Bursaria spinosa*, *Persoonia linearis* and rarely *Pultenaea villosa*, *Leucopogon juniperinus* or patches of *Melaleuca nodosa*. The mid-dense ground layer	A tall sclerophyll open forest with a mid-stratum of dry and soft-leaved species and a grassy ground cover on the foothills of the lower north coast and lower Hunter valley, from Quorrobolong to Stratford. The canopy very frequently includes *Corymbia maculata*, commonly with an ironbark (*Eucalyptus crebra* or *Eucalyptus siderophloia*), *Eucalyptus tereticornis* or *Eucalyptus moluccana*, which may be prominent in localised areas. The sparse mid-stratum commonly includes taller Acacia species, with *Acacia falcata* and *Acacia implexa* most frequently recorded. Smaller shrubs *Breynia oblongifolia, Leucopogon juniperinus*, *Notelaea longifolia* and *Persoonia linearis* are also common in the mid-stratum. The mid-dense ground layer is typically comprised of a diverse suite of grasses, soft-leaved forbs, twiners and a hardy fern. *Cymbopogon refractus*, *Lobelia purpurascens* and *Cheilanthes*

Potential PCTs	3241	3432	3433	3446
	layer very frequently includes *Breynia oblongifolia*, commonly *Denhamia silvestris* and *Notelaea longifolia*, occasionally with *Persoonia linearis, Pittosporum revolutum* or *Indigofera australis*. The mid-dense ground layer consists of grasses and small forbs, very frequently including *Imperata cylindrica* and *Microlaena stipoides*, commonly *Oplismenus imbecillis*, *Themeda triandra* and *Poa labillardierei var. labillardierei*, occasionally with *Entolasia marginata*. Forbs and vines very frequently or commonly include *Dichondra repens*, *Desmodium gunnii, Lobelia purpurascens, Eustrephus latifolius* and *Geitonoplesium cymosum*. A widespread forest, this PCT is associated with Narrabeen sandstone south of the Hunter River, mainly on the drier margins of the Watagan and Hunter Ranges. North of the Hunter River it is common on the Carboniferous sediments on the eastern foothills of the Barrington Fall between Muswellbrook, Dungog and Gloucester. It extends north to the Port Macquarie district on a range of sedimentary substrates. Primarily located less than 400 metres asl, this community spans a wide range of rainfall gradients from drier zones east of	occasionally includes a tall sparse cover of *Allocasuarina littoralis* with a lower dry shrub layer commonly including *Persoonia linearis, Dillwynia retorta* or *Acacia ulicifolia*. The ground layer is a mid-dense to dense cover of grasses that almost always include *Themeda triandra* and *Entolasia stricta*, very frequently with *Rytidosperma pallidum*, *Aristida vagans* and *Microlaena stipoides*. The grass tree *Xanthorrhoea latifolia* is also common along with the sedge *Ptilothrix deusta*. The distribution of this PCT is concentrated on the rises north of Warnervale, around West Wallsend and the footslopes of Mount Sugarloaf and extending north onto Carboniferous sandstone and conglomerate north of the Hunter River. This community overlaps in distribution with PCT 3433 which occupies similar elevation and substrate and shares many ground cover species, however is without the sclerophyll shrub species and *Angophora costata* and *Corymbia gummifera* are absent from the canopy. There is also a weaker species overlap with PCTs 3582 and 3581 which occur at lower elevations with poorer quartz-rich	typically includes graminoids, forbs, twiners and a hardy fern. *Entolasia stricta* is almost always present, with *Themeda triandra, Lobelia purpurascens, Microlaena stipoides, Aristida vagans*, *Lomandra multiflora subsp. multiflora, Glycine clandestina* and *Cheilanthes sieberi subsp. sieberi* all very frequent. This PCT occurs primarily on Permian sediments, however is also present on claystones of the Narrabeen Group. It is commonly recorded at elevations below 150 metres asl, with scattered records up to 300 metres asl, in a moist climate with a mean annual rainfall of 1030 mm. As rainfall decreases in adjacent areas this PCT grades into PCT 3444, with considerable spatial overlap occurring in the Cessnock area. While this PCT has a higher frequency of mahogany eucalypts and melaleucas than PCT 3444, there is considerable overlap in the assemblage of both PCTs. On coastal foothills it grades into PCT 3432 which is characterised by different canopy species such as *Angophora costata* and *Corymbia gummifera*.	*sieberi subsp. sieberi* are almost always present while *Themeda triandra*, *Microlaena stipoides, Dichondra repens, Lomandra multiflora subsp. multiflora* and *Glycine tabacina* are very frequent. This PCT typically occurs on sedimentary (lithic sandstone, conglomerate, siltstone) and volcanic substrates (ignimbrites, tuffs) in a hot, moist climate, with most samples from elevations below 300 metres asl but with scattered instances up to 600 metres asl on northern Hunter valley slopes. It overlaps floristically with PCT 3329 which differs in that red gums are almost always present and *Corymbia maculata* and ironbarks are rare and it occurs on more fertile substrates on the floor of the rain shadow valleys of the lower north coast.

Potential PCTs	3241	3432	3433	3446
	Muswellbrook to wetter coastal areas, as well as on dry slopes on the lower north coast. It grades into PCT 3242 on more sheltered slopes or in wetter areas, and into PCT 3244 on more exposed sites or those with more sandy soils.	soils and have a more diverse sclerophyll shrub stratum.		
Vegetation Formation	Wet Sclerophyll Forests (Grassy sub-formation);	Dry Sclerophyll Forests (Shrub/grass sub-formation);	Dry Sclerophyll Forests (Shrub/grass sub-formation);	Dry Sclerophyll Forests (Shrub/grass sub-formation);
Vegetation Class	Northern Hinterland Wet Sclerophyll Forests;	Hunter-Macleay Dry Sclerophyll Forests;	Hunter-Macleay Dry Sclerophyll Forests;	Hunter-Macleay Dry Sclerophyll Forests;
Elevation (min-median-max)	6.1 181.8 588.5	12.3 46.8 373.8	10.2 48.4 302.1	10 114.3 592.6
Rainfall (min-median-max)	737 1068 1560	925 1043 1264	772 1044 1310	680 984 1304
PCT Determination	This PCT was discounted due to the absence of diagnostic canopy and shrub layer species. Vegetation formation, elevation parameters, and floristic composition of these plots are more closely associated with PCT 3432 and 3433.	This PCT has similar floristic composition, vegetation formation, and elevation parameters, however is not considered best match for the vegetation recorded on site.	**This PCT is considered the most accurate description of the vegetation in these plots due to high similarity in floristic composition, and highly suitable elevation and rainfall parameters. This PCT is also mapped within the Subject Site (DPE 2023)**	This PCT has similar floristic composition and vegetation formation, however is not considered best match for the vegetation recorded on site due to less appropriate rainfall and elevation parameters.

Potential PCTs	3241	3432	3433	3446
Result	**PCT 3433 - *Hunter Coast Foothills Spotted Gum-Ironbark Grassy Forest***			
BAM Plots	**1, 10**			
Estimate cleared value of PCT (%)	68.6			
Associated TECs	BC Act Listed EEC: *Lower Hunter Spotted Gum Ironbark Forest in the Sydney Basin and NSW North Coast Bioregions*			

Table 7 – Vegetation Zones in PCT 3433

Category	Description
Description of Vegetation Zone	**PCT 3433** BAM 1 was undertaken in the south-west section of the allotment. This area is dominated by the tree species *Eucalyptus punctata* with *Casuarina glauca* present. *Callistemon salignus* is present in the midstorey and ground covers are dominated by exotic species including *Cynodon* spp., *Juncus acutus,* and *Plantago lanceolata.* BAM 10 was undertaken on the eastern boundary of the allotment, being a disturbed roadside plot. This area is dominated by the tree species *Eucalyptus punctata,* with *Eucalyptus microcorys* and *Eucalyptus robusta* present. Some *Melaleuca bracteata* and *Hakea sericea* is present in the shrub layer, and the ground layer is dominated by exotic species including *Cynodon* spp., *Olea europaea subsp. cuspidata*,* and *Briza maxima.*
Area of Vegetation Zone (ha)	This vegetation zone covers approximately 0.20ha of the Study Area of which 0.07ha PCT 3433 will be impacted.
BAM plots	1, 10

Plate 1 – PCT 3433 – BAM 1 (Start)

Plate 2– PCT 3433 – BAM 1 (End)

Category	Description	
		
	Plate 2 – PCT 3433 – BAM 10 (Start)	**Plate 3 – PCT 3433 – BAM 10 (End)**

Table 8 – PCT Determination for Plot 3 & 4

Potential PCTs	4020	4023	4042	4044
PCT Name	Coastal Creekflat Layered Grass-Sedge Swamp Forest	Coastal Valleys Riparian Forest	Lower North Riverflat Eucalypt-Paperbark Forest	Northern Creekflat Eucalypt-Paperbark Mesic Swamp Forest
SVTM 2023	No	**YES**	No	No
IBRA Region	NSW North Coast; **Sydney Basin**;	**Sydney Basin**;	NSW North Coast; **Sydney Basin**;	NSW North Coast; **Sydney Basin**;
IBRA Subregion	Karuah Manning; Macleay Hastings; **Hunter**; Illawarra; Jervis; Wyong;	Cumberland; **Hunter**;	Coffs Coast and Escarpment; Karuah Manning; Macleay Hastings; Upper Hunter; **Hunter**; Wyong;	Karuah Manning; Macleay Hastings; **Hunter**; Pittwater; Wyong; Yengo;
LGA	Central Coast; Kempsey; Lake Macquarie; **Maitland**; Mid-Coast; Port Macquarie-Hastings; Port Stephens; Shoalhaven;	Blacktown; Camden; Cessnock; Liverpool; Penrith; Singleton; The Hills Shire;	Central Coast; Cessnock; Dungog; Kempsey; Lake Macquarie; **Maitland**; Mid-Coast; Nambucca Valley; Port Macquarie-Hastings; Port Stephens;	Central Coast; Cessnock; Kempsey; Lake Macquarie; **Maitland**; Mid-Coast; Port Macquarie-Hastings;
Present Diagnostic Species within Subject Site	**Tree Form Group:** *Eucalyptus robusta, Eucalyptus tereticornis, Casuarina glauca, Corymbia maculata, Eucalyptus microcorys, Eucalyptus punctata,* **Shrub Form Group:** *Callistemon salignus, Melaleuca ericifolia, Pittosporum undulatum,* **Grass Form Group:** *Themeda triandra, Carex appressa, Juncus usitatus, Eragrostis brownii, Lachnagrostis aemula, Empodisma minus, Fimbristylis dichotoma,* **Forb Form Group:** *Lobelia purpurascens, Centella asiatica, Dichondra repens, Ranunculus inundatus,*	**Tree Form Group:** *Casuarina glauca, Eucalyptus tereticornis, Corymbia maculata,* **Shrub Form Group:** *Pittosporum revolutum,* **Grass Form Group:** *Juncus usitatus, Eragrostis brownii, Fimbristylis dichotoma, Themeda triandra, Bothriochloa macra, Lachnagrostis filiformis, Austrostipa ramosissim, Carex appressa, Lachnagrostis aemula, Sporobolus elongatus,* **Forb Form Group:** *Dichondra repens, Lobelia purpurascens, Centella asiatica, Rumex brownii,* **Fern Form Group:** *Cheilanthes sieberi subsp. sieberi,*	**Tree Form Group:** *Eucalyptus tereticornis, Corymbia maculata, Eucalyptus microcorys, Casuarina glauca, Eucalyptus robusta,* **Shrub Form Group:** *Callistemon salignus, Pittosporum revolutum, Pittosporum undulatum, Melaleuca ericifolia,* **Grass Form Group:** *Carex appressa, Themeda triandra, Eragrostis brownii, Juncus usitatus, Fimbristylis dichotoma, Austrostipa ramosissima, Lachnagrostis filiformis, Sporobolus elongatus* **Forb Form Group:** *Dichondra repens, Lobelia purpurascens, Centella asiatica, Ranunculus inundatus,*	**Tree Form Group:** *Eucalyptus robusta, Casuarina glauca, Eucalyptus microcorys, Eucalyptus punctata, Eucalyptus tereticornis, Corymbia maculata,* **Shrub Form Group:** *Callistemon salignus, Pittosporum revolutum, Pittosporum undulatum, Melaleuca ericifolia,* **Grass Form Group:** *Carex appressa, Juncus usitatus, Themeda triandra,* **Forb Form Group:** *Lobelia purpurascens, Dichondra repens, Centella asiatica,* **Fern Form Group:** n/a **Other Form Group:** *Parsonsia straminea*

Potential PCTs	4020	4023	4042	4044
	Fern Form Group: n/a **Other Form Group:** *Parsonsia straminea,*	**Other Form Group:** *Parsonsia straminea,*	**Fern Form Group:** *Cheilanthes sieberi subsp. sieberi ,* **Other Form Group:** *Parsonsia straminea,*	
PCT Description	A tall to very tall sclerophyll open forest with a sub-canopy of Melaleuca trees and a dense ground layer of sedges and grasses found on low-lying coastal silty alluvial soils between the Shoalhaven and the mid north coast. The tree canopy is variable, however commonly includes *Eucalyptus robusta*, and may be accompanied or replaced by *Eucalyptus tereticornis* or *Eucalyptus amplifolia*, or rarely *Angophora floribunda*, *Eucalyptus resinifera* and in the Shoalhaven, *Eucalyptus longifolia*. Sometimes a sparse cover of tall Melaleuca species is included amongst the eucalypt canopy. The mid-stratum is characterised by a mid-dense cover of smaller trees that almost always includes a patchy cover of *Melaleuca linariifolia*, occasionally or rarely with other Melaleuca species depending on location. North of the Hawkesbury River these may include *Melaleuca quinquenervia* or *Melaleuca sieberi*, while in the Shoalhaven it may include *Melaleuca ericifolia*, *Melaleuca decora* or *Melaleuca biconvexa*. The climber *Parsonsia*	A tall Casuarina open forest with a dense grassy ground layer that is found adjacent to streams or on river flats, primarily in the South Creek catchment of the Cumberland Plain to the west of Sydney and from Ellalong to north of Rothbury in the central Hunter valley. The canopy is one of the distinguishing features of this PCT, very frequently including a high cover of relatively young *Casuarina glauca* amongst a mix of old and young eucalypts, commonly red gums (*Eucalyptus amplifolia* and *Eucalyptus tereticornis*) or occasionally *Eucalyptus moluccana*. The only common species in the sparse shrub layer is *Bursaria spinosa*. There is a dense ground cover, typical of river flat forests, that is typically comprised of grasses, forbs, twiners and ferns. A high cover of *Microlaena stipoides* is almost always present, with more scattered *Brunoniella australis* and *Dichondra repens* being very frequent. Common ground covers include *Solanum prinophyllum*, *Glycine tabacina*, *Cheilanthes sieberi subsp. sieberi*, *Oplismenus aemulus* and *Lobelia*	A very tall to extremely tall sclerophyll open forest with a sub-canopy of Melaleuca trees and a grassy and herbaceous ground cover found on low-lying coastal alluvial soils between Wyong and Nambucca, Central Coast and north coast. The tree canopy includes a range of eucalypt species, with no single species consistently recorded across all sites and each being occasional or rarely occurring. Collectively however, species are mostly from Angophora, red gum, mahogany and ironbark eucalypt groups. Common combinations are *Eucalyptus tereticornis* or *Eucalyptus amplifolia* with *Angophora floribunda* or *Angophora subvelutina*, however one or all of these species are sometimes absent. Other eucalypts that occasionally occur include *Eucalyptus siderophloia* and *Eucalyptus resinifera*. A sub-canopy of Melaleuca is typical, commonly including *Melaleuca linariifolia*, *Melaleuca nodosa* or *Melaleuca styphelioides,* also commonly with *Callistemon salignus*. A sparse cover of the climber *Parsonsia straminea* is very frequently recorded on the stems of these smaller trees. A lower sparse to mid-dense shrub layer commonly	A structurally variable coastal swamp forest found on central and lower north coast alluvial creek flats. This PCT ranges from a tall to very tall eucalypt open forest with a sub-canopy of Melaleuca and mesophyll trees, to a mid-high closed forest, commonly with emergent eucalypts. Where eucalypts are present they represent the tallest stratum, although the cover and composition ranges from very sparse (emergent) to mid-dense. A diverse suite of coastal species may be encountered, however none occur more than occasionally, with the most frequent including *Eucalyptus resinifera, Eucalyptus robusta* and *Eucalyptus piperita*. Characteristic of the PCT is the open to closed sub-canopy (or upper stratum where eucalypts are absent) of smaller trees. Species very frequently include a patchy cover of *Melaleuca linariifolia*, commonly *Callistemon salignus*, occasionally *Melaleuca styphelioides* and rarely *Casuarina glauca*, *Melaleuca quinquenervia, Melaleuca nodosa*, and on the Central Coast *Melaleuca biconvexa*. There are also mesic species, almost always including *Glochidion ferdinandi* and occasionally *Acmena smithii*. The vine

Potential PCTs	4020	4023	4042	4044
	straminea is commonly recorded on the trunks of the sub-canopy trees. Other small trees that are occasionally recorded include a sparse cover of *Glochidion ferdinandi* and *Callistemon salignus* or soft-leaved small shrubs such as *Breynia oblongifolia*. The ground layer is mid-dense to dense and very frequently includes clumps of the tall sedge Gahnia clarkei, graminoid *Lomandra longifolia*, together with grasses *Entolasia marginata*, *Imperata cylindrica* and *Oplismenus imbecillis*. Other common grasses include *Microlaena stipoides* and a patchy cover of *Hemarthria uncinata*, very frequently with small forbs including *Centella asiatica* and *Lobelia purpurascens*. This PCT is widespread across coastal lowlands, however is restricted to alluvial flats at elevations below 30 metres asl that are likely to be subject to periodic inundation from floodwaters. It occurs on soils which are clay-rich rather than sandy loams, and in wet areas where rainfall generally exceeds 1000 mm of rainfall per annum. This community only weakly overlaps floristically with other PCTs in NSW. It does however, have extensive spatial overlap with other coastal alluvial forests	*purpurascens*. It is possible that this PCT represents a successional state in a community that is re-establishing following clearing. In addition, the dominance of the salt tolerant *Casuarina glauca* may indicate saline conditions. This PCT typically occurs at elevations below 70 metres asl in a hot, dry climate. On broader floodplains of the Cumberland Plain, it grades into PCT 4025, which rarely includes *Casuarina glauca* however nevertheless has considerable floristic overlap with this PCT. Near the edge of the floodplain, it adjoins the grassy forests of either the Cumberland Plain (PCT 3320) or the Hunter valley (PCT 3315). Again, *Casuarina glauca* is rare in these PCTs.	includes Melaleuca species, *Breynia oblongifolia* and *Glochidion ferdinandi*, occasionally with Acacia irrorata and *Leptospermum polygalifolium*. The ground layer consists of a dense cover of grasses, forbs and graminoids that very frequently includes *Dichondra repens*, *Lobelia purpurascens, Dianella caerulea, Oplismenus imbecillis* and *Lomandra longifolia*, commonly with *Entolasia marginata* and *Imperata cylindrica*. This PCT occurs on creek flats, river flats and elevated residual alluvial terraces mainly below 50 metres asl and in the coastal rainfall zones that generally exceed 1000 mm per annum. The original extent of this PCT is likely to have been heavily depleted by past clearing, with remnants only remaining in narrow ribbons in the headwaters of catchments or as isolated patches in cleared landscapes. It grades into a range of coastal swamp forests on impeded alluviums including PCTs 4044 and 4020. In the lower Hunter district, where annual rainfall is below 900 mm per annum, this PCT is replaced by the related alluvial creek flat forest PCT 3328. On river flats north of Nambucca it is primarily replaced by PCT 4045.	*Parsonsia straminea* is very frequently recorded on the stems of the sub-canopy species. A sparse to very sparse cover of lower shrubs commonly includes *Breynia oblongifolia*, occasionally with *Acacia irrorata* and *Notelaea longifolia*. The ground layer is a mid-dense to dense cover of tall sedges, ferns, grasses and mesic climbers. Species very frequently include the tall sedge *Gahnia clarkei*, with a sparse to mid-dense cover, *Adiantum aethiopicum* and *Oplismenus imbecillis*, commonly *Entolasia marginata*, *Geitonoplesium cymosum*, *Gynochthodes jasminoides* and *Lomandra longifolia*, occasionally with *Calochlaena dubia* and *Pteridium esculentum*. This PCT very frequently occurs on low-lying coastal valley alluvial deposits that are often narrow and positioned between low to gently rising coastal hills. It occurs below 90 metres asl, however unlike other coastal swamp forests it is distributed most extensively, however not exclusively, in the coastal lowlands more than 10 kilometres from the coastline. This community has moderate floristic and spatial overlap with very tall layered forest PCT 4042, which occupies major alluvial flats on larger creeks and rivers, and is characterised by a grassy and herbaceous ground cover and a tree canopy including *Eucalyptus tereticornis*. Swamp forest PCT 4047

Potential PCTs	4020	4023	4042	4044
	including PCT 4042, which occurs in drier less frequently inundated alluviums, and has a low frequency of *Eucalyptus robusta*; and PCT 4021, which includes a higher proportion of sclerophyll shrubs on sandy loams. Small areas of PCT 4020 are included in coastal reserves, however it is more extensive on private lands, some of which has been subject to past clearing.			does not strongly overlap with the distribution of this PCT on the central coast, however shares moderate floristic overlap. It is readily distinguishable as it is almost always exclusively dominated by *Eucalyptus robusta* and includes a very high cover of *Gahnia clarkei*.
Vegetation Formation	Forested Wetlands;	Forested Wetlands;	Forested Wetlands;	Forested Wetlands;
Vegetation Class	Coastal Floodplain Wetlands;	Coastal Floodplain Wetlands;	Coastal Floodplain Wetlands;	Coastal Floodplain Wetlands;
Elevation (min-median-max)	0 10.6 145.3	19.7 53.2 113.5	0 23.3 132.1	2.3 25.6 92.1
Rainfall (min-median-max)	979 1220 1471	735 807 880	928 1239 1488	962 1192 1446
PCT Determination	As described above, this PCT shares extensive spatial overlap with the other PCT considerations tabled. However, this PCT is not considered the most accurate	The canopy in this vegetation zone is dominated by *Casuarina glauca,* which is indicative of this PCT; however, no *Bursaria spinosa* is present in the shrub	The canopy in this vegetation zone is dominated by *Casuarina glauca,* with *Melaleuca ericifolia* as the dominant shrub species. Rainfall parameters	The canopy in this vegetation zone is dominated by *Casuarina glauca,* with *Melaleuca ericifolia* as the dominant shrub species. The groundlayer is dominated by exotic species including

Potential PCTs	4020	4023	4042	4044
	description of the vegetation community on site due to weaker floristic similarity, and less closely matched rainfall and elevation parameters.	layer, with *Melaleuca ericifolia* as the dominant shrub species. Despite some floristic similarity, this PCT is not known to occur within this LGA. Furthermore, elevation parameters are less closely matched than other PCTs in this table. This PCT is not considered the most accurate description of vegetation in this area.	are less closely matched than other PCTs in this table. This PCT has considerable spatial and floristic similarities to PCT 4044. This PCT is not considered the most accurate description of vegetation in this area.	*Ehrharta erecta, Cynodon* spp., and *Briza subaristata.* The absence of *Eucalyptus tereticornis* indicates less likelihood to be associated with the floristically similar PCT 4020. This PCT is known in the geographic area, has appropriate rainfall parameters, and elevation parameters are within an appropriate range. **This PCT is considered the most accurate description of the vegetation in these plots.**
Result	**PCT 4044 - *Northern Creekflat Eucalypt-Paperbark Mesic Swamp Forest***			
BAM Plots	3, 4			
Estimate cleared value of PCT (%)	70.06			
Associated TECs	BC Act Listed EEC: *Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions*			

Table 9 – Vegetation Zones in PCT 4044

Category	Description
Description of Vegetation Zone	**PCT 4044** BAM 3 was undertaken in the southern section of the allotment. This area is dominated by the tree species *Casuarina glauca*. Very sparse *Dichondra repens* is present in the midstorey and ground covers are dominated by exotic species including *Ehrharta erecta, Paspalum dilatatum, Plantago lanceolata,* and *Sida rhombifolia.* BAM 4 was a modified plot undertaken in the north-western section of the allotment, being a small remnant patch of *Melaleuca ericifolia*. This area has some *Sporobolus elongatus* and *Euchiton* spp. present in the ground layer, however this stratum is dominated by exotics including *Cynodon* spp.*, Briza maxima* and *Hypochaeris radicata.*
Area of Vegetation Zone (ha)	This vegetation zone covers approximately 0.78ha of the Study Area of which 0.70ha PCT 4044 will be impacted.
BAM plots	3, 4

Plate 4 – PCT 4044 – BAM 3 (Start)

Plate 5 – PCT 4044 – BAM 3 (End)

Category	Description
 Plate 6 – PCT 4044 – BAM 4 (Start)	 Plate 7 – PCT 4044 – BAM 4 (End)

Table 10 – PCT Determination for Plot 6 PCT

Potential PCTs	3328	3446	4042
PCT Name	Lower Hunter Red Gum-Paperbark Riverflat Forest	Lower North Foothills Ironbark-Box-Gum Grassy Forest	Lower North Riverflat Eucalypt-Paperbark Forest
SVTM 2023	No (PCT 1594 previously mapped on site has weak association lineage relationship to PCT 3328)	No	No
IBRA Region	**Sydney Basin**;	NSW North Coast; **Sydney Basin**;	NSW North Coast; **Sydney Basin**;
IBRA Subregion	**Hunter**;	Karuah Manning; Mummel Escarpment; Upper Hunter; **Hunter**; Wyong; Ellerston; Tomalla; Yengo;	Coffs Coast and Escarpment; Karuah Manning; Macleay Hastings; Upper Hunter; **Hunter**; Wyong;
LGA	Cessnock; **Maitland**;	Cessnock; Dungog; **Maitland**; Mid-Coast; Newcastle; Port Stephens; Singleton; Muswellbrook;	Central Coast; Cessnock; Dungog; Kempsey; Lake Macquarie; **Maitland**; Mid-Coast; Nambucca Valley; Port Macquarie-Hastings; Port Stephens;
Present Diagnostic Species within Subject Site	**Tree Form Group:** *Eucalyptus tereticornis* **Shrub Form Group:** *Hakea sericea, Pittosporum undulatum,* **Grass Form Group:** *Themeda triandra, Fimbristylis dichotoma, Juncus usitatus,* **Forb Form Group:** *Lobelia purpurascens, Dichondra repens, Centella asiatica,* **Fern Form Group:** *Cheilanthes sieberi subsp. sieberi,* **Other Form Group:** n/a	**Tree Form Group:** *Corymbia maculata, Eucalyptus tereticornis, Eucalyptus punctata, Casuarina glauca, Eucalyptus microcorys,* **Shrub Form Group:** *Pittosporum undulatum, Pittosporum revolutum, Callistemon salignus, Hakea sericea,* **Grass Form Group:** *Themeda triandra, Eragrostis brownii, Fimbristylis dichotoma, Juncus usitatus, Bothriochloa macra, Carex appressa, Sporobolus elongatus, Austrostipa ramosissima, Lachnagrostis aemula, Rytidosperma pallidum, Lachnagrostis filiformis,* **Forb Form Group:** *Lobelia purpurascens, Dichondra repens, Centella asiatica, Rumex brownii,*	**Tree Form Group:** *Eucalyptus tereticornis, Corymbia maculata, Eucalyptus microcorys, Casuarina glauca, Eucalyptus robusta,* **Shrub Form Group:** *Callistemon salignus, Pittosporum revolutum, Pittosporum undulatum, Melaleuca ericifolia,* **Grass Form Group:** *Carex appressa, Themeda triandra, Eragrostis brownii, Juncus usitatus, Fimbristylis dichotoma, Austrostipa ramosissima, Lachnagrostis filiformis, Sporobolus elongatus,* **Forb Form Group:** *Dichondra repens, Lobelia purpurascens, Centella asiatica, Ranunculus inundatus,* **Fern Form Group:** *Cheilanthes sieberi subsp. sieberi,* **Other Form Group:** *Parsonsia straminea,*

Potential PCTs	3328	3446	4042
		Fern Form Group: *Cheilanthes sieberi subsp. sieberi,* **Other Form Group:** *Parsonsia straminea,*	
PCT Description	A tall to very tall sclerophyll open forest with a sub-canopy of Melaleuca trees and a grassy ground layer found on low-lying alluvial soils in the lower Hunter valley. The tree canopy very frequently includes a high cover of *Eucalyptus amplifolia* which is rarely replaced by *Eucalyptus tereticornis*. Other rarely occurring eucalypts include *Eucalyptus moluccana*, hybrid *Eucalyptus canaliculata - punctata*, or *Eucalyptus siderophloia*. The mid-stratum is characterised by a sparse to mid-dense cover of mid-high Melaleuca trees, including commonly, *Melaleuca nodosa*, occasionally *Melaleuca linariifolia* and *Melaleuca styphelioides* and rarely *Melaleuca decora*. A lower layer of shrubs very frequently includes *Bursaria spinosa*, commonly *Breynia oblongifolia* or occasionally *Acacia parvipinnula*. The ground layer has a mid-dense to dense and diverse cover of grasses, forbs, twiners and small ferns. *Cheilanthes sieberi subsp. sieberi* is almost always present, very frequently with *Microlaena stipoides, Oxalis perennans, Glycine tabacina, Themeda triandra* and *Lobelia purpurascens*, commonly with *Aristida ramosa* and *Cymbopogon refractus*. This PCT occurs in drier and warmer environments than coastal river flat eucalypt forests to the east (PCT 4042) which share some structural and species characteristics, however have more mesophyll species because of the higher rainfall. It occurs on creek-lines draining low-elevation Permian sediments, generally at elevations of less than 130 metres asl and is currently restricted to small isolated remnants, or	A tall sclerophyll open forest with a mid-stratum of dry and soft-leaved species and a grassy ground cover on the foothills of the lower north coast and lower Hunter valley, from Quorrobolong to Stratford. The canopy very frequently includes *Corymbia maculata*, commonly with an ironbark (*Eucalyptus crebra* or *Eucalyptus siderophloia*), *Eucalyptus tereticornis* or *Eucalyptus moluccana*, which may be prominent in localised areas. The sparse mid-stratum commonly includes taller Acacia species, with *Acacia falcata* and *Acacia implexa* most frequently recorded. Smaller shrubs *Breynia oblongifolia, Leucopogon juniperinus, Notelaea longifolia* and *Persoonia linearis* are also common in the mid-stratum. The mid-dense ground layer is typically comprised of a diverse suite of grasses, soft-leaved forbs, twiners and a hardy fern. *Cymbopogon refractus*, *Lobelia purpurascens* and *Cheilanthes sieberi subsp. sieberi* are almost always present while *Themeda triandra, Microlaena stipoides, Dichondra repens*, *Lomandra multiflora subsp. multiflora* and *Glycine tabacina* are very frequent. This PCT typically occurs on sedimentary (lithic sandstone, conglomerate, siltstone) and volcanic substrates (ignimbrites, tuffs) in a hot, moist climate, with most samples from elevations below 300 metres asl but with scattered instances up to 600 metres asl on northern Hunter valley slopes. It overlaps floristically with PCT 3329 which differs in that	A very tall to extremely tall sclerophyll open forest with a sub-canopy of Melaleuca trees and a grassy and herbaceous ground cover found on low-lying coastal alluvial soils between Wyong and Nambucca, Central Coast, and north coast. The tree canopy includes a range of eucalypt species, with no single species consistently recorded across all sites and each being occasional or rarely occurring. Collectively however, species are mostly from Angophora, red gum, mahogany, and ironbark eucalypt groups. Common combinations are *Eucalyptus tereticornis* or *Eucalyptus amplifolia* with *Angophora floribunda* or *Angophora subvelutina*, however one or all of these species are sometimes absent. Other eucalypts that occasionally occur include *Eucalyptus siderophloia* and *Eucalyptus resinifera*. A sub-canopy of Melaleuca is typical, commonly including *Melaleuca linariifolia*, *Melaleuca nodosa* or *Melaleuca styphelioides*, also commonly with *Callistemon salignus*. A sparse cover of the climber *Parsonsia straminea* is very frequently recorded on the stems of these smaller trees. A lower sparse to mid-dense shrub layer commonly includes *Melaleuca species*, *Breynia oblongifolia* and *Glochidion ferdinandi*, occasionally with *Acacia irrorata* and *Leptospermum polygalifolium*. The ground layer consists of a dense cover of grasses, forbs and graminoids that very frequently includes *Dichondra repens*, *Lobelia purpurascens*, *Dianella caerulea, Oplismenus imbecillis* and *Lomandra longifolia*, commonly with *Entolasia marginata* and *Imperata cylindrica*. This PCT occurs on creek flats, river flats and elevated residual alluvial terraces

Potential PCTs	3328	3446	4042
	narrow creek flats in larger patches in the Cessnock district. Native vegetation on alluvial soils in the region has been depleted and current remnants are likely to represent a small proportion of the original extent in the wider lower Hunter valley.	red gums are almost always present and *Corymbia maculata* and ironbarks are rare and it occurs on more fertile substrates on the floor of the rain shadow valleys of the lower north coast.	mainly below 50 metres asl and in the coastal rainfall zones that generally exceed 1000 mm per annum. The original extent of this PCT is likely to have been heavily depleted by past clearing, with remnants only remaining in narrow ribbons in the headwaters of catchments or as isolated patches in cleared landscapes. It grades into a range of coastal swamp forests on impeded alluviums including PCTs 4044 and 4020. In the lower Hunter district, where annual rainfall is below 900 mm per annum, this PCT is replaced by the related alluvial creek flat forest PCT 3328. On river flats north of Nambucca it is primarily replaced by PCT 4045.
Vegetation Formation	Grassy Woodlands;	Dry Sclerophyll Forests (Shrub/grass sub-formation);	Forested Wetlands;
Vegetation Class	Coastal Valley Grassy Woodlands;	Hunter-Macleay Dry Sclerophyll Forests;	Coastal Floodplain Wetlands;
Elevation (min-median-max)	13.4 47.5 127.4	10 114.3 592.6	0 23.3 132.1
Rainfall (min-median-max)	756 811 905	680 984 1304	928 1239 1488
PCT Determination	**Despite lower floristic similarities, consideration of the dominance of *Eucalyptus* spp. in the canopy layer, matching rainfall and elevation parameters,**	No *Corymbia maculata* occurs in this area, with the canopy consisting predominantly of *Eucalyptus* spp., including *Eucalyptus tereticornis.* No shrub layer present. The	Has a present canopy of Eucalyptus spp., including Eucalyptus tereticornis, however no sub-canopy or shrub layer is present. The ground layer has some *Sporobolus elongatus,* but is dominated by exotics

Potential PCTs	3328	3446	4042
	and lineage connection to PCT 1592 (previously mapped in the area) indicate that this PCT is the most accurate description of vegetation in this area.	ground layer has some *Sporobolus elongatus,* but is dominated by exotics including *Cynodon* spp.*, Briza subaristata, and Paspalum dilatatum.* Rainfall and elevation parameters less accurate than adjacent PCT considerations. This PCT is not considered an accurate description of the vegetation in this area.	including *Cynodon* spp.*, Briza subaristata, and Paspalum dilatatum.* As described above, "In the lower Hunter district, where annual rainfall is below 900 mm per annum, this PCT is replaced by the related alluvial creek flat forest PCT 3328.". Average rainfall is approximately 870mm (Maitland Airport, 3.6km away {BOM}). Therefore, this PCT is not considered the most accurate description of the vegetation in this area.
Result	**PCT 3328 - *Lower Hunter Red Gum-Paperbark Riverflat Forest***		
BAM Plots	6		
Estimate cleared value of PCT (%)	83.92		
Associated TECs	BC Act Listed: EEC – *Hunter Lowland Redgum Forest in the Sydney Basin and New South Wales North Coast Bioregions* BC Act Listed: EEC – *River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin, and South East Corner Bioregions* EPBC Act Listed: CEEC – *River-flat eucalypt forest on coastal floodplains of southern New South Wales and eastern Victoria*		

Table 11 – Vegetation Zones in PCT 3328

Category	Description
Description of Vegetation Zone	**PCT 3328** BAM 6 (AEP) was undertaken in the northern section of the allotment. This area represents a stand of *Eucalyptus* spp., including *Eucalyptus tereticornis,* within a grazed paddock. No sub-canopy or shrub layer is present, due to grazing and possible slashing. The ground layer has some *Sporobolus elongatus,* but is dominated by exotics including *Cynodon* spp., *Briza subaristata, and Paspalum dilatatum.*
Area of Vegetation Zone (ha)	This vegetation zone covers approximately 0.03ha of the Study Area of which 0.03ha will be impacted.
BAM plots	6

Plate 8 – PCT 3328 – BAM 6 (Start)

Plate 9 – PCT 3328 – BAM 6 (End)

Table 12 – PCT Determination for Plot 9 PCT

Potential PCTs	3967	3975	4020	4042
PCT Name	Northern Lower Floodplain Eleocharis Wetland	Southern Lower Floodplain Freshwater Wetland	Coastal Creekflat Layered Grass-Sedge Swamp Forest	Lower North Riverflat Eucalypt-Paperbark Forest
SVTM 2023	No	No	No	No
IBRA Region	NSW North Coast; South Eastern Queensland; **Sydney Basin**;	NSW North Coast; South East Corner; **Sydney Basin**;	NSW North Coast; **Sydney Basin**;	NSW North Coast; **Sydney Basin**;
IBRA Subregion	Coffs Coast and Escarpment; Karuah Manning; Macleay Hastings; Clarence Lowlands; **Hunter**; Burringbar-Conondale Ranges;	Karuah Manning; South East Coastal Ranges; Cumberland; **Hunter**; Illawarra; Wyong; Yengo;	Karuah Manning; Macleay Hastings; **Hunter**; Illawarra; Jervis; Wyong;	Coffs Coast and Escarpment; Karuah Manning; Macleay Hastings; Upper Hunter; **Hunter**; Wyong;
LGA	Cessnock; Clarence Valley; Coffs Harbour; Kempsey; Mid-Coast; Nambucca Valley; Newcastle; Tweed;	Bega Valley; Blacktown; Central Coast; Cessnock; Hawkesbury; Port Stephens; Wollongong;	Central Coast; Kempsey; Lake Macquarie; **Maitland**; Mid-Coast; Port Macquarie-Hastings; Port Stephens; Shoalhaven;	Central Coast; Cessnock; Dungog; Kempsey; Lake Macquarie; **Maitland**; Mid-Coast; Nambucca Valley; Port Macquarie-Hastings; Port Stephens;
Present Diagnostic Species within Subject Site	***Tree Form Group:*** *Casuarina glauca,* ***Shrub Form Group:*** *Melaleuca ericifolia, Callistemon salignus* ***Grass Form Group:*** *Carex appressa, Juncus usitatus, Lachnagrostis filiformis,* ***Forb Form Group:*** *Ludwigia peploides subsp. montevidensis, Ranunculus inundatus, Centella asiatica, Rumex brownii,* ***Fern Form Group:*** *n/a* ***Other Form Group:*** *Parsonsia straminea*	***Tree Form Group:*** *Casuarina glauca, Eucalyptus tereticornis,* ***Shrub Form Group:*** *Melaleuca ericifolia,* ***Grass Form Group:*** *Juncus usitatus, Carex appressa, Lachnagrostis filiformis* ***Forb Form Group:*** *Ludwigia peploides subsp. montevidensis, Ranunculus inundatus, Centella asiatica;* ***Fern Form Group:*** *n/a* ***Other Form Group:*** *n/a*	**Tree Form Group:** *Eucalyptus robusta, Eucalyptus tereticornis, Casuarina glauca, Corymbia maculata, Eucalyptus microcorys, Eucalyptus punctata,* **Shrub Form Group:** *Callistemon salignus, Melaleuca ericifolia, Pittosporum undulatum,* **Grass Form Group:** *Themeda triandra, Carex appressa, Juncus usitatus, Eragrostis brownii, Lachnagrostis aemula, Empodisma minus, Fimbristylis dichotoma,* **Forb Form Group:** *Lobelia purpurascens, Centella asiatica,*	**Tree Form Group:** *Eucalyptus tereticornis, Corymbia maculata, Eucalyptus microcorys, Casuarina glauca, Eucalyptus robusta,* **Shrub Form Group:** *Callistemon salignus, Pittosporum revolutum, Pittosporum undulatum, Melaleuca ericifolia,* **Grass Form Group:** *Carex appressa, Themeda triandra, Eragrostis brownii, Juncus usitatus, Fimbristylis dichotoma, Austrostipa ramosissima, Lachnagrostis filiformis, Sporobolus elongatus,* **Forb Form Group:** *Dichondra repens, Lobelia purpurascens,*

Potential PCTs	3967	3975	4020	4042
			Dichondra repens, Ranunculus inundatus, **Fern Form Group:** n/a **Other Form Group:** *Parsonsia straminea,*	*Centella asiatica, Ranunculus inundatus,* **Fern Form Group:** *Cheilanthes sieberi subsp. sieberi,* **Other Form Group:** *Parsonsia straminea,*
PCT Description	A tall to very tall freshwater sedgeland occurring in poorly drained Quaternary alluvial backswamps on broad coastal floodplains of the North Coast botanical division, usually at elevations of below 5 metres asl on organically enriched fine-grained sediments. *Eleocharis equisetina* very frequently forms a mid-dense to dense upper layer, almost always accompanied by a sparse or very sparse layer of other sedges, rushes, aquatic forbs and grasses. *Paspalum distichum* very frequently occurs, while *Ludwigia peploides subsp. montevidensis, Azolla pinnata* and *Persicaria decipiens* are common, *Typha orientalis* is occasional, and *Eleocharis sphacelata* and *Schoenoplectus validus* are rare. A very sparse emergent tree layer is rare, however may include *Casuarina glauca* or melaleucas. This PCT describes very low-lying non-woody sedgelands on muddy backswamp deposits on wide river floodplains of the North Coast that are not dominated by *Phragmites australis*. Within this domain this PCT can encompass a range of sedgeland and	A tall to very tall freshwater sedgeland or forbland occurring in depressions on Quaternary alluvial deposits (primarily backswamps with organic-rich mud, silt or clay soils) on coastal floodplains of the Central Coast and South Coast botanical divisions. Almost all known locations occur at elevations of below 10 metres asl, however this PCT can occur at higher elevations in lagoons that have prolonged inundation, such as Ellalong Lagoon south-west of Cessnock which is just over 100 metres asl. This PCT describes non-woody freshwater wetlands on Quaternary alluvium south from the Hunter valley that are not dominated by *Phragmites australis* or *Eleocharis equisetina* and are either on low coastal floodplains or at the edges of more elevated lagoons that have prolonged inundation. Within these environmental and floristic parameters this PCT can encompass a range of sedgeland and aquatic forb assemblages. On	A tall to very tall sclerophyll open forest with a sub-canopy of Melaleuca trees and a dense ground layer of sedges and grasses found on low-lying coastal silty alluvial soils between the Shoalhaven and the mid north coast. The tree canopy is variable, however commonly includes *Eucalyptus robusta*, and may be accompanied or replaced by *Eucalyptus tereticornis* or *Eucalyptus amplifolia*, or rarely *Angophora floribunda*, *Eucalyptus resinifera* and in the Shoalhaven, *Eucalyptus longifolia*. Sometimes a sparse cover of tall Melaleuca species is included amongst the eucalypt canopy. The mid-stratum is characterised by a mid-dense cover of smaller trees that almost always includes a patchy cover of *Melaleuca linariifolia*, occasionally or rarely with other Melaleuca species depending on location. North of the Hawkesbury River these may include *Melaleuca quinquenervia* or *Melaleuca sieberi*, while in the Shoalhaven it may include *Melaleuca ericifolia*, *Melaleuca decora* or *Melaleuca biconvexa*. The climber *Parsonsia straminea* is	A very tall to extremely tall sclerophyll open forest with a sub-canopy of Melaleuca trees and a grassy and herbaceous ground cover found on low-lying coastal alluvial soils between Wyong and Nambucca, Central Coast, and north coast. The tree canopy includes a range of eucalypt species, with no single species consistently recorded across all sites and each being occasional or rarely occurring. Collectively however, species are mostly from Angophora, red gum, mahogany, and ironbark eucalypt groups. Common combinations are *Eucalyptus tereticornis* or *Eucalyptus amplifolia* with *Angophora floribunda* or *Angophora subvelutina*, however one or all of these species are sometimes absent. Other eucalypts that occasionally occur include *Eucalyptus siderophloia* and *Eucalyptus resinifera*. A sub-canopy of Melaleuca is typical, commonly including *Melaleuca linariifolia*, *Melaleuca nodosa* or *Melaleuca styphelioides*, also commonly with *Callistemon salignus*. A sparse cover of the climber *Parsonsia straminea* is

Potential PCTs	3967	3975	4020	4042
	aquatic forb assemblages. For example, two plots (one in the Hunter valley and one in the Clarence valley) with a very high foliage cover of *Maundia triglochinoides* and other aquatic forbs, rushes and sedges, and are included in this PCT based on environmental domain. Other floristic variants are likely to remain unsampled using standard plot-based techniques. This PCT overlaps in environmental domain with PCT 3962, sometimes occurring within the same swamp, however the latter is distinguished by the strong dominance of *Phragmites australis*. PCT 3975 also occurs on alluvial backswamps of coastal floodplains, however primarily occurs on the Central Coast and South Coast botanical divisions (with overlap on the lower Hunter River floodplain) and does not feature *Eleocharis equisetina*. PCT 3967 is weakly floristically related to PCT 3970, however the latter occurs in freshwater swamps on sand behind coastal barrier deposits. PCT 3964 also occurs on the North Coast, however it is at higher elevations (around 20 metres asl), is further inland and on currently available information lacks *Eleocharis equisetina* and *Paspalum distichum*. PCT 3967 often occurs in disturbed	presently available information the aquatic forb *Persicaria decipiens* is very frequently present with very sparse cover. The grasses *Cynodon dactylon* and *Paspalum distichum* and the reed *Typha orientalis* commonly occur with sparse cover, while the sedge *Eleocharis sphacelata* is occasionally present however where it does occur tends to have mid-dense cover. A diversity of other sedges, rushes and aquatic forbs are occasionally or rarely recorded, such as *Persicaria hydropiper*, *Cycnogeton microtuberosum*, *Ludwigia peploides subsp. montevidensis*, *Alternanthera denticulata* and species of Juncus. Rarely, a very sparse emergent tree layer is present, which may include *Casuarina glauca,* melaleucas or, very rarely, overhanging Eucalypts. Some sedges such as *Machaerina articulata*, *Fimbristylis velata, Eleocharis acuta* and Bolboschoenus species dominate individual sites, reflecting the floristic diversity of this PCT. This community often occurs in disturbed environments and may potentially include derived states. The assessment of new non-woody freshwater wetland plots against this PCT should primarily consider environmental domain.	commonly recorded on the trunks of the sub-canopy trees. Other small trees that are occasionally recorded include a sparse cover of *Glochidion ferdinandi* and *Callistemon salignus* or soft-leaved small shrubs such as *Breynia oblongifolia*. The ground layer is mid-dense to dense and very frequently includes clumps of the tall sedge Gahnia clarkei, graminoid *Lomandra longifolia*, together with grasses *Entolasia marginata*, *Imperata cylindrica* and *Oplismenus imbecillis*. Other common grasses include *Microlaena stipoides* and a patchy cover of *Hemarthria uncinata*, very frequently with small forbs including *Centella asiatica* and *Lobelia purpurascens*. This PCT is widespread across coastal lowlands, however is restricted to alluvial flats at elevations below 30 metres asl that are likely to be subject to periodic inundation from floodwaters. It occurs on soils which are clay-rich rather than sandy loams, and in wet areas where rainfall generally exceeds 1000 mm of rainfall per annum. This community only weakly overlaps floristically with other PCTs in NSW. It does however, have extensive spatial overlap with other coastal alluvial forests including PCT 4042, which occurs in drier less frequently inundated alluviums, and has a low frequency of *Eucalyptus robusta*; and PCT 4021, which includes a higher	very frequently recorded on the stems of these smaller trees. A lower sparse to mid-dense shrub layer commonly includes *Melaleuca species*, *Breynia oblongifolia* and *Glochidion ferdinandi*, occasionally with *Acacia irrorata* and *Leptospermum polygalifolium*. The ground layer consists of a dense cover of grasses, forbs and graminoids that very frequently includes *Dichondra repens*, *Lobelia purpurascens*, *Dianella caerulea, Oplismenus imbecillis* and *Lomandra longifolia*, commonly with *Entolasia marginata* and *Imperata cylindrica*. This PCT occurs on creek flats, river flats and elevated residual alluvial terraces mainly below 50 metres asl and in the coastal rainfall zones that generally exceed 1000 mm per annum. The original extent of this PCT is likely to have been heavily depleted by past clearing, with remnants only remaining in narrow ribbons in the headwaters of catchments or as isolated patches in cleared landscapes. It grades into a range of coastal swamp forests on impeded alluviums including PCTs 4044 and 4020. In the lower Hunter district, where annual rainfall is below 900 mm per annum, this PCT is replaced by the related alluvial creek flat forest PCT 3328. On river flats north of

Potential PCTs	3967	3975	4020	4042
	environments and may potentially include derived states.	The grassy wetland PCT 4055 also occurs on alluvium on the far South Coast, however has a much higher median elevation (known between 100 and 200 metres asl), and includes *Isachne globosa, Lachnagrostis filiformis, Carex gaudicha*udiana and *Cyperus sphaeroideus* which are all unknown or very rare in PCT 3975.	proportion of sclerophyll shrubs on sandy loams. Small areas of PCT 4020 are included in coastal reserves, however it is more extensive on private lands, some of which has been subject to past clearing.	Nambucca it is primarily replaced by PCT 4045.
Vegetation Formation	Freshwater Wetlands;	Freshwater Wetlands;	Forested Wetlands;	Forested Wetlands;
Vegetation Class	Coastal Freshwater Lagoons;	Coastal Freshwater Lagoons;	Coastal Floodplain Wetlands;	Coastal Floodplain Wetlands;
Elevation (min-median-max)	0 1.5 10.7	0 1.7 116.4	0 10.6 145.3	0 23.3 132.1
Rainfall (min-median-max)	993 1134 1683	792 1024 1238	979 1220 1471	928 1239 1488
PCT Determination	This PCT is not known in this LGA, and has inconsistent rainfall and elevation parameters with those found on site. This PCT is not an accurate description of the vegetation on site.	This PCT is not known in this LGA, and known locations of this PCT occur >5m ASL. Diagnostic grass species are present; including *Juncus usitatus, Ludwigia peploides subsp.*	Diagnostic grass species are present; including *Juncus usitatus, Ludwigia peploides subsp. montevidensis*, and *Lachnagrostis aemula*, however this stratum is dominated by exotics including	**This PCT is considered the most accurate description of vegetation in this zone. Despite the absence of a canopy or shrub layer due to the modified dam plot, some diagnostic grass species are**

Potential PCTs	3967	3975	4020	4042
		montevidensis, and *Lachnagrostis aemula*, however this stratum is dominated by exotics including *Cynodon* spp., *Paspalum dilatatum, Cyperus eragrostis*, and *Briza subaristata*. This PCT is not an accurate description of the vegetation on site.	*Cynodon* spp., *Paspalum dilatatum, Cyperus eragrostis*, and *Briza subaristata.* The absence of a canopy and shrub layer reduce the accuracy of PCT identification. This PCT is not considered the most accurate description of the vegetation on site.	**present; including *Juncus usitatus, Ludwigia peploides subsp. montevidensis*, and *Lachnagrostis aemula.*** **Given the relationship to PCT 3328 described above, which has been identified elsewhere on site, this PCT is considered the most accurate description of vegetation in this area.**
Result	**PCT 4042 - *Lower North Riverflat Eucalypt-Paperbark Forest***			
BAM Plots	9			
Estimate cleared value of PCT (%)	73.11			
Associated TECs	No Associated TECs			

Table 13 – Vegetation Zones in PCT 4042

Category	Description
Description of Vegetation Zone	**PCT 4042** BAM 9 (AEP) was undertaken in the central section of the allotment. This area is a modified dam plot, with no present canopy or shrub layer. The ground layer has some *Juncus usitatus, Ludwigia peploides subsp. montevidensis*, and *Lachnagrostis aemula*, however is dominated by exotics including *Cynodon* spp.*, Paspalum dilatatum, Cyperus eragrostis*, and *Briza subaristata.*
Area of Vegetation Zone (ha)	This vegetation zone covers approximately 0.13ha of the Subject Site of which 0.13ha will be impacted.
BAM plots	9

Plate 10 – PCT 4042 – BAM 9: Start

1.3.5 Grassland Assessment

PlantNet (2023) describes *Cynodon dactylon* as a rhizomatous and/or stoloniferous mat-forming perennial, to 0.3m high, rooting at the nodes; culms erect or geniculate. Being distributed widespread through all states and very common; widely cultivated as a lawn grass and for pasture. PlantNet does not discuss the origin of the species as it does with many other natives and non-natives. This is likely to the high level of debate that surrounds the species.

The debate of the origins of the species started back in 1810 with Robert Brown describing samples he had collected as an introduced species and also by Woolls in 1867, who wrote, *Cynodon Dactylon* was rapidly replacing the native grass *Themeda australis* in grazing areas, considering the species to be introduced from the East indies (Langdon, 1954). Langdon also presented the case that associated fungal parasites of *Cynodon dactylon* are a rust and a smut, fungi whose arrival in Australia appears in the early 1800's, soil records show it was not present before this time. Therefore, Langdon (1954) concluded it was introduced as fodder for livestock.

Friedel (2017) also states that the species was "deliberately introduced into Australia for use in crops, pasture, gardens and horticulture". More recently, Identic Pty Ltd, 2016, stated "*the species most probably originated from sub-Saharan Africa and/or on islands in the western parts of the Indian Ocean*".

The *National recovery plan for the community of native species dependent on natural discharge of groundwater from the Great Artesian Basin* (DECCW 2010), published in the Commonwealth *Species Profile and Threats Database* mentions the terminology "*Cynodon dactylon* (non-native)", confirming the species' status with the Commonwealth department as exotic.

The species has become dominate in most communities even wetlands in the western division of NSW. It can survive in times of drought and other harsh conditions such as saline soils, floods, etc and given it is thought to have been introduced in the 1800s it has replaced other native species that may not have been identified, resulting in some species in the western division being dependant on its presence, such as Night Parrot, Dusky Hopping Mouse and Plains Wanderer. Hence DECCW (2010), provides guidance measures on how to manage the species and return native grasses to these environments with a focus on the Great Artesian Basin.

The Department of Primary Industries (Agricultural), 2023, Local Land Services and Department of Industry and Investment, promote the planting / sowing of *Cynodon dactylon* at a rate of 6-10kg on well drained and alluvial soils. The species tolerates saline, heat conditions, drought tolerance, and is flood tolerant. *Cynodon dactylon* can adapt to all conditions such as shade, full sun and even wetter areas (Department of Industry and Investment, 2011). The species has great pasture features, such as the ability to adapt and high tolerance to a changing environment, it also binds soils and prevents erosion and provides fodder for domestic stock annually and it is readily available. Hence its high use in the Hunter catchment for pasture improvement (Department of Primary Industries, 2023).

Within the Hunter, *Cynodon dactylon* is heavily used for turf or lawn. Turf farms throughout the region farm the species. The species is also used in large subdivisions as it is quick growing has tough, mat-forming rhizomes which binds the soils; it tolerates heat and full sun; and the matting rhizomes limit other species such as weeds colonising the new lots.

Morgan (1998) has researched the decline in species of *Themeda* species within grasslands, and *Cynodon dactylon* and other invasive species were dominating especially in areas of higher soil phosphorus. Morgan (1998) considered this change as being permanent naturalising these species, recommending management actions to reduce if not eradicate the species due to their invasive properties and the significant reduction in diversity of natives. Such management actions are applied throughout the Hunter Catchment within the Bush Regeneration field. *Cynodon dactylon* is a target species for eradication as it is considered an invasive weed. The species prevents diversity within a

community with its ability to matt the top 10cm of topsoil, prohibiting orchids, herbs and forbs from persisting. The reduction in diversity within a Bush Regeneration site results in targets not being achieved and limits fauna use.

AEP recognises the importance of the species in the western division of NSW as listed species have become dependent on the species. However, AEP also supports the Commonwealth decision to list the species as non-native especially in the eastern division of the state with a focus on the Hunter Catchment Area where the species is known to dominate grazing lands and known to invade endemic PCTs reducing biodiversity. Recognising the species as an endemic native will significantly impact the regeneration within the Hunter, halting the progression to eradicate the species from the communities. AEP's collective knowledge and expertise within the Hunter Catchment Area does not agree with the species being considered a native species within Hunter Catchment Area and AEP are concerned such a decision will have a significant impact on Bush Regeneration and on the diversity within the region resulting in the loss of endemic species.

1.3.5.1 Planted Native Assessment

While *Cynodon dactylon* is considered native according to the NSW Herbarium, as stated above, the Commonwealth list the species as non-native and it is highly recognised that the species is listed as a widely cultivated native species (DPE, 2022) as a lawn and pasture grass. The site has historically been managed for agricultural grazing whereby this species was likely sown and is generally assumed as such east of the dividing range. As such, *Cynodon dactylon* (Common Couch) present within the Subject site was classified as 'planted native vegetation' and Appendix D of the BAM 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.

It is noted that throughout this BDAR and the PCT determination contained within, the species has been referred to as *Cynodon dactylon*. The total area of this zone within the Study Area is 24.11ha.

AEP acknowledges that Maitland City Council require this species when identified with no shrub or canopy stratum, and with high weed / pasture, the assessments for the species should be undertaken as a planted native.

This assessment module has been used to assess this site after detailed assessment against the decision-making framework in **Appendix D.2** and consultation with the Maitland City Council and BOS Support.

AEP has used **Appendix D.2** of the BAM to assess *Cynodon dactylon* present within the Study Area. It is noted that if the surveys show suitable habitat or record sightings of threatened species the assessor must apply **Section 8.4** of the BAM to mitigate and manage impacts as credits are not applied to 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. This species does not represent suitable habitat for any threatened species identified on site and as such no further assessment is required.

Table 14 – Decision-Making Key (Appendix D 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?	**Yes** - The planted native vegetation must be allocated to the best-fit PCT and the BAM must be applied. **No** - Go to 2.	The Subject Site is reflective of a diverse range of plants such as: Listed weed species, exotics, native vegetation from other regions / States and endemic vegetation. The diversity of species is consistent with the site's previous land use as grazing pasture. The general flora assessment and BAM Plots undertaken showed the Subject Site did not contain a mosaic of planted species or remnant native vegetation that could be assigned to a Plant Community Type (PCT). **NO**
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	**Yes** - The planted native vegetation must be assessed in accordance with Chapters 4 and 5 of the BAM. **No** - Go to 3.	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 b. the primary objective was not to replace or regenerate a plant community type or a threatened plant species population or its habitat. **NO**
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:	**Yes** - The planted native vegetation must be assessed in accordance with Chapters 4 and 5 of the BAM. **No** - Go to 4.	Refer below.
3a	A species recovery project		The planted vegetation within the Subject Site was not planted / Translocated for the purpose of a species recovery project. **NO**
3b	Saving our Species project		The planted vegetation within the Subject Site was not planted / Translocated for the purpose of Saving our Species project. **NO**
3c	Other types of government funded restoration project.		The planted vegetation within the Subject Site was not planted / Translocated for the purpose of other types of government funded restoration project **NO**
3d	Condition of consent for a development approval that required those		The planted vegetation within the Subject Site was not planted / Translocated for the purpose

Item	Standard for Assessment	Options	AEP Assessment
	species to be planted or translocated for the purpose of providing threatened species habitat		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 **NO**
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 without consent issued under the BC Act or the Native Vegetation Act)		The planted vegetation within the Subject Site was not 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 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 was not 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 was not 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 was not 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),	**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 was not planted / Translocated for the functional, aesthetic, horticultural or plantation forestry purposes. **NO**

Item	Standard for Assessment	Options	AEP Assessment
	landscaping in parks, gardens and sport fields/complexes, macadamia plantations or teatree 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)?	**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** - 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.	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. **NO**
Evidence demonstrating the application of the decision-making key to the areas of planted native vegetation must be provided in the BDAR or BCAR.			A meeting was held with Maitland City Council's Ecologist on 08/11/2023 to explain the position of non-endemic native.

1.3.6 Weed Species

In NSW, all plants are regulated with a general biosecurity duty to prevent, eliminate or minimise biosecurity risk they may pose. Any person who deals with any plant, who knows of any biosecurity risk, has a duty to ensure the risk is prevented, eliminated or minimised, so far as is reasonably practical as per the NSW *Biosecurity Act 2015* (BA Act).

Thirty-nine (39) exotic flora species were recorded within the proposal Study Area during field surveys, with five (5) listed under the NSW *Biosecurity Act 2015* (BA Act) as priority weeds for the Hunter Region. one (1) of those priority weeds are also listed as Weeds of National Significance (WONS). The Priority Weeds and WONS of environmental weeds recorded are outlined below in **Table 15.**

Table 15 – Environmental Weeds recorded within the Study Area

Scientific Name	Common Name	Region	WONS
Andropogon virginicus	Whisky Grass	N	N
Araujia sericifera	Mothvine	N	N
Bidens pilosa	Cobbler's Pegs	N	N
Briza maxima	Quaking Grass	N	N
Briza minor	Shivery Grass	N	N
Briza subaristata		N	N
Bromus spp.	A Brome	N	N
Centaurium erythraea	Common Centaury	N	N
Chloris gayana	Rhodes Grass	N	N
Conyza bonariensis	Flax-leaf Fleabane	N	N
Cyclospermum leptophyllum	Slender Celery	N	N
Cyperus eragrostis	Umbrella Sedge	N	N
Cyperus sesquiflorus		N	N
Ehrharta erecta	Panic Veldtgrass	N	N

Scientific Name	Common Name	Region	WONS
Foeniculum vulgare	Fennel	N	N
Galenia pubescens	**Galenia**	**Y**	N
Gomphocarpus fruticosus	Narrow Leaf Cotton Bush	N	N
Hypochaeris radicata	Flatweed	N	N
Juncus acutus		**Y**	N
Juncus cognatus		N	N
Lolium rigidum	Wimmera Ryegrass	N	N
Lysimachia arvensis var. caerulea	Blue Pimpernel	N	N
Megathyrsus maximus	Guinea Grass	N	N
Olea europaea subsp. cuspidata	**African Olive**	**Y**	N
Oncosiphon pilulifer		N	N
Onopordum acanthium subsp.	Scotch Thistle	N	N
Paspalum dilatatum	Paspalum	N	N
Persicaria spp.	**Knotweed**	**Y**	N
Plantago lanceolata	Ribwort	N	N
Poa spp.		N	N
Senecio madagascariensis	**Fireweed**	**Y**	**Y**
Setaria pumila	Pale Pigeon Grass	N	N
Sida rhombifolia	Paddy's Lucerne	N	N
Silybum marianum	Variegated Thistle	N	N
Solanum nigrum	Black Nightshade, Black-berry	N	N
Solanum seaforthianum	Climbing Nightshade	N	N
Stenotaphrum secundatum	Buffalo Grass	N	N
Trifolium repens	White Clover	N	N
Verbena bonariensis	Purpletop	N	N

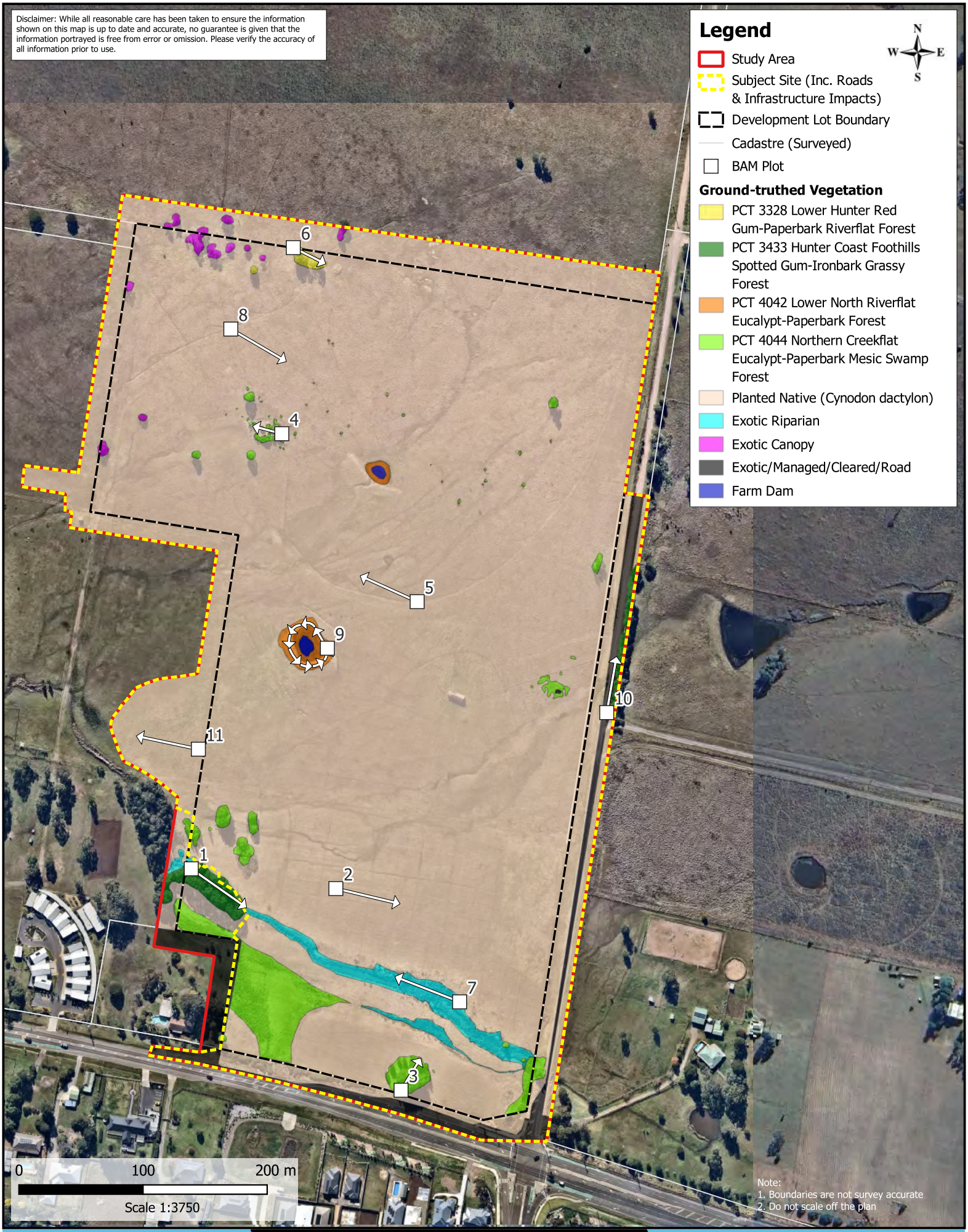
Additional site photographs are included in **Appendix E**.

Table 16 provides a summary of the ground-truthed PCTs within the Site.

Table 16 – Summary of PCTs

PCT	Total Study Area (ha)	Area of Removal (ha)	Vegetation proposed for retention within VRZ
PCT 3328	0.03	0.03	0
PCT 3433	0.20	0.07	0.10
PCT 4042	0.13	0.13	0
PCT 4044	0.78	0.70	0.06
Total Native Vegetation (ha)	**1.14**	**0.94**	**0.16**
Planted Native (*Cynodon dactylon)*	24.11	23.94	0.08
Exotic /disturbed/structures	1.24	1.00	0
Farm Dams	0.02	0.02	0
Total Planted Native/ Exotic/ Cleared/Dams	**25.37**	**24.97**	**0.08**
Total (ha)	**26.51**	**25.91**	**0.24**

Discrepancies in numbers may be due to rounding.



AEP

Figure 4 - Ground-truthed Vegetation

Date: July 2024

Location: 898 New England Hwy, 25 & 39 Wyndella Rd, Lochinvar NSW

Client: Lochinvar Developments Pty Ltd
C/- ADW Johnson Pty Ltd

AEP ref: 2699.04
BOAMS: 00048759

1.3.7 Vegetation Integrity Assessment

1.3.7.1 Patch Size

The native vegetation that exists within the Study Area possesses limited connection to the broader vegetation in the locality. Lochinvar is a historically highly agricultural region with low levels of native vegetation The native vegetation that exists within the Subject Site is tenuously connected to fragmented vegetation to the northwest, that, as defined by the BAM, extends as a patch of approximately 50ha. The patch size of '50ha' is therefore appropriate for each vegetation zone and was entered as such within the Calculator.

1.3.7.2 Vegetation Integrity Score

Plot data was used to determine the composition, structure and function condition score the vegetation zones within the Subject Site, which informed the vegetation integrity score. Plot data has been tabulated (refer **Tables 16**) and includes corresponding condition scores along with the overall Vegetation Integrity Score. Vegetation Condition Class has been rated using the following percentage bands associated with the Vegetation Integrity Scores:

- 70 – 100 Good;
- 50 – 69 Moderate;
- 35 – 49 Poor;
- 25 – 34 Degraded;
- 16 – 24 Highly Degraded; and
- <15 – Severely Degraded.

1.3.8 Vegetation Zones for BAM-C

As stated in the BAM – Appendix C – Table 13, under the Streamlined Assessment Module for Small Area Development, the assessment is required to determine PCTs as follows:

> *Identify if the PCT is associated with a threatened ecological community (TEC) as required by Subsection 4.2.2.*
>
> *Where a TEC is identified on a site that is not associated with the dominant PCT, that TEC is required to be assessed and offset accordingly. In this situation more than one PCT may be selected for assessment.*

Table 16 shows the dominant PCT within the Subject Site is PCT 4044 and thus must be assessed under the BAM. Furthermore, assessment of other PCTs found on site for potential association with TECs determined that PCT 3328 and PCT 4042 were not commensurate with any TECs, whereas PCT 3433 was considered to be commensurate with associated TEC *Lower Hunter Spotted Gum – Ironbark Forest* and thus must be assessed under the BAM.

Table 17 shows the PCTs entered into the BAM-C and assessed therein, and associated plot-based survey data included for assessment under the SBDAR as per requirements outlined in Section 4.2 of the BAM.

Whilst PCT 3328 and PCT 4042 were not assessed as individual zones, the areas (ha) of those zones were combined with that of PCT 4044 to ensure all vegetation proposed for clearing is accounted for.

Table 17 – Vegetation Integrity Score for Vegetation Zones entered in BAM-C

Vegetation Zones	PCT 3433		PCT 4044	
Plot #	1	10	3	4
Location	355746E 6381081N	355916E 6380900N	355913E 6380902N	355817E 6381431N
Bearing	115	180	15	275
Tree	4	4	1	0
Shrub	2	4	0	1
Grass & Grass-like	3	4	0	5
Forb	3	1	1	0
Fern	0	0	0	0
Other	1	0	0	0
Composition Condition Score	**21.9**		**6.2**	
Tree	90	62	80	0
Shrub	8.5	14.1	0	30
Grass & Grass-like	0.4	1.1	0	10.4
Forb	1.3	0.1	0.1	0
Fern	0	0	0	0
Other	1	0	0	0
Structure Condition Score	**38.4**		**34.7**	
Regenerating Stems (<5cm DBH)	Present	Present	Present	Present
Stem Classes (cm DBH)	5-9, 10-19, 20-29, 30-49	5-9, 10-19, 20-29, 30-49	5-9, 10-19, 20-29, 30-49	5-9, 10-19
# Large Trees	0	0	0	0
Hollow-bearing Trees	0	0	0	0
Litter Cover (%)	61	32	70	24
Coarse Woody Debris (m)	12	3	0	15
High Threat Weed Cover	1.6	66.2	5.2	15.6
Function Condition Score	**44.5**		**59.6**	
Current Vegetation Integrity Score	**33.5**		**23.4**	

1.5 Threatened Species

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

A predicted Ecosystem Credit Species assessment is presented in **Table 18**, potential Species Credit Species assessment is presented in **Table 19** and Species Credit Species assessment presented in **Table 21**. Species Credit Species that were excluded in accordance with *Section 5.2.2.2 (a, b or c)* of BAM 202 is outlined in **Table 20**.

Figure 5 shows the location of NSW BioNet Atlas records of threatened species in the locality within 10km of the Subject Site.

1.5.1 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 18**.

Table 18 – Predicted Ecosystem Credit Species

Scientific Name	Common Name	Sensitivity to Gain Class	Recorded within 10km (BioNet Atlas 2024) Y/N	Recorded by AEP within site or nearby surrounds Y/N
Anthochaera phrygia	Regent Honeyeater	High	Y	N
Artamus cyanopterus cyanopterus	Dusky Woodswallow	Moderate	Y	N
Botaurus poiciloptilus	Australasian Bittern	Moderate	N	N
Calidris canutus	Red Knot	High	N	N
Calidris ferruginea	Curlew Sandpiper	High	N	N
Calidris tenuirostris	Great Knot	High	N	N
Calyptorhynchus lathami lathami	**South-eastern Glossy Black-Cockatoo**	**High**	**Y**	**Y**
Charadrius leschenaultii	Greater Sand-plover	High	N	N
Charadrius mongolus	Lesser Sand-plover	High	N	N
Chthonicola sagittata	Speckled Warbler	High	N	N
Climacteris picumnus victoriae	Brown Treecreeper (eastern subspecies)	High	N	N
Dasyurus maculatus	Spotted-tailed Quoll	High	Y	N
Ephippiorhynchus asiaticus	Black-necked Stork	Moderate	Y	N
Falco subniger	Black Falcon	Moderate	N	N
Glossopsitta pusilla	**Little Lorikeet**	**High**	**Y**	**Y**
Haliaeetus leucogaster	White-bellied Sea-Eagle	High	N	N
Hirundapus caudacutus	White-throated Needletail	High	Y	N
Irediparra gallinacea	Comb-crested Jacana	Moderate	N	N
Lathamus discolor	Swift Parrot	Moderate	Y	N
Limicola falcinellus	Broad-billed Sandpiper	High	N	N
Limosa lapponica baueri	Bar-tailed Godwit (baueri)	High	N	N
Limosa limosa	Black-tailed Godwit	High	N	N
Micronomus norfolkensis	Eastern Coastal Free-tailed Bat	High	Y	N

Scientific Name	Common Name	Sensitivity to Gain Class	Recorded within 10km (BioNet Atlas 2024) Y/N	Recorded by AEP within site or nearby surrounds Y/N
Miniopterus australis	Little Bent-winged Bat	High	Y	N
Miniopterus orianae oceanensis	Large Bent-winged Bat	High	Y	N
Pandion cristatus	Eastern Osprey	Moderate	N	N
Petroica boodang	Scarlet Robin	Moderate	N	N
Petroica phoenicea	Flame Robin	Moderate	N	N
Pomatostomus temporalis temporalis	**Grey-crowned Babbler (eastern subspecies)**	**Moderate**	**Y**	**Y**
Pteropus poliocephalus	**Grey-headed Flying-fox**	**High**	**Y**	**Y**
Ptilinopus superbus	Superb Fruit-Dove	Moderate	N	N
Rostratula australis	Australian Painted Snipe	Moderate	N	N
Stagonopleura guttata	Diamond Firetail	Moderate	N	N
Xenus cinereus	Terek Sandpiper	High	N	N

1.5.2 Species Credit Species

Additional threatened fauna species determined by the BAM calculator that have the potential to use the Subject Site as suitable habitat are generated from the PCT data entered are identified in **Table 19** and candidate species that were excluded from the assessment are presented within **Table 20**.

The observed flora and fauna species lists for the site are included in **Appendices F** and **G.** respectively.

Table 19 – Potential Species Credit Species

Species	Risk Weighting (BRW)	SAII Candidate (Y/N)	BioNet Records (10km)	Details of BioNet Record	Habitat Requirements / Habitats Searched / General Notes
Flora					
Eucalyptus pumila Pokolbin Mallee	3	Y	0	Not Available	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 *Eucalyptus fibrosa, Callitris endlicheri* and, to a lesser extent, *Corymbia maculata*.
Rhodamnia rubescens Scrub Turpentine	3	Y	0	Not Available	Occurs in coastal districts north from Batemans Bay in New South Wales. Found in littoral, warm temperate and subtropical rainforest and wet sclerophyll forest usually in volcanic and sedimentary soils. This species was not found during field surveys. The habitat that is suitable to this species is not consistent with the vegetation in the Subject Site.
Rhodomyrtus psidioides Native Guava	3	Y	0	Not Available	Occurs from Broken Bay, approximately 90km north of Sydney, New South Wales, to Maryborough in Queensland. Populations are typically restricted to coastal and sub-coastal areas of low elevation however the species does occur up to 120km inlands in the Hunter. Pioneer species found in littoral, warm temperate and subtropical rainforest and wet sclerophyll forest often near creeks and drainage lines. This species was not found during field surveys. The habitat that is suitable to this species is not consistent with the vegetation in the Subject Site.
Fauna					
Anthochaera phrygia Regent Honeyeater (Breeding)	3	Y	3	Three (3) records from 2011 were located approx. 2km north-east of the site.	Regent Honeyeaters inhabit woodlands that support a significantly high abundance and species richness of bird species. These woodlands have significantly large numbers of mature trees, high canopy cover and abundance of mistletoes. Regent Honeyeaters usually nest in horizontal branches or forks in tall mature eucalypts and Sheoaks. Also nest in

Species	Risk Weighting (BRW)	SAII Candidate (Y/N)	BioNet Records (10km)	Details of BioNet Record	Habitat Requirements / Habitats Searched / General Notes
					mistletoe haustoria. An open cup-shaped nest is constructed of bark, grass, twigs and wool by the female.
Calidris ferruginea Curlew Sandpiper (Breeding)	3	Y	0	Not Available	It generally occupies littoral and estuarine habitats, and in New South Wales is mainly found in intertidal mudflats of sheltered coasts. It also occurs in non-tidal swamps, lakes and lagoons on the coast and sometimes inland. It forages in or at the edge of shallow water, occasionally on exposed algal mats or waterweed, or on banks of beach-cast seagrass or seaweed. It roosts on shingle, shell or sand beaches; spits or islets on the coast or in wetlands; or sometimes in salt marsh, among beach-cast seaweed, or on rocky shores.
Calidris tenuirostris Great Knot (Breeding)	3	Y	0	Not Available	Occurs within sheltered, coastal habitats containing large, intertidal mudflats or sandflats, including inlets, bays, harbours, estuaries and lagoons. Often recorded on sandy beaches with mudflats nearby, sandy spits and islets and sometimes on exposed reefs or rock platforms. Forages for food by methodically thrusting its bill deep into the mud to search for invertebrates, such as bivalve molluscs, gastropods, polychaete worms and crustaceans.
Lathamus discolor Swift Parrot (Breeding)	3	Y	0	Not Available	On the mainland they occur in areas where eucalypts are flowering profusely or where there are abundant lerp (from sap-sucking bugs) infestations. Favoured feed trees include winter flowering species such as Swamp Mahogany Eucalyptus robusta, Spotted Gum Corymbia maculata, Red Bloodwood C. gummifera, Forest Red Gum E. tereticornis, Mugga Ironbark E. sideroxylon, and White Box E. albens.
Miniopterus australis Little Bent-winged Bat (Breeding)	3	Y	7	Records are scattered with the closest recorded approx 1.8km north-east of the site in 2012, and the most recent record from 2021 approx 3.5km south-east of the site.	Little Bentwing-bats roost in caves, tunnels, tree hollows, abandoned mines, stormwater drains, culverts, bridges and sometimes buildings during the day, and at night forage for small insects beneath the canopy of densely vegetated habitats. Moist eucalypt forest, rainforest, vine thicket, wet and dry sclerophyll forest, Melaleuca swamps, dense coastal forests and banksia scrub. Generally found in well-timbered areas.

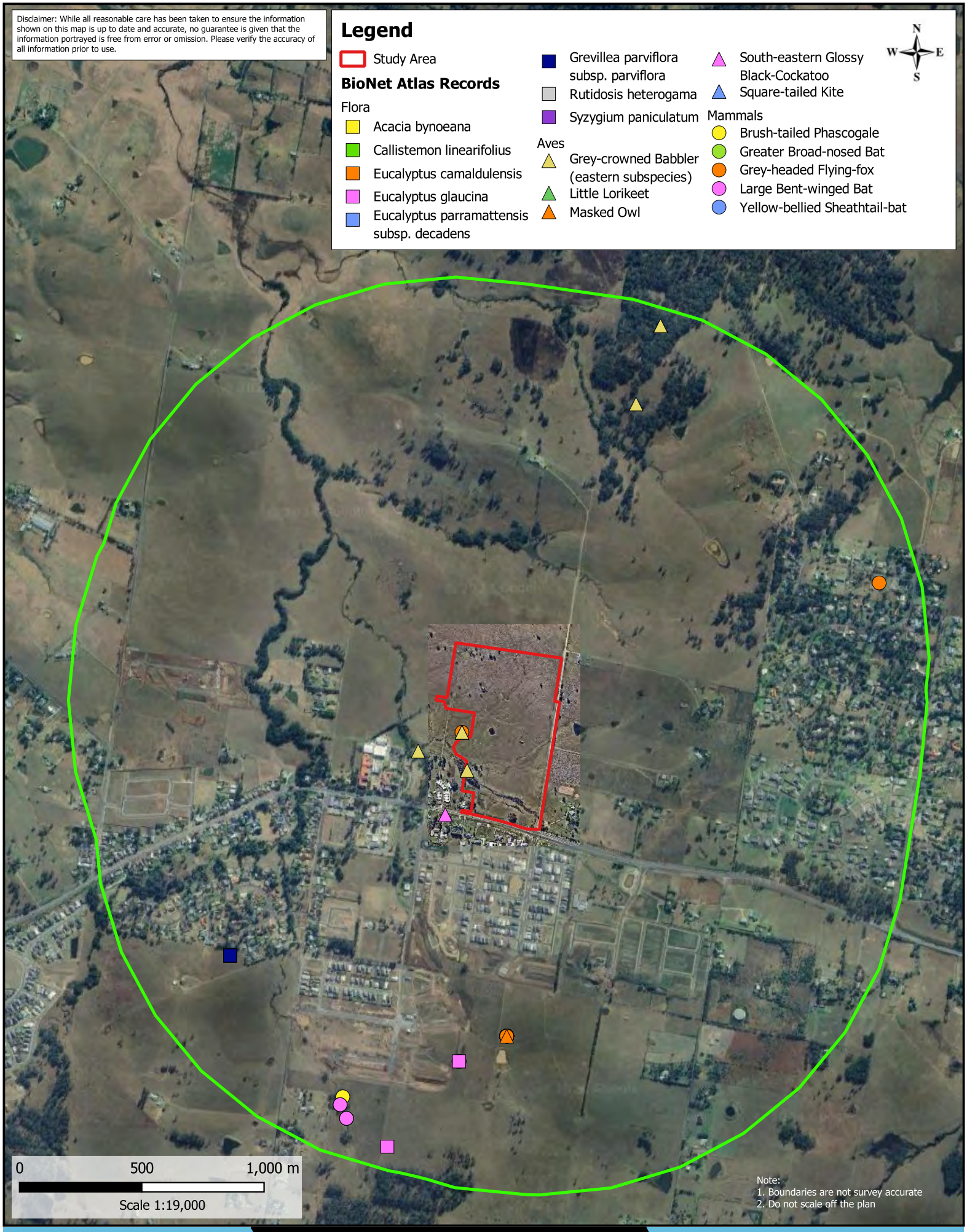
Species	Risk Weighting (BRW)	SAII Candidate (Y/N)	BioNet Records (10km)	Details of BioNet Record	Habitat Requirements / Habitats Searched / General Notes
Miniopterus orianae oceanensis Large Bent-winged Bat (Breeding)	3	Y	13	Records are scatted with the closest rrecorded approx 1km south of the site in 2017, and the most recent record from November 2021 approx 4.8km north-west of the site.	Caves are the primary roosting habitat, but also use derelict mines, storm-water tunnels, buildings and other man-made structures.

The following Potential Credit Species have been excluded from the Species Credits species list in accordance with *Section 5.2.2.2 (a, b or c)* of BAM 202 (refer to *for* the Subject Site.

Table 20 – Excluded Species

Scientific Name	Habitat Constraints (Y / N)	Habitat Degraded (Y / N)	Geographic Limitations (Y / N)	Species is Vagrant (Y / N)	Comments
Anthochaera Phrygia Regent Honeyeater (Breeding)	Y	N	N	N	In accordance with Section *5.2.2.2 (a) the* Subject Site is not mapped as per important habitat. Therefore, the species has been removed from further assessment due to habitat constraints.
Calidris ferruginea Curlew Sandpiper (Breeding)	Y	N	N	N	In accordance with Section *5.2.2.2 (a) the* Subject Site is not mapped as per important habitat. Therefore, the species has been removed from further assessment due to habitat constraints.
Calidris tenuirostris Great Knot (Breeding)	Y	N	Y	N	In accordance with Section *5.2.2.2 (a) the* Subject Site is not mapped as per important habitat. Therefore, the species has been removed from further assessment due to habitat constraints.
Eucalyptus pumila Pokolbin Mallee	Y	Y	Y	N	In accordance with Section 5.2.1.2 (b) the site is located over 17km south east from the nearest and single known population. The site does not provide suitable habitat with no sandstone slopes present.
Lathamus discolor Swift Parrot (Breeding)	Y	N	N	N	In accordance with Section *5.2.2.2 (a) the* Subject Site is not mapped as per important habitat. Therefore, the species has been removed from further assessment

Scientific Name	Habitat Constraints (Y / N)	Habitat Degraded (Y / N)	Geographic Limitations (Y / N)	Species is Vagrant (Y / N)	Comments
					due to habitat constraints.
Miniopterus australis Little Bent-winged Bat (Breeding)	Y	N	N	N	In accordance with Section *5.2.2.2 (a) the* Subject Site is not mapped as per important habitat. Therefore, the species has been removed from further assessment due to habitat constraints.
Miniopterus orianae oceanensis Large Bent-winged Bat (Breeding)	Y	N	N	N	In accordance with Section *5.2.2.2 (a) the* Subject Site is not mapped as per important habitat. Therefore, the species has been removed from further assessment due to habitat constraints.



AEP

Figure 5 - BioNet Atlas Records

Date: July 2024

Location: 898 New England Hwy, 25 & 39 Wyndella Rd, Lochinvar NSW

Client: Lochinvar Developments Pty Ltd
C/- ADW Johnson Pty Ltd

AEP ref: 2699.04
BOAMS: 00048759

1.5.3 Field Survey Methods

1.5.3.1 Habitat Features Surveys

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 **Tables 18** and **19**. 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.

1.5.3.2 Flora Field Survey

All required flora survey techniques were utilised for targeted survey of the species listed in **Table 19** above and guided by *Surveying threatened plants and their habitats NSW survey guide for the Biodiversity Assessment Method* (DPIE, 2020a) and the BAM (DPIE, 2020b).

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.
- 11 plot-based vegetation surveys (BAM plots) were undertaken in accordance with the BAM by AEP.
- Updated/Refined Vegetation Community Mapping involving traversal over the entire Subject Site, concentrating particularly on mapping the boundaries between the identified Biometric Vegetation Types of the BAM and refining the original mapping which involved a larger number of vegetation units.

1.5.3.3 Fauna Field Surveys

All required fauna survey techniques were utilised for targeted survey of the species and guided by the *Threatened Species Survey and Assessment Guidelines* (2004).

1.5.3.4 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.

1.6 Survey Effort and Results

The survey methods used were utilised across the Subject Site in August and December 2022, January 2023, and April 2024. The survey effort was based on that required for a standard BDAR. However, design iterations and changes have meant that the impact areas have reduced significantly resulting in the final application being assessed under the Streamlined Assessment Module for Small Area Development of the BAM. AEP has provided the full survey effort to show ecological surveys within the Study Area in **Table 21** and **Figure 6**. Flora and fauna species list for those species recorded during field surveys are provided in **Appendices F** and **G**.

Table 21 – Field Survey Periods

Date	Time	Hours	Field activity	Targeted Species	No. of Persons on Site	Staff	Rainfall
23/08/22	08:15 – 12:45	4.5	General site reconnaissance, rapid data points flora survey, general habitat assessment		2	Frances O'Brien Kathleen Bushell	0mm rainfall
30/08/22	08:30 – 13:30	5	Riparian assessment		2	Chris Wark Kathleen Bushell	0mm rainfall
19/12/22	11:30 – 21:30	10	General vegetation assessment BAM plots Flora transects Nocturnal spotlighting Call playback Diurnal Birds	*Rhodamnia rubescens* (Scrub Turpentine) *Rhodomyrtus psidioides* (Native Guava)	2	Sam Rayfield Darcy Kilvert	2.6mm rainfall
20/12/22	10:30 – 21:00	10.5	BAM plots Koala SATs Flora transects Nocturnal spotlighting Call playback Diurnal Birds	*Phascolarctos cinereus* (Koala), *Rhodamnia rubescens* (Scrub Turpentine), *Rhodomyrtus psidioides* (Native Guava)	3	Angela Metcalfe Sam Rayfield Darcy Kilvert	0mm rainfall (8.6mm rainfall in the previous 7 days)
23/01/2023	19:00 – 21:30	2.5	Mist netting Incidentals	Microbats	3	Angela Metcalfe Rachael Smethurst Kathleen Bushell	8.4mm rainfall
02/04/2024	09:00 - 11:00	2	Riparian Assessment		1	Brendon Young	0mm rainfall
11/04/2024-	10:00 – 11:30	1.5	Biodiversity Management Plan preliminary inspection		2	Dennis Neader Emma O'Dwyer	0mm rainfall
18/04/2023	11:30 – 14:00	2.5	Vegetation assessment BAM plot		1	Stephen Curry	0mm rainfall
25/06/2024	10:30 – 11:30	1	Vegetation assessment		1	Oliver Saunders	0mm rainfall

1.6.1 Habitat Trees

The Subject Site offers limited habitat for fauna. Native canopy species are present within the Subject Site (*Corymbia maculata, Eucalyptus fibrosa, Lophostemon confertus*) which may constitute suitable feed trees for some bird species and arboreal mammals. There were no habitat trees observed to be containing hollows at the time of survey. Despite thorough surveying, hollows may have gone unnoticed that would be suitable for small species such as microbats. Others may have gone unobserved due to the height and orientation of potential hollows.

1.6.2 Water Features and Hydrology

Mapped hydrolines are present within the Study Area. A first-order hydroline occurs in the south of the Study Area, bisecting the site from west to east. Three (3) farm dams are present in the northern portion of the Subject Site. Water features within the site may represent potential habitat for amphibians and water birds as well as foraging habitat for bats.

Refer to the Riparian Assessment (**Appendix C**) for a detailed assessment.

1.6.3 Other habitat features

The Subject Site possesses very limited additional habitat features including a small cluster of fallen logs surrounded by *Melaleuca* spp. in the centre of the site; remnants of a stone fireplace; and a medium sized farm shed containing rubbish and old equipment that may provide potential habitat. The farm shed appears to be the most significant habitat feature currently being utilised on site. A Barn Owl was found to be currently using the shed, and a mud nest, likely built by Magpie-larks was present.

No caves, karsts or rocky outcrops occurred on site and are considered a habitat constraint for cave dwelling microbats.

1.6.4 Species Credit Species Survey Results

Table 22 presents the results of targeted surveys.

Table 22 – 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 (Y/N)	Observed within Subject Site (Y/N)	Assumed Present (Y /N)	Species Credits Apply (Y /N)
Flora											
Rhodamnia rubescens Scrub Turpentine	All year	Parallel walking transects: Maximum distance between transects 10m in open, 5m in dense vegetation. For each hectare of potential habitat average field traverse length 2km at 5m separation or 1km at 10m separation. When local reference population is flowering.	Y	10m targeted flora transects	19-20/12/2022	Understorey on site is severely degraded and dominated by non-native plant species.	N/A	N	N	N	N
Rhodomyrtus psidioides Native Guava	All year	Parallel walking transects: Maximum distance between transects 10m in open, 5m in dense vegetation. For each hectare of potential habitat average field traverse length 2km at 5m separation or 1km at 10m separation. When local reference population is flowering.	Y	10m targeted flora transects	19-20/12/2022	Understorey on site is severely degraded and dominated by non-native plant species.	N/A	N	N	N	N

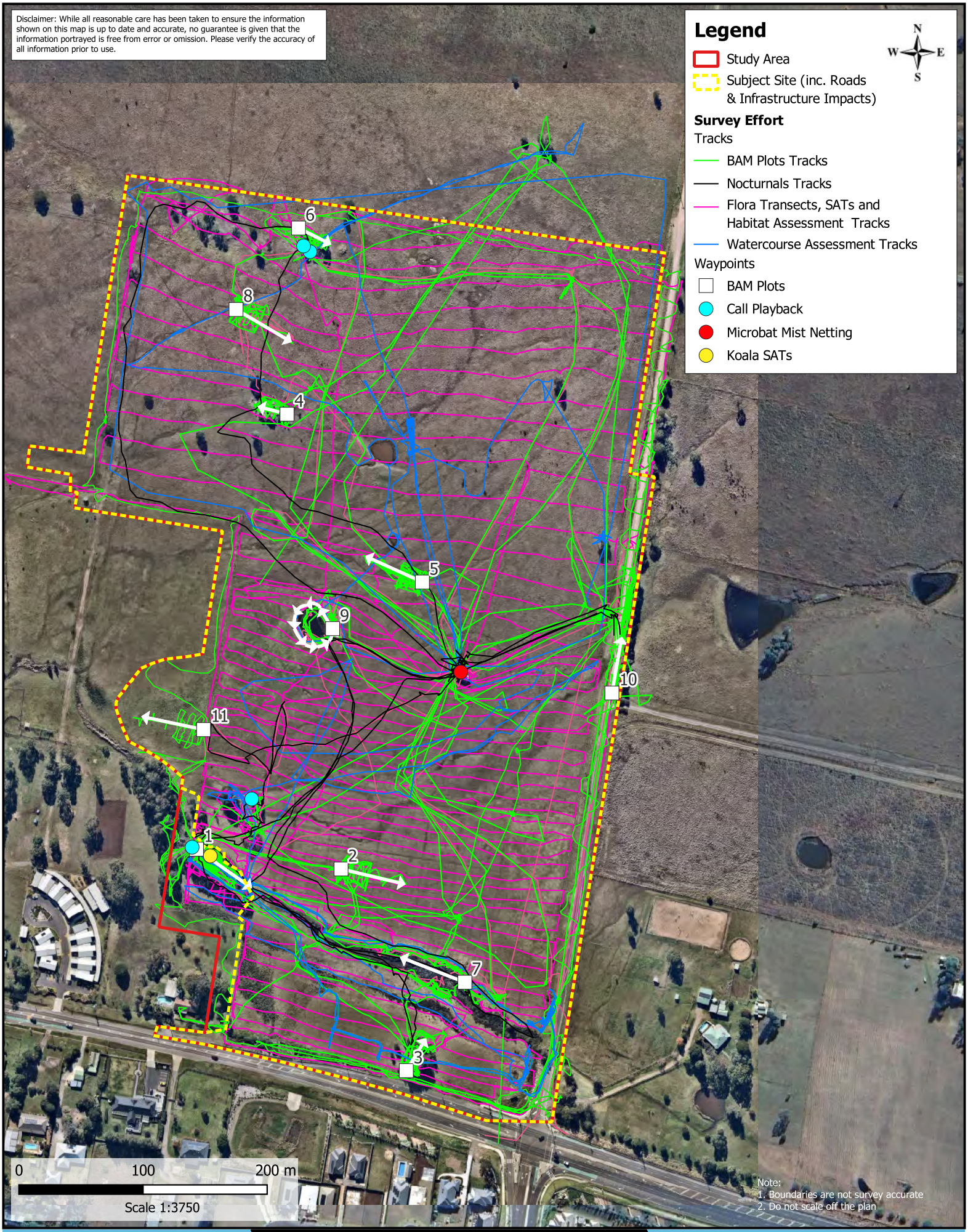


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Figure 6 - Survey Effort

Date: July 2024

Location: 898 New England Hwy, 25 & 39 Wyndella Rd, Lochinvar NSW

Client: Lochinvar Developments Pty Ltd
C/- ADW Johnson Pty Ltd

AEP ref: 2699.04
BOAMS: 0004879

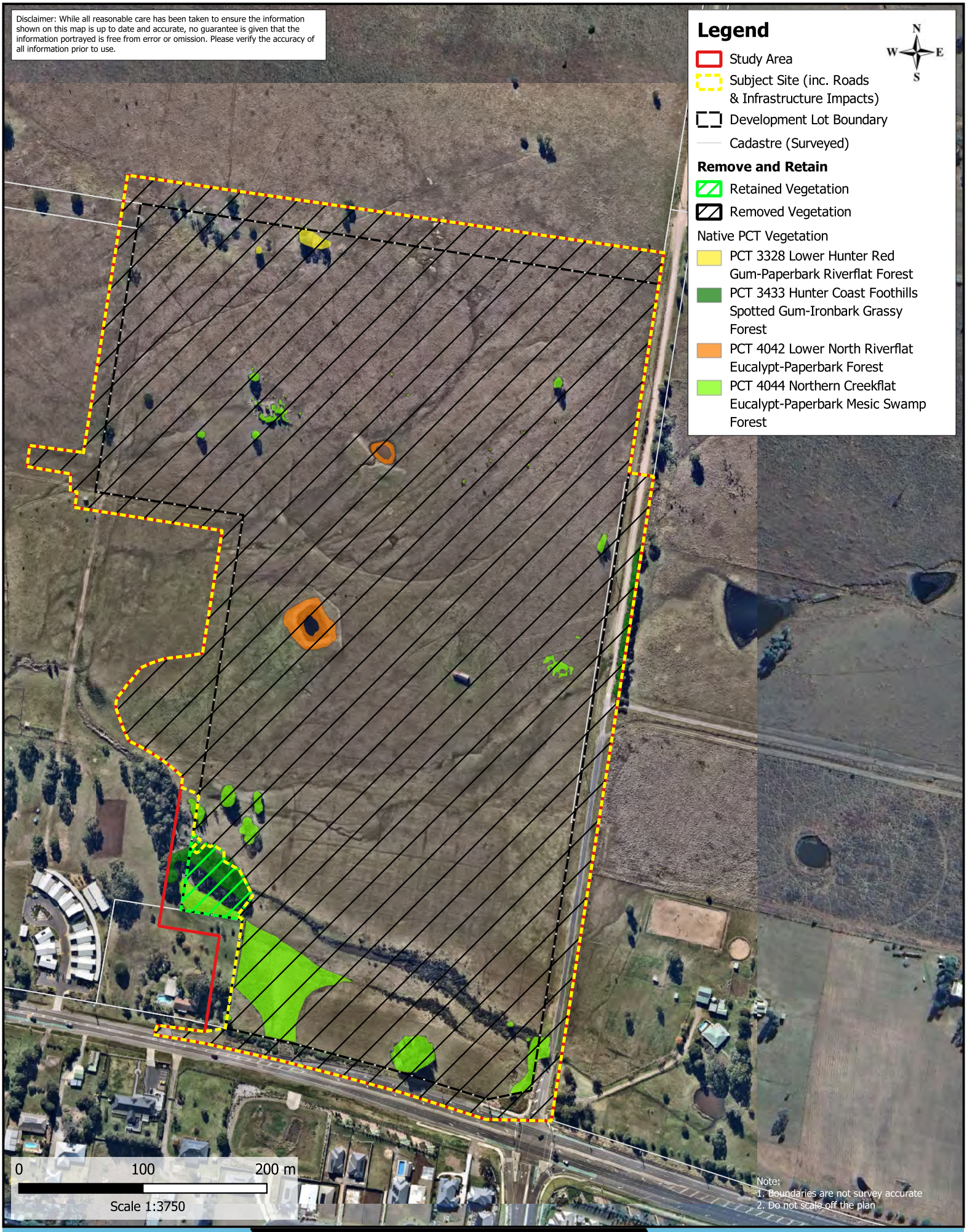

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Figure 7 - Impacts and Retention Area

Date: July 2024

Location: 898 New England Hwy, 25 & 39 Wyndella Rd, Lochinvar NSW

Client: Lochinvar Developments Pty Ltd
C/- ADW Johnson Pty Ltd

AEP ref: 2699.04
BOAMS: 00048759

2.0 Stage 2 – Impact Assessment (Biodiversity Values)

2.1 Avoid and Minimise Summary

Section 8 of the BAM provides a list of measures that need to be taken into consideration during project planning and design, to minimise impacts upon native vegetation, habitat and other prescribed biodiversity values. Applicable measures taken as part of this project to minimise impacts are provided below.

The Avoid and Minimise strategy for the development (in accordance with Section 8 of the BAM), is discussed in greater detail in **Table 23** below.

The prescribed impact risk assessment and mitigation measures (in accordance with Section 9 of the BAM) are included in **Tables 23** to **30** 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 Impact Avoidance Measures

2.2.1 Project Design

As discussed in Section 1 previously there have been several changes to the design footprint over the development of the proposal. The proposal commenced with full clearing of the Subject Site. After preliminary surveys undertaken by AEP, the application was reduced below the 0.25ha area clearing threshold, resulting in an Ecological Assessment Report being produced in accordance with *Section 7.3* of the BC Act.

This application required modifications for road works and other infrastructure requirements, which resulted in an increase of the clearing area, which resulted in the requirement for an assessment as per the Streamlined Assessment Module for Small Area Development of the BAM.

The proposed subdivision has been designed to meet local zoning requirements. The overall design and configuration of the proposal has allowed for the proponent to retain an area of PCT 3433 and PCT 4044 along the riparian corridor which will be managed under a Biodiversity Management Plan. The remaining BMP land will include regeneration and management of freshwater wetland with PCT3975 to provide amphibian habitat, specifically targeting Green and Gold Bell Frog (*Litoria aurea*), and establishment of TEC *Freshwater Wetlands on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions.* Additionally, realignment of the existing watercourse as part of the development will reinstating the natural channels and ensure the key hydrological features are present within the creek, and as a result improve water quality and habitat for both terrestrial and aquatic organisms. This vegetated area will provide a native education area that will bound the realigned creek line as part of the BMP.

2.2.2 Landscaping

Where possible, landscaping is to occur in conjunction with the proposed development and provide some future resources for native fauna in the area;

Landscaping areas are to incorporate plantings with species that occur within the vegetation communities that are currently present on site, specifically PCT 3433 and PCT 4044. Species to incorporate into the landscape plan include:

- **Canopy species:** *Corymbia maculata, Eucalyptus fibrosa, Eucalyptus umbra, Eucalyptus globoidea, Eucalyptus punctata, Notelaea longifolia, Allocasuarina torulosa, Eucalyptus siderophloia, Eucalyptus acmenoides, Glochidion ferdinandi, Eucalyptus moluccana*
- **Mid-strata (shrubs and small trees):** *Daviesia ulicifolia, Bursaria spinosa, Persoonia linearis, Pultenaea villosa, Leucopogon juniperinus, Phyllanthus hirtellus, Acacia ulicifolia, Acacia falcata, Breynia oblongifolia, Melaleuca nodosa, Hibbertia aspera, Denhamia silvestris, Exocarpos cupressiformis, Ozothamnus diosmifolius, Acacia irrorata, Dillwynia retorta, Lissanthe strigosa, Acacia elongata, Acacia longifolia, Pultenaea euchila, Acacia parvipinnula, Dodonaea triquetra, Podolobium scandens;* and
- **Ground cover:** *Cheilanthes sieberi subsp. sieberi, Entolasia stricta, Microlaena stipoides, Themeda triandra, Aristida vagans, Lomandra multiflora subsp. multiflora, Lepidosperma laterale, Panicum simile, Lomandra filiformis, Imperata cylindrica, Lomandra longifolia, Cymbopogon refractus, Paspalidium distans, Dichelachne micrantha, Eragrostis brownii, Lomandra confertifolia, Rytidosperma pallidum, Echinopogon caespitosus, Echinopogon ovatus, Ptilothrix deusta, Poa labillardierei var. labillardierei, Digitaria ramularis, Lobelia purpurascens, Dianella caerulea, Brunoniella australis, Vernonia cinerea, Dianella revoluta, Opercularia diphylla, Goodenia heterophylla, Lagenophora stipitata, Desmodium rhytidophyllum, Gonocarpus tetragynus, Dichondra repens, Pomax umbellata, Pseuderanthemum variabile, Oxalis perennans, Glycine clandestina, Hardenbergia violacea, Billardiera scandens, Eustrephus latifolius, Glycine tabacina, Pandorea pandorana subsp. pandorana, Geitonoplesium cymosum, Dendrophthoe vitellina, Parsonsia straminea.*

2.2.3 Water quality and Hydrology

- An Erosion and Sedimentation Control Plan (ESCP) should be 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 before work commences to limit offsite movement of materials into the adjacent vegetation;
- Erosion and sedimentation controls should be checked daily and maintained in working order especially after rain events; and
- Bio-retention basin tail-out scour protection areas will be maintained by hand weeding and will not utilise chemical weed control, to ensure water quality of any discharge is maintained.

2.2.4 General Clearing Principles

The following measures are provided to help mitigate impacts of the construction and ongoing operation of the proposed development on the biodiversity values identified within the Subject Site and surrounds:

- Where possible, vegetation clearing is to be timed to avoid extended cold weather periods. 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;
- Implement clearing protocols, including pre-clearance surveys to identify habitat and vegetation to be retained. 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.

- In addition, prior to clearing of any vegetation, and 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.
- 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: Under scrubbing;
    - Phase 2 Clearing: Removal of non-habitat trees; and
    - Phase 3 Clearing: If habitat features are identified during pre-clearance surveys, removal of habitat trees must be undertaken 48 hours after clearing of other non-habitat 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 vegetation.
- Civil Construction staff to be inducted into pre-clearing and clearing protocols, and to identify environmental features for protection.
- If practical, 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 are to be relocated into areas of any retained vegetation.

2.2.5 Project Design, Construction & Operation

The following general measures are provided to help mitigate impacts of the construction and ongoing operation of the proposed development on the biodiversity values identified within the Subject Site and surrounds:

- Temporary construction fencing around the Subject Site and delineating any Tree Protection Zones for trees to be retained is to be erected during the construction phase to limit incursions of fauna and delineate the boundary of clearing works;
- Implement hygiene protocols for machinery to prevent the spread of weeds outside the development site;
- Best practice erosion and sedimentation (ERSED) and dust suppression control methods are to be adopted, enforced and maintained throughout any vegetation clearing works, particularly for downstream areas. Such are to be in accordance with “Managing Urban Stormwater, 3rd Edition (1998)” published by NSW Department of Housing, and Council requirements;
- It is anticipated that stormwater will disperse into watercourse;
- Water quality runoff is appropriately similar to existing conditions within the site;
- Where possible landscaping is to occur in conjunction with the proposed development and provide some future resources for native fauna in the area;
- Bushfire protection measures in the form of Asset Protection Zones (APZ’s) will be incorporated within the Subject Site, disturbed areas or future development lands, to avoid requirements for additional vegetation removal in surrounding areas;
- During construction phase, the Subject Site should be fenced to prevent unauthorised access and potential disturbance/rubbish dumping. No barbed wire is to be used within the Subject Site. Fencing within the Subject Site is to prevent incursions by fauna into the construction site;

- Following construction phase, the BMP land should be fenced to reduce unauthorised access by vehicles, and potential disturbance/rubbish dumping. No barbed wire is to be used within the Subject Site; and
- Development of Construction Environmental Management Plan (CEMP) that incorporates pre, during and post construction mitigation measure to reduce both direct and indirect, such as lighting, vehicle strike, runoff etc.

2.3 Biodiversity Management Plan

The aim for the retained areas within the Study Area is to establish a Biodiversity Management Plan (BMP). The purpose of the BMP is to reconstruct the existing riparian area, manage amphibian habitat, schedule weed management and revegetation measures necessary to enhance habitat value and improve landscape connectivity of designated lands.

The BMP aims to:

- Reinstate a natural channel creating both ecological and hydraulic function;
- Manage the freshwater wetland for amphibian habitat purposes;
- Create a Wildlife Corridor for native fauna in the area; and
- Reconstruct vegetation to a state of natural regeneration.

The BMP incorporates best practices in bushland restoration, management of invasive species and revegetation in order to achieve the following objectives within the 5 years imparted:

- Regenerate physical and biological functions of the remnant bushland present within the BMP lands to improve habitat values and connectivity for locally occurring biota;
- Reconstruct highly disturbed area that cannot naturally regenerate, to stabilise and reinstate landforms and vegetation communities that are generally representative of those present prior to disturbance;
- Develop management actions detailed using the 'SMART' goals approach (Specific, Measurable, Achievable, Reasonable and Time bound).
- Ensure the site is maintained until vegetation in rehabilitated areas achieves a self-sustaining state;
- Enhance habitat and connectivity across the site through salvage of biomass from the development site and revegetation;
- Implement erosion and sediment control measures to minimise the transfer of soil and sediments into downslope receptors; and
- Implement a hygiene protocol to prevent the transfer of weeds and pathogens onto and off the site.

Table 23 – Avoid and Minimise Impacts on Biodiversity Values

Objectives/Requirements	Evidence of compliance
Locate the proposal to avoid or minimise direct and indirect impacts on native vegetation, threatened species, threatened ecological communities and their habitat.	
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.	The development site is located in the Lochinvar Urban Release Area (LURA) and is zoned R1 under the Maitland LEP 2011 (MLEP2011). The lots adjoining the Subject Site to the east is RU2 – Rural Landscape, RU1 – Primary Production to the north and R1 – General Residential to the west. R1 is also zoned opposite the New England Highway south of the site. The Subject Site is 25.91ha, of which approximately 0.94ha consists of native vegetation and 24.97ha is planted native / exotic / cleared / existing infrastructure. The native vegetation within the Study Area has been confirmed through ground-truthing to be commensurate with PCT 3433 - *Hunter Coast Foothills Spotted Gum-Ironbark Grassy Forest* (0.20ha), PCT 3328 - *Lower Hunter Red Gum-Paperbark Riverflat Forest* (0.03ha), PCT 4020 - *Coastal Creekflat Layered Grass-Sedge Swamp Forest* (0.13ha) and PCT 4044 - *Northern Creekflat Eucalypt-Paperbark Mesic Swamp Forest* (0.78ha). The condition of the vegetation zones entered into the BAM-C for the site (VIS of 23.4 and 33.5) is classified as Degraded to Highly Degraded. Considering the zoning and surrounding residential lots directly adjoining the Subject Site, the location is deemed suitable for development. The management of site and developments surrounding this site have led to the Subject Site being degraded. The habitat on site is marginal and would provide little opportunity for recruitment of local fauna. No threatened flora or fauna was detected during field surveys. The subdivision has been designed to meet the local zoning requirements. Although native vegetation has been identified within the Subject Site, the proposed 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, and encourage the retention of 0.16ha of native vegetation. The realignment of hydroline, reconstruction of frog, and regeneration of associated vegetation under a BMP will further increase the value of biodiversity habitat.
Selecting a final proposal location may be an iterative process. Decisions may need to be revisited after all field surveys have been completed.	As discussed above, the development is located in a suitable area, but will be subjected to partial clearing. Direct impacts to the remnant vegetation present will be approximately 0.94ha, with the better condition area vegetation of 0.16ha being retained and managed as part of the BMP. The proposed development is considered to have minimal impacts to the biodiversity of the area in context of the broader locality that would result in significantly more ecological impact. The realignment of hydroline, reconstruction of frog, and regeneration of associated vegetation under a BMP will further increase the value of biodiversity habitat.
Impacts from clearing native vegetation and threatened species habitat can be avoided or minimised by locating the proposal in areas: *a) lacking biodiversity values* *b) where the native vegetation or threatened species, habitat is in the poorest condition (i.e. areas that have a low vegetation integrity score)* *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.* d) *outside of the buffer area around breeding habitat features such as nest trees or caves.*	a) The site is not mapped as biodiversity values land and the proposed layout of the development has been designed to not impact areas of high biodiversity, to retain intact vegetation that provides suitable habitat to the greater area, and to reinstate natural channels and freshwater wetland that will improve water quality and habitat for both terrestrial and aquatic organisms within the site. b) As discussed above, suitable areas for development would be within low constraint vegetation; previously cleared or managed area in highly disturbed condition with low VIS of 23.9 and 33.5 for PCT 3433 and 4044 respectively. Of the native vegetation within the Study Area (1.14ha), a total of 0.94ha is proposed to be removed and is considered to be minimal in the context of the broader locality and landscape. The site has been selected for maximum avoidance of biodiversity values as is demonstrated with the retainment of 0.16ha of PCT 3433 and PCT 4044 that is present in better condition than elsewhere on site. The realignment of hydroline and regeneration of the freshwater wetland will increase vegetation and habitat value following completed civil works for the subdivision. c) Land is not mapped as high biodiversity or important habitat. d) Vegetation present within the site is marginally connected to native vegetation (50ha patch size) to the west/northwest via scattered trees and degraded riparian corridors. Proposed removal of vegetation is not likely to reduce connectivity to these areas. The proposed realignment and regeneration of the freshwater wetland in conjunction with revegetation within the BMP will enhance connectivity in the south/south-west portion of the site. No stick nests or rocky habitat were found on site. The single shed on site was searched but no threatened microbat species were observed to be utilising it as habitat. Given this information it is unlikely that threatened fauna was utilising the site to breed in during the survey period. Furthermore, the site is impacted by historical use and surrounding development and as such would limit the movement of local fauna into the site thus restricting the potential for breeding to occur within the site. No caves were evident in the immediate vicinity of the site. Given the small site in the context of the broader locality and degraded status of the remnant vegetation due to historical use, impacts to breeding habitat is not anticipated and the development is not expected to reduce biodiversity in the area.
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: *a) alternative modes or technologies that would avoid or minimise impacts on biodiversity values* *b) alternative routes that would avoid or minimise impacts on biodiversity values* *c) alternative locations that would avoid or minimise impacts on biodiversity values* *d) alternative sites within a property on which the proposal is located that would avoid or minimise impacts on biodiversity values.*	a) Consideration of alternative modes or technologies have been reviewed and used within the footprint layout of a development within the Subject Site. Examples of such modes or technologies include implementation of WSUD principals in design, erosion and sediment control plan, flood compensatory calculations and retention of vegetation to reduce impacts to TECs on site. b) The Subject Site was considered an appropriate location as determined by the current R1-General Residential land zoning and has been designed to meet these requirements. Within the current context of the development, the site has been chosen within a lot that consists of previously cleared/exotic/non-native, planted non endemic native and non-native vegetation. The project will retain 0.16ha of native vegetation which is in the best condition within the site to assist in providing some habitat for local flora and fauna in the area. c) The Subject Site was considered an appropriate location as determined by the existing use on the land and the current zoning of the land. The design process has sought to avoid areas of vegetation in better condition, and revegetate BMP land following realignment of

Objectives/Requirements	Evidence of compliance
	hydroline and regeneration of the freshwater wetland which will provide higher biodiversity values located in the western portion of the site. The proposed Subject Site is located in an area where the VISs are low. d) This location has undergone substantial development in surrounding lots in the wider vicinity on the outskirts of town. No alternative locations were considered, the proposed site location will have minimal impacts to the surrounding area. As mentioned previously, most areas within the site of higher biodiversity value are being avoided and the proposed Subject Site is located in an area which contains the lowest level of biodiversity values throughout the site whilst retaining the highest biodiversity value area.
The proposal may also list and map site constraints, such as: *a) bushfire protection requirements, including clearing for asset protection zones* *b) flood planning levels* *c) servicing constraints.*	a) Bushfire assessment has been conducted and APZ requirements have been incorporated into the design. b) Residential lots are located outside the flood planning area defined by Flood Planning Map and flooding has been considered specifically as part of the proposal by others, as detailed in the Stormwater Management Plan accompanying the development application. c) Servicing constraints have been considered and the proposal has met the required standards.
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.	As detailed above, the final development footprint is a feasible option to enable the project to progress. Considering the location of the development footprint in the context of the site, and taking into account recommendations to retain remnant vegetation, landscape using plants that commensurate with PCT 3433 and PCT 4044, and increase biodiversity values following the realignment of hydroline and regeneration of the freshwater wetland, it has the least impact on biodiversity values, native vegetation, connectivity routes and fauna movements whilst still being located on appropriately residentially zoned land which has access to services.
Designing a Project to Avoid and Minimise Impacts on Native Vegetation and Habitat	
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: *a) Reducing the proposal's clearing footprint by minimising the number and type of facilities* *b) Locating ancillary facilities in areas that have no biodiversity values* *c) 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)* *d) 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 (SAII)* *e) 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.*	a) – d) The proposed design has gone through an iterative design process and has allowed for the retention of 0.16ha of native vegetation. As explained above, the site was deemed appropriate for development as a result of the land zoning, the ability to link into surrounding development services, and the lack of significant biodiversity or habitat on the site. The proposed subdivision has been designed to meet local zoning requirements. The overall design and configuration of the proposal has allowed for the proponent to retain an area of PCT 3433 along the riparian corridor which will be managed under a Biodiversity Management Plan. The remaining BMP land will include regeneration of the freshwater wetland, and realignment of the existing mapped hydroline as part of the development footprint. Reinstating the natural channels within the unnamed creek would ensure the key hydrological features are present within the creek, and as a result improved water quality and habitat for both terrestrial and aquatic organisms will be provided. This vegetated area will provide a native education area that will bound the realigned creek line as part of the Biodiversity Management Plan. e) In addition to the retention of 0.10ha of PCT 3433 and 0.06ha of PCT 4044 and works associated with the BMP, no threatened species are expected to be impacted as part of the proposal. Landscaping plans will utilise species commensurate with PCT 3433 and 4044 to provide future supplementary resources and connectivity for mobile fauna. Considering the location of the site in the broader landscape, the proposed impacts will not affect larger ecosystem connectivity and have a relatively minor impact on local connectivity and will not impact connectivity of broader patches of vegetation in the area.
The BDAR or BCAR must document and justify efforts to avoid or minimise impacts through design.	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 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 other vegetation zones. Realising the full development potential of the residentially zoned land within the Subject Site, will avoid and minimise impacts to biodiversity within the site and the wider locality by reducing pressures to develop less suited land with higher biodiversity values.

Table 24 – Prescribed Impact Avoidance and Minimisation

Objectives/Requirements	Evidence of compliance
Avoiding and Minimising Prescribed Biodiversity Impacts during Project Planning	
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.	The Subject Site has no caves, rocky outcrops, or flyways, and the exotic grassland and non-native/exotic areas provide minimal habitat for native flora and fauna. As such it has been determined suitable for these areas to be developed. Areas of higher biodiversity value within the site are being avoided and key features such as riparian vegetated zones are proposed for retention, reconstruction and management on site. All other vegetation is considered to be of poor quality with restricted habitat value. Direct and indirect impacts to biodiversity were identified for the Subject Site. Direct, indirect, prescribed and residual impacts are considered in **Tables 17, 18, 19 and 20** of the SBDAR.
Locating a Project to Avoid and Minimise Prescribed Biodiversity Impacts	
To avoid or minimise prescribed biodiversity impacts, the proponent must consider how to: *a) Locate surface works to avoid direct impacts on the habitat features identified in Chapter 6* *b) 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* *c) 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* *d) Optimise the proposal layout to minimise interactions with threatened entities; for example, design a wind farm that has:* *i. 100 m turbine-free buffers around features that attract and support aerial species, such as forest edges, riparian corridors, wetlands, ridgetops and gullies* *ii. turbine-free corridors in zones of regular movement for species of concern, to avoid a barrier effect* *e) locate the proposal to avoid impacts on water bodies or hydrological processes*	a) The Subject Site: i. Does not contain karsts, caves, crevices, cliffs. Present within the site are areas containing abundant small sticks and log piles, stumps, and infrastructure. No other features of geological significance supporting threatened species and ecological communities are present; ii. Does not contain rocks as discussed above, which may support habitat for threatened species; iii. Contains human made structures that was inspected for microbats use on site and no threatened species were observed to be utilising; 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 include local roads with a maximum speed limit of 50km/hr, the likelihood of vehicle strike is considered much lower than higher speed roads. b) No sub-surface work is expected as a result of the proposed development. Erosion and sediment control has been incorporated to ensure works will avoid direct impacts on habitat features such as retained vegetation on site and adjoining lots. c) As discussed previously, the proposed impact area constitutes only 0.94ha of remnant native vegetation which is directly bordered by land that will be managed under a BMP. A total of 0.16ha of native vegetation will be retained as part of the proposal whilst the remaining BMP land will be revegetated following realignment of hydroline and regeneration of the freshwater wetland. It is therefore considered unlikely that movement throughout the landscape will be hindered by the proposed development, especially if remnant vegetation is retained and habitat reinstated. The proposed impact mitigation measures and native landscape plantings will aid in creating movement pathways for these species. It is therefore considered unlikely that movement throughout the landscape will be hindered by the proposed potential future development. d) The development location has been selected in an area land zoned as R1 – General Residential and where the land has been subjected to clearing. The location and proposed layout have been selected to avoid impacting large tracts of remnant/connected vegetation and has focussed design on land containing non-native/cleared vegetation. Thus, it is avoiding areas of vegetation in better condition and reinstating features that will provide higher biodiversity habitat value. Additionally, retaining remnant native vegetation, revegetation of remaining BMP land and landscaping utilising native vegetation from the area, the site can assist in providing foraging and future habitat for species in the area. e) The site contains artificial agricultural dams with low to no biodiversity values proposed for removal. The development footprint includes the realignment of an existing unnamed mapped hydroline. Reinstating the natural channels within the unnamed creek would ensure the key hydrological features are present within the creek, and as a result improved water quality and habitat for both terrestrial and aquatic organisms will be provided. It is anticipated that stormwater will disperse into the watercourse. Future housing on each lot will manage their stormwater with rainwater reuse tanks and the like as required by Council. Water quality and runoff are appropriately similar to existing conditions within the Subject Site.
When locating a proposal, the following need to be analysed and justification should be provided for each alternative selected: *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.*	a) Water Sensitive Urban Design will be implemented to minimise prescribed impacts on biodiversity values linked to hydrology and water quality. b) The proposed development has been designed to ensure as much of the infrastructure have been located in cleared areas within the development footprint or within proposed road reserves. c) Given the land zoning and current use of land, it was considered that development of the site would minimise impacts of higher biodiversity value within the region. d) As per section c). Furthermore, proposed works within the BMP land will increase biodiversity value within the site and region by improving water quality and habitat for both terrestrial and aquatic organisms.
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: *a) bushfire protection requirements, including clearing for asset protection zones* *b) flood planning levels* *c) servicing constraints.*	a) Bushfire assessment has been conducted. Clearing required for APZs has been factored into the Development Footprint. b) Residential lots are located outside the flood planning area defined by Flood Planning Map and flooding has been considered and assessed as part of the aquatic assessment included as part of the Development Application c) Servicing constraints have been considered and the proposal has met the required standards.

Objectives/Requirements	Evidence of compliance
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.	Discussed above.
Designing a Project to Avoid and Minimise Prescribed Biodiversity Impacts	
Design measures that can avoid or minimise prescribed impacts include: *a) Engineering solutions, such as proven techniques to:* *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:* *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* *c) Maintaining environmental processes that are critical to the formation and persistence of habitat features not associated with native vegetation* *d) Maintaining hydrological processes that sustain threatened entities* *e) Controlling the quality of water released from the site, to avoid or minimise downstream impacts on threatened entities.*	a) – e) As explained above, the site was deemed appropriate for development as a result of the land zoning and use of land already subjected to residential infrastructure which has disturbed native vegetation within the Subject Site. A total of 0.16ha of native vegetation will be retained, and the remaining BMP land will be revegetated following reinstatement of habitat features. The retention of this vegetation and associated BMP works will also serve to maintain connectivity, as well as landscaping with PCT 3433 and PCT 4044 species is expected to increase fauna habitat. It is anticipated that stormwater will be discharged into the gutter and stormwater drainage system associated with Wyndella Road infrastructure. Water quality and runoff ais anticipated to be appropriately similar or better than to existing conditions within the Subject Site and will be provided in a Storm Water Management Plan for the development.
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	Field surveys have been carried out to identify threatened species within the area or presence has been assumed. The development has been designed to follow the principles of avoid and minimise by utilising cleared and degraded land where possible.

2.4 Assessment of Impacts

Section 8 of the BAM states that the SBDAR "*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 25** to **28** provide a summary of measures proposed to avoid and minimise direct, indirect, prescribed and residual impacts on biodiversity.

Table 25 – 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. 0.94ha native vegetation	The size and depth of the proposed lots has allowed for the proponent to retain 0.16ha of native vegetation. This area is to be managed as part of the proposed BMP. The remaining BMP land will include regeneration following the realignment of the existing mapped hydroline as part of the development footprint. Reinstating the natural channels within the unnamed creek would ensure the key hydrological features are present within the creek, and as a result improved water quality and habitat for both terrestrial and aquatic organisms will be provided. Landscaping within the development will utilise PCT 3433 and PCT 4044 native species suitable for future fauna use.	Operation and post-operation	Council Project coordinator	HR	MR
Threatened native vegetation	Pre-Construction and Construction	No threatened flora species have been identified on site, hence to impact.	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable
Habitat in the form of tree hollows	Pre-Construction and Construction	Removal of tree hollows providing habitat for native birds and mammals. No hollows were noted at the time of surveys.	If hollows are identified during preclearance surveys, all hollows removed during the clearing process will be replaced at a ratio of 2:1 with salvaged hollows and/or nest boxes in order to ensure no net loss of hollow resources to be installed within retained land by qualified ecologists and according to the *Habisure* system (Franks & Franks 2006) or similar. No hollow bearing trees were identified on site at the time of surveys.	Pre-Construction	Project coordinator Project Ecologist	HR	MR
Fauna home range and connectivity	Pre-Construction and Construction	Disturbance to fauna habitat during pre-operation clearing and construction.	Installation of a fauna-protecting fence, including relevant signage, to create a fauna protection zone which coincides with the tree protection zone. A permanent fence should be installed once construction of the new development is complete.	Pre-, during and post-operation	Project coordinator Construction staff Site manager Project Ecologist	HR	LR
	Operation	Reduction in connectivity	The size and depth of the proposed lots has allowed for the proponent to retain 0.16ha of native vegetation. This area is to be managed as part of the proposed BMP. The remaining BMP land will include regeneration following the realignment of the existing mapped hydroline as part of the development footprint. Reinstating the natural channels within the unnamed creek would ensure the key hydrological features are present within the creek, and as a result improved water quality and habitat for both terrestrial and aquatic organisms will be provided. Landscaping within the development will utilise PCT 3433 and PCT 4044 native species suitable for future fauna use. The proposed mitigation measures will ensure urban connectivity is maintained within the proposed Subject Site.	Pre-, during and post-operation	Council Project coordinator Ecologists	MR	LR
Reduction of biodiversity values	Pre-Construction, Construction and Operation	Removal of approx. 0.94ha native vegetation	The size and depth of the proposed lots has allowed for the proponent to retain 0.16ha of native vegetation. This area is to be managed as part of the proposed BMP. The remaining BMP land will include regeneration following the realignment of the existing mapped hydroline as part of the development footprint. Reinstating the natural channels within the unnamed creek would ensure the key hydrological features are present within the creek, and as a result improved water quality and habitat for both terrestrial and aquatic organisms will be provided. Landscaping within the development will utilise PCT 3433 native species suitable for future fauna use. The proposed mitigation measures will ensure urban connectivity is maintained within the proposed Subject Site.	Pre- and during-operation	Project coordinator Construction staff Site manager Project Ecologist	HR	LR

Aspect	Project Phase	Potential Impact	Mitigation	Timing	Responsibility	Risk before mitigation	Risk after mitigation
	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. Where practical, clearing and excavation will be restricted to drier periods.	During development	Project coordinator Construction staff Site manager Project Ecologist	MR	LR
		Change in stream flow and structure	Incorporation of Water Sensitive Urban Design (WSUD) principles within stormwater infrastructure is to occur to minimise hydrology changes. Reinstating the natural channels within the unnamed creek would ensure the key hydrological features are present within the creek, and as a result improved water quality and habitat for both terrestrial and aquatic organisms will be provided.	During development and Operational	Project coordinator Construction staff Site manager Project Ecologist	MR	LR

Table 26 – 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	Human-made structures are present on site. However, no evidence of use by threatened species was identified. Present within the site are areas containing log piles, rubbish, and infrastructure such as shedding. No other features of geological significance supporting threatened species and ecological communities are present.	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	No additional reduction in connectivity is proposed within the development due to connectivity already being very limited. The size and depth of the proposed lots has allowed for the proponent to retain 0.16ha of native vegetation. This area is to be managed as part of the proposed BMP. The remaining BMP land will include regeneration following the realignment of the existing mapped hydroline as part of the development footprint. Reinstating the natural channels within the unnamed creek would ensure the key hydrological features are present within the creek, and as a result improved water quality and habitat for both terrestrial and aquatic organisms will be provided. Landscaping within the development will utilise PCT 3433 and PCT 4044 native species suitable for future fauna use. The proposed mitigation measures will ensure urban connectivity is maintained within the proposed Subject Site.	Pre-operation and operation	Council Project coordinator Project Ecologist	MR	LR
Movement of threatened species that maintains their lifecycle	Construction and operation	Vegetation clearing and resulting habitat clearing are unlikely to affect movement of threatened species due to the absence of evidence of site use by such species. Retention of native vegetation will continue to support connectivity for highly mobile species. Reinstating the natural channels within the unnamed creek would ensure the key hydrological features are present within the creek, and as a result improved water quality and habitat for both terrestrial and aquatic organisms will be provided.	Pre-operation and operation	Council Project coordinator Project Ecologist	MR	LR
Water quality, water bodies and hydrological processes that sustain threatened species and threatened ecological communities	Construction and operation	The development footprint includes the realignment of the existing mapped hydroline that will be revegetated and managed under a BMP. Reinstating the natural channels within the unnamed creek would ensure the key hydrological features are present within the creek, and as a result improved water quality and habitat for both terrestrial and aquatic organisms will be provided.	Not applicable	Not applicable	Not applicable	Not applicable

Subject of Prescribed Impact	Project Phase	Mitigation	Timing	Responsibility	Risk before mitigation	Risk after mitigation
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 and 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 limits as well as speed limiting devices on the precinct's roads.	Pre-operation and operation	Project coordinator Construction staff Site manager Project Ecologist	HR	MR

Table 27 – Indirect Impact Assessment

Aspect	Project Phase	Potential Impact	Mitigation	Timing	Responsibility	Risk before mitigation	Risk after mitigation
Noise	Pre-operation and Construction	Noise during construction due to clearing works and related vehicular 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.	Pre-operation and Operation	Project coordinator Construction staff Site manager	HR	MR
	Operation	Noise due to traffic. Potential disturbance to threatened species within the surrounding area.	Suitable fencing to be installed and maintained between development and retained lands to prevent access and reduce potential interaction with threatened species. Standard residential speed limits should apply which would limit traffic noise.	During operations and Operational	Civil Contractor	MR	LR
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: • Daily monitoring of dust generated by construction activities; and • Dust suppression measures (setting maximum speed limits and application of dust suppressants) will be implemented during construction works to limit dust on site.	During construction	Project coordinator Site manager Construction staff	LR	LR
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. Light-sensitive threatened species are unlikely to occur on site.	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	MR	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: • 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 deter access and degradation of retained lands.	During operations	Civil Contractor	LR	LR

Table 28 – 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	Clearing of 0.94ha of native vegetation	The Subject Site has been located so as to avoid most areas of higher biodiversity values. It is therefore considered to be situated in an optimal part of the parent lot. The retention of 0.16ha of native vegetation be managed as part of the proposed BMP. The remaining BMP land will include regeneration following the realignment of the existing mapped hydroline as part of the development footprint. Reinstating the natural channels within the unnamed creek would ensure the key hydrological features are present within the creek, and as a result improved water quality and habitat for both terrestrial and aquatic organisms will be provided.	PCT 3328 – 0.03ha PCT 3433 – 0.07ha PCT 4042 – 0.13ha PCT 4044 – 0.68ha	Yes
		Removal of HBTs with potential for use by fauna – Not Applicable	Installation of nest boxes, as well as any recovered hollows in the Subject Site to be installed within retained lands in the broader parent lot.		Not applicable
Noise, dust, light spill	Pre-operation and Operation	Disturbance to local fauna	Implementation of Light Sensitive urban design to limit light spill into retained and surrounding vegetation. Application of CEMP/BMP as mentioned above.	Noise, dust and light spill will still occur but a low magnitude, thus keeping the impact on local fauna to a low level	No

Table 29 – Risk Matrix

Maximum reasonable consequence	Probability A	B	C	D	E
1	CR	CR	HR	HR	MR
2	CR	HR	HR	MR	LR
3	HR	HR	MR	LR	LR
4	HR	MR	LR	LR	LR
5	MR	LR	LR	LR	LR

CRITICAL	CR
HIGH RISK	HR
MEDIUM RISK	MR
LOW RISK	LR

Table 30 – 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)

2.5 Summary of Potential Impacts on Biodiversity

2.5.1 Prescribed Impacts Requiring Offsetting

Credit offsets are required due to the VISs for the remnant vegetation present on site being above lower threshold limits. Potential for Serious and Irreversible Impacts was surveyed and assessed but not found to be likely to occur.

2.5.2 Serious and Irreversible Impacts (SAIIs)

Candidate SAII species 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 (DPE 2020).

The following candidate SAII species were predicted as potentially occurring within the Subject Site:

- *Rhodamnia rubescens* - Scrub Turpentine; and
- *Rhodomyrtus psidioides* - Native Guava.

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 PCT present on site as well as BioNet Atlas records from the locality and where potential habitat was present within or near the Subject Site.

No additional candidate species were included due to the lack of BioNet records and lack of mapped important areas in the locality.

As per **Section 1.5** of this report the following species were able to be removed from the assessment due to various constraints (refer to **Table 19**) and no further assessment of these species was required. These species included:

- *Anthochaera phrygia* - Regent Honeyeater;
- *Calidris ferruginea* - Curlew Sandpiper;
- *Calidris tenuirostris* - Great Knot;
- *Lathamus discolor* - Swift Parrot;
- *Miniopterus australis* - Little Bent-winged Bat; and
- *Miniopterus orianae oceanensis* - Large Bent-winged Bat.

2.5.3 Vegetation Clearance Requiring Offsetting

The development would result in impact to an area of approx 25.91ha, incldin the loss of approx. 0.94ha of native vegetation. A total of 0.16ha of native vegetation will be retained on site and be managed under a BMP, with the remaining BMP land being revegetated following realignment of hydroline.

2.5.4 Vegetation Clearance Not Requiring Offsetting

Vegetation clearance not requiring offsetting includes approx.. 23.94ha of planted native *Cynodon dactylon* and approx. 1.03ha exotic / cleared / existing infrastructure.

2.5.5 Impacts requiring offset

2.5.5.1 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 two (2) PCTs entered for assessment along with the required credit outputs are provided in **Table 31**. As per section 1.3.9, PCT 3328 and PCT 4042 were not assessed as individual zones, and the areas (in ha) of those zones were combined with that of PCT 4044 to ensure all vegetation proposed for clearing was accounted for. A total of 11 ecosystem credits are incurred to offset the proposed development. Impact areas requiring offset are shown in **Figure 7**.

Table 31 – Ecosystem Credit Requirements

Vegetation Zone	Condition	Impact Area (ha)	Future VIS	Vegetation Integrity Score Loss	Biodiversity Risk Weighting	Credit Requirements
PCT 3433	Degraded	0.07	0	-33.5	2	1
PCT 4044	Highly Degraded	0.87	0	-23.4	2	10
Total		**0.94**	**0**			**11**

Discrepancies in decimals due to rounding on the BAM-C

2.6 Biodiversity Credit Report

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

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 vegetation within the site was found to be commensurate with PCT 3328, PCT 3433, PCT 4042 and PCT 4044. The proposal will retain 0.16ha of native vegetation and will require impact to 0.94ha of native vegetation. As a result, a total of 11 Ecosystem Credits will be incurred to offset the residual impacts to native vegetation to achieve no net loss to biodiversity (refer **Table 31**).

Other legislation applicable to this development is addressed in **Appendix I.**

4.0 References

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Appendix A – BV Map

Department of Planning and Environment

Biodiversity Values Map and Threshold Report

This report is generated using the Biodiversity Values Map and Threshold (BMAT) tool. The BMAT tool is used by proponents to supply evidence to your local council to determine whether or not a Biodiversity Development Assessment Report (BDAR) is required under the Biodiversity Conservation Regulation 2017 (Cl. 7.2 & 7.3).

The report provides results for the proposed development footprint area identified by the user and displayed within the blue boundary on the map.

There are two pathways for determining whether a BDAR is required for the proposed development:

1. Is there Biodiversity Values Mapping?
2. Is the 'clearing of native vegetation area threshold' exceeded?

Biodiversity Values Map and Threshold Report

Date of Report Generation		25/07/2024 12:19 PM
1. Biodiversity Values (BV) Map - Results Summary (Biodiversity Conservation Regulation Section 7.3)		
1.1	**Does the development Footprint intersect with BV mapping?**	no
1.2	Was ALL BV Mapping within the development footprinted added in the last 90 days? (dark purple mapping only, no light purple mapping present)	no
1.3	**Date of expiry of dark purple 90 day mapping**	N/A
1.4	**Is the Biodiversity Values Map threshold exceeded?**	no
2. Area Clearing Threshold - Results Summary (Biodiversity Conservation Regulation Section 7.2)		
2.1	**Size of the development or clearing footprint**	243,609.9 sqm
2.2	**Native Vegetation Area Clearing Estimate (NVACE)** (within development/clearing footprint)	233,327.9 sqm
2.3	**Method for determining Minimum Lot Size**	LEP
2.4	**Minimum Lot Size** (10,000sqm = 1ha)	450 sqm
2.5	**Area Clearing Threshold** (10,000sqm = 1ha)	2,500 sqm
2.6	**Does the estimate exceed the Area Clearing Threshold?** (NVACE results are an estimate and can be reviewed using the Guidance)	yes

REPORT RESULT: Is the Biodiversity Offset Scheme (BOS) Threshold exceeded for the proposed development footprint area? (Your local council will determine if a BDAR is required)	**yes**

What do I do with this report?

• If the result above indicates the BOS Threshold has been exceeded, your local council may require a Biodiversity Development Assessment Report with your development application. Seek further advice from Council. An accredited assessor can apply the Biodiversity Assessment Method and prepare a BDAR for you. For a list of accredited assessors go to: https://customer.lmbc.nsw.gov.au/assessment/AccreditedAssessor.

• If the result above indicates the BOS Threshold has not been exceeded, you may not require a Biodiversity Development Assessment Report. This BMAT report can be provided to Council to support your development application. Council can advise how the area clearing threshold results should be considered. Council will review these results and make a determination if a BDAR is required. Council may ask you to review the area clearing threshold results. You may also be required to assess whether the development is '"likely to significantly affect threatened species" as determined under the test in Section 7.3 of the *Biodiversity Conservation Act 2016*.

• If a BDAR is not required by Council, you may still require a permit to clear vegetation from your local council.

• If all Biodiversity Values mapping within your development footprint was less than 90 days old, i.e. areas are displayed as dark purple on the BV map, a BDAR may not be required if your Development Application is submitted within that 90 day period. Any BV mapping less than 90 days old on this report will expire on the date provided in Line item 1.3 above.

For more detailed advice about actions required, refer to the Interpreting the evaluation report section of the Biodiversity Values Map Threshold Tool User Guide .

Review Options:

• If you believe the Biodiversity Values mapping is incorrect please refer to our BV Map Review webpage for further information.

• If you or Council disagree with the area clearing threshold estimate results from the NVACE in Line Item 2.6 above (i.e. area of Native Vegetation within the Development footprint proposed to be cleared), review the results using the Guide for reviewing area clearing threshold results from the BMAT Tool.

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: _____

(Typing your name in the signature field will be considered as your signature for the purposes of this form)

25/07/2024 12:19 PM

Biodiversity Values Map and Threshold Tool

The Biodiversity Values (BV) Map and Threshold Tool identifies land with high biodiversity value, particularly sensitive to impacts from development and clearing.

The BV map forms part of the Biodiversity Offsets Scheme threshold, which is one of the factors for determining whether the Scheme applies to a clearing or development proposal. You have used the Threshold Tool in the map viewer to generate this BV Threshold Report for your nominated area. This report calculates results for your proposed development footprint and indicates whether Council may require you to engage an accredited assessor to prepare a Biodiversity Development Assessment Report (BDAR) for your development.

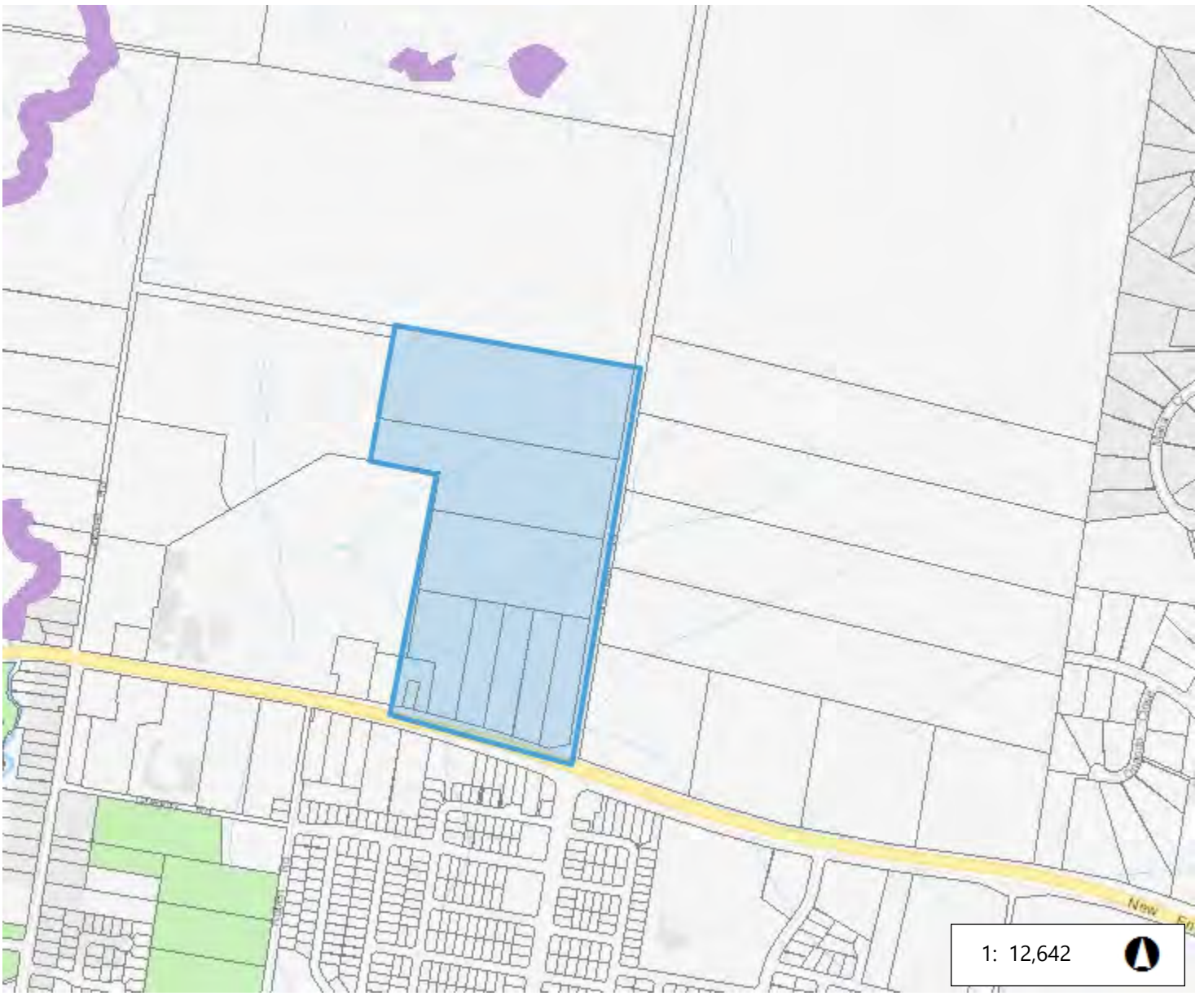
This report may be used as evidence for development applications submitted to councils. You may also use this report when considering native vegetation clearing under the State Environmental Planning Policy (Biodiversity and Conservation) 2021 - Chapter 2 vegetation in non-rural areas.

What's new? For more information about the latest updates to the Biodiversity Values Map and Threshold Tool go to the updates section on the Biodiversity Values Map webpage.

Map Review: Landholders can request a review of the BV Map where they consider there is an error in the mapping on their property. For more information about the map review process and an application form for a review go to the Biodiversity Values Map Review webpage.

If you need help using this map tool see our Biodiversity Values Map and Threshold Tool User Guide or contact the Map Review Team at map.review@environment.nsw.gov.au or on 1800 001 490.

Biodiversity Values Map



642.2 0 321.10 642.2 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.

Legend

- Biodiversity Values that have been mapped for more than 90 days
- Biodiversity Values added within last 90 days
- Native Vegetation Area Clearing Estimate (NVACE)
- Development area selected by proponent

25/07/2024 12:19 PM

The results provided in this tool are generated using the best available mapping and knowledge of species habitat requirements.

This map is valid as at the date the report was generated. Checking the Biodiversity Values Map viewer for mapping updates is recommended.

Appendix B – Development Plan

240332-MP-005-R

1
DP65706

2
DP818314

11
DP1219648

1
DP743130

227
DP246447

226
DP246447

225
DP246447

223
DP246447

224
DP246447

STAGE 13 FRONTAGE OF WYNDELLA ROAD UPGRADE SUBJECT TO SEPARATE APPROVAL

ROAD WIDENING

TEMPORARY BASIN 2

EXISTING PIPELINE EASEMENT

ROAD WIDENING

ROAD WIDENING

STAGE 1
STAGE 2
STAGE 3
STAGE 4
STAGE 5
STAGE 6
STAGE 7
STAGE 8
STAGE 9
STAGE 10
STAGE 11
STAGE 12
STAGE 13
STAGE 14

FUTURE PARK 1
SUBJECT TO FUTURE DA
230

FUTURE PARK 2
SUBJECT TO FUTURE DA
422

BASIN 1
1401

RIPARIAN CORRIDOR
231

WYNDELLA ROAD

NEW ENGLAND HIGHWAY

LEGEND

- SITE BOUNDARY
- PROPOSED BOUNDARY
- PROPOSED STAGE BOUNDARY
- STAGE 1 - 27 LOTS
- STAGE 2 - 29 LOTS + PARK & RIPARIAN CORRIDOR
- STAGE 3 - 23 LOTS
- STAGE 4 - 21 LOTS + PARK
- STAGE 5 - 17 LOTS
- STAGE 6 - 19 LOTS
- STAGE 7 - 16 LOTS
- STAGE 8 - 16 LOTS
- STAGE 9 - 20 LOTS
- STAGE 10 - 22 LOTS
- STAGE 11 - 20 LOTS
- STAGE 12 - 11 LOTS
- STAGE 13 - 17 LOTS
- STAGE 14 - BASIN LANDSCAPING

NOTES:

BASIN 1 IS TO CONSTRUCTED WITHIN STAGE 1. LANDSCAPING AND DEDICATED OF THE BASIN AS DRAINAGE RESERVE IS TO OCCUR IN THE SUBSEQUENT STAGES OF THE PROPOSAL

THE STAGING IN THIS PLAN MAY BE UNDERTAKEN OUT OF NUMERICAL ORDER.

GDA2020

SHEET 1 OF 4

ver.	date	comment	drawn	pm	level information	scale (A1 original size)	notes
R	17/06/2024	MINOR CHANGE	AM	MLO	DATUM: N/A CONTOUR INTERVAL: N/A	A1 1:1250 — 0 25.0 50.0 62.5m — A3 1:2500	

drawing title:

PROPOSED SUBDIVISION PLAN STAGING

location: NEW ENGLAND HWY & WYNDELLA ROAD, LOCHINVAR

council: MAITLAND CITY COUNCIL

dwg ref: 240332-MP-005-R

client: CPG ESTATES

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240332-MP-005-R

1
DP65706

2
DP818314

227
DP246447

226
DP246447

225
DP246447

11
DP1219648

WYNDELLA ROAD

STAGE 4
422
5010m²
PUBLIC RESERVE
FUTURE PARK 2
SUBJECT TO SEPARATE DA

STAGE 5
513 500m² | 512 504m² | 511 450m² | 510 450m²
405 504m² | 404 450m² | 403 450m² | 402 450m² | 401 450m²

STAGE 6
406 505m² | 407 450m² | 408 450m² | 409 511m² | 410 450m² | 411 450m² | 412 511m² | 413 450m²
414 501m² | 415 562m² (499m² EXCL HANDLE) | 416 450m² | 417 450m² | 418 450m² | 419 480m²
614 450m² | 613 511m² | 611 493m²

STAGE 7
706 559m² | 707 560m² (500m² EXCL HANDLE) | 705 450m² | 704 450m² | 703 450m² | 702 450m² | 701 925m²
615 450m² | 616 450m² | 617 511m² | 618 450m²
420 500m² | 421 450m² | 708 450m² | 709 508m² | 710 591m² | 711 450m² | 712 472m² | 713 484m²
517 494m² | 516 504m² | 515 450m² | 514 450m² | 801 504m²
714 452m² | 715 450m² | 716 700m²

STAGE 8
805 621m² | 804 450m² | 803 450m² | 802 570m²
TEMPORARY BASIN 2

STAGE 9
816 724m² | 815 592m² | 814 450m² | 813 450m² | 812 521m² | 811 450m² | 810 450m² | 809 521m² | 808 450m² | 807 450m² | 806 450m²
910 500m² | 909 561m² | 908 512m² | 907 512m² | 906 450m² | 905 450m² | 904 512m² | 903 512m² | 902 450m² | 901 450m²

STAGE 10
911 500m² | 912 450m² | 913 505m² | 914 450m² | 915 511m² | 916 511m² | 917 450m² | 918 511m² | 919 511m² | 920 450m²
1013 518m² | 1014 450m² | 1015 450m² | 1016 450m² | 1017 511m² | 1018 450m² | 1019 450m² | 1020 511m² | 1021 450m² | 1022 450m²
1012 510m² | 1011 450m² | 1010 450m² | 1009 450m² | 1008 501m² | 1007 450m² | 1006 450m² | 1005 450m² | 1004 541m² | 1003 450m² | 1002 450m² | 1001 450m²
1111 561m² | 1110 450m² | 1109 450m² | 1108 450m² | 1107 590m² | 1106 450m² | 1105 450m² | 1104 590m² | 1103 450m² | 1102 540m² | 1101 500m²

STAGE 11
1112 504m² | 1113 511m² | 1114 511m² | 1115 450m² | 1116 450m² | 1117 511m² | 1118 511m² | 1119 482m² | 1120 450m²
1317 541m² | 1316 450m² | 1207 450m² | 1206 450m² | 1205 519m² | 1204 450m² | 1203 450m² | 1202 450m² | 1201 450m²

STAGE 12
1211 533m²
1301 450m² | 1302 450m² | 1303 450m² | 1304 493m²

STAGE 13
1314 464m² | 1315 535m² | 1313 450m² | 1312 450m² | 1311 450m² | 1310 454m²
1208 450m² | 1209 515m² | 1210 465m² | 1307 645m² (534m² EXCL HANDLE) | 1306 585m² (487m² EXCL HANDLE)
1309 457m² | 1308 452m² | 1305 677m²

LURA ROAD WIDENING 129.5m²

AURA ROAD WIDENING 32.4m²

GDA2020

SHEET 2 OF 4

ver.	date	comment	drawn	pm	co-ordinate information	level information	scale (A1 original size)	notes
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drawing title:
PROPOSED SUBDIVISION PLAN
DETAIL SHEET

location: NEW ENGLAND HIGHWAY, LOCHINVAR
council: MAITLAND CITY COUNCIL
dwg ref: 240332-MP-005-R
client: CPG ESTATES

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240332-MP-005-R

STAGE 7

STAGE 5

STAGE 4

STAGE 3

STAGE 2

STAGE 1

422
5010m²
PUBLIC RESERVE
FUTURE PARK 2
SUBJECT TO SEPARATE DA

1401
5325m²
DRAINAGE RESERVE
BASIN 1

WYNDELLA ROAD

AURA
ROAD WIDENING
1939m²

EXISTING PIPELINE
EASEMENT

11
DP1219648

226
DP246447

225
DP246447

224
DP246447

GDA2020

SHEET 3 OF 4

ver.	date	comment	drawn	pm	co-ordinate information	level information	scale (A1 original size)	notes
R	17/06/2024	MINOR CHANGE	AM	ML	CO-ORDINATE SYSTEM: MGA56	DATUM: N/A CONTOUR INTERVAL: N/A	0 15.0 30.0m SCALE: 1:600 (FULL)	

drawing title:
PROPOSED SUBDIVISION PLAN
DETAIL SHEET

location: NEW ENGLAND HIGHWAY, LOCHINVAR

council: MAITLAND CITY COUNCIL

dwg ref: 240332-MP-005-R

client: CPG ESTATES

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Plotted By: Generalw Plot Date: 18/07/24 8:40:11 PM Cad File: N:\240332\DWG\PLANNING\MP\240332-MP-005-R.DWG

This plan includes coloured information. If you have a black and white copy you do not have all of the information. This note is coloured RED.

240332-MP-005-R

STAGE 1

STAGE 14

1401
5325m²

DRAINAGE RESERVE
BASIN 1

RIPARIAN CORRIDOR

231
14961m²

STAGE 2

230
5102m²

PUBLIC RESERVE
FUTURE PARK 1
SUBJECT TO SEPARATE DA

PUBLIC RESERVE

11
DP1219648

1
DP743130

224
DP246447

223
DP246447

WYNDELLA ROAD

AURA
ROAD WIDENING
1939m²

LURA
ROAD WIDENING
820.7m²

NEW ENGLAND HIGHWAY

GDA2020

SHEET 4 OF 4

ver.	date	comment	drawn	pm	co-ordinate information	level information	scale (A1 original size)	notes
R	17/06/2024	MINOR CHANGE	AM	ML	CO-ORDINATE SYSTEM: MGA56	DATUM: N/A CONTOUR INTERVAL: N/A	0 15.0 30.0m SCALE: 1:600 (FULL)	

drawing title:
PROPOSED SUBDIVISION PLAN
DETAIL SHEET

location: NEW ENGLAND HIGHWAY, LOCHINVAR

council: MAITLAND CITY COUNCIL

dwg ref: 240332-MP-005-R

client: CPG ESTATES

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Appendix C – Riparian Assessment

AEP

BIODIVERSITY | BUSHFIRE | ARBORICULTURE

NEWCASTLE SYDNEY

Riparian Assessment Report

898 New England Hwy, 25 Wyndella Rd and 39 Wyndella Rd Lochinvar, NSW

Prepared for: Lochinvar Developments Pty Ltd

C/- ADW Johnson Pty Ltd

AEP Ref: 2699

Revision: 01

July 2024

Newcastle | Sydney
10 Darvall St Carrington 2294 | 275 Stanmore Rd Petersham 2049
P 0420 624 707 E info@andersonep.com.au ABN 57 659 651 537

Document Control

Document Name	Riparian Assessment Report for 898 New England Hwy, 25 Wyndella Rd and 39 Wyndella Rd Lochinvar, NSW
Project Number	2699
Client Name	Lochinvar Developments Pty Ltd C/- ADW Johnson Pty Ltd
AEP Project Team	Brendon Young Jarod Baxter Kathleen Bushell Chris Wark Natalie Black

Revision

Revision	Date	Author	Reviewed	Approved
00	26/06/2024	Jarod Baxter	Brendon Young	Natalie Black
01	19/07/2024	Jarod Baxter	Brendon Young	Natalie Black

Distribution

Revision	Date	Name	Organisation
00	26/06/2024	Matthew London	ADW Johnson Pty Ltd
01	19/07/2024	Matthew London	ADW Johnson Pty Ltd

Contents

Tables

Figures

Appendices

Abbreviations

API	Aerial Photography Interpretation
CAA	Controlled Activity Approval
DA	Development Application
DPI	NSW Department of Primary Industries
DPE	NSW Department of Planning and Environment
DPIE	The former NSW Department of Planning, Industry and Environment
LGA	Local Government Area
NEH	New England Highway
NRAR	Natural Resource Access Regulator
DCCEEW	NSW Department of Climate Change, Energy, the Environment and Water
SEED	Sharing and Enabling Environmental Data in NSW
SVTM	State Vegetation Type Mapping
VMP	Vegetation Management Plan
VRZ	Vegetated Riparian Zone
WFL	Waterfront Land
WFLT	Waterfront Land Tool
WM Act	*Water Management Act 2000*
WM Regulations	*Water Management (General) Regulation 2018*

1.0 Introduction

Anderson Environment & Planning was commissioned by ADW Johnson to undertake a Riparian Assessment Report (RAR) to determine the presence of Waterfront Land within the Subject Site. 'Waterfront land' is defined as the bed of any river, lake or estuary, and the land within 40 metres of the river banks, lake shore or estuary mean high-water mark (NSW Department of Planning, Industry and Environment, 2020).

This report has been prepared in accordance with NSW Department of Planning, Industry and Environment, Natural Resources Access Regulator, 2020, Waterfront Land Tool (WFLT). The WFLT was developed by the Department to assist applicants determine what is waterfront land under the controlled activity provisions of the Water Management Act 2000 (WM, Act) within a Subject Site.

The WFLT identifies waterfront land based on consideration of three key factors:

- The presence of defined bed and banks;
- Evidence of flow and geomorphic features; and
- A change in vegetation indicating a wetland.

The WFLT steps through a series of questions to ensure that the right information is assessed to determine the presence or absence of these features and whether the combination of features is indicative of waterfront land. The results of which allow an applicant to prepare ground-truthed map showing the location of waterfront land to inform the required Vegetated Riparian Zones (VRZs) for the Controlled Activities Approval (CAA).

AEP has undertaken the desktop and field assessment to prepare RAR to inform the requirements of a CAA for potential residential subdivisions at 898 New England Hwy, 25 Wyndella Rd and 39 Wyndella Rd Lochinvar, NSW, refer **Figure 1**.

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

> Anderson Environment & Planning (2024). *Riparian Assessment Report for 898 New England Hwy, 25 Wyndella Rd and 39 Wyndella Rd Lochinvar, NSW.* Unpublished report for ADW Johnson.

2.0 Site Particulars

Table 1 – Site Details

Detail	Comments
Client	ADW Johnson
Address	898 New England Hwy, 25 Wyndella Rd and 39 Wyndella Rd Lochinvar, NSW
Title(s)	Lot 2/DP 747391; Lot 3/DP 747391; Lot 4/DP 747391; Lot 5/DP 747391; Lot 6/DP 747391; Lot 12/DP 1219648; Lot 13/DP 1219648; and Lot 9/DP 747391.
Study Area	The Study Area encompasses the entirety of Lot 2/DP 747391; Lot 3/DP 747391; Lot 4/DP 747391; Lot 5/DP 747391; Lot 6/DP 747391; Lot 12/DP 1219648; Lot 13/DP 1219648; and Lot 9/DP 747391, and all upstream tributaries mapped by Water Management (General) Regulation 2018 hydroline spatial data 1.0 and associated Waterfront Land as defined by the *Water Management Act 2000* (**Figure 1**).
Subject Site	The Subject Site approx. 22.54ha, consists rural land currently being grazed. The vegetation is dominated by pasture grasses, exotics and weeds with remnant native vegetation dominate by scattered paddock trees
LGA	Maitland City Council
Zoning	C3 - Environmental Management: (pub. 21-4-2023) R1 - General Residential: (pub. 21-4-2023)
Current Land Use	The Study Area is a vacant, fenced lot consisting of unmanaged grassland and hydrolines, likely historically used as pasture.
NSW River Condition Index	This map describes the riverine condition. It is used to combine a range of indicators into a single condition score. The indicators include riparian vegetation, geomorphic condition, hydrologic stress, biodiversity, catchment disturbance and water quality. The Subject Site is mapped as “Very Poor”.
NSW River Styles Mapping	This map describes the physical characteristics and diversity of rivers and assesses geomorphic stream condition. It considers their capacity to adjust, sensitivity to change due to disturbance, and the pressures (natural and human) that affect their geomorphic condition. The Geomorphic stream condition of the Subject Site is mapped as “Poor”.
High Ecological Value Aquatic Ecosystem (HEVAE) Mapping	This map describes a range of instream values and their importance for NSW freshwater river reach. This includes values such as diversity, distinctiveness, naturalness and vital habitat. NSW HEVAE Instream Value is “Low” within the Subject Site.
Proposed Development	The proposed development includes a residential subdivision within the Lochinvar Urban Release Area.

AEP

Figure 1 - Site Location

Date: July 2024

Location: New England Hwy and Wyndella Rd, Lochinvar

Client: Lochinvar Developments Pty Ltd

AEP ref: 2699

3.0 Methodology

The WFLT requires assessment of both desktop and field components to determine the status of waterfront land.

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 and surrounding locality using the latest NSW Spatial Services (SIX Maps) and NearMap imagery, accessed May 2024;
- NSW Government (2018) *Determining Stream Order* Fact Sheet;
- *Water Management (General) Regulation 2018 Hydroline spatial data 1.0*, accessed May 2024 (refer **Appendix A**);
- SVTM v2.0 for native vegetation of southeast NSW; and
- Collective knowledge gained from previous ecological survey and assessment in the area over the past 30 years.

3.2 Desktop Assessment

The desktop assessment consists of a historical assessment and State mapping review to inform the report and established data for field assessment.

3.2.1 Historical Assessment

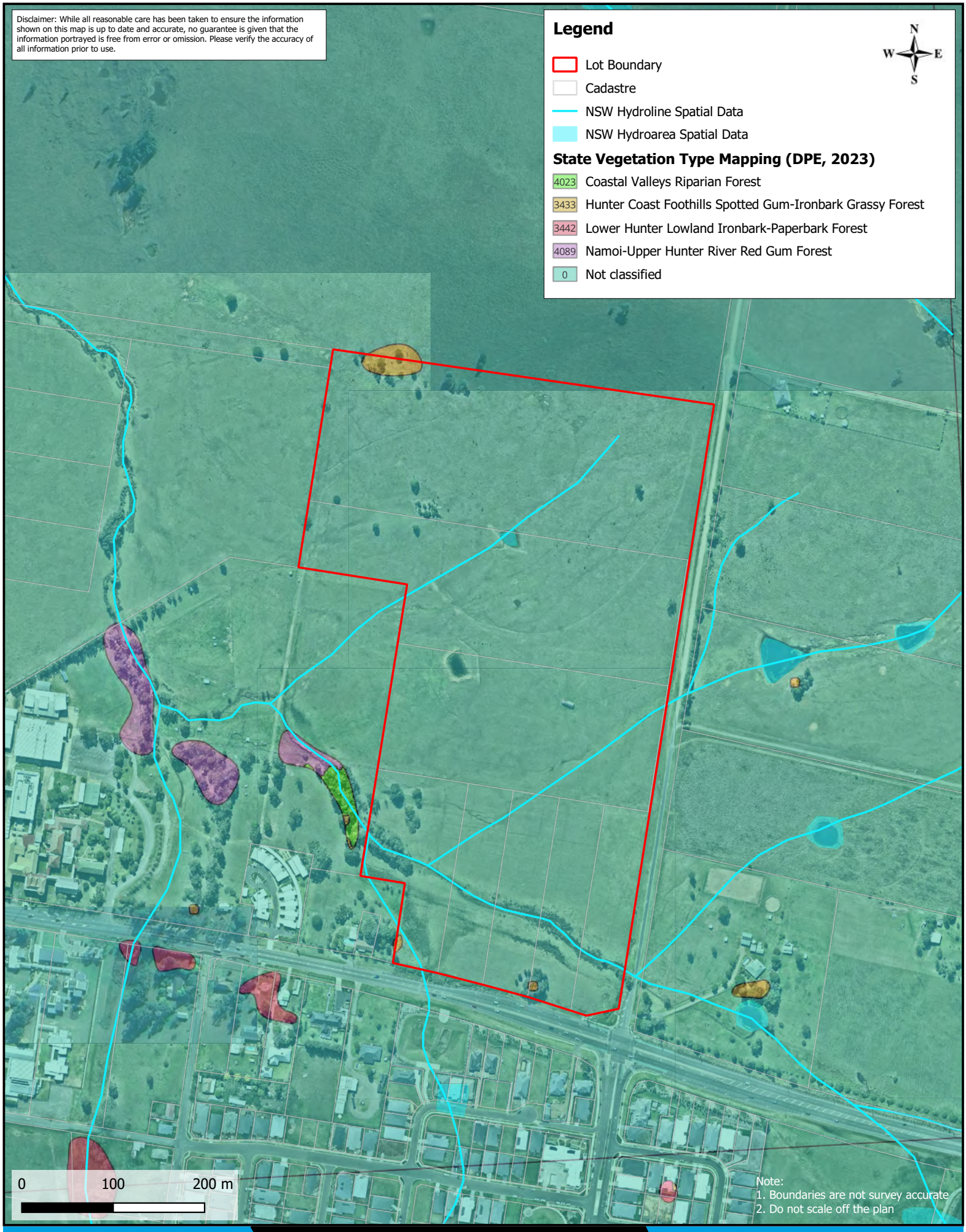
Review of historical API revealed a number of impacts to the mapped reach, upstream of the Subject Site, likely to influence the presence of waterfront land:

- The New England Highway was constructed bisecting the Study Area and channels water along road side swales were flow traverses the highway via a series of culverts;
- Larger urban developments on the southern side of the NEH have resulted in the construction of significant stormwater infrastructure including stormwater drainage systems, on-site detention systems and detention basins. A large detention basin collects water and discharge through culverts under the NEH within the Study Area; and
- Numerous farm dams have been historically constructed on mapped hydrolines throughout the reach Study Area.

3.2.2 State Mapping Review

AEP undertook a detailed assessment of the current State mapping programs where the following was determined and used to establish the field proforma for the Subject Site:

- STVM v2.0 accessed via the SEED Portal (May 2024) was utilised to identify vegetation communities occurring within the Subject Site (**Figure 2**);
- *Water Management (General) Regulation 2018 Hydroline spatial data 1.0* was used to show Strahler Stream Order in accordance with Schedule 2 of the *Water Management (General) Regulation 2018* (**Figure 3**); and
- The literature review, historical assessment and the Strahler Stream ordering is used to establish the survey sites and allocate segments for assessment in the field (**Figure 4**).



AEP

Figure 2 - State Vegetation Type Mapping (DEP, 2023) Date: July 2024

Location: New England Hwy and Wyndella Rd, Lochinvar

Client: Lochinvar Developments Pty Ltd AEP ref: 2699

AEP

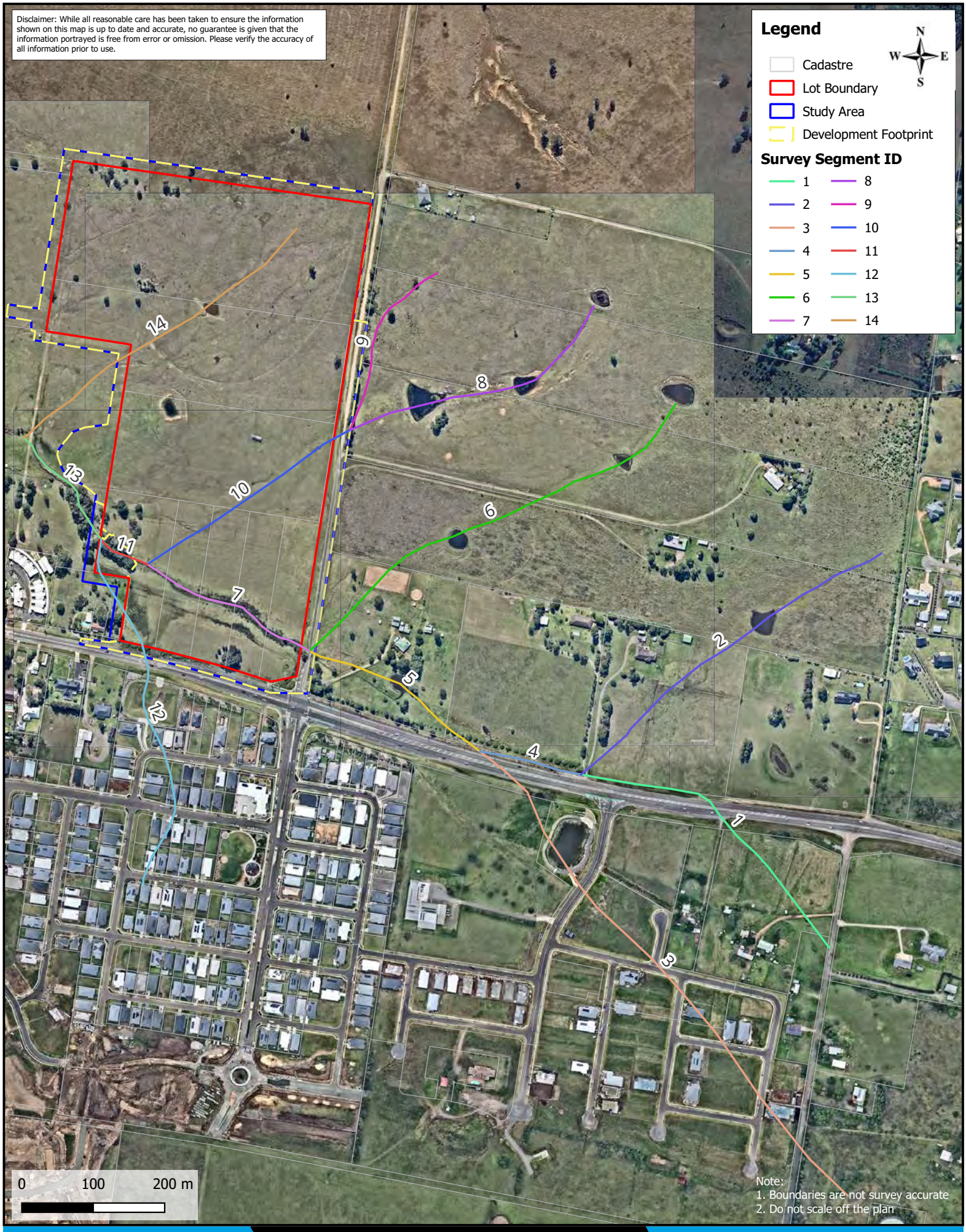
Figure 3 - NSW Hydroline Data

Date: July 2024

Location: New England Hwy and Wyndella Rd, Lochinvar

Client: Lochinvar Developments Pty Ltd

AEP ref: 2699



AEP

Figure 4 - Hydroline Segment ID

Date: July 2024

Location: New England Hwy and Wyndella Rd, Lochinvar

Client: Lochinvar Developments Pty Ltd

AEP ref: 2699

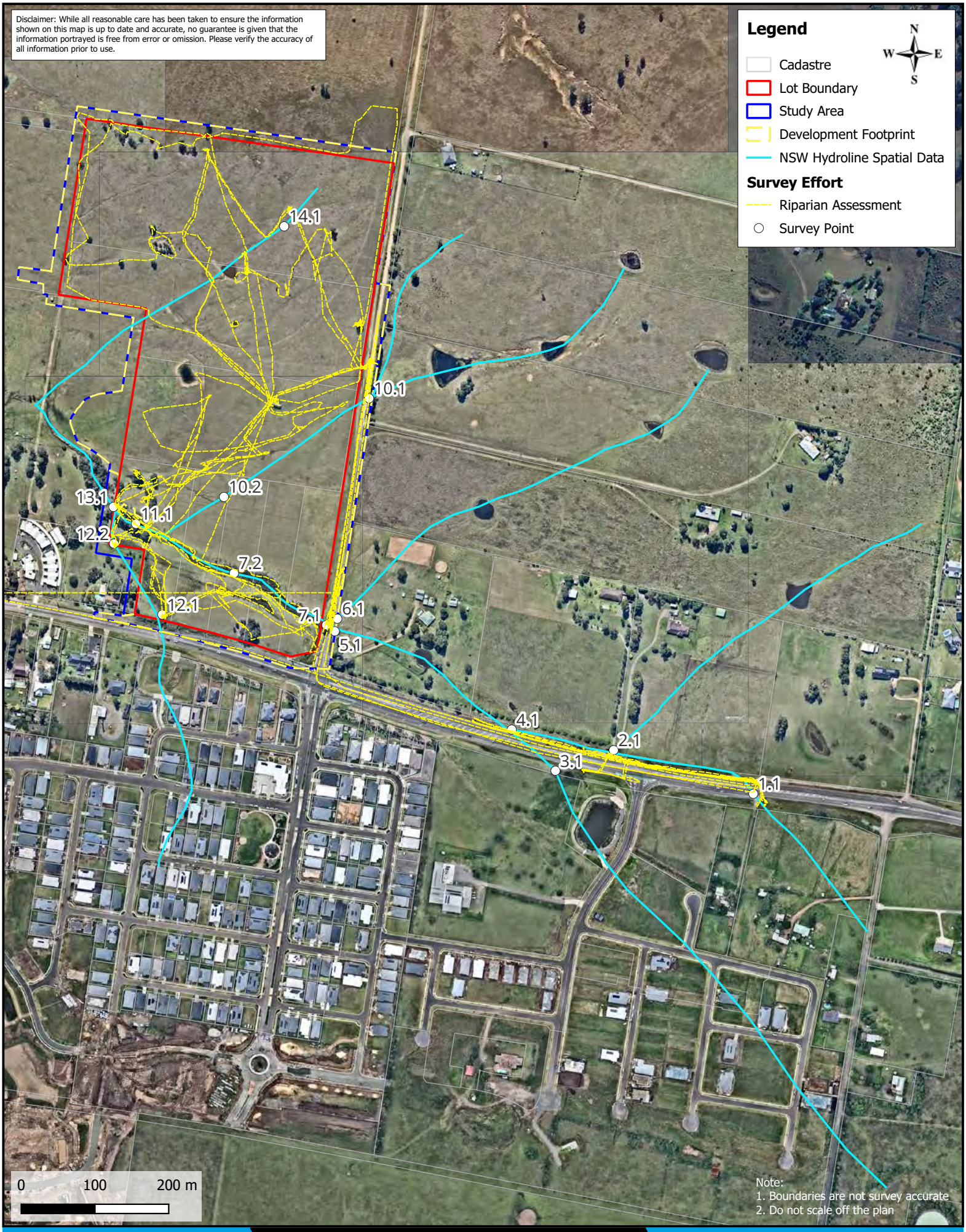
3.3 Site Assessment

The mapped hydrolines within the Subject Site were assigned individual Segment ID numbers (refer **Figure 4**) and assessed at various survey points with the mapped WFLT.

Desktop stream order indicated two (2) 1st order streams two (2) 2nd order streams and one (1) 3rd order stream was mapped within the Study Area. As a result, fifteen (15) hydroline segments and eighteen (18) survey points were identified for investigation. General observations outside of the Subject Site were undertaken to assess the hydrolines in the broader locality (refer **Figure 5** for survey effort). Investigations for streams outside of the Subject Site consist of roadside visual inspections and further desktop analysis.

The following data was collected at each Survey Point in accordance with the WFLT to ground-truth desktop level assessments:

- Identification of defined bed and banks;
- The location of the top of bank and high bank;
- Identification of the type of watercourse present;
- Determine and notate watercourse features;
- Determine presence of any Lakes or Wetlands; and
- Determine and notate any changes in vegetation communities indicating the presence of a wetland.



AEP

Figure 5 - Survey Effort

Date: July 2024

Location: New England Hwy and Wyndella Rd, Lochinvar

Client: Lochinvar Developments Pty Ltd

AEP ref: 2699

4.0 Site Assessment Results

Fieldwork was conducted on 23rd and 30th August 2022 and the 20th May 2024 to assess desktop determined Survey Points with the WFLT.

Site investigations to ground-truth waterfront land for the purpose of determining appropriate Vegetated Riparian Zones (VRZs) based on current hydrology and geomorphology identified some variation from the mapped hydrolines and stream order. Results of the WFLT site assessment are provided in **Tables 2-16**.

Table 2 – Segment ID 1 Riparian Assessment

Task – Waterland Tool (2020)	Assessment	Comments (provide evidence)	Figures
Desktop Assessment – Survey Point 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	The Subject Site is not located in a nominated shaded area, and is not exempt from Controlled Activity Approval.	1
Is your property within the shaded area on the NRAR Map—Western land map local government area? (Appendix 2- NRAR Guidelines, 2020)	No	The site location is Maitland LGA, which is excluded from the Western Land map.	1
Is there a watercourse visible on your property?	Yes	Yes, NSW Hydroline Spatial Data 1.0 indicates there is one (1) hydroline within the Subject Site and an additional twenty (20) hydroline segments within the upstream reach (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 wetlands or lakes are within 40m of the Subject Site.	3
Using the Determining Stream Order fact sheet (Appendix 4 - NRAR Guidelines, 2020) and the NSW Hydro Line Spatial Data Map, what is the stream order of your watercourse?	1	Based on the desktop assessment, Segment ID 1 is mapped as a 1st order stream.	3
Field Assessment – Survey Point 1.1			
Defined Bed and Banks (Yes / No)	No	No defined bed and bank visible	6
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		6
Watercourse Feature Present (Pool, Riffle, Erosion and Deposition, Inside and Outside bend)	None	No watercourse features present	-
Lakes or Wetlands (Appendix 3 - NRAR Guidelines, 2020)	No		-
Change in Vegetation Present to Indicate Wetlands (Appendix 7 - NRAR Guidelines, 2020)	No	No change in vegetation indicating wetlands.	-
High Bank (Appendix 8 - NRAR Guidelines, 2020)	No		-

Task – Waterland Tool (2020)	Assessment	Comments (provide evidence)	Figures
Ground-truthed Waterfront Land present?	No	The survey did not identify a defined bed and bank, or watercourse features as described in Appendix 6 of the Waterfront Land Tool. This survey point does not constitute waterfront land.	6
Ground-truthed Numbering to Determine VRZ	N/A	Not applicable	6
Controlled Activity Approval Required (Y / N)	N/A	WFL does not occur at this survey point.	-
Vegetated Riparian Zone Required (m)	No	Not applicable	-
Comments	Segment 1 is mapped as a 1st order stream and the location is now occupied by a swale along the NEH. Urban development has altered the hydrological and geomorphological characteristics of the landscape. The inspection showed stormwater infrastructure through an urban environment. No WFL features, such as a defined bed and bank or a change in vegetation indicating a wetland were identified. Survey Point 1.1 does not constitute waterfront land.		

Site Photos – Survey Point 1.1

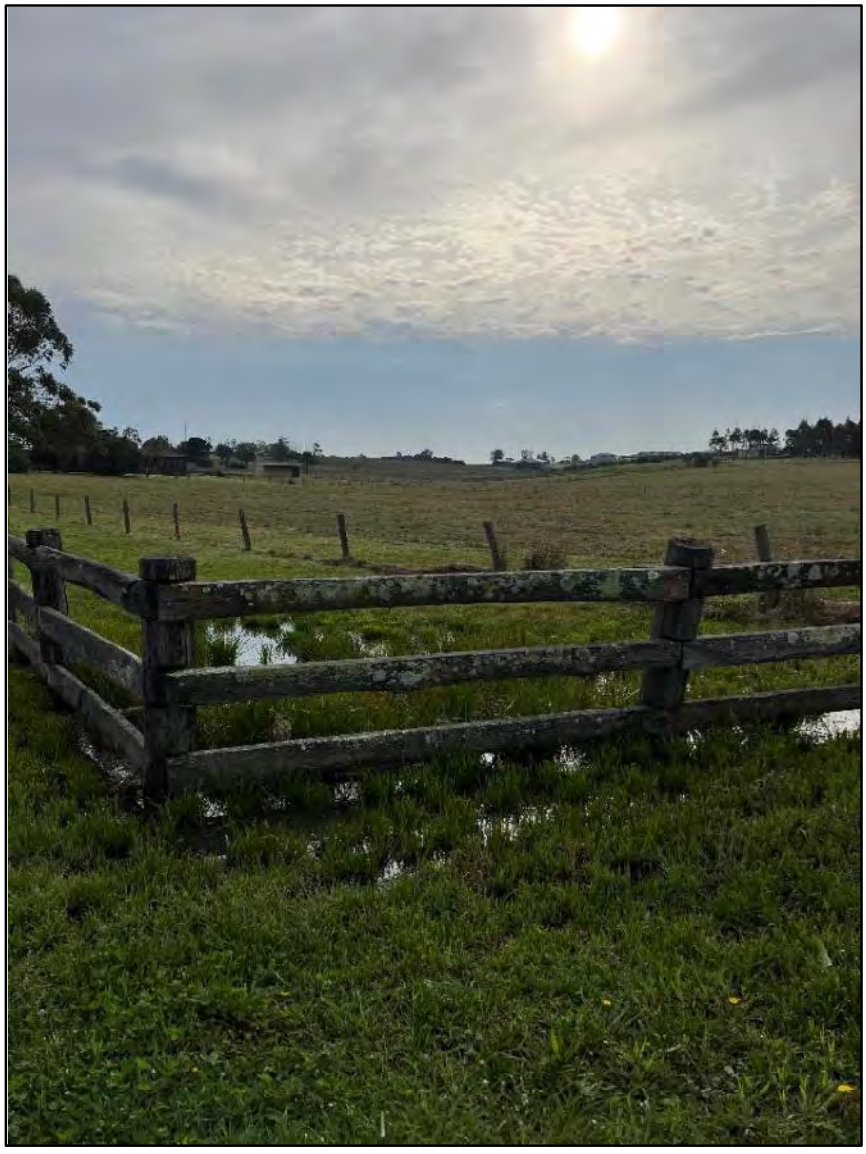
Survey Point 1.1

Table 3 - Segment ID 2 Riparian Assessment

Task – Waterland Tool (2020)	Assessment	Comments (provide evidence)	Figures
Desktop Assessment – Survey Point 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	The Subject Site is not located in a nominated shaded area, and is not exempt from Controlled Activity Approval.	1
Is your property within the shaded area on the NRAR Map—Western land map local government area? (Appendix 2- NRAR Guidelines, 2020)	No	The site location is Maitland LGA, which is excluded from the Western Land map.	1
Is there a watercourse visible on your property?	Yes	Yes, NSW Hydroline Spatial Data 1.0 indicates there is one (1) hydroline within the Subject Site and an additional twenty (20) hydroline segments within the upstream reach (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 wetlands or lakes are within 40m of the Subject Site.	3
Using the Determining Stream Order fact sheet (Appendix 4 - NRAR Guidelines, 2020) and the NSW Hydro Line Spatial Data Map, what is the stream order of your watercourse?	1	Based on the desktop assessment, Segment ID 2 is mapped as a 1st order stream.	3
Field Assessment – Survey Point 2.1			
Defined Bed and Banks (Yes / No)	No	No defined bed and bank visible	6
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		6
Watercourse Feature Present (Pool, Riffle, Erosion and Deposition, Inside and outside bend)	None	No watercourse features present	-
Lakes or Wetlands (Appendix 3 - NRAR Guidelines, 2020)	No		-
Change in Vegetation Present to Indicate Wetlands (Appendix 7 - NRAR Guidelines, 2020)	No	No change in vegetation indicating wetlands.	-
High Bank (Appendix 8 - NRAR Guidelines, 2020)	No		-
Ground-truthed Waterfront Land present?	No	The survey did not identify a defined bed and bank, or watercourse features as described in Appendix 6 of the Waterfront Land Tool. This survey point does not constitute waterfront land.	6
Ground-truthed Numbering to Determine VRZ	N/A	Not applicable	6

Task – Waterland Tool (2020)	Assessment	Comments (provide evidence)	Figures
Controlled Activity Approval Required (Y / N)	N/A	WFL does not occur at this survey point.	-
Vegetated Riparian Zone Required (m)	No	Not applicable	-
Comments	Segment 2 is mapped as a 1st order stream. No WFL features, such as a defined bed and bank, or a change in vegetation indicating a wetland were identified. A farm dam is visible on aerial photography north east of Survey Point 2.1, and likely historical land use for agriculture has altered the surface hydrology and geomorphology of the mapped hydroline. Survey Point 2.1 does not constitute waterfront land.		

Site Photos – Survey Point 2.1



Survey Point 2.1 - mapped upstream

Table 4 – Segment ID 3 Riparian Assessment

Task – Waterland Tool (2020)	Assessment	Comments (provide evidence)	Figures
Desktop Assessment – Survey Point 3.1			
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	The Subject Site is not located in a nominated shaded area, and is not exempt from Controlled Activity Approval.	1
Is your property within the shaded area on the NRAR Map—Western land map local government area? (Appendix 2- NRAR Guidelines, 2020)	No	The site location is Maitland LGA, which is excluded from the Western Land map.	1
Is there a watercourse visible on your property?	Yes	Yes, NSW Hydroline Spatial Data 1.0 indicates there is one (1) hydroline within the Subject Site and an additional twenty (20) hydroline segments within the upstream reach (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 wetlands or lakes are within 40m of the Subject Site.	3
Using the Determining Stream Order fact sheet (Appendix 4 - NRAR Guidelines, 2020) and the NSW Hydro Line Spatial Data Map, what is the stream order of your watercourse?	1	Based on the desktop assessment, Segment ID 3 is mapped as a 1st order stream.	3
Field Assessment – Survey Point 3.1			
Defined Bed and Banks (Yes / No)	No	No defined bed and bank visible	6
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		6
Watercourse Feature Present (Pool, Riffle, Erosion and Deposition, Inside and outside bend)	None	No watercourse features present	-
Lakes or Wetlands (Appendix 3 - NRAR Guidelines, 2020)	No		-
Change in Vegetation Present to Indicate Wetlands (Appendix 7 - NRAR Guidelines, 2020)	No	No change in vegetation indicating wetlands.	-
High Bank (Appendix 8 - NRAR Guidelines, 2020)	No		-
Ground-truthed Waterfront Land present?	No	The survey did not identify a defined bed and bank, or watercourse features as described in Appendix 6 of the Waterfront Land Tool. This survey point does not constitute waterfront land.	6
Ground-truthed Numbering to Determine VRZ	N/A	Not applicable	6

Task – Waterland Tool (2020)	Assessment	Comments (provide evidence)	Figures
Controlled Activity Approval Required (Y / N)	N/A	WFL does not occur at this survey point.	-
Vegetated Riparian Zone Required (m)	No	Not applicable	-
Comments	Segment 3 is mapped as a 1st order stream. A roadside swale along the NEH and recently constructed detention Basin for a subdivision development on the southern side of the NEH have likely altered the hydrological and geomorphological characteristics of the landscape. The inspection showed stormwater infrastructure through an urban environment (swales, culverts and detention basin). No WFL features, such as a defined bed and bank or a change in vegetation indicating a wetland were identified. Survey Point 3.1 does not constitute waterfront land.		

Site Photos – Survey Point 3.1

Survey Point 3.1 mapped upstream

Task – Waterland Tool (2020)	Assessment	Comments (provide evidence)	Figures

Survey Point 3.1 mapped downstream

Table 5 – Segment ID 4 Riparian Assessment

Task – Waterland Tool (2020)	Assessment	Comments (provide evidence)	Figures
Desktop Assessment – Survey Point 4.1			
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	The Subject Site is not located in a nominated shaded area, and is not exempt from Controlled Activity Approval.	1
Is your property within the shaded area on the NRAR Map—Western land map local government area? (Appendix 2- NRAR Guidelines, 2020)	No	The site location is Maitland LGA, which is excluded from the Western Land map.	1
Is there a watercourse visible on your property?	Yes	Yes, NSW Hydroline Spatial Data 1.0 indicates there is one (1) hydroline within the Subject Site and an additional twenty (20) hydroline segments within the upstream reach (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 wetlands or lakes are within 40m of the Subject Site.	3
Using the Determining Stream Order fact sheet (Appendix 4 - NRAR Guidelines, 2020) and the NSW Hydro Line Spatial Data Map, what is the stream order of your watercourse?	2	Based on the desktop assessment, Segment ID 4 is mapped as a 2nd order stream.	3
Field Assessment – Survey Point 4.1			
Defined Bed and Banks (Yes / No)	No	No defined bed and bank visible	6
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		6
Watercourse Feature Present (Pool, Riffle, Erosion and Deposition, Inside and outside bend)	None	No watercourse features present	-
Lakes or Wetlands (Appendix 3 - NRAR Guidelines, 2020)	No		-
Change in Vegetation Present to Indicate Wetlands (Appendix 7 - NRAR Guidelines, 2020)	No	No change in vegetation indicating wetlands.	-
High Bank (Appendix 8 - NRAR Guidelines, 2020)	No		-
Ground-truthed Waterfront Land present?	No	The survey did not identify a defined bed and bank, or watercourse features as described in Appendix 6 of the Waterfront Land Tool. This survey point does not constitute waterfront land.	6
Ground-truthed Numbering to Determine VRZ	N/A	Not applicable	6

Task – Waterland Tool (2020)	Assessment	Comments (provide evidence)	Figures
Controlled Activity Approval Required (Y / N)	N/A	WFL does not occur at this survey point.	-
Vegetated Riparian Zone Required (m)	No	Not applicable	-
Comments	Segment 4 is mapped as a 2nd order stream and the location is now occupied by a swale along the NEH. Urban development has altered the hydrological and geomorphological characteristics of the landscape. The previously mapped hydroline is not present. The inspection showed stormwater infrastructure through an urban environment. No WFL features, such as a defined bed and bank or a change in vegetation indicating a wetland were identified. Survey Point 4.1 does not constitute waterfront land.		

Site Photos – Survey Point 4.1

Survey Point 4.1 – mapped upstream

Task – Waterland Tool (2020)	Assessment	Comments (provide evidence)	Figures

Survey Point 4.1 – mapped downstream

Table 6 – Segment ID 5 Riparian Assessment

Task – Waterland Tool (2020)	Assessment	Comments (provide evidence)	Figures
Desktop Assessment – Survey Point 5.1			
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	The Subject Site is not located in a nominated shaded area, and is not exempt from Controlled Activity Approval.	1
Is your property within the shaded area on the NRAR Map—Western land map local government area? (Appendix 2- NRAR Guidelines, 2020)	No	The site location is Maitland LGA, which is excluded from the Western Land map.	1
Is there a watercourse visible on your property?	Yes	Yes, NSW Hydroline Spatial Data 1.0 indicates there is one (1) hydroline within the Subject Site and an additional twenty (20) hydroline segments within the upstream reach (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 wetlands or lakes are within 40m of the Subject Site.	3
Using the Determining Stream Order fact sheet (Appendix 4 - NRAR Guidelines, 2020) and the NSW Hydro Line Spatial Data Map, what is the stream order of your watercourse?	1	Based on the desktop assessment, Segment ID 5 is mapped as a 2nd order stream.	3
Field Assessment – Survey Point 5.1			
Defined Bed and Banks (Yes / No)	No	No defined bed and bank visible	6
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		6
Watercourse Feature Present (Pool, Riffle, Erosion and Deposition, Inside and outside bend)	None	No watercourse features present	-
Lakes or Wetlands (Appendix 3 - NRAR Guidelines, 2020)	No		-
Change in Vegetation Present to Indicate Wetlands (Appendix 7 - NRAR Guidelines, 2020)	No	No change in vegetation indicating wetlands.	-
High Bank (Appendix 8 - NRAR Guidelines, 2020)	No		-
Ground-truthed Waterfront Land present?	No	The survey did not identify a defined bed and bank, or watercourse features as described in Appendix 6 of the Waterfront Land Tool. This survey point does not constitute waterfront land.	6
Ground-truthed Numbering to Determine VRZ	N/A	Not applicable	6

Task – Waterland Tool (2020)	Assessment	Comments (provide evidence)	Figures
Controlled Activity Approval Required (Y / N)	N/A	WFL does not occur at this survey point.	-
Vegetated Riparian Zone Required (m)	No	Not applicable	-
Comments	Segment 5 is mapped as a 2nd order stream. Urban development has altered the hydrological and geomorphological characteristics of the landscape. The adjacent rural property is occupied by a farm dam and dam overflow flows under an internal access road culvert and along a straight drainage channel to an existing culvert under Wyndella road. The inspection showed farm and stormwater infrastructure through a modified environment. No WFL features, such as a defined bed and bank or a change in vegetation indicating a wetland were observed. Survey Point 5.1 does not constitute waterfront land.		

Site Photos – Survey Point 5.1

Survey Point 5.1 – mapped upstream

Table 7 – Segment ID 6 Riparian Assessment

Task – Waterland Tool (2020)	Assessment	Comments (provide evidence)	Figures
Desktop Assessment – Survey Point 6.1			
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	The Subject Site is not located in a nominated shaded area, and is not exempt from Controlled Activity Approval.	1
Is your property within the shaded area on the NRAR Map—Western land map local government area? (Appendix 2- NRAR Guidelines, 2020)	No	The site location is Maitland LGA, which is excluded from the Western Land map.	1
Is there a watercourse visible on your property?	Yes	Yes, NSW Hydroline Spatial Data 1.0 indicates there is one (1) hydroline within the Subject Site and an additional twenty (20) hydroline segments within the upstream reach (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 wetlands or lakes are within 40m of the Subject Site.	3
Using the Determining Stream Order fact sheet (Appendix 4 - NRAR Guidelines, 2020) and the NSW Hydro Line Spatial Data Map, what is the stream order of your watercourse?	1	Based on the desktop assessment, Segment ID 6 is mapped as a 1st order stream.	3
Field Assessment – Survey Point 6.1			
Defined Bed and Banks (Yes / No)	No	No defined bed and bank visible	6
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		6
Watercourse Feature Present (Pool, Riffle, Erosion and Deposition, Inside and outside bend)	None	No watercourse features present	-
Lakes or Wetlands (Appendix 3 - NRAR Guidelines, 2020)	No		-
Change in Vegetation Present to Indicate Wetlands (Appendix 7 - NRAR Guidelines, 2020)	No	No change in vegetation indicating wetlands.	-
High Bank (Appendix 8 - NRAR Guidelines, 2020)	No		-
Ground-truthed Waterfront Land present?	No	The survey did not identify a defined bed and bank, or watercourse features as described in Appendix 6 of the Waterfront Land Tool. This survey point does not constitute waterfront land.	6
Ground-truthed Numbering to Determine VRZ	N/A	Not applicable	6

Task – Waterland Tool (2020)	Assessment	Comments (provide evidence)	Figures
Controlled Activity Approval Required (Y / N)	N/A	WFL does not occur at this survey point.	-
Vegetated Riparian Zone Required (m)	N/A	Not applicable	-
Comments	Segment 6 is mapped as a 1st order stream. Rural development has altered the hydrological and geomorphological characteristics of the landscape. Multiple farm dams and a horse training yard occupy the upstream area mapped as Segment 6. No WFL features, such as a defined bed and bank or a change in vegetation indicating a wetland. Survey Point 6.1 does not constitute waterfront land.		

Site Photos – Survey Point 6.1

Survey Point 6.1

Table 8 – Segment ID 7 Riparian Assessment

Task – Waterland Tool (2020)	Assessment	Comments (provide evidence)	Figures
Desktop Assessment – Survey Point 7.1			
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	The Subject Site is not located in a nominated shaded area, and is not exempt from Controlled Activity Approval.	1
Is your property within the shaded area on the NRAR Map—Western land map local government area? (Appendix 2- NRAR Guidelines, 2020)	No	The site location is Maitland LGA, which is excluded from the Western Land map.	1
Is there a watercourse visible on your property?	Yes	Yes, NSW Hydroline Spatial Data 1.0 indicates there is one (1) hydroline within the Subject Site and an additional twenty (20) hydroline segments within the upstream reach (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 wetlands or lakes are within 40m of the Subject Site.	3
Using the Determining Stream Order fact sheet (Appendix 4 - NRAR Guidelines, 2020) and the NSW Hydro Line Spatial Data Map, what is the stream order of your watercourse?	2	Based on the desktop assessment, Segment ID 7 is mapped as a 2nd order stream.	3
Field Assessment – Survey Point 7.1			
Defined Bed and Banks (Yes / No)	Yes	Defined bed and bank visible	6
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)	Type 3b	Laterally Unconfined Continuous – Low Sinuosity	6
Watercourse Feature Present (Pool, Riffle, Erosion and Deposition, Inside and outside bend)	Yes	Pools, Erosion, Deposition	-
Lakes or Wetlands (Appendix 3 - NRAR Guidelines, 2020)	No		-
Change in Vegetation Present to Indicate Wetlands (Appendix 7 - NRAR Guidelines, 2020)	No	Riparian vegetation is present, such as Casuarina and *Juncus usitatus,* however a wetland is not present.	-
High Bank (Appendix 8 - NRAR Guidelines, 2020)	Yes		7
Ground-truthed Waterfront Land present?	Yes	The survey identified a defined bed and bank, and watercourse features as described in Appendix 6 of the Waterfront Land Tool. This survey point does constitute waterfront land.	7
Ground-truthed Numbering to Determine VRZ	1	Under *Water Management (General) Regulation 2018* Schedule 2, Survey Point 7.1 is	6

Task – Waterland Tool (2020)	Assessment	Comments (provide evidence)	Figures
		considered Order 1 for the purposes of determining the appropriate VRZ.	
Controlled Activity Approval Required (Y / N)	Yes	CAA required for works within 40m of the top of banks.	6
Vegetated Riparian Zone Requirement	10m	A VRZ of 10m is required from the top of bank either side of the watercourse.	7
Comments	Survey Point 7.1 occurs at a culvert on the western side of Wyndella, Road. Discharge from the culvert has resulted in WFL and includes watercourse features such as a defined bed and bank, pools and a change in vegetation indicating a wetland. Survey Point 7.1 constitutes waterfront land and a CAA is required for works within 40m of the top of bank.		
Site Photos – Survey Point 7.1			

Task – Waterland Tool (2020)	Assessment	Comments (provide evidence)	Figures

Survey Point 7.1 - upstream

Survey Point 7.1 - downstream

Task – Waterland Tool (2020)	Assessment	Comments (provide evidence)	Figures
Desktop Assessment – Survey Point 7.2			
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	The Subject Site is not located in a nominated shaded area, and is not exempt from Controlled Activity Approval.	1
Is your property within the shaded area on the NRAR Map—Western land map local government area? (Appendix 2- NRAR Guidelines, 2020)	No	The site location is Maitland LGA, which is excluded from the Western Land map.	1
Is there a watercourse visible on your property?	Yes	Yes, NSW Hydroline Spatial Data 1.0 indicates there is one (1) hydroline within the Subject Site and an additional twenty (20) hydroline segments within the upstream reach (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 wetlands or lakes are within 40m of the Subject Site.	3
Using the Determining Stream Order fact sheet (Appendix 4 - NRAR Guidelines, 2020) and the NSW Hydro Line Spatial Data Map, what is the stream order of your watercourse?	2	Based on the desktop assessment, Segment ID 8 is mapped as a 2nd order stream.	3
Field Assessment – Survey Point 7.2			
Defined Bed and Banks (Yes / No)	Yes	Defined bed and bank visible	6
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)	Type 3b	Laterally Unconfined Continuous – Low Sinuosity	6
Watercourse Feature Present (Pool, Riffle, Erosion and Deposition, Inside and outside bend)	Yes	Pools, Erosion, Deposition	-
Lakes or Wetlands (Appendix 3 - NRAR Guidelines, 2020)	No		-
Change in Vegetation Present to Indicate Wetlands (Appendix 7 - NRAR Guidelines, 2020)	No	Riparian vegetation is present, such as Casuarina and *Juncus usitatus,* however a wetland is not present.	-
High Bank (Appendix 8 - NRAR Guidelines, 2020)	Yes		7
Ground-truthed Waterfront Land present?	Yes	The survey identified a defined bed and bank, and watercourse features as described in Appendix 6 of the Waterfront Land Tool. This survey point does constitute waterfront land.	7
Ground-truthed Numbering to Determine VRZ	1	Under *Water Management (General) Regulation 2018* Schedule 2, Survey Point 7.1 is	6

Task – Waterland Tool (2020)	Assessment	Comments (provide evidence)	Figures
		considered Order 1 for the purposes of determining the appropriate VRZ.	
Controlled Activity Approval Required (Y / N)	Yes	CAA required for works within 40m of the top of banks.	6
Vegetated Riparian Zone Required (m)	10m	A VRZ of 10m is required from the top of bank either side of the watercourse.	7
Comments	Watercourse features are present at Survey Point 7.2. Survey Point 7.2 constitutes waterfront land and a CAA is required for works within 40m of the top of bank.		
Site Photos – Survey Point 7.2			

Survey Point 7.2 - upstream

Task – Waterland Tool (2020)	Assessment	Comments (provide evidence)	Figures

Survey Point 7.2 - downstream

Table 9 – Segment ID 10 Riparian Assessment

Task – Waterland Tool (2020)	Assessment	Comments (provide evidence)	Figures
Desktop Assessment – Survey Point 10.1			
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	The Subject Site is not located in a nominated shaded area, and is not exempt from Controlled Activity Approval.	1
Is your property within the shaded area on the NRAR Map—Western land map local government area? (Appendix 2- NRAR Guidelines, 2020)	No	The site location is Maitland LGA, which is excluded from the Western Land map.	1
Is there a watercourse visible on your property?	Yes	Yes, NSW Hydroline Spatial Data 1.0 indicates there is one (1) hydroline within the Subject Site and an additional twenty (20) hydroline segments within the upstream reach (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 wetlands or lakes are within 40m of the Subject Site.	3
Using the Determining Stream Order fact sheet (Appendix 4 - NRAR Guidelines, 2020) and the NSW Hydro Line Spatial Data Map, what is the stream order of your watercourse?	2	Based on the desktop assessment, Segment ID 10 is mapped as a 2nd order stream.	3
Field Assessment – Survey Point 10.1			
Defined Bed and Banks (Yes / No)	No	No defined bed and bank visible	6
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		6
Watercourse Feature Present (Pool, Riffle, Erosion and Deposition, Inside and outside bend)	None	No watercourse features present	-
Lakes or Wetlands (Appendix 3 - NRAR Guidelines, 2020)	No		-
Change in Vegetation Present to Indicate Wetlands (Appendix 7 - NRAR Guidelines, 2020)	No	No change in vegetation indicating wetlands.	-
High Bank (Appendix 8 - NRAR Guidelines, 2020)	No		-
Ground-truthed Waterfront Land present?	No	The survey did not identify a defined bed and bank, or watercourse features as described in Appendix 6 of the Waterfront Land Tool. This survey point does not constitute waterfront land.	6
Ground-truthed Numbering to Determine VRZ	N/A	Not applicable	6

Task – Waterland Tool (2020)	Assessment	Comments (provide evidence)	Figures
Controlled Activity Approval Required (Y / N)	N/A	WFL does not occur at this survey point.	-
Vegetated Riparian Zone Required (m)	No	Not applicable	-
Comments	Segment 10 is mapped as a 2nd order stream and Survey Point 10.1 represents the juncture of Segment 8 and 9. Roadside inspection reveal a lack of bed and bank, and watercourse features, north east in the direction of mapped Segment 8 and 9. A culvert is present under Wyndella Road, with small erosion pools at the entrance and exit points, formed by the convergence of over land flow at the culvert. No WFL features, such as a defined bed and bank or a change in vegetation indicating a wetland were observed. Survey Point 10.1 does not constitute waterfront land.		
Site Photos – Survey Point 10.1			

Survey Point 10.1 – mapped upstream

Task – Waterland Tool (2020)	Assessment	Comments (provide evidence)	Figures

Survey Point 10.1 - downstream

Task – Waterland Tool (2020)	Assessment	Comments (provide evidence)	Figures
Desktop Assessment – Survey Point 10.2			
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	The Subject Site is not located in a nominated shaded area, and is not exempt from Controlled Activity Approval.	1
Is your property within the shaded area on the NRAR Map—Western land map local government area? (Appendix 2- NRAR Guidelines, 2020)	No	The site location is Maitland LGA, which is excluded from the Western Land map.	1
Is there a watercourse visible on your property?	Yes	Yes, NSW Hydroline Spatial Data 1.0 indicates there is one (1) hydroline within the Subject Site and an additional twenty (20) hydroline segments within the upstream reach (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 wetlands or lakes are within 40m of the Subject Site.	3
Using the Determining Stream Order fact sheet (Appendix 4 - NRAR Guidelines, 2020) and the NSW Hydro Line Spatial Data Map, what is the stream order of your watercourse?	2	Based on the desktop assessment, Segment ID 10 is mapped as a 2nd order stream.	3
Field Assessment – Survey Point 10.2			
Defined Bed and Banks (Yes / No)	No	No defined bed and bank visible	6
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		6
Watercourse Feature Present (Pool, Riffle, Erosion and Deposition, Inside and outside bend)	None	No watercourse features present	-
Lakes or Wetlands (Appendix 3 - NRAR Guidelines, 2020)	No		-
Change in Vegetation Present to Indicate Wetlands (Appendix 7 - NRAR Guidelines, 2020)	No	No change in vegetation indicating wetlands.	-
High Bank (Appendix 8 - NRAR Guidelines, 2020)	No		-
Ground-truthed Waterfront Land present?	No	The survey did not identify a defined bed and bank, or watercourse features as described in Appendix 6 of the Waterfront Land Tool. This survey point does not constitute waterfront land.	6
Ground-truthed Numbering to Determine VRZ	N/A	Not applicable	6
Controlled Activity Approval Required (Y / N)	N/A	WFL does not occur at this survey point.	-

Task – Waterland Tool (2020)	Assessment	Comments (provide evidence)	Figures
Vegetated Riparian Zone Required (m)	No	Not applicable	-
Comments	Segment 10 is mapped as a 2nd order stream and the location is now occupied by managed grassland. Rural development has likely altered the hydrological and geomorphological characteristics of the landscape through pastural land use and construction of farm dams and drainage lines. No WFL features, such as a defined bed and bank or a change in vegetation indicating a wetland. Survey Point 10.2 does not constitute waterfront land.		
Site Photos – Survey Point 10.2			

Survey Point 10.1

Task – Waterland Tool (2020)	Assessment	Comments (provide evidence)	Figures

Survey Point 10.2 -downstream

Table 10 – Segment ID 11 Riparian Assessment

Task – Waterland Tool (2020)	Assessment	Comments (provide evidence)	Figures
Desktop Assessment – Survey Point 11.1			
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	The Subject Site is not located in a nominated shaded area, and is not exempt from Controlled Activity Approval.	1
Is your property within the shaded area on the NRAR Map—Western land map local government area? (Appendix 2- NRAR Guidelines, 2020)	No	The site location is Maitland LGA, which is excluded from the Western Land map.	1
Is there a watercourse visible on your property?	Yes	Yes, NSW Hydroline Spatial Data 1.0 indicates there is one (1) hydroline within the Subject Site and an additional twenty (20) hydroline segments within the upstream reach (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 wetlands or lakes are within 40m of the Subject Site.	3
Using the Determining Stream Order fact sheet (Appendix 4 - NRAR Guidelines, 2020) and the NSW Hydro Line Spatial Data Map, what is the stream order of your watercourse?	3	Based on the desktop assessment, Segment ID 11 is mapped as a 3rd order stream.	3
Field Assessment – Survey Point 11.1			
Defined Bed and Banks (Yes / No)	Yes	Defined bed and bank visible	6
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)	Type 3a	Laterally Unconfined Continuous – Bank Confined	6
Watercourse Feature Present (Pool, Riffle, Erosion and Deposition, Inside and outside bend)	Yes	Erosion, Deposition, Riffle	-
Lakes or Wetlands (Appendix 3 - NRAR Guidelines, 2020)	No		-
Change in Vegetation Present to Indicate Wetlands (Appendix 7 - NRAR Guidelines, 2020)	Yes	Yes, there are change in vegetation indicating wetlands.	-
High Bank (Appendix 8 - NRAR Guidelines, 2020)	No		-
Ground-truthed Waterfront Land present?	Yes	The survey did identify a defined bed and bank, or watercourse features as described in Appendix 6 of the Waterfront Land Tool. This survey point does constitute waterfront land.	6
Ground-truthed Numbering to Determine VRZ	Yes	1	6

Task – Waterland Tool (2020)	Assessment	Comments (provide evidence)	Figures
Controlled Activity Approval Required (Y / N)	Yes	CAA required.	6
Vegetated Riparian Zone Required (m)	10m	Defined bed and bank visible	7
Comments	Watercourse features are present at Survey Point 11.1. The bed and bank have been heavily impacted by cattle. Survey Point 11.1 constitutes waterfront land and a CAA is required for works within 40m of the top of bank.		
Site Photos – Survey Point 11.1			

Survey Point 11.1 – upstream

Task – Waterland Tool (2020)	Assessment	Comments (provide evidence)	Figures

Survey Point 11.1 - downstream

Table 11 – Segment ID 12 Riparian Assessment

Task – Waterland Tool (2020)	Assessment	Comments (provide evidence)	Figures
Desktop Assessment – Survey Point 12.1			
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	The Subject Site is not located in a nominated shaded area, and is not exempt from Controlled Activity Approval.	1
Is your property within the shaded area on the NRAR Map—Western land map local government area? (Appendix 2- NRAR Guidelines, 2020)	No	The site location is Maitland LGA, which is excluded from the Western Land map.	1
Is there a watercourse visible on your property?	Yes	Yes, NSW Hydroline Spatial Data 1.0 indicates there is one (1) hydroline within the Subject Site and an additional twenty (20) hydroline segments within the upstream reach (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 wetlands or lakes are within 40m of the Subject Site.	3
Using the Determining Stream Order fact sheet (Appendix 4 - NRAR Guidelines, 2020) and the NSW Hydro Line Spatial Data Map, what is the stream order of your watercourse?	1	Based on the desktop assessment, Segment ID 12 is mapped as a 1st order stream.	3
Field Assessment – Survey Point 12.1			
Defined Bed and Banks (Yes / No)	No	No defined bed and bank visible	6
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		6
Watercourse Feature Present (Pool, Riffle, Erosion and Deposition, Inside and outside bend)	None	No watercourse features present	-
Lakes or Wetlands (Appendix 3 - NRAR Guidelines, 2020)	No		-
Change in Vegetation Present to Indicate Wetlands (Appendix 7 - NRAR Guidelines, 2020)	No	No change in vegetation indicating wetlands.	-
High Bank (Appendix 8 - NRAR Guidelines, 2020)	No		-
Ground-truthed Waterfront Land present?	No	The survey did not identify a defined bed and bank, or watercourse features as described in Appendix 6 of the Waterfront Land Tool. This survey point does not constitute waterfront land.	6
Ground-truthed Numbering to Determine VRZ	N/A	Not applicable	6

Task – Waterland Tool (2020)	Assessment	Comments (provide evidence)	Figures
Controlled Activity Approval Required (Y / N)	N/A	WFL does not occur at this survey point.	-
Vegetated Riparian Zone Required (m)	No	Not applicable	-
Comments	A roadside swale along the NEH and recently constructed detention Basin for a subdivision development on the southern side of the NEH have likely altered the hydrological and geomorphological characteristics of the landscape. The inspection showed stormwater infrastructure through an urban environment (swales, culverts and detention basin). No WFL features, such as a defined bed and bank were observed. Inundation due to discharge from the NEH culvert has resulted in sporadic occurrence of *Juncus spp.* Survey Point 12.1 does not constitute waterfront land.		
Site Photos – Survey Point 12.1			

Task – Waterland Tool (2020)	Assessment	Comments (provide evidence)	Figures
Survey Point 12.1 – mapped upstream			

Survey Point 12.1 – mapped downstream

Task – Waterland Tool (2020)	Assessment	Comments (provide evidence)	Figures
Desktop Assessment – Survey Point 12.2			
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	The Subject Site is not located in a nominated shaded area, and is not exempt from Controlled Activity Approval.	1
Is your property within the shaded area on the NRAR Map—Western land map local government area? (Appendix 2- NRAR Guidelines, 2020)	No	The site location is Maitland LGA, which is excluded from the Western Land map.	1
Is there a watercourse visible on your property?	Yes	Yes, NSW Hydroline Spatial Data 1.0 indicates there is one (1) hydroline within the Subject Site and an additional twenty (20) hydroline segments within the upstream reach (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 wetlands or lakes are within 40m of the Subject Site.	3
Using the Determining Stream Order fact sheet (Appendix 4 - NRAR Guidelines, 2020) and the NSW Hydro Line Spatial Data Map, what is the stream order of your watercourse?	1	Based on the desktop assessment, Segment ID 12 is mapped as a 1st order stream.	3
Field Assessment – Survey Point 12.2			
Defined Bed and Banks (Yes / No)	No	No defined bed and bank visible	6
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		6
Watercourse Feature Present (Pool, Riffle, Erosion and Deposition, Inside and outside bend)	None	No watercourse features present	-
Lakes or Wetlands (Appendix 3 - NRAR Guidelines, 2020)	No		-
Change in Vegetation Present to Indicate Wetlands (Appendix 7 - NRAR Guidelines, 2020)	No	No change in vegetation indicating wetlands.	-
High Bank (Appendix 8 - NRAR Guidelines, 2020)	No		-
Ground-truthed Waterfront Land present?	No	The survey did not identify a defined bed and bank, or watercourse features as described in Appendix 6 of the Waterfront Land Tool. This survey point does not constitute waterfront land.	6
Ground-truthed Numbering to Determine VRZ	N/A	Not applicable	6
Controlled Activity Approval Required (Y / N)	N/A	WFL does not occur at this survey point.	-

Task – Waterland Tool (2020)	Assessment	Comments (provide evidence)	Figures
Vegetated Riparian Zone Required (m)	No	Not applicable	-
Comments	A roadside swale along the NEH and recently constructed detention Basin for a subdivision development on the southern side of the NEH have likely altered the hydrological and geomorphological characteristics of the landscape. No WFL features, such as a defined bed and bank were observed. Inundation due to discharge from the NEH culvert has resulted in sporadic occurrence of *Juncus spp.* Survey Point 12.2 does not constitute waterfront land.		
Site Photos – Survey Point 12.2			

Survey Point 12.2 – mapped upstream

Task – Waterland Tool (2020)	Assessment	Comments (provide evidence)	Figures

Survey Point 12.2 – mapped downstream

Table 12 – Segment ID 13 Riparian Assessment

Task – Waterland Tool (2020)	Assessment	Comments (provide evidence)	Figures
Desktop Assessment – Survey Point 13.1			
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	The Subject Site is not located in a nominated shaded area, and is not exempt from Controlled Activity Approval.	1
Is your property within the shaded area on the NRAR Map—Western land map local government area? (Appendix 2- NRAR Guidelines, 2020)	No	The site location is Maitland LGA, which is excluded from the Western Land map.	1
Is there a watercourse visible on your property?	Yes	Yes, NSW Hydroline Spatial Data 1.0 indicates there is one (1) hydroline within the Subject Site and an additional twenty (20) hydroline segments within the upstream reach (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 wetlands or lakes are within 40m of the Subject Site.	3
Using the Determining Stream Order fact sheet (Appendix 4 - NRAR Guidelines, 2020) and the NSW Hydro Line Spatial Data Map, what is the stream order of your watercourse?	1	Based on the desktop assessment, Segment ID 13 is mapped as a 3rd order stream.	3
Field Assessment – Survey Point 13.1			
Defined Bed and Banks (Yes / No)	Yes	Defined bed and bank visible	6
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)	Type 3a	Laterally Unconfined Continuous – Bank Confined	6
Watercourse Feature Present (Pool, Riffle, Erosion and Deposition, Inside and outside bend)	Yes	Erosion, Deposition, Riffle, Pool	-
Lakes or Wetlands (Appendix 3 - NRAR Guidelines, 2020)	No		-
Change in Vegetation Present to Indicate Wetlands (Appendix 7 - NRAR Guidelines, 2020)	No	No change in vegetation indicating wetlands.	-
High Bank (Appendix 8 - NRAR Guidelines, 2020)	Yes		-
Ground-truthed Waterfront Land present?	Yes	The survey did identify a defined bed and bank, and watercourse features as described in Appendix 6 of the Waterfront Land Tool. This survey point does constitute waterfront land.	6
Ground-truthed Numbering to Determine VRZ	Yes	1	6

Task – Waterland Tool (2020)	Assessment	Comments (provide evidence)	Figures
Controlled Activity Approval Required (Y / N)	Yes	CAA required.	6
Vegetated Riparian Zone Required (m)	10m	Defined bed and bank visible	7
Comments	Watercourse features are present at Survey Point 13.1. Survey Point 13.1 constitutes waterfront land and a CAA is required for works within 40m of the top of bank.		

Site Photos – Survey Point 13.1

Survey Point 13.1

Table 13 – Segment ID 14 Riparian Assessment

Task – Waterland Tool (2020)	Assessment	Comments (provide evidence)	Figures
Desktop Assessment – Survey Point 14.1			
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	The Subject Site is not located in a nominated shaded area, and is not exempt from Controlled Activity Approval.	1
Is your property within the shaded area on the NRAR Map—Western land map local government area? (Appendix 2- NRAR Guidelines, 2020)	No	The site location is Maitland LGA, which is excluded from the Western Land map.	1
Is there a watercourse visible on your property?	Yes	Yes, NSW Hydroline Spatial Data 1.0 indicates there is one (1) hydroline within the Subject Site and an additional twenty (20) hydroline segments within the upstream reach (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 wetlands or lakes are within 40m of the Subject Site.	3
Using the Determining Stream Order fact sheet (Appendix 4 - NRAR Guidelines, 2020) and the NSW Hydro Line Spatial Data Map, what is the stream order of your watercourse?	1	Based on the desktop assessment, Segment ID 14 is mapped as a 1st order stream.	3
Field Assessment – Survey Point 14.1			
Defined Bed and Banks (Yes / No)	No	No defined bed and bank visible	6
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		6
Watercourse Feature Present (Pool, Riffle, Erosion and Deposition, Inside and outside bend)	None	No watercourse features present	-
Lakes or Wetlands (Appendix 3 - NRAR Guidelines, 2020)	No		-
Change in Vegetation Present to Indicate Wetlands (Appendix 7 - NRAR Guidelines, 2020)	No	No change in vegetation indicating wetlands.	-
High Bank (Appendix 8 - NRAR Guidelines, 2020)	No		-
Ground-truthed Waterfront Land present?	No	The survey did not identify a defined bed and bank, or watercourse features as described in Appendix 6 of the Waterfront Land Tool. This survey point does not constitute waterfront land.	6
Ground-truthed Numbering to Determine VRZ	N/A	Not applicable	6

Task – Waterland Tool (2020)	Assessment	Comments (provide evidence)	Figures
Controlled Activity Approval Required (Y / N)	N/A	WFL does not occur at this survey point.	-
Vegetated Riparian Zone Required (m)	No	Not applicable	-
Comments	Survey Point 14.1 is occupied by managed grassland. Rural development has likely altered the hydrological and geomorphological characteristics of the landscape through pastural land use and construction of farm dams and drainage lines. No WFL features, such as a defined bed and bank or a change in vegetation indicating a wetland. Survey Point 14.1 does not constitute waterfront land.		

Site Photos – Survey Point 14.1

Survey Point 14.1 – mapped downstream

4.1 Summary of Results

Desktop assessment indicated the presence of two (2) 1st order, two (2) 2nd order and one (1) 3rd order stream mapped within the Subject Site, and an additional six (6) 1st order streams and two (2) 2nd order streams mapped within the Study Area.

However, field surveys identified no WFL features at Segments 1, 2, 3, 4, 5, 6, 8, 9, 10, 12, and 14. API and historical review identified urban and rural development has likely resulted in the modification at the location of these segments, and consequently are not considered WFL or tributaries as defined under the WM Act.

WFL features were observed at Segments 7, 11 and 13 and these Segments were determined to be WFL.

Under **Schedule 2** of the WM Act, Order 1 was allocated to Segment 7 for the purpose of a CAA and determining the appropriate VRZ within the Subject Site. Consequently, a 10m VRZ is required.

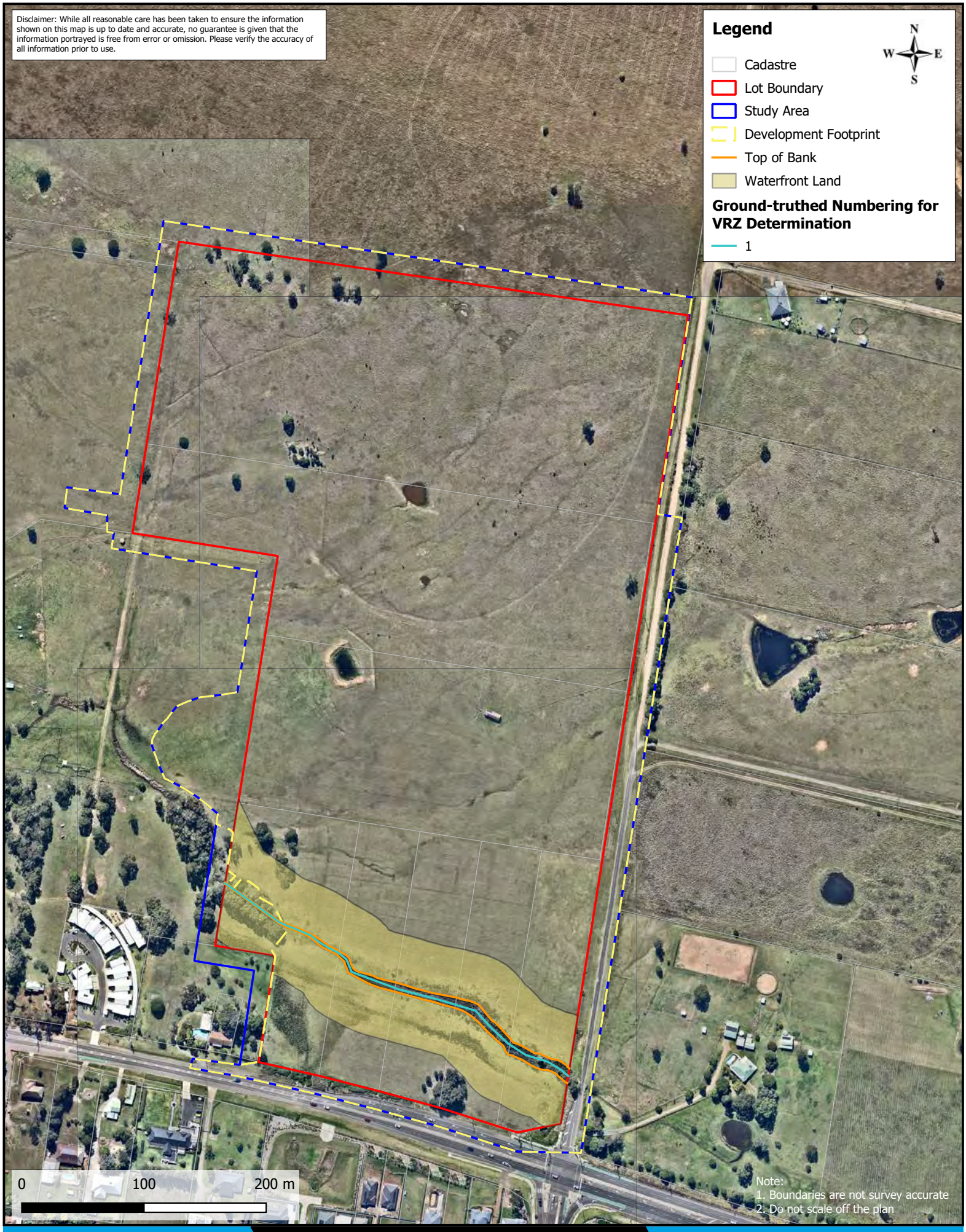
The results of the assessment are provided in **Figure 6** to inform CAA requirements for appropriate works, in accordance with **Table 14**, and based in the current ground-truth conditions.

Table 14 outlines the works and activities that can occur on WFL and in riparian corridors under the WM Act (note approvals may be required under other legislation). **Figure 7** provides the location of the stream re-alignment of Segment 7. A Biodiversity Management Plan (BMP) has been created to support the CAA and rehabilitate works that disturb or modify the riparian corridor, including regeneration an area of freshwater wetland (**Appendix B**).

Table 14 - Riparian Corridor Matrix (DPI Water, 2018)

Stream Order	VRZ	RC Offsetting for non-RC uses	Cycleways and pathways	Detention basins		Stormwater outlet structures and essential services	Stream realignment	Road crossings		
				Only within 50% outer VRZ	Online			Any	Culvert	Bridge
1st	10m	Yes	Yes	Yes	Yes	Yes	**Yes**	Yes	-	-
2nd	20m	Yes	Yes	Yes	Yes	Yes	-	Yes	-	-
3rd	30m	Yes	Yes	Yes	-	Yes	-	-	Yes	Yes
4th+	40m	Yes	Yes	Yes	-	Yes	-	-	Yes	Yes

Note: Where a watercourse 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.



AEP

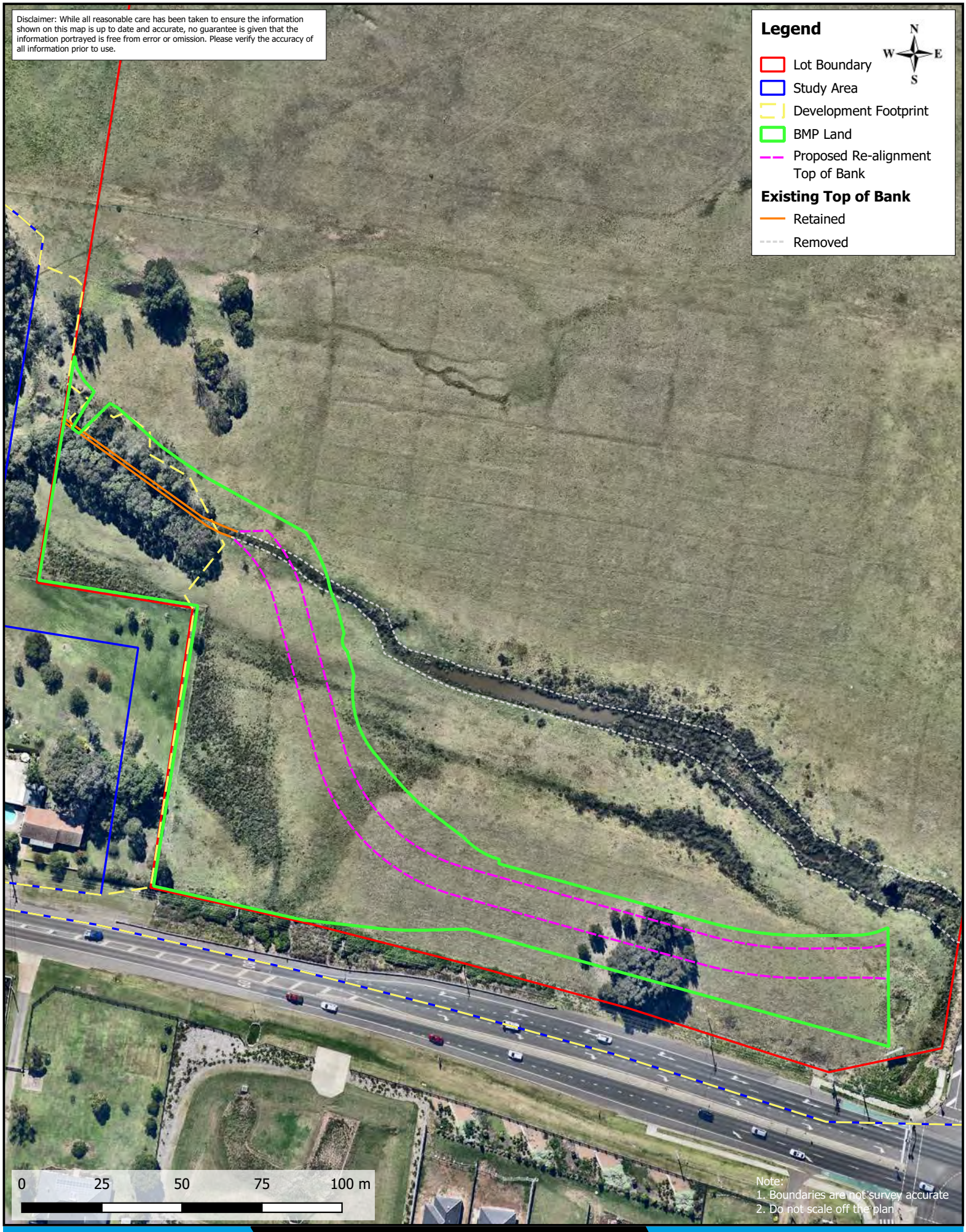
Figure 6 - Ground-truthed WFL Assessment

Date: July 2024

Location: New England Hwy and Wyndella Rd, Lochinvar

Client: Lochinvar Developments Pty Ltd

AEP ref: 2699



AEP

Figure 7 - Stream Re-alignment

Date: July 2024

Location: New England Hwy and Wyndella Rd, Lochinvar

Client: Lochinvar Developments Pty Ltd

AEP ref: 2699

5.0 Conclusion

No WFL features were identified at Segment IDs 1, 2, 3, 4, 5, 6, 8, 9, 10, 12, and 14, and these Segments do not constitute waterfront land, or tributaries under the Strahler ordering system, as defined under the WM Act.

WFL features were observed at Segments 7, 11, and 13 and these Segments were determined to constitute waterfront land as defined under the WM Act. Under **Schedule 2** of the WM Act, Order 1 was allocated to Segment 7 for the purpose of a CAA and determining the appropriate VRZ within the Subject Site. Consequently, a 10m VRZ is required.

Works will occur within Waterfront Land and a CAA will be required to accompany any Development Application (DA) for works that occurs within 40m of top of bank.

A number of controlled activities can occur within the VRZ, including the proposed stream re-alignment. A CAA application will require riparian vegetation is rehabilitated within the VRZ to reconstruct natural function of the riparian corridor. A 5-year BMP has been provided to fulfill this requirement.

6.0 References

Department of Planning, Industry and Environment (2020) Natural Resources Access Regulator Waterfront Land Tool https://www.dpie.nsw.gov.au/nrar/how-to-apply/controlled-activities/tools accessed June 2024.

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New South Wales Office of Water (2012) Controlled activities on waterfront land - Guidelines for riparian corridors on waterfront land. Department of Primary Industries.

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 June 2024.

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Strahler, A.N. (1952) Dynamic basis of geomorphology. Geological society of America bulletin, 63(9), pp.923-938.

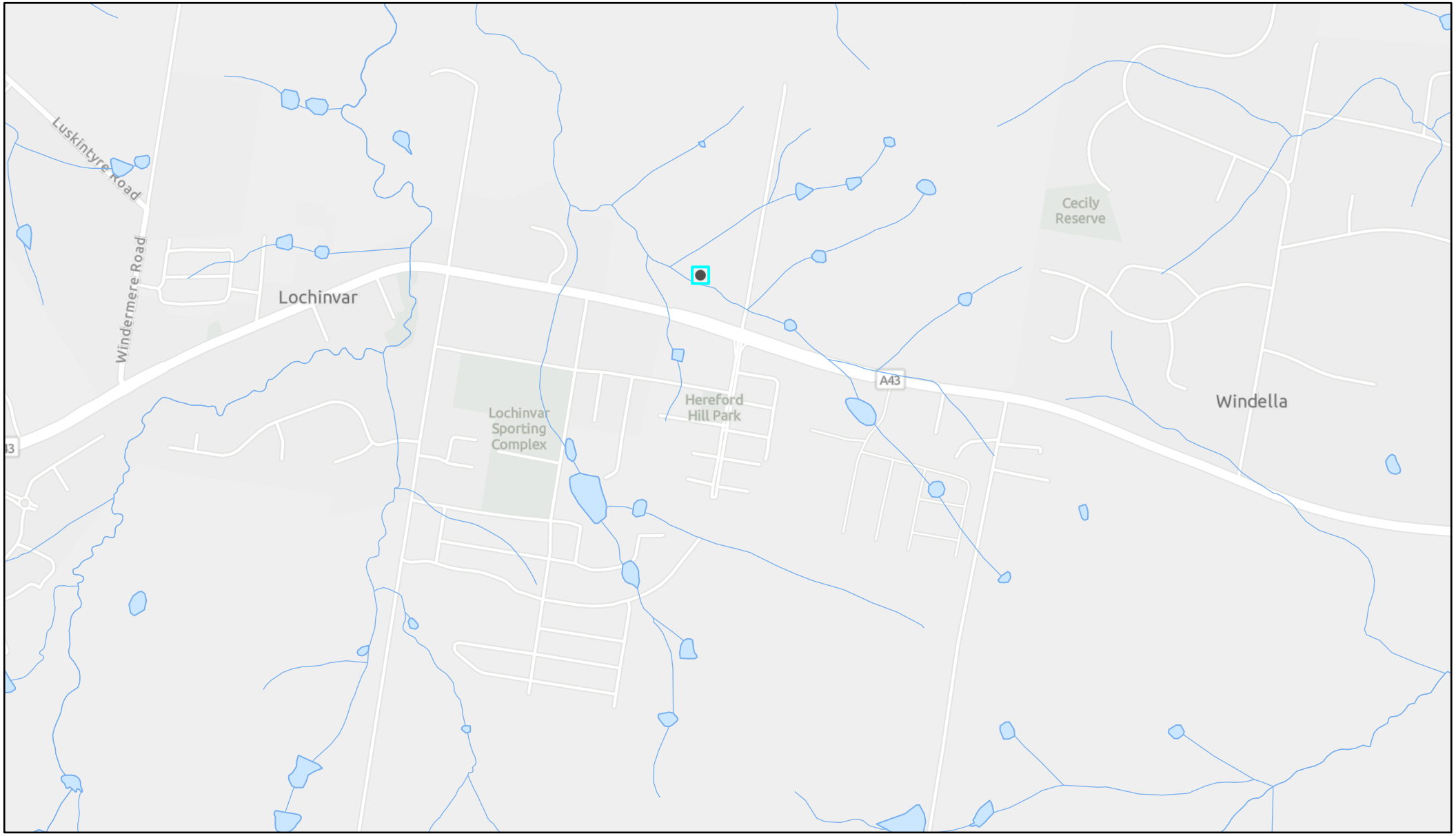
Texas Parks & Wildlife (n.d.) *Glossary of River Terminology*. https://tpwd.texas.gov/landwater/water/habitats/rivers/glossary.phtml#P accessed April 2024.

Thwaites, R. & Brooks, A. (2021) *A gully is not a stream channel. How do we tell the difference and why does it matter?* In WELCOME TO THE 10TH AUSTRALIAN STREAM MANAGEMENT CONFERENCE, p. 524.

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 June 2024.

Appendix A – NRAR Hydroline Spatial Data

2018 Hydroline spatial data 1.0



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Esri Community Maps Contributors, Maitland City Council, Esri, TomTom, Garmin, Foursquare, METI/NASA, USGS

Water Management (General) Regulation

NSW Department of Industry | Lands and Water | Water

Appendix B – Biodiversity Management Plan

Draft Biodiversity Management Plan – 898 New England Hwy, 25 Wyndella Rd and 39 Wyndella Rd, Lochinvar, NSW

Prepared For: Lochinvar Developments Pty Ltd

Prepared By: Anderson Environment and Planning

Date: July 2024

AEP Reference: 2699.04

Revision: 01

Plate 1 – Existing creek line north west of BMP lands

Plate 2 – Planted native vegetation resembles PCT 3433

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Appendices

1.0 Introduction

At the request of Lochinvar Developments Pty Ltd, on behalf of ADW Johnson Pty Ltd (the client) Anderson Environment & Planning (AEP) have undertaken the necessary investigations to inform the production of a Biodiversity Management Plan (BMP) to schedule rehabilitation measures associated with the development of land at 898 New England Hwy, 25 Wyndella road and 39 Wyndella Road Lochinvar, NSW, henceforth referred to as the Subject Site (**Figure 1**). As the proposed development will be impacting waterfront land, a BMP is required as part of the controlled activity approvals outlined below (DPI 2012):

> *Controlled activities carried out in, on or under waterfront land are regulated by the Water Management Act 2000 (WM Act). When a proposed controlled activity disturbs or substantially modifies the riparian corridor, its restoration or rehabilitation will be a requirement of the controlled activity approval. A vegetation management plan (VMP) details how the restoration or rehabilitation will be carried out.*

Although this level of detail is not typically provided as part of the development application, rather it comes with the application for the CAA post-consent, it has been provided upfront to support the proposed stream realignment works.

1.1 Biodiversity Management Plan Objectives

The aim of this BMP is to determine the reconstruction of a riparian area, schedule weed management and revegetation measures necessary to enhance habitat value and improve landscape connectivity of retained lands. This will be achieved by providing a stable watercourse and riparian corridor as well as enhancing existing vegetation.

The purpose of this plan is to:

- Reinstate a natural channel creating both ecological and hydraulic function.
- To create a Wildlife Corridor for native fauna in the area, with provisions such as connective canopy species such as the Endangered *Petaurus norfolcensis* (Squirrel Glider) are able to move through the Subject Site.
- To revegetation to a point that it can be naturally regenerated.
- To improve water quality within the Hunter Catchment.
- Provide habitat for both native terrestrial and aquatic species.

The BMP requires action to regenerate riparian lands while creating safe space within the proposed subdivision. The BMP incorporates best practices in bushland restoration, management of invasive species and revegetation to achieve the following objectives within the 5 years imparted:

- Regenerate physical and biological functions of the remnant bushland present within the VMP Lands to improve habitat values and connectivity for locally occurring biota;
- Reconstruct highly disturbed areas that cannot naturally regenerate, to stabilise and reinstate landforms and vegetation communities that are generally representative of those present prior to disturbance;
- Develop management actions detailed using the 'SMART' goals approach (Specific, Measurable, Achievable, Reasonable and Time bound);
- Ensure the site is maintained until vegetation in rehabilitated areas achieves a self-sustaining state;
- Enhance habitat and connectivity across the site through salvage of biomass from the development site and revegetation.
- Implement erosion and sediment control measures to minimise the transfer of soil and sediments into downslope receptors; and
- Implement a hygiene protocol to prevent the transfer of weeds and pathogens onto and off the site.

1.2 Supporting Reports

The BMP must be read and implemented in conjunction with the following reports:

- Anderson Environment & Planning (2024) *Streamlined Biodiversity Assessment Report for Residential Subdivision and Associated Infrastructure at 898 New England Hwy, 25 Wyndella Rd and 39 Wyndella Rd, Lochinvar, NSW.*
- Anderson Environment & Planning (2024) *Aquatic Ecology Assessment Report for 898 New England Hwy, 25 Wyndella Rd and 39 Wyndella Rd, Lochinvar, NSW.*

2.0 Site Context and Existing Condition

2.1 Local Context

Lochinvar Developments Pty Ltd are proposing a 258 Lot residential subdivision with internal road, services, and asset protection zones (APZs). The residential development will be situated within Lots 2-6 and 9 DP747391, Lots 12 and 13 DP1219648 (approx. 21.99ha) currently zoned for General Residential (R1) land use. The proposed development is a large residential subdivision planned under the Lochinvar Urban Release Area with retained creek line proposed to be managed under a biodiversity management plan.

The BMP lands, totalling 1.37ha, are situated within an area designated as R1 - General Residential zoning, and were previously cleared and managed as agricultural land. The BMP will apply to land within the following five (5) lots:

- Lot 2 in DP 747391;
- Lot 3 in DP 747391;
- Lot 4 in DP 747391;
- Lot 5 in DP 747391;
- Lot 6 in DP 747391.

General ecological inspections and floristic surveys were undertaken by AEP in April 2024. Riparian assessments and fauna surveys were conducted between August 2022 and January 2023. The existing hydroline was assessed against the NRAR *Waterfront Land Tool* for the purposes of determining Vegetated Riparian Zones (VRZ).

A section of the creek is proposed to be realigned under the BMP and will require plantings and erosion and sediment controls to ensure the banks of the creek remain stable and natural flow and ecological function are maintained.

The BMP will utilise the principles of Brisbane City Council's 2003 Natural Channel Design to restore natural features within the proposed management zones and regenerate aquatic and riparian ecosystems. The channel will be restored with species from PCT 3975, and the riparian corridor PCT 3433, to create a functioning wildlife corridor focusing on *Petaurus norfolcensis* (Squirrel Glider), *Litoria aurea* (Green and Gold Bell Frog) and other native fauna. Proposed interventions include pocket plantings of canopy trees for Glider movement, low-lying fire-resistant species to minimize bushfire risk, and compliance with Safer by Design Guidelines to reduce potential antisocial behaviour.

To ensure consistency with water sustainable urban design principles the tailout scour protection area will not utilise chemical weed control this area is proposed to be managed by hand weed removal to ensure water quality is maintained (refer **Figure 3**).

The BMP lands are proposed to be managed under a 5-year Biodiversity Management Plan, including natural channel design, plantings, weed management, pest and disease management and installation of habitat.

All APZs are located outside of BMP lands and are to be managed under the provisions outlined in the Bushfire Report.

Figure 2 shows ground-truthed vegetation boundaries. **Figure 3** outlines the proposed management zones and areas impacted by the development.

2.2 Stages

The development is proposed in stages, to ensure the regeneration works are not impacted Stage 1 of the regeneration works are temporary to stabilise soils.

Stage 1 is the installation of a culvert on Wyndella Road. The removal of the existing road crossing will be undertaken and replaced with a culvert designed to ensure Fish Passage is maintained in perpetuity. The works are will be seeded with native groundcovers to stabilise soils.

Stage 2 is the commencement of the BMP, as outlined below.

2.3 Existing Vegetation Description

The Study Area covers approximately 26.49ha and the Subject Site totals approx. 22.25ha, comprising approx. 0.87ha of poor and highly degraded condition native vegetation, with the remainder of the Subject Site

consisting of non-endemic planted natives, exotic species and cleared lands.

The native vegetation within the BMP lands contains two (2) plant community types (PCTs), which are present in varying condition.

- 4044 - *Northern Creekflat Eucalypt-Paperbark Mesic Swamp Forest* – Highly degraded (0.51ha)
- 3433 - *Hunter Coast Foothills Spotted Gum-Ironbark Grassy Forest* – Degraded (0.12ha)

It should be noted that PCT 3433, a dry sclerophyll forest community (**Plate 2**), was planted approximately 20 years ago at the western extent of the riparian corridor. However, this vegetation type is not the most appropriate for a riparian zone as it does not naturally occur in these low-lying areas. PCT 4044 is expected to occur within this area and is likely to have been the naturally occurring plant community type historically.

Figure 1 and **2** shows the site location ground-truthed vegetation respectively.

2.3.1 PCT 3433 - Hunter Coast Foothills Spotted Gum-Ironbark Grassy Forest

PCT 3433 - Hunter Coast Foothills-Ironbark Grassy Forest currently present on site is dominated by a canopy of Spotted Gum (*Corymbia maculata*) and Grey Gum (*Eucalyptus punctata*). The vegetation is deemed not remnant due to being planted in what appears to be parallel lines no later than 20 years ago.

The species present are a mixture of Dry Sclerophyll Forest and Forested Wetland species such as *Casuarina glauca, Carex appressa* and *Juncus usitatus* as a result of plantings adjacent to the hydroline. Ground stratum species include *Centella asiatica, Rumex brownii, Lachnagrostis aemula* and *Parsonsia straminea*.

PCT 3433 – *Hunter Coast Foothills Spotted Gum-Ironbark Grassy Forest* is associated with the Endangered Ecological Community *Lower Hunter Spotted Gum – Ironbark Forest* (BC Act 2016). Given the absence of midstory, sparse native understory and fragmented condition of the site, the vegetation present is a highly disturbed variant of the EEC.

Plate 3 – PCT 3433 – Hunter Coast Foothills Spotted Gum – Ironbark Grassy Forest

2.3.2 PCT 4044 - Northern Creekflat Eucalypt-Paperbark Mesic Swamp Forest

This PCT is in the southern low-lying areas of the BMP lands covering approx. 0.51ha. The canopy is dominated *Casuarina glauca*, with a ground stratum consisting of *Juncus appressa, Juncus usitatus* and *Cynodon dactylon.*

Plate 4 – PCT 4044 – Northern Creekflat Eucalypt-Paperbark Mesic Swamp

2.3.3 Planted Native

Much of the BMP Lands consists of highly disturbed grassland (**Plate 5**). This area is largely cleared and dominated by planted *Cynodon dactylon* (Couch Grass) and introduced species such as *Paspalum dilatatum* (Paspalum), *Senecio madagascariensis* (Fireweed), and *Juncus acutus*.

While *Cynodon dactylon* is considered native by the NSW Herbarium, it is listed as non-native by the Commonwealth. Despite being widely cultivated as a lawn and pasture grass (DPE, 2022), it is historically associated with agricultural grazing practices, where it was likely sown. Consequently, the *Cynodon dactylon* present at the site is classified as 'planted native vegetation'.

Plate 5 – Exotic grassland in southern BMP lands

2.3.4 Exotic Riparian

The riparian zone of the BMP lands located in the south, is dominated by exotic species including *Juncus acutus, Hypochaeris radicata* and *Cyperus eragrostis*.

Plate 6 – Exotic riparian vegetation in unaltered hydroline alignment

2.4 Native Vegetation Condition

2.4.1 PCT 3433 - Hunter Coast Foothills Spotted Gum - Ironbark Grassy Forest

Areas of PCT 3433 are in moderate condition as a result of edge effects and disturbance from grazing cattle. The mid stratum is absent likely due to suppression of shrubs from grazing. The lower stratum, although highly disturbed, containing a large number of exotics, also comprises regenerating native understory species.

Plate 7 – PCT 3433 in moderate condition in west of BMP lands

2.4.2 PCT 4044 - Northern Creekflat Eucalypt-Paperbark Mesic Swamp Forest

PCT 4044 within the BMP lands is in a highly degraded condition. The native vegetation is limited to a small number of native species including *Casuarina glauca, Carex appressa* and *Juncus usitatus.* The majority of weed load in this area is comprised of understory species *Cyperus eragrostis* and *Juncus acutus.* Degraded ground cover in the south west is subject to extensive runoff from the development south of the NEH draining into this area and is starting to form a freshwater wetland, albeit in the early stages. Areas directly impacted by increased runoff will be reconstructed with aquatic species from PCT 3975 *Southern Lower Floodplain Freshwater Wetland* to reflect and support the change in conditions, assist in water treatment from road runoff and from adjoining residential subdivision, the species in this PCT are known for their ability to improve water quality. Additionally, reconstruction of PCT 3975 will be undertaken to ensure vegetation communities are commensurate with the Threatened Ecological Community (TEC) *Freshwater Wetlands on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions.* The wetland PCT will also provide potential habitat for amphibians such as Green and Golden Bell Frog.

Plate 8 – PCT 4044 in poor condition view facing east to west, proposed to be regenerated with PCT 3975 as freshwater wetland.

3.0 Regeneration Approach and Targets

Regeneration of the BMP lands will be undertaken over a period of 5 years. Management of the site will be undertaken to ensure compliance with the *Biosecurity Act 2015*.

Regeneration of the BMP Lands will aim to reach a state of "Natural Regeneration" requiring minimal to no intervention. To achieve this, an Integrated Regeneration Approach has been designed, with key elements and targets identified for each vegetation community within each Management Zone.

It is anticipated that after the 5 years duration of the BMP, the vegetation present will be in a state of natural regeneration and will be self-sustaining only requiring a low level of maintenance to address sporadic weed incursions.

3.1 Integrated Regeneration Approach for BMP Lands

Regeneration of the BMP lands will be undertaken by utilising where possible the principles of the *Society for Ecological Restoration Australasia* (2021) *National standards for the practice of ecological restoration in Australia Edition 2.2* and an ecological regeneration approach has been deemed suitable for the BMP lands. This approach utilises three integrated restoration techniques to achieve the goal of a Natural Regenerating ecosystem and include:

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

National Guidelines assigned to BMP Land areas are based on their history of disturbance and current state. These include the Natural Regeneration and Facilitated Regeneration approaches that will be utilised within the BMP lands with the aim of achieving the Natural Regeneration state by the end of the BMP Management period.

Note that the Reconstruction Approach will not be utilised due to the low weed load within the BMP Lands and resilience of the vegetation present. Nonetheless, adaptive management require the consideration for active restoration via supplementary planting due to the potential for unforeseen factors to arise such as new weed incursion, vandalism or introduction of pathogens that may impact one or more strata of vegetation.

3.1.1 Reconstruction Approach

This approach is used across sites where the vegetation condition is poor, generally due to a range of causes of degradation that have led to partial or total damage to biotic and abiotic factors. The Reconstruction Approach includes:

- Site preparation:
- Primary weeding;
- Installation of jute matting and coir logs in areas of high water-flow;
- Planting of tree, shrub and ground species in appropriate areas;
- Installation of guards around tree and shrub species;
- Watering;
- Secondary weeding;
- Mulching in areas without jute matting;
- Maintenance watering;
- Maintenance of tree guards; and
- Replacement of dead plants.

Zones 1,2,4,5 and 6 within the BMP lands have been appointed to be reconstructed.

3.1.2 Facilitated Regeneration Approach

This approach is generally used on sites where regeneration progress is at an intermediate level and active intervention is minimised.

As stated, the Facilitated Regeneration Approach requires active interventions, the tasks of which will be determined by the Bush Regeneration Contractor (BRC) and may involve the following tasks:

- Replacement of dead plants;
- Weeding;
- Watering;
- Mulching; and
- Maintenance of tree guards.
- Maintenance of jute matting

3.1.3 Natural Regeneration Approach

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

The Natural Regeneration Approach requires limited to no interventions with weeding being the only task undertaken to encourage continual natural regeneration.

The majority of the BMP Lands will be managed via this approach due to weed loads being mostly low to negligible. Where weed densities are moderate, ongoing weed control targeting the vicinity of the tracks is expected to manage the edge effect and provide opportunities for native flora to recruit and colonize areas cleared of exotic species. Ongoing monitoring will determine whether weed control is effective and if adjusting management strategy to facilitated regeneration and/or reconstruction is necessary.

3.1.4 Natural Channel Design and Vegetated Riparian Zone

As part of the development footprint, the existing mapped hydroline will be realigned within the BMP lands. A section of the creek, currently vegetated with planted PCT 3433, will be retained. The rest of the riparian corridor will be regenerated with PCT 3433, In-stream aquatic vegetation will be from PCT 3975. This is shown in **Figure 3**.

The existing creek is highly degraded, eroded and modified by past and present agricultural uses. The Department of Planning and Environment (Water) requires a 10m VRZ from the top of bank on a 1st order stream.

The realigned creek has been designed to include:

- Defined bed and bank;
- Meanders;
- Pools;
- Riffles; and
- Aquatic vegetation.

Plates 9-12 below show examples of these design features.

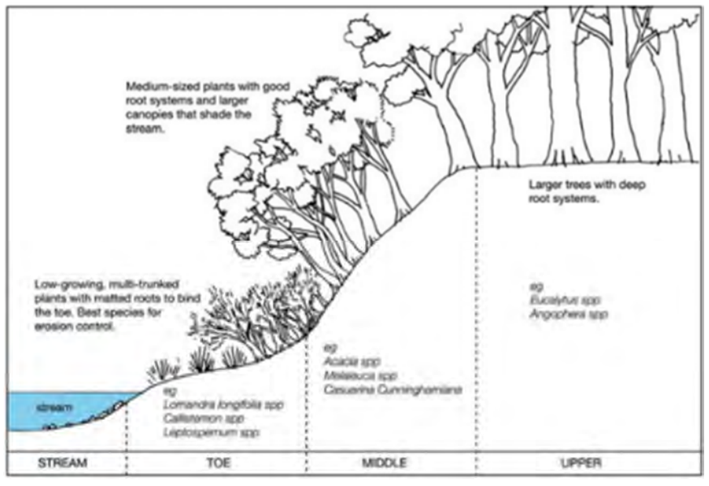

Plate 9 - Cross Section of Stream (NSW Water, 2022)

A review of the current literature showed that reinstated natural channels within the unnamed creek would ensure the above key hydrological features are present within the creek, and as a result improved water quality and habitat for both terrestrial and aquatic organisms will be provided. **Plates 7 – 9** show photos of natural channel design examples.

This BMP provides the concept plan for the channel design, detailed engineering plans will be prepared prior to Construction Certificate.

Plate 10 – Meanders, Riffles and shallow pools (STORMWATER, 2018).

Plate 11 – Low Flow Channel (Australian Wetland Consulting, 2018).

Plate 12 – Bundamba Creek Restoration works (Australian Wetland Consulting, 2018)

4.0 BMP Stages

4.1 Stage 1

Before the commencement of BMP works in Stage 2, temporary regeneration will occur before the stream alignment. This is due to the upgrade of Wyndella Road carriageway and the installation of a shared pathway. The focus of this stage is temporary bank stabilisation prior to Stage 2 works. The operation of the stream will also be in use short term, by implementing the BMP to a two-stage approach, the necessary road closures of Wyndella Road will be reduced to minimise disruption to local residents.

4.2 Stage 2

The permanent stream realignment will occur in association with the subdivision stage. Once all civil works are completed for the subdivision, the BMP works will commence.

5.0 Management Zones

The BMP lands within will be managed in six (6) Management Zones (MZs) to clearly identify objectives and targets. **Figure 4** shows the Management Zones.

- Management Zone 1 (MZ1): PCT 3975 Reconstruction - Low Flow Channel;
- Management Zone 2 (MZ2): PCT 3433 Reconstruction - Watercourse Bank;
- Management Zone 3 (MZ3): PCT 3433 – Facilitated Regeneration ;
- Management Zone 4 (MZ4): PCT 3433 Reconstruction – Riparian;
- Management Zone 5 (MZ5): PCT 3975 Reconstruction - Freshwater Wetland (Ground Cover); and

- Management Zone 6 (MZ6): PCT 3433 Reconstruction - Proposed Berm.

5.1 Management Zone 1 : PCT 3975 Reconstruction - Low Flow Channel

MZ1 (approx. 0.07ha) zone is located in the low flow channel to the top of the toe, consisting of a width of 1m – 2m. It will include the reinstating of aquatic vegetation and habitat such as snags and woody debris.

The Reconstruction Approach is being utilised in MZ1 due to the realignment of the creek line and density of weeds found on either end of the creek (East and West). De-watering, trenching, digging, construction and planting of native water plants will need to be implemented**.**

Weeding as defined in **Table 2**, effectively controlling priority species and areas through appropriate methods to eliminate highly competitive weeds from an area.

All works should be undertaken to ensure bed and bank stability, provisions of aquatic habitat for both flora and fauna.

As stated, the Reconstruction Approach requires active interventions, the tasks of which will be determined by the Bush Regeneration Contractor (BRC) and may involve the following tasks:

- Construction of natural channel;
- Planting of grasses;
- Installation of snags;
- Weeding;
- Watering; and
-
- Replacement of dead plants (1:1).

The BMP aims to move into Natural Regeneration Approach by the end of Year 5.

5.2 Management Zone 2 : PCT 3433 Reconstruction - Watercourse Bank

MZ2 (approx. 0.34ha) is located from the top of the toe to the top of the high bank approximately 2m either side of MZ1. MZ2 will be planted out with species commensurate with PCT 3433.

The Reconstruction Approach is being utilised in this section due to the realignment of the creek line and density of weeds found on either end of the creek (East and West). Therefore, planting of native species from PCT 3433 will assist with meeting the Targets outlines in Section 6.

To prepare for planting, spot spraying of the area should be undertaken and direct seeding of native grasses and ground covers may occur around the planting. This will be decided by the bush regeneration contractor.

Maintenance of the plantings will include watering and spot spraying of herbaceous weeds over the following months as well as replacement of dead plants if conditions are still favourable for planting. If weather is unsuitable, replacement and infill planting will be postponed till the following spring at autumn.

Weeding will be commenced, as defined in **Table 2** (effectively control priority species and areas through appropriate methods to eliminate highly competitive weeds from an area).

All works should be undertaken to ensure bed and bank stability, provisions of terrestrial habitat for both flora and fauna.

As stated, the Reconstruction Approach requires active interventions, the tasks of which will be determined by the Bush Regeneration Contractor (BRC) and may involve the following tasks:

- Planting of grasses and shrubs;
- Weeding;
- Watering;
- Mulching (if required); and
- Replacement of dead plants (1:1).

The BMP aims to move into Natural Regeneration Approach by the end of Year 5.

5.3 Management Zone 3 : PCT 3433 - Facilitated Regeneration

MZ3 (approximately 0.12ha) is located on the western boundary and currently consists of planted PCT 3433 and some regenerating casuarinas surrounding an existing watercourse. While canopy cover is present, there is no midstory, necessitating the initial planting of shrubs to establish a microclimate conducive to groundcover growth. Proposed interventions include pocket plantings of canopy trees and low-lying, fire-resistant species to facilitate Squirrel Glider movement, minimize bushfire risk, and comply with Safer by Design Guidelines to reduce potential antisocial behaviour.

The Facilitated Regeneration Approach is being employed in MZ3 due to high weed loads and the absence of mid and lower stratum vegetation. Planting native species from PCT 3433 will help achieve the targets outlined in **Section 5**. Primary weeding, as detailed in **Table 2**, will involve foliar herbicide application and the physical removal of woody weeds to effectively control priority species and eliminate highly competitive weeds.

As stated, the Facilitated Regeneration Approach requires active interventions, the tasks of which will be determined by the Bush Regeneration Contractor (BRC) and may involve the following tasks:

- Weeding;
- Planting;
- Watering;
- Mulching (if required); and
- Maintenance of tree guards;
- Maintenance of jute matting;
- Replacement of dead plants (1:1).

The BMP aims to move into Natural Regeneration Approach by the end of Year 5.

5.4 Management Zone 4 : PCT 3433 Reconstruction - Riparian

MZ4 (approx. 0.45ha) is from the edge of the floodplain to the landscaped road batters and parkland area. This zone will be planted to reflect a derived woodland of PCT 3433. This will ensure the Safer by Design Guidelines are met with more pocket plantings to ensure clear sightlines and no spaces where antisocial behaviour can occur.

The Reconstruction Approach is being utilised in MZ4 due to the high weed loads and lack of native vegetation within this zone. Therefore, canopy trees, shrubs and understory form PCT 3433 will assist with meeting the Targets outlines in **Section 6.**

Primary weeding as defined in **Table 2** to effectively control priority weed species and eliminate highly competitive weeds from an area. This may include high-volume herbicide application.

As stated, the Reconstruction Approach requires active interventions, the tasks of which will be determined by the Bush Regeneration Contractor (BRC) and may involve the following tasks:

- Installation of logs along edge as a buffer;
- Planting of grasses, shrubs and canopy species;
- Installation of habitat;
- Weeding;
- Watering;
- Mulching (if required); and
- Replacement of dead plants (1:1).

The BMP aims to move into Natural Regeneration Approach by the end of Year 5.

5.5 Management Zone 5: PCT 3975 Reconstruction - Freshwater Wetland

MZ5 (approximately 0.31ha) will be established to enhance connectivity and support the surrounding hydrological regime as part of a water sustainable urban design. This area will predominantly feature a mixture of freshwater wetland and semi-aquatic groundcover commensurate with PCT 3975. MZ5 plantings will be limited to ground cover only to reduce future bushfire risk to adjacent properties. These elements are designed to integrate with the terrestrial environment and meet the hydrological needs of the site. It is crucial to design this area to avoid shading the water features, as prolonged shading will reduce habitat suitability. The planting densities are based on evidence and historical data from various reports and case studies.

Shrubs and canopy in MZ4 will add a layered structure that assists MZ5 in reducing grassy weed cover and preventing weed incursion into the BMP lands from the road to the south.

The following management tasks are to be undertaken:

- Primary planting (Aquatic and terrestrial wetland ground cover vegetation commensurate with PCT 3975);
- Watering; and
- Ongoing maintenance (Watering, replacement of unsuccessful plantings).
- Primary and secondary weeding.

5.6 Management Zone 6: PCT 3433 Reconstruction - Proposed Berm

MZ6 (approximately 0.09ha) has been established to manage hydrological overflow and dispersion as part of a water sustainable urban design. This zone will regenerate PCT 3433 ground cover and shrub layer on a constructed berm and support various ecological functions.

The following management tasks are to be undertaken:

- Primary weeding;
- Planting of ground cover and mid-strum species only from PCT 3433;
- Weed control; and
- Maintenance weeding and replacement of any dead plantings.

6.0 Regeneration Targets

6.1 Ecosystem Targets

"Ecological restoration is the process of assisting the recovery of an ecosystem that has been degraded, damaged or destroyed. (SER 2021)*"*

The overall target for the BMP Lands is to establish a naturally regenerating community that provides habitat for foraging, roosting and nesting for species associated with the PCTs and local region.

There are many ways to generate targets and establish measure tools to determine the health of an ecosystem such as:

- Benchmark conditions set under the Biodiversity Assessment Methods 2020;
- Percentage of species presence from community list per as a whole, or per stratum;
- Species composition;
- Physical condition;
- Absence or presence of threats;
- Structural diversity;
- Coverage of the flora species;
- Diversity of fauna guilds present; and
- Abundance of fauna recorded within the subject site.

AEP acknowledges that all the above are valid assessment tools to utilise and measure success, however there are several factors that limit all communities from reaching Benchmark Conditions:

- Availability to purchase seed or tube stock of many native species;
- Topographic features of each site vary;
- Aspect of BMP lands variation between sites;
- Accessibility / connectivity for mobile fauna to access and use the site;
- Soil types;
- Surrounding vegetation communities influence the seed stock and hence natural regeneration;
- Presence of absence of canopy, impacting the microclimates;
- Rainfall variation; and
- Growth timeframes.

When developing targets for BMP Lands the above must be taken into consideration without losing the main objective to *assist the recovery of an ecosystem.* Therefore, AEP has developed targets (refer to **Appendix A)** for each Regeneration Approach that can achieve a naturally regeneration functioning ecosystem, within the timeframes outlined in the BMP.

Utilising ecological references to identify the terrestrial or aquatic ecosystem and inform the targets of a regeneration project involves describing the specific compositional, structural, and functional attributes needing reinstatement. Only then can the desired outcome of "assisting the recovery of an ecosystem" be achieved. These attributes in combination can then be used to derive the targets for a BMP. A restored state is considered to have been achieved when an ecosystem is naturally regenerating.

6.1.1 BMP Land Targets

Integrated Regeneration Approach will be applied across the entire BMP Lands, with the following targets designed to be specific, measurable, achievable, reasonable, and time-bound (SMART), providing quantitative data within the BMP Lands.

Given the current condition of the BMP Lands the focus is on weed removal, which in turn will promote the growth of native vegetation from the seed bank in the soil and the seed brought in by mobile fauna.

Appendix A outlines the targets the BMP is aiming for each attribute within the BMP Lands.

When surveys were undertaken by AEP the vegetation within communities were was identified to be in two conditions requiring two of the three approaches to regeneration:

- **Management Zones 1, 2, 4, 5 and 6** were in poor condition requiring regeneration based on Reconstruction Approach. Targets are outlined in **Tables 1 - 2.**.
- **Management Zone 3** was identified in moderate condition requiring regeneration based on a Facilitated approach. Targets are outline in **Tables 1 - 2.**.

As stated above the condition of vegetation communities can vary significantly and as such baseline data will be collected to determine the targets for each of the Management Zones within the BMP Lands. The baseline report will be prepared at commencement of the BMP and submitted to Council outlining the specific targets for each zone, based on **Tables 1 - 2.**.

The Integrated Regeneration Approach will be used across the entire BMP Lands and the targets (**Tables 1 - 2**) have been designed to be measurable, providing both quantitative and qualitative data on species abundance and cover for the vegetation communities within the BMP Lands.

Weeds have a significant impact on structural integrity of vegetation communities. African Olive (*Olea europaea subsp. cuspidate*) was the only woody weed present, as both in juvenile and adult form. Various exotic grasses and herbs were present, primarily Black Nightshade (*Solanum nigrum*), Galenia (*Galenia pubescence*), Fire weed (*Senecio madagascariensis*), Pale Pidgeon *Grass (Setaria pumila),* Panic Veldt grass *(Ehrharta erecta),* Paspalum *(Paspalum dilatatum*) and Purple top (*Verbena bonariensis*).

Some of these species are identified as priority weeds (**Appendix A**) for the Hunter. These include priority weeds African Olive, Fire Weed and Galenia. Treatment of all other weeds will be a secondary measure.

To achieve Natural Regeneration throughout the entire BMP lands within five (5) years targets have been set within **Tables 1 - 2.**.

Table 1 – Regeneration Targets for Reconstruction Approach

Attribute	Baseline Data	Level 1	Level 2	Level 3	Level 4	Level 5
Approximate Timeframe from Commencement	**Commencement**	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**
Species composition	At each monitoring point collect: • Native Species abundance • Native Species Cover • Weed / exotic Species abundance • Weed / exotic Species Cover	• 70% survival of each planted stratum. • 50% reduction in weeds from baseline data.	• 80% survival of each planted stratum. • 60% reduction in weeds from baseline data.	• 80% survival of each planted stratum. • 80% reduction in weeds from baseline data.	• 80% survival of each planted stratum. • 90% reduction in weeds from baseline data.	• 80% survival of each planted stratum. • 95% reduction in weeds from baseline data.
Structural diversity	Record the native growth forms present: • Tree; • Shrub; • Grass / grass like; • Forb; • Fern; and • Other.	One or fewer strata present and no spatial patterning or trophic complexity relative to from baseline data.	More strata present but low spatial patterning and trophic complexity, relative to benchmark from baseline data.	Most strata present and some spatial pattering and trophic complexity relative to benchmark from baseline data.	All strata present. Spatial pattering evident and substantial trophic complexity developing, relative benchmark from baseline data.	All strata present and spatial pattering and trophic complexity high. Further complexity and spatial pattering able to naturally regenerate.
Ecosystem Function	Leaf litter	A 2% - 5% increase from baseline data.	A 5% - 15% increase from baseline data.	A 15% - 25% increase from baseline data.	A 25% - 35% increase from baseline data.	A 35% - 50% increase from baseline data.
	Ground habitat installed	No decline in ground habitat (replace if removed or damaged)	No decline in ground habitat (replace if removed or damaged)	No decline in ground habitat (replace if removed or damaged)	No decline in ground habitat (replace if removed or damaged)	No decline in ground habitat (replace if removed or damaged)
	Stem classes present	No increase required as tube stock planted.	No increase required as tube stock planted.	No increase required as tube stock planted.	No increase required as tube stock planted.	2 -10% increase in stem class presence from baseline data
	Observed fauna: • Native species • Pest species	• No increase of native fauna required from baseline data. • 5%-10% reduction in pest species from baseline data	• No increase of native fauna required from baseline data. • 10% -20% reduction in pest species from baseline data	• 5% -15% increase in observed native fauna from baseline data. • 5% -10% reduction in pest species from baseline data	• 15% -25% increase in observed native fauna from baseline data. • 5% -10% reduction in pest species from baseline data	• 25% - 50% increase in observed native fauna from baseline data. • 5% -10% reduction in pest species from baseline data

Table 2 – Regeneration Targets for Facilitated Approach

Attribute	Baseline Data	Tired Targets (base on Baseline Data)	Level 2	Level 3	Level 4	Level 5	Level 5
Approximate Timeframe from Commencement	**Commencement**		**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**
Species composition	At each monitoring point collect: • Native Species abundance • Native Species Cover • Weed / exotic Species abundance • Weed / exotic Species Cover	**Tier 1 – Diversity good at baseline.** No supplementary planting or other works required.	• Diversity / cover Maintained or improved from baseline data. • 60% reduction in weeds from baseline data.	• Diversity / cover Maintained or improved from baseline data. • 80% reduction in weeds from baseline data.	• Diversity / cover Maintained or improved from baseline data. • 90% reduction in weeds from baseline data.	• Diversity / cover Maintained or improved from baseline data. • 95% reduction in weeds from baseline data.	Maintain or improve on Year 4 targets
		Tier 2 – Diversity moderate to low at baseline. Works required such as supplementary planting, possible thinning, etc required.	• 80% survival of each planted stratum. Noting this will increase diversity in where required. • Maintain diversity recorded at baseline data. • 60% reduction in weeds from baseline data.	• 80% survival of each planted stratum. Noting this will increase diversity in where required. • Maintain diversity recorded at baseline data. • 80% reduction in weeds from baseline data.	• 80% survival of each planted stratum. Noting this will increase diversity in where required. • Maintain diversity recorded at baseline data. • 90% reduction in weeds from baseline data.	• 80% survival of each planted stratum. Noting this will increase diversity in where required. • Maintain diversity recorded at baseline data. • 95% reduction in weeds from baseline data.	
Structural diversity	Record the native growth forms present: • Tree; • Shrub; • Grass / grass like; • Forb; • Fern; and • Other.	N/A	More strata present but low spatial patterning and trophic complexity, relative to benchmark from baseline data.	Most strata present and some spatial pattering and trophic complexity relative to benchmark from baseline data.	All strata present. Spatial pattering evident and substantial trophic complexity developing, relative benchmark from baseline data.	All strata present and spatial pattering and trophic complexity high. Further complexity and spatial pattering able to naturally regenerate.	
Ecosystem Function	Leaf litter	N/A	A 5% - 15% increase from baseline data.	A 15% - 25% increase from baseline data.	A 25% - 35% increase from baseline data.	A 35% - 50% increase from baseline data.	
	Ground habitat installed		No decline in ground habitat (replace if removed or damaged)	No decline in ground habitat (replace if removed or damaged)	No decline in ground habitat (replace if removed or damaged)	No decline in ground habitat (replace if removed or damaged)	
	Stem classes present		No increase required as tube stock planted.	No increase required as tube stock planted.	No increase required as tube stock planted.	2 -10% increase in stem class presence from baseline data	

Attribute	Baseline Data	Tired Targets (base on Baseline Data)	Level 2	Level 3	Level 4	Level 5	Level 5
Approximate Timeframe from Commencement	Commencement		Year 1	Year 2	Year 3	Year 4	Year 5
	Observed fauna: • Native species • Pest species		• No increase of native fauna required from baseline data. • 10% -20% reduction in pest species from baseline data	• 5% -15% increase in observed native fauna from baseline data. • 5% -10% reduction in pest species from baseline data	• 15% -25% increase in observed native fauna from baseline data. • 5% -10% reduction in pest species from baseline data	• 25% - 50% increase in observed native fauna from baseline data. • 5% -10% reduction in pest species from baseline data	

7.0 Wildlife Management Strategy

7.1 Fauna Management

Macropods and possums were observed onsite and in the surrounding area. Consequently, protective guards should be installed around plantings to safeguard revegetation efforts in BMP lands from browsing. Should monitoring within management zones identify significant interference by pest species — such as excessive feeding — management strategies will be reassessed to mitigate these impacts.

Incidental fauna records are to be undertaken during monitoring surveys and reported.

Throughout all works onsite, any required fauna handling is to consider and/or implement the following:

- Native terrestrial and aquatic fauna will be transported by an appropriate method to a suitable nearby, vegetated area or permanent waterway as determined by the Project Ecologist.
- If fauna species encountered are listed as threatened species, all work must cease and the Project Ecologist must consult with a Council Ecology representative and Department of Primary Industries (Fisheries Unit) to review procedures.
- Frog handling will be undertaken in accordance with the Hygiene Protocol for the Control of Disease in Frogs (Murray et al. 2011).
- Fish species identified as exotic are to be ethically euthanised by a suitable method as determined by the Project Ecologist, and pest species eggs encountered are to be disposed at a suitably licenced landfill.
- The tailout scour protection area will not utilise chemical weed control to ensure water quality is maintained (refer **Figure 3**).

7.2 Habitat Corridor

The riparian vegetation and installation of ground habitat throughout the BMP Lands will provide a wildlife corridor within the Subject Site. The design of the corridor focused on both terrestrial and aquatic species ensuring mobile fauna can move through the BMP lands, including fish. The design of the corridor and planting regime must be undertaken to ensure a functioning corridor.

The focus was to ensure, movement and canopy connection. The Squirrel Gliders was not detected within the Subject Site, however, has been detected within the LGA, BioNet indicates sightings within 2 km. AEP used the movement, foraging and nesting requirements of this species to determine densities, and species to ensure they will be able to move through the BMP lands. This design supports the movement and foraging for many other native species.

Below outlines the species requirements.

7.2.1 Squirrel Glider

Squirrel Gliders (*Petaurus norfolcensis*) are threatened small gliding marsupials that have distinctive membranes of skin, stretching between their front and hind legs, that enable them to glide with ease through the air.

7.2.2 Breeding and foraging habitat

The Squirrel Glider prefers wet and dry sclerophyll forests and woodlands. The most common vegetation area where they can be found are typically characterized by one or more species of ironbark eucalypts (Australian Museum, 2024).

Squirrel Gliders tend to occur within three broad habitat types; Dry sclerophyll forests and woodlands dominated by winter flowering eucalypts such as Spotted Gum (*E. maculata*), various Box Gums and Ironbarks (such as *E. crebra*), Swamp Mahogany or Red Gum (*E. tereticornis*); Dry sclerophyll forests with an understorey of gum-producing acacias; Dry sclerophyll forests and woodlands with understorey of winter and autumn flowering banksias, as well as spring and summer flowering eucalypts (A.P.Smith and M.Murray, 2003).

The facilitated regeneration of MZ3 using PCT 3433 and reconstruction of MZ1,2,4,5 and 6 using species from PCT 3433 and PCT 3975 will allow for a suitable wildlife corridor and provide habitat for this species.

Where planting constraints allow the planting of canopy trees, a minimum twenty (20) *Eucalyptus robusta* will be planted and maintained by the BRC for the life of the BMP, to establish food and gliding resources.

7.2.3 Gliding Requirements

Glide calculations - extract from Goldingay & Taylor, 2009, the glide angle on average is 28.5 degrees with horizontal distance varying based on launch height. With the average gap crossing being 1.8m times the height. Therefore, gliding distance is launch height x 1.8. The above recommendation of planting 20 *Eucalyptus Robusta* approximately 15m apart should allow for future movement of the species within the BMP Lands.

7.3 Other habitat features

The BMP proposes the installation of Overwintering Habitat Structures, the aim of these structures is to create areas of refuge outside of the inundated areas and to provide some form of overwintering habitat for fauna that require them, including insects, lizards, snakes and amphibians. The simplest construction of these types of refuges is the placement of rocks into a pile while a slightly more complex structure can involve digging a small hole approx. 0.5m in depth and up to 1m width, filling the hole with a jumble of bricks or rocks up to approx. 0.5m above ground level and then placing plant material, soil/clay and other natural material loosely over the top of the bricks or rocks. The aim being to create small spaces that are reasonably thermally stable that can be used to hibernate or seek refuge if threatened while commuting or foraging.

Rocks used in this process should be between approx. 150mm to 200mm in diameter and environmentally stable, meaning they will not affect the pH of the water.

At least one (1) of these structures should be placed in Zone 6 area as indicatively indicated in **Figure 3**.

7.4 Aquatic Fauna

7.4.1 Conservation and Habitat Restoration

Habitat for various aquatic fauna species includes semi-permanent/ephemeral wet areas and within 1km of swamps, waterbodies or wet areas. Potential habitat is present for Green and Golden Bell Frog (*Litoria aurea)* within the broader lot. However, two nights of nocturnal searches within the recommended survey period did not detect this species within the proposed impacted dams (*AEP, EAR 2023*). The creek realignment will include the creation of four (4) in-channel reservoirs within the low flow line. In addition, one (1) dispersion area and overwintering habitat structure will be installed in the south west of the BMP lands. Freshwater wetland in MZ5 will utilise vegetation species from PCT 3975 for regeneration plantings which is known to be associated with *L. aurea.* All these areas offer suitable habitat for numerous aquatic species potentially present within the locality as documented in historic Bionet records.

7.4.2 Breeding and Foraging Habitat

A large range of aquatic fauna species have been recorded in the locality within a number of habitat types including coastal swamps, marshes, dune swales, lagoons, lakes and other estuary wetlands, as well as around floodplain wetlands and slow flowing or non-perennial streams. Many of these species prefer foraging in areas that contain flowering plants, grasses and foliage. The vegetation may be near breeding sites or considerable distance away. Tussock forming plants provide ideal foraging habitat and shelter. Regenerated vegetation will aim to provide habitat for a range of aquatic fauna.

7.4.3 Hydrological Dispersion and Overwintering Habitat Structures Construction

Examples of aquatic habitat are provided within **Appendix D** and are provided to give examples, not to be strictly adhered to, with on-site conditions likely to determine exact shape and placement of potential permanent and/or ephemeral habitat.

7.4.4 Permanent and Refuge Aquatic Habitat

A permanently inundated freshwater wetland area will be established adjacent to the road to manage stormwater runoff, as depicted in **Figure 3**. This area, integral to water sustainable urban design and biodiversity management, will measure approximately 15 to 20 meters in diameter. It will feature a sloped or stepped design with a compacted clay base of 0.3 meters, overlaid with topsoil to support aquatic vegetation planting.

To enhance habitat and ecosystem balance refuge habitat is recommended to be installed in the form of large rocks and, where available, hollow logs strategically placed along the water's edge to provide sunning spots and refuges for wildlife. Note that rock placement will be selective rather than encompassing the entire perimeter.

7.5 Pest Species

Rabbits have been observed onsite. Therefore, protection guards should be placed around 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, burrowing, spreading seed etc.), then management actions will be reviewed to address these issues.

It is strongly recommended to engage with Local Land Services (LLS) and adjacent landholders to identify the most suitable approach to control rabbits in the locality. The most effective approach combines a number of specific management actions including

- Baiting with Pindone;
- Warren destruction;
- Warren fumigation;
- Trapping; and
- Biological control.

Note that baiting with 1080 should not occur less than 500m from habitations as per LLS guidelines and as such should not be used onsite. Pindone is the only poison that can be used in urban area. Also note that Shooting is not recommended due to proximity to existing and proposed urban development.

No significant evidence of other feral animals was observed on site.

8.0 Regeneration Management

8.1 Site Preparation

The schedule of works and timing has been outlined in **Table 3**. Prior to the commencement of regeneration, the BMP Lands must be prepared. The following works have been recommended to assist in site preparation:

- Establishment of pathogens and diseases controls. Diseases which could affect the site include Myrtle Rust (*Puccinia psidii*), affecting Myrtaceous plants, including Melaleuca species; and Amphibian Chytrid fungus disease, Chytridiomycosis, caused by Chytrid fungus (*Batrachochytrium dendrobatidis*). Appropriate hygiene controls are to be employed to minimise the chances of any such introduction occurring. This may include a hygiene station equipped with sterilizing agents and cleaning equipment to clean boots, tools and machinery. Response plans are needed to be designed and implemented to mitigate impacts in the event of disease or pathogen outbreaks;
- All extant 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, for example, concrete, rocks and timber posts. This material may inadvertently provide geomorphic stability;
- Clearly mark native vegetation for retention and approved removal;
- Install temporary fence around the BMP Lands, and clearly mark as a “No Go Area” prior to commencement of civil works;
- Fencing should have clearly visible signage erected at key entry points to BMP (**Appendix E**).
- 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);
- Construction of the natural channel;
- Establish monitoring and photo points;
- Vegetation clearing;
- Determine baseline data;
- Primary weed removal;
- Installation of ground habitat;
- Planting of Vegetation (see **Appendix C** for a detailed species list). 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; and
- Mulching and watering.

8.2 Vegetation Clearing

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;

- Vegetation clearing should 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;
- 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 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;
- 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;
- In addition, 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;
- Civil Construction staff to be inducted into pre-clearing and clearing protocols, and to identify environmental features for protection;
- Suitable logs from felled trees are to be emplaced along the cleared/retained boundary to create a physical barrier between Subject Site and the retained lands;
- 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.

8.3 Weed Management

Weed control works within each Management Zone are to be undertaken by a qualified bushland regeneration team using industry standards (summary provided in **Table 3**).

Any reproductive material of weeds, including weeds that 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 may be stockpiled within the Subject Site, 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 actions for these measures may be required. Weed control is required to occur in the following sequence:

1. **Primary Weeding** – Initial period of weeding within Management Zones.
2. **Consolidation** – After initial weeding, weed control zones will need monthly monitoring to remove regenerating weeds and those stimulated by disturbance, which compete with planted and regenerating native plants. Regular visits are crucial to prevent

weed recolonization, dominance, and inhibition of native species regeneration.

3. **Maintenance Weeding** – After six months, monthly maintenance will continue due to issues with woody weeds and other annual weeds in the area.

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 results indicating management zones have reached targets set out in this BMP.

Establishment of monitoring point and compliance checking of other aspects within this rehabilitation plan will be the responsibility of the Project Ecologist working with the Civil Contractor.

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 rehabilitation plan (Table 3). The Project Ecologist will be responsible for the establishment of monitoring points within the BMP along with collection of baseline data that will be monitored against this over the five-year period of this rehabilitation plan with the overall targets. The Project Ecologist will be responsible for monitoring and reporting on weed management, and Regeneration Approach success.

Table 3 – Weed Control Activities

Activity	Minimum Requirement
Pre-works	Undertake baseline surveys to identify priority weeds present on site to be the focus of weed management activities. Priority weeds based on listings under the *Biosecurity Act 2015*, and notably problematic weeds on site have been identified, and listed in **Section 6.0**.
Primary Works	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 which would pose safety hazards to the public or others if left to perish *in-situ*.
Secondary Works	Treat any regrowth from primary weed control and expand on control measures by targeting Priority species and expanding the primary control boundaries where desirable. Thin retained weeds to increase light penetration where appropriate. Generally, expand on and solidify primary work.
Maintenance Works	Maintain exclusion of weeds controlled during Primary and Secondary works. Prevent reinfestation of weeds progressively, and others as time permits.
Woody Trees & Shrubs	Where appropriate, remove trees via mechanical means (i.e., chainsaw or handsaw) and apply chemical to the cut stump. Material may be retained on-Site or disposed of appropriately off-Site. Retained material should be situated to provide additional ground habitat and slope stability but should not be left in such a way that would hamper natural regeneration or existing native plants. Care should be taken with species which have the capacity to regrow vegetatively such as *Erythrina x sykesii* (Coral Tree). Alternatively, trees and shrubs may be treated via frill or drill application of herbicide and left to perish *in-situ* as habitat.
Woody Thickets	Treat via cut or scrape and paint or high-concentration low-volume foliar herbicide control (i.e., splatter application). Material may be left *in-situ* (particularly after spraying) or broken up and rafted off the ground to perish (taking care to remove from expected high flow areas of the dam). Do not manually remove root stock in a manner that will encourage soil instability or erosion. Once dead, standing material may be broken down and left on the ground as mulch. Mechanical removal (i.e., brush cutter equipped with mulching blade or similar) may be used where practical and regrowth treated with foliar application of herbicide.
Vines and Creepers	Skirt from trees and vegetation to prevent smothering and leave material to perish *in-situ*. Cut or scrape and paint stems or runners. Foliar herbicide control where appropriate. Do not unduly expose soil via manual removal of plants where they may be providing soil stabilisation. Isolated manual removal as appropriate.
Ground Cover	Retain exotic species where they are providing ground stabilisation or habitat until such time as they hinder native species establishment or are no longer necessary. Relevant examples include retaining *Tradescantia fluminensis* (Trad) along drainage lines where removal would expose bare soil to erosion. Weed control is to focus on the patch removal of such weeds from around native regeneration or planting, with progressive removal of larger patches over time.
Retention of forage/habitat	Retain trees and shrubs that have evidence of occupation i.e., bird nest/possum dreys, until such time as other suitable habitat is available or the nest is abandoned. Retain manageable clumps of vegetation that can be easily removed at a later date for intermediate food and habitat supply within the semi-cleared and disturbed landscape, which will emerge between weed control and establishment of native plants.
	These retained features can be removed as they become redundant at the discretion of the Bush Regeneration Contractor (BRC).

9.0 Project Management

Establishment of monitoring points and compliance checking of other aspects within this BMP will be the responsibility of the Project Ecologist working with the Civil Contractor.

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 the following qualifications:

- 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.
- 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.

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 this over the three-year period of this BMP with the overall targets. The Project Ecologist will be responsible for monitoring and reporting on weed management, and Regeneration Approach success.

9.1 Monitoring

Monitoring will occur at commencement and biannual basis at monitoring points

9.1.1 Baseline Data

Baseline data is collected at commencement of the BMP refer.

Indicative monitoring points have been identified within the BMP Lands (refer **Figure 3)**. The final location of the monitoring points is to be determined when commencing works, as environmental conditions change over time and the indicative locations may not be reflective of the communities at the time of commencement.

Baseline data will cover:

- Species diversity (both native and exotic);
- Species Abundance (both native and exotic);
- Overall health of the BMP Lands;
- Photos in north, east, south and west aspects; and
- Record incidental fauna.
- Presence/absence of Survey for exotic Mosquito Fish (*Gambusia affinis)* within pond and pools using the dip netting technique

The Monitoring Points established for the baseline surveys will then be monitored on a biannual basis, as per **8.1 Monitoring**.

9.1.2 Biannual Monitoring

The following tasks are scheduled every six (6) months from the start, continuing for up to three years or until the targets are achieved, whichever comes later:

- Weed species, coverage and location;
- Native species, coverage and location;
- Effectiveness of weed control methods;
- Photo records at monitoring points at each aspect (north, east, south, west);
- General health of each Management Zone
- Survey for Gambusia within Ponds using the dip netting technique
- Incidental fauna use of site; and
- Evaluation of management effectiveness.

9.2 Reporting

A baseline report is prepared at the beginning of the BMP and submitted to Council. Subsequently, annual status reports are to be prepared and submitted to the consent authority throughout the duration of the BMP. A final report will be prepared at the conclusion of the BMP, detailing the fulfillment of BMP conditions.

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

As part of adaptive management, the reports will include evaluations and recommendations relating to all areas covered in the monitoring schedule and address any other problems or deficiencies found during monitoring. If required, the report should also outline any changes that are required to planned works to ensure better ecological outcomes.

Regeneration of the BMP Lands will occur over a period of five (5) years or until the Year five (5) overall targets are achieved. Once the targets are met, the BMP lands will transition to a state of natural regeneration. Management of the site thereafter will adhere to the requirements of the *Biosecurity Act 2015* and *Biosecurity Regulations 2017*.

9.2.1 Future Management Actions

With all regeneration plans, objectives and targets are set based on good conditions, however, this may not always be the case. The following table has been prepared for an immediate and concise action plan is generated to ensure targets can be achieved.

Table 4 – Intervention: Handling Unexpected Outcomes

Element Change	Step 1	Step 2	Step 3	Step 4	Step 5
Fire	BRC to notify Project Ecologist and arrange a joint site inspection.	Assess impact to BMP Lands.	Prepare regeneration plan	Submission of notification and modified Plan to Council.	Implement approved Plan
Flood					
Drought					
Other weather event					
Pest Species damage					
Introduction of pathogen					
Vandalism					
Theft					

Table 5 – Proposed Works Schedule

Activity	Specific Action	Year 1				Year 2				Year 3				Year 4				Year 5			
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
VMP Lands Preparation	Installation / removal of temporary fencing and signage	Installed at the beginning of Year 1 and removed once construction is finished																			
	Implementation of pathogen and disease controls	To be implemented throughout the duration of the VMP																			
	Installation / removal of sediment and erosion control	Installed at the beginning of Year 1 and monitored throughout the duration of the VMP																			
	Realignment of watercourse and construction of ponds and hibernacula																				
	Relocation of logs to BMP Lands																				
Weed control	Primary weeding all MZs (Monthly)																				
	Consolidation (Secondary and Tertiary) weeding (Monthly)																				
	Maintenance Weeding (to be adjusting according to findings from monitoring)																				
Revegetation	Buffer Planting along VMP Lands boundary (MZ4)																				
	Initial canopy planting (MZ4)																				
	Consolidation and replacement planting (All zones)																				
	Direct Seeding of groundcovers (if required). (MZ1,2,4,5 and 6)																				
	Shrub (MZ2,3,4,6) and grasses, macrophytes (MZ1,5) planting																				
	Replacement of dead plants if required																				
Project Management	Set up Monitoring Plots and collect baseline data																				
	Survey for Gambusia within Ponds (dip netting)																				
	Vegetation Cover, Dispersion Area and Hibernacula monitoring (Spring and autumn)																				
	Reporting (to be submitted to MCC within a month of second bi-annual monitoring event)																				**Final**

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AEP

Figure 1 - Site Map

Date: July 2024

Location: 898 New England Hwy, 25 & 39 Wyndella Rd, Lochinvar NSW

Client: Lochinvar Developments Pty Ltd
C/- ADW Johnson Pty Ltd

AEP ref: 2699.04
BOAMS: 00048759

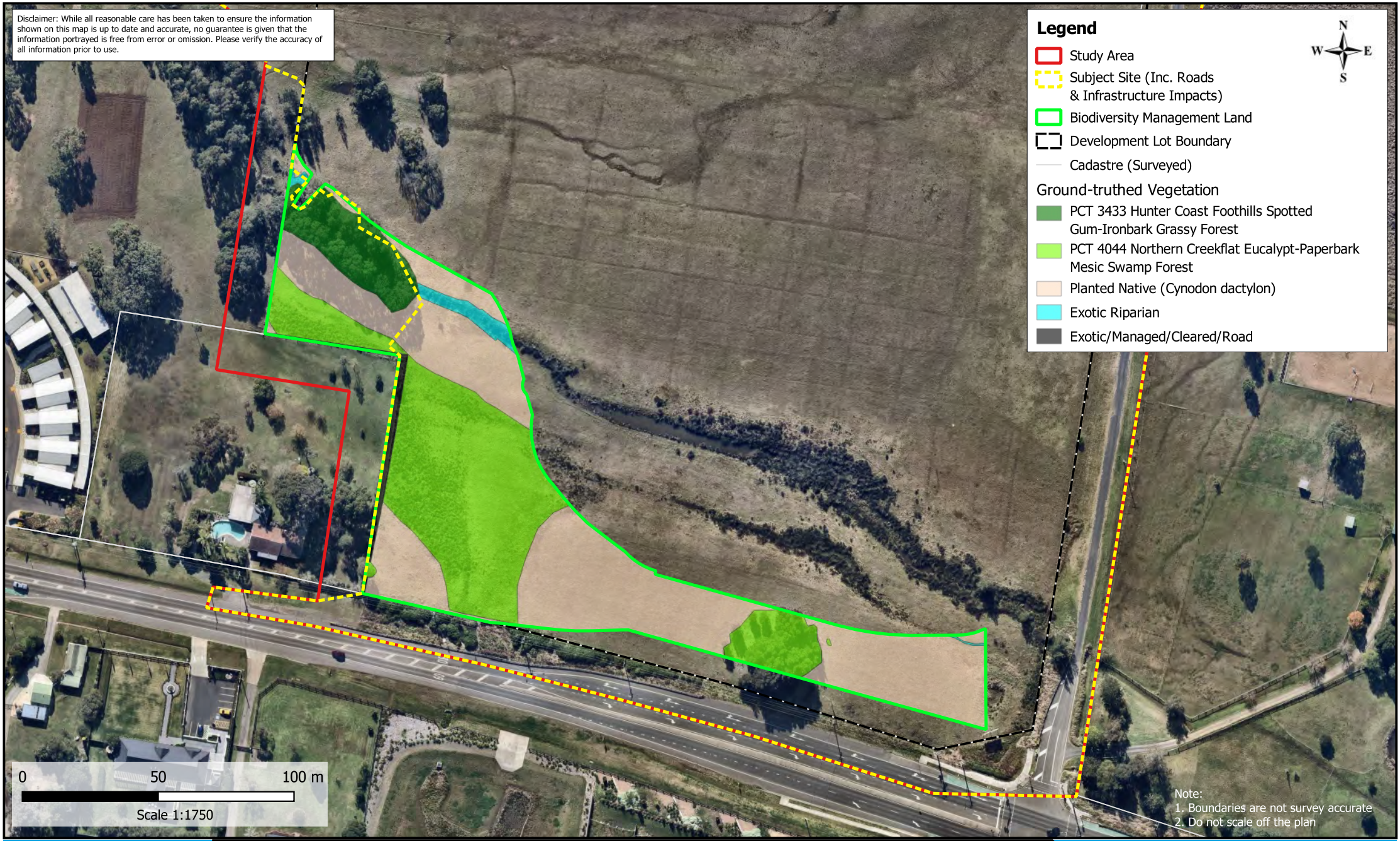

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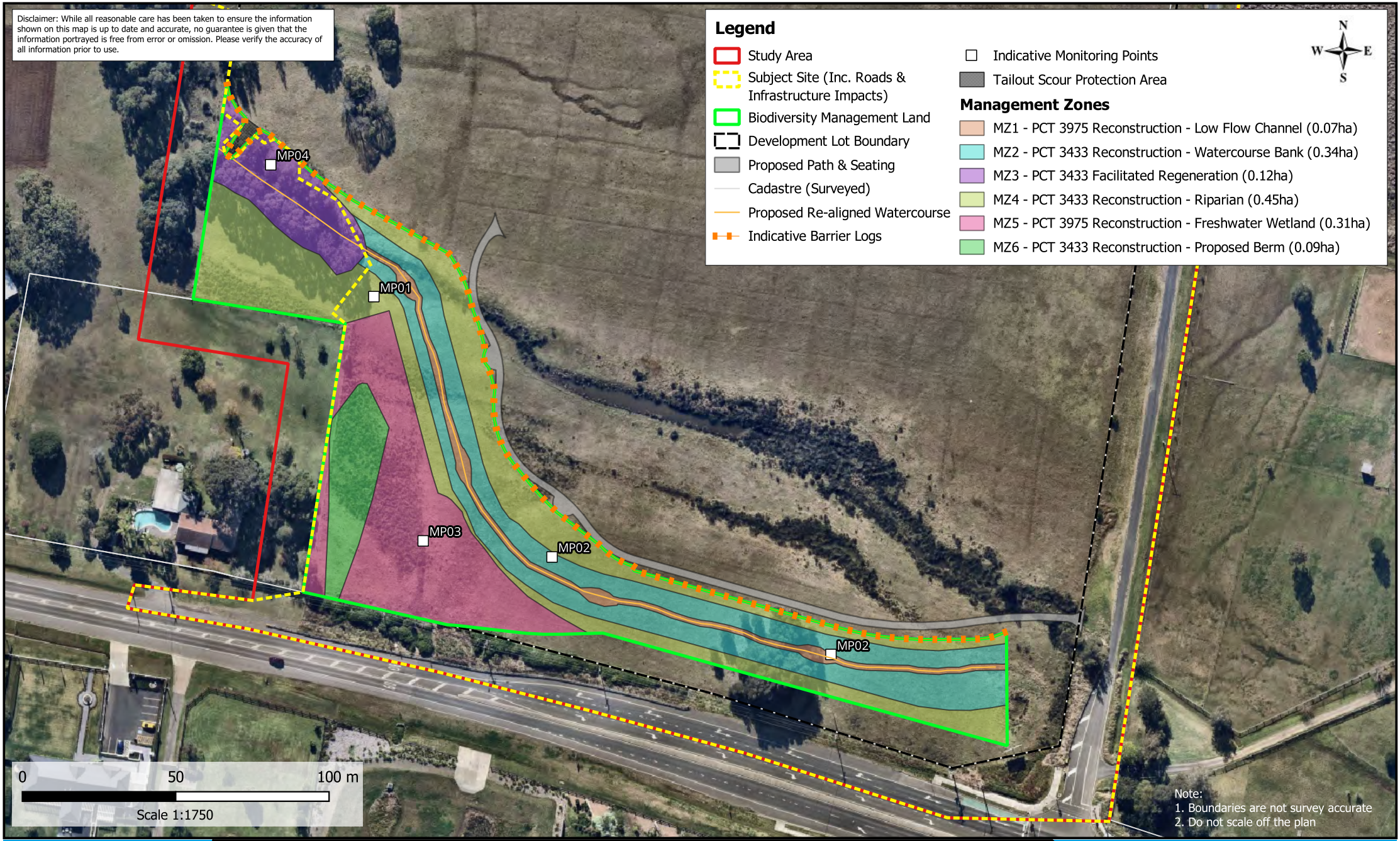
Figure 2 - Ground-truthed Vegetation — Date: July 2024

Location: 898 New England Hwy, 25 & 39 Wyndella Rd, Lochinvar NSW

Client: Lochinvar Developments Pty Ltd — AEP ref: 2699.04
C/- ADW Johnson Pty Ltd — BOAMS: 00048759



AEP

Figure 3 - Management Zones & Monitoring Points Date: July 2024

Location: 898 New England Hwy, 25 & 39 Wyndella Rd, Lochinvar NSW

Client: Lochinvar Developments Pty Ltd AEP ref: 2699.04
C/- ADW Johnson Pty Ltd BOAMS: 00048759

Appendix A – Flora and Priority Weeds within BMP lands

Family Name	Scientific Name	Common Name	Priority weed under Biosecurity Act 2015 Hunter Regional Strategic Weeds Management Plan
Aizoaceae	***Galenia pubescens****	**Galenia**	**Regional Priority - Containment**
Apiaceae	*Foeniculum vulgare**	Fennel	General Biosecurity Duty
Apiaceae	*Centella asiatica*	Swamp Pennywort	
Apiaceae	*Cyclospermum leptophyllum**	Slender Celery	General Biosecurity Duty
Apocynaceae	*Parsonsia straminea*	Common Silkpod	
Apocynaceae	*Araujia sericifera**	Mothvine	General Biosecurity Duty
Apocynaceae	*Gomphocarpus fruiticosus**	Narrow Leaf Cotton Bush	General Biosecurity Duty
Asteraceae	*Bidens pilosa**	Cobbler's Pegs	General Biosecurity Duty
Asteraceae	*Conyza bonariensis**	Flax-leaf Fleabane	General Biosecurity Duty
Asteraceae	*Oncosiphon piluliferum**		General Biosecurity Duty
Asteraceae	*Onopordum acanthium subsp. Acanthium**	Scotch Thistle	General Biosecurity Duty
Asteraceae	*Silybum marianum**	Variegated Thistle	General Biosecurity Duty
Asteraceae	*Hypochaeris radicata**	Flatweed	General Biosecurity Duty
Asteraceae	*Senecio madagascariensis**	Fireweed	General Biosecurity Duty
Casuarinaceae	*Casuarina glauca*	Swamp Oak	
Convolvulaceae	*Dichondra repens*	Kidney Weed	
Cyperaceae	*Baumea juncea*		
Cyperaceae	*Cyperus sesquiflorus**		General Biosecurity Duty
Cyperaceae	*Cyperus spp.*		
Cyperaceae	*Fimbristylis dichotoma*	Common Fringe-rush	
Cyperaceae	*Carex appressa*	Tall Sedge	
Cyperaceae	*Cyperus eragrostis**	Umbrella Sedge	General Biosecurity Duty
Fabaceae	*Trifolium repens**	White Clover	General Biosecurity Duty
Gentianaceae	*Centaurium erythraea**	Common Centaury	General Biosecurity Duty
Juncaceae	***Juncus acutus****		**Regional Priority - Asset Protection**
Juncaceae	*Juncus cognatus**		General Biosecurity Duty
Juncaceae	*Juncus usitatus*	Common Rush	
Lobeliaceae	*Lobelia purpurascens*	Whiteroot	
Malvaceae	*Sida rhombifolia**	Paddy's Lucerne	General Biosecurity Duty
Myrtaceae	*Eucalyptus punctata*	Grey Gum	
Myrtaceae	*Eucalyptus spp.*		
Myrtaceae	*Corymbia maculata*	Spotted Gum	

Family Name	Scientific Name	Common Name	Priority weed under Biosecurity Act 2015 Hunter Regional Strategic Weeds Management Plan
Myrtaceae	*Eucalyptus microcorys*	Tallowwood	
Myrtaceae	*Eucalyptus robusta*	Swamp Mahogany	
Myrtaceae	*Eucalyptus tereticornis*	Forest Red Gum	
Myrtaceae	*Melaleuca bracteata*	Black Tea-tree	
Myrtaceae	*Melaleuca ericifolia*	Swamp Paperbark	
Oleaceae	***Olea europaea subsp. cuspidata****	**African Olive**	**Regional Priority - Containment**
Onagraceae	*Ludwigia peploides subsp. montevidensis*	Water Primrose	
Phormiaceae	*Dianella caerulea*	Blue Flax-lily	
Pittosporaceae	*Pittosporum revolutum*	Yellow Pittosporum	
Pittosporaceae	*Pittosporum undulatum*	Sweet Pittosporum	
Plantaginaceae	*Plantago lanceolata**	Ribwort	
Poaceae	*Cynodon spp.**		General Biosecurity Duty
Poaceae	*Setaria pumila**	Pale Pigeon Grass	General Biosecurity Duty
Poaceae	*Paspalum dilatatum**	Paspalum	General Biosecurity Duty
Poaceae	*Stenotaphrum secundatum**	Buffalo Grass	General Biosecurity Duty
Poaceae	*Andropogon virginicus**	Whisky Grass	General Biosecurity Duty
Poaceae	*Austrostipa ramosissima*	Stout Bamboo Grass	
Poaceae	*Bothriochloa macra*	Red Grass	
Poaceae	*Briza maxima**	Quaking Grass	
Poaceae	*Briza minor**	Shivery Grass	
Poaceae	*Briza subaristata**		
Poaceae	*Chloris gayana**	Rhodes Grass	
Poaceae	*Eragrostis brownii*	Brown’s Lovegrass	
Poaceae	*Rytidosperma pallidum*	Silvertop Wallaby Grass	
Poaceae	*Megathyrsus maximus**	Guinea Grass	General Biosecurity Duty
Poaceae	*Bromus spp.**	A Brome	General Biosecurity Duty
Poaceae	*Poa spp.**		General Biosecurity Duty
Poaceae	*Ehrharta erecta**	Panic Veldtgrass	General Biosecurity Duty
Poaceae	*Sporobolus elongatus*	Slender Rat’s Tail Grass	
Poaceae	*Lachnagrostis aemula*	Blown Grass	
Poaceae	*Themeda triandra*	Kangaroo Grass	
Poaceae	*Lolium rigidum**	Wimmera Ryegrass	General Biosecurity Duty

Family Name	Scientific Name	Common Name	Priority weed under Biosecurity Act 2015 Hunter Regional Strategic Weeds Management Plan
Polygonaceae	*Rumex brownii*	Swamp Dock	
Polygonaceae	*Persicaria spp.**	Knotweed	General Biosecurity Duty
Primulaceae	*Lysimachia arvensis var. caerulea**	Blue Pimpernel	General Biosecurity Duty
Proteaceae	*Hakea bakeriana*		
Pteridaceae	*Cheilanthes sieberi*	Rock Fern	
Ranunculaceae	*Ranunculus inundatus*	River Buttercup	
Restionaceae	*Empodisma minus*	Spreading Rope-rush	
Solanaceae	*Solanum nigrum**	Black Nightshade, Black-berry Nightshade	General Biosecurity Duty
Solanaceae	*Solanum seaforthianum**	Climbing Nightshade	General Biosecurity Duty
Verbenaceae	*Verbena bonariensis**	Purpletop	General Biosecurity Duty

Appendix B – Regeneration Species List

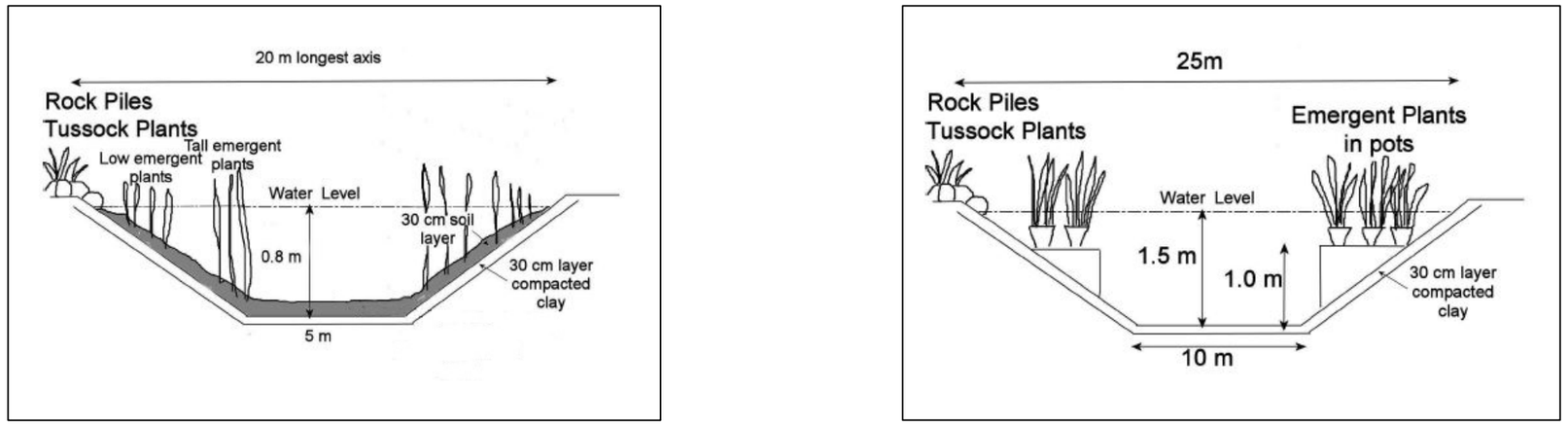
Species List – Approximate densities and species for regeneration.

It should be noted that not all the listed species below are easily obtainable, substitutions to be made on the advice of bush regeneration contractor or Project Ecologist.

Canopy	Density	Shrubs	Density	Ground Cover	Density
Management Zone 1 and 5 – PCT 3975					
Not Applicable in this Management Zone	N/A	Not Applicable in this Management Zone	N/A	*Paspalum distichum*	6 to 8 /1m^2
				Typha orientalis	
				Eleocharis sphacelata	
				Juncus polyanthemus	
				Bolboschoenus caldwellii	
				Juncus usitatus	
				Carex appressa	
				Phragmites australis	
				Eleocharis acuta	
				Juncus gregiflorus	
				Persicaria decipiens	
				Cycnogeton microtuberosum	
				Ludwigia peploides subsp. Montevidensis	
				Alisma plantago-aquatica	
				Cycnogeton procerum	
Management Zone 2, 3, 4 and 6 - PCT 3433					
Eucalyptus punctata	1/20 m^2	*Bursaria spinosa*	1/10m^2	*Paspalidium distans*	5/m^2 or Direct Seeding
Eucalyptus umbra		*Persoonia linearis*		*Aristida vagans*	
Eucalyptus globoidea		*Leptospermum polygalifolium*		*Microlaena stipoides*	
Corymbia maculata		*Melaleuca nodosa*		*Themeda triandra*	
Eucalyptus fibrosa		*Acacia ulicifolia*		*Cymbopogon refractus*	
		Leucopogon juniperinus		*Lomandra confertifolia*	
		Breynia oblongifolia		*Entolasia stricta*	
		Dillwynia retorta		*Lepidosperma laterale*	
		Callistemon linearis		*Dichelachne micrantha*	
		Melaleuca styphelioides		*Echinopogon caespitosus*	
		Polyscias sambucifolia		*Fimbristylis dichotoma*	
		Pultenaea villosa		*Juncus usitatus*	
		Melaleuca decora		*Lomandra longifolia*	
				Panicum simile	
				Commelina cyanea	

Canopy	Density	Shrubs	Density	Ground Cover	Density
				Dianella revoluta	
				Pomax umbellata	
				Dianella caerulea	
				Poa labillardierei var. labillardierei	
				Entolasia marginata	

Appendix C – Aquatic Habitat and Hibernacula Examples



Example Pond designs - Breeding ponds to the left, Refuge ponds on the right (Ecological, Arncliffe Habitat Creation Plan).

Example of a hibernacula made from bricks and wood and grass material (AggNet – Brickworth, UK)

Appendix D – 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

AEP VMP SIGNAGE permanent sign, minimum size 600mm x 400mm erected and maintained at key access points to VMP lands for the life of the project

Appendix E – CVs

Staff	Title/Qualification	Tasks
Natalie Black	Senior Environmental Manager BSc (Hons), Master Planning, Cert IV (TA) BAAS: 19076	Report review
Emma O'Dwyer	Ecologist BEnvSc. Hons EnvSc	Field surveys and report
Bryce Dedal	Ecologist BEnvSc. Cert IV CLM	Report
Alissa Rogers	Ecologist BParkMgt. Cert IV CLM	Report and mapping
Angela Metcalfe	Ecologist / Spatial Analyst BEnvSc. Hons (Earth Science) GradCert GeospSc (completion in 2025)	Report and mapping amendments following client feedback and changes in development plans

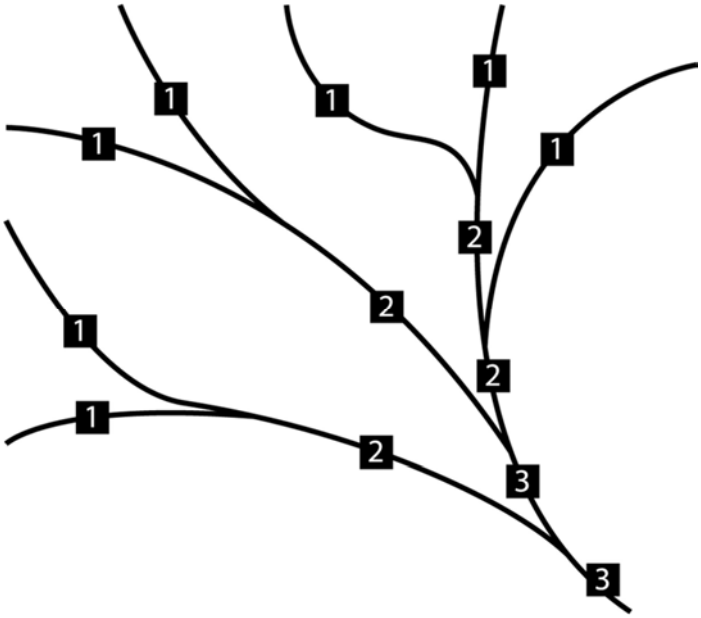
Appendix C – Glossary of Terms

Activity Approval	A controlled activity approval or an aquifer interference approval.
Alluvial	Deposited by running water.
Alluvium	A general term for detrital deposits made by stream processes on riverbeds, floodplains, and alluvial fans; esp. a deposit of silt or silty clay laid down during times of flood. The term applies to stream deposits of recent time. It does not include subaqueous sediments of seas or lakes.
Anabranch	A diverging branch of a river that re-enters the main stream.
Aquatic Vegetation	A plant characteristically growing wholly or partly submerged in water.
Aquifer	A geological structure or formation, or an artificial landfill, that is permeated with water or is capable of being permeated with water.
Aquifer Interference Activity	means an activity involving any of the following— (a) the penetration of an aquifer, (b) the interference with water in an aquifer, (c) the obstruction of the flow of water in an aquifer, (d) the taking of water from an aquifer in the course of carrying out mining, or any other activity prescribed by the regulations, (e) the disposal of water taken from an aquifer as referred to in paragraph (d).
Bank	The side slopes of a channel between which the streamflow is normally confined.
Bed	The bottom of a channel.
Channel	An area that contains continuously or periodically flowing water that is confined by banks and a streambed.
Coastal Lake	A large open body of saline or brackish water which has a relatively narrow permanent or intermittent connection to the sea.
Construct a Work	includes install, maintain, repair, alter or extend the work.
Controlled Activity	As defined in the Dictionary of the *Water Management Act, 2000:* (a) the erection of a building or the carrying out of a work (within the meaning of the Environmental Planning and Assessment Act 1979), or (b) the removal of material (whether or not extractive material) or vegetation from land, whether by way of excavation or otherwise, or (c) the deposition of material (whether or not extractive material) on land, whether by way of landfill operations or otherwise, or (d) the carrying out of any other activity that affects the quantity or flow of water in a water source.
Deposition	The laying down of sediment carried by wind, flowing water, the sea or ice.
Drainage Work	means a work (such as a pump, pipe or channel) for the purpose of draining water from land, including a reticulated system of such works, and includes all associated pipes, sluices, sluicegates, valves, metering equipment and other equipment, but does not include— (a) any sewage work (within the meaning of Part 2 of Chapter 6), or (b) any work declared by the regulations not to be a drainage work.
Environment	includes all aspects of the surroundings of human beings, whether affecting them as individuals or in their social groupings.

Erosion	Wearing away of rock or soil by the gradual detachment of soil or rock fragments by water, wind, ice, and other mechanical, chemical, or biological forces.
Estuary	As defined in the Dictionary of the Water Management Act, 2000 (a) any part of a river whose level is periodically or intermittently affected by coastal tides, or (b) any lake or other partially enclosed body of water that is periodically or intermittently open to the sea, or (c) anything declared by the regulations to be an estuary, but does not include anything declared by the regulations not to be an estuary.
Flood Channel	Low sinuosity subsidiary channel. Entrance height approximates bankfull stage. Commonly observed at valley margins. Floodchannel depth tends to increase down-pocket with the basal section of the floodchannel elevated above the low flow channel
Flood Work	A work (such as a barrage, causeway, cutting or embankment)— (a) that is situated— (i) in or in the vicinity of a river, estuary or lake, or (ii) within a floodplain, and (b) that is of such a size or configuration that, regardless of the purpose for which it is constructed or used, it is likely to have an effect on— (i) the flow of water to or from a river, estuary or lake, or (ii) the distribution or flow of floodwater in times of flood, and includes all associated pipes, valves, metering equipment and other equipment, but does not include any work declared by the regulations not to be a flood work.
Floodplain	an area of low-lying ground adjacent to a river, formed mainly of river sediments and subject to flooding.
Floodplain Pocket	Narrow, discrete floodplain typically on the bank of valley confined channel.
Floodplain Vegetation	Vegetation that is seasonally or irregularly flooded by changes in river level, hence can tolerate inundation for periods of time. It is noted that the tolerance to inundation reduces with the distance from the waterfront land
Flora Stratum	Vertical layering of vegetation in the riparian zone and the classification of its layers and height of growth including trees, heath/shrubs or a ground layer consisting of grasses or sedges.
Gravel Bed	An unconsolidated natural accumulation of rounded rock fragments, mostly of particles larger than sand (diameter greater than 2 mm), such as boulders, cobbles, pebbles, granules, or any combination of these.
Groundwater	Water contained under the ground's surface, located in the spaces between soil particles and in the cracks of sand, gravel, and rock; a natural resource and source of water for drinking, irrigation, recreation, and industry.
Gully	a. is not a 'stream channel' (or watercourse); b. is a persistent erosional feature, with active head or walls on average > 0.5 m deep, and has multiple modes of expansion, but always including headward retreat into an otherwise un-dissected landscape; c. erodes unconsolidated materials and saprolite, but not bedrock; d. must have an active head scarp or head wall at the upslope limit of the gully (which may or may not be a clear nick point): e. sometimes a series of head scarps may occur; • a 'scalded' or desiccated area (i.e. an area stripped of its topsoil with degraded vegetative cover) may often fringe the upslope area of the head scarp and head walls;

	• has an erosional gully wall scarp, or clear erosional cut. • some exceptions, such as the expanding, shrink-swell, cracking clays (i.e. Vertosols† and friable Black Dermosols, or 'blacksoil', and 'reactive clays') that may have convex walls and a head 'ramp' need considering for evidence of other active erosion present in these cases, e.g. piping, tunnels or slumping; • has the head (head scarp, head wall), or heads, marking the upstream boundary of concentrated water flow and sediment transport between definable banks; f. has a cross-sectional shape (U-shaped, V-shaped, trapezoidal, slot, or tiered‡) that is permanently recognizable without flow; g. has a straight bed long-profile, rather than a curved one (of stream channels); h. has a dominant proportion of a 'hard margin' (a comparatively sharp break of slope from the unbroken land surface to the incisional feature, that represents a gully head scarp and wall scarp of active erosion, commonly referred to as a rim, edge or scarp), active or otherwise, or equivalent; i. has active erosional walls of at least moderately steep gradient (~ 30o; ~ 60 %), and gully walls are dominantly bare soil materials; j. are autonomous – having the active sediment source predominantly within the gully (a clear autocthonous, or 'internal', erosional zone); k. may have land upslope of the head, or beyond, that may be a drainage depression (swale), or marshland in keeping with the incisional caveats above; l. k. is typically driven by proximal ephemeral flows (i.e. associated with rainfall directly in the gully and in the gully catchment).
Headwater	Source of a river of stream.
High Bank	The upper most extent of the bank.
Inside Bend	Inside bank of a meander subject to deposition from slow flow.
Instream Habitat	Any area occupied, or periodically or occasionally occupied, by fish or marine vegetation (or both), and includes any biotic or abiotic component.
Lake	(a) a wetland, a lagoon, a saltmarsh and any collection of still water, whether perennial or intermittent and whether natural or artificial, and (b) any water declared by the regulations to be a lake, whether or not it also forms part of a river or estuary, but does not include any water declared by the regulations not to be a lake.
Land	includes any water source, and also includes the land on or in which any water source is situated.
Levee	Raised elongate asymmetrical ridge that borders the channel. Composed almost entirely of suspended load sediments (dominantly silt, often sandy).
Meander	The winding of a stream channel, usually in an erodible alluvial valley. A series of sine-generated curves characterized by curved flow and alternating banks and shoals.
Outside Bend	Outside bank of a meander subject to erosion from high flow.
Overland Flow	4A Meaning of "overland flow water" (1) In this Act, overland flow water means water (including floodwater, rainfall run-off and urban stormwater) that is flowing over or lying on the ground as a result of— (a) rain or any other kinds of precipitation, or (b) rising to the surface from underground, or (c) any other process or action of a kind prescribed by the regulations.

	(2) Water is flowing over the ground for the purposes of subsection (1) even if it flows over the ground by means of artificial structures such as roads, canals or road gutters. (3) However, subsection (1) does not include— (a) water that is collected from a roof (including water collected from a roof using a rainwater tank), or (b) water that is flowing over or lying on the bed of a river, lake or estuary, or (c) water flowing over or lying on the ground in such circumstances as may be prescribed by the regulations.
Oxbow	An abandoned meander in a river or stream, caused by cutoff. Used to describe the U-shaped bend in the river or the land within such a bend of a river.
Pools	A reach of a stream that is characterized by deep, low-velocity water and a smooth surface.
Riffles	Topographic highs along an undulating reach-scale longitudinal profile.
Rip Rap	Run of quarry rock placed over a bedding layer of cobbles used to stabilise and rehabilitate disturbed areas including topsoil, revegetation and regeneration. Must be able to withstand the velocities of runoff or discharge from site.
Riparian Corridor	A riparian corridor (RC) forms a transition zone between the land, also known as the terrestrial environment, and the river or watercourse (aquatic environment). Riparian corridors perform a range of important environmental functions
Riparian Vegetation	The plants growing on the water's edge, the banks of rivers and creeks and along the edges of wetlands
River	As defined in the Dictionary of the *Water Management Act, 2000:* (a) any watercourse, whether perennial or intermittent and whether comprising a natural channel or a natural channel artificially improved, and (b) any tributary, branch or other watercourse into or from which a watercourse referred to in paragraph (a) flows, and (c) anything declared by the regulations to be a river, whether or not it also forms part of a lake or estuary, but does not include anything declared by the regulations not to be a river.
Bar	Deposited sediment accumulation from altered in-stream flow due to variation in channel geomorphology.
Segment ID	Assigned segment identification number to potential watercourse.
Snag	Term used to describe large woody debris from trees and shrubs, including whole fallen trees, broken branches and exposed roots that have fallen or washed into a waterway and are now wholly or partially submerged by water.
Study Area	The Study Area comprises applicable land, any mapped hydrolines that occur within that land, any mapped upstream tributaries, and waterfront land associated with the mapped hydrolines.
Subject Site	The Subject Site comprises the mapped hydrolines and associated waterfront land that occurs within the applicable land boundary.
Survey Point	The location of a watercourse assessment with the Waterfront Land Tool.
The Strahler System	As defined in *Schedule 2* - Water Management (General) Regulation 2018: The method of determining the stream order of a watercourse shown on a topographic map is the Strahler system. The Strahler system is as follows—

	(a) Any watercourse that has no other watercourses flowing into it is classed as a first order stream. (b) If 2 streams join, the resulting stream is— (i) the same order as the highest order of the 2 streams, or (ii) if the 2 streams are of the same order, the order greater than that of the 2 streams. For example, in the diagram below— (a) If 2 first order streams join, the stream becomes a second order stream (2). (b) If a second order stream is joined by a first order stream, it remains a second order stream. (c) If 2 second order streams join they form a third order stream (3). (d) If a third order stream is joined by a first or second order stream, it remains a third order stream. (e) If 2 third order streams join they form a fourth order stream. 
Vegetated Riparian Zone	The required width of the VRZ measured from the top of the high bank on each side of the watercourse.
Vegetation Management Plan	Details how the restoration or rehabilitation of the riparian corridor will be carried out. The main objective of a VMP is to provide a stable watercourse and riparian corridor which will emulate local native vegetation communities.
Water Source	means the whole or any part of— (a) one or more rivers, lakes or estuaries, or (b) one or more places where water occurs on or below the surface of the ground (including overland flow water flowing over or lying there for the time being), and includes the coastal waters of the State.
Waterfront Land	Land within 40m of a river, stream, creek, wetlands, estuary
Waterfront Land	As defined in the Dictionary of the *Water Management Act 2000*: (a) the bed of any river, together with any land lying between the bed of the river and a line drawn parallel to, and the prescribed distance inland of, the highest bank of the river, or

	(a1) the bed of any lake, together with any land lying between the bed of the lake and a line drawn parallel to, and the prescribed distance inland of, the shore of the lake, or (a2) the bed of any estuary, together with any land lying between the bed of the estuary and a line drawn parallel to, and the prescribed distance inland of, the mean high water mark of the estuary, or (b) if the regulations so provide, the bed of the coastal waters of the State, and any land lying between the shoreline of the coastal waters and a line drawn parallel to, and the prescribed distance inland of, the mean high water mark of the coastal waters, where the prescribed distance is 40 metres or (if the regulations prescribe a lesser distance, either generally or in relation to a particular location or class of locations) that lesser distance. Land that falls into 2 or more of the categories referred to in paragraphs (a), (a1) and (a2) may be waterfront land by virtue of any of the paragraphs relevant to that land.
Waterfront Land Maps	CAA exemptions can only apply within certain waterfront land shown in maps that include shaded areas such as: • Botany Bay and Georges River area, • Brisbane Water area, • Hunter River area, • Lake Macquarie area, • Lake Mulwala area, • Port Hacking area, • Port Jackson (Sydney Harbour) area, • Port Stephens area, • Tuggerah Lakes area, and, • Wallis Lakes area These can be found within the WFLT.
WaterNSW	WaterNSW is a State-Owned Corporation established under the *Water NSW Act 2014* and operates under an Operating Licence.
Western Land Map	NRAR Map – Western land map within the WFLT that includes shaded local government areas in inland NSW areas.
Wetlands	Includes marshes, mangroves, swamps, or other areas that form a shallow body of water when inundated intermittently or permanently with fresh, brackish or salt water, and where the inundation determines the type and productivity of the soils and the plant and animal communities.
Woody Debris	Consists of large masses of trees or shrubs that have fallen or been washed into rivers and streams, and onto floodplains. Once instream, they become waterlogged and rest in the streambed providing both habitat and refuges for aquatic fauna

Appendix D – Waterfront Land eTool

From: Google Forms
To: Brendon Young
Subject: Waterfront land e-tool
Date: Friday, 12 July 2024 2:58:56 PM

Google Forms

Thanks for filling in Waterfront land e-tool

Here's what was received.

Edit response

Waterfront land e-tool

Version 1 - 2020

Email *

brendon@andersonep.com.au

Is this the right e-tool for me?

This waterfront land e-tool has been developed to help controlled activity applicants and consultants determine if a controlled activity approval is required under the provisions of the Water Management Act 2000. The tool can be used to help identify:

• if there is waterfront land
• the location of top of bank of the waterfront land and
• if an exemption applies for works within certain mapped areas under clause 36 of Schedule 4 of the
Regulation

The e-tool is recommended for use by people who are familiar with environmental assessment and suitably qualified consultants. Members of the general public who are planning works near waterfront land should seek professional advice.

The e-tool must be completed separately for each individual mapped or visible watercourse on, or near, your property. If you have multiple

properties or multiple watercourses on or near your property, submit your response for the first assessment and then re-start the tool from the beginning to assess another watercourse or property. This will ensure each property and watercourse receives its own separate emailed result outcome that you can keep as a record.

Using the tool

Some of the questions in this e-tool can be answered using materials online. Depending on your circumstances, you may also need to the visit the site of the proposed work in person to gather supporting evidence.

There is a PDF version of the tool available that you can download and take into the field at: https://water.nsw.gov.au/__data/assets/pdf_file/0009/367272/waterfront-land-tool.pdf

The e-tool must be completed separately for each individual mapped or visible watercourse on the property. Each watercourse assessed with the e-tool will then receive a separate emailed result outcome.

Stopping and returning

You can choose to exit the tool at certain questions where field work is recommended. You will be asked if you wish to exit, and, if you agree, be emailed a link that you can use to return to the tool later to complete the rest of the questions.

If you close the tool anywhere else - without completing it and clicking the 'Submit' button - your data will not be retained. Please ensure you only close the tool when prompted if you wish to retain your answers.

Supporting evidence

When you complete the tool, you will receive email confirmation containing your answers, which you must keep as a record of your decision-making. You must also keep all reference material and information used–including maps, photos and observations to answer the tool questions. You will be prompted throughout the tool about what information to keep.

NSW Department of Climate Change, Energy, the Environment and Water may request copies of the Waterfront land tool answers and supporting documents from landholders where works are carried out without a controlled activity approval under the Water Management Act 2000.

The Waterfront land e-tool will store your email address so you can be emailed a record of your answers on completion. It will also record your answers but it will not identify your location or any other personal details. If you do not wish to supply your email address, please use the hard copy version of the tool at:
https://water.nsw.gov.au/__data/assets/pdf_file/0009/367272/waterfront-land-tool.pdf

More information

• about this e-tool, contact NSW Department of Climate Change, Energy, the Environment and

Water via email:
waterlicensing.servicedesk@dpie.nsw.gov.au
• about controlled activity approvals, visit
https://water.dpie.nsw.gov.au/licensing-and-trade/controlled-activity-approvals

Disclaimer

• This tool is intended for guidance purposes only and cannot be used as evidence of compliance with the Water Management Act 2000.
• Users of this tool will be responsible for making their own assessment of the material and should verify all relevant representations, statements and information with their own professional advisers.
• This tool only applies controlled activities on waterfront land—it does not apply to water access licences or water supply work and/or water use approvals.
• This is not an approval to undertake work on waterfront land and you will still need to obtain relevant approvals as required under the Water Management Act 2000 (WM Act).
• The use of this tool does not remove the obligation to obtain approval under any other relevant legislation.
• Users should also refer to the disclaimer on the department's website at:
https://www.industry.nsw.gov.au/disclaimer

Description or Reference

Please enter a description or reference number below for the property or watercourse you are going to assess. This will allow you to easily identify this assessment from any other assessments you undertake using the tool. *

2699 Lochinvar

Question 1 - Department of Planning and Environment—Water waterfront land maps

After answering the question, click next at the bottom of the screen.

Is your property located on a watercourse, lake or estuary within the area marked in orange in any of the Department of Planning and Environment—Water waterfront land maps below? *

- ◯ Yes, Botany Bay

- ○ Yes, Brisbane Water
- ○ Yes, Hunter River
- ○ Yes, Lake Macquarie
- ○ Yes, Lake Mulwala
- ○ Yes, Port Hacking
- ○ Yes, Port Jackson
- ○ Yes, Port Stephens
- ○ Yes, Tuggerah Lakes
- ○ Yes, Wallis Lakes
- ◉ No, none of the above

Using the maps below

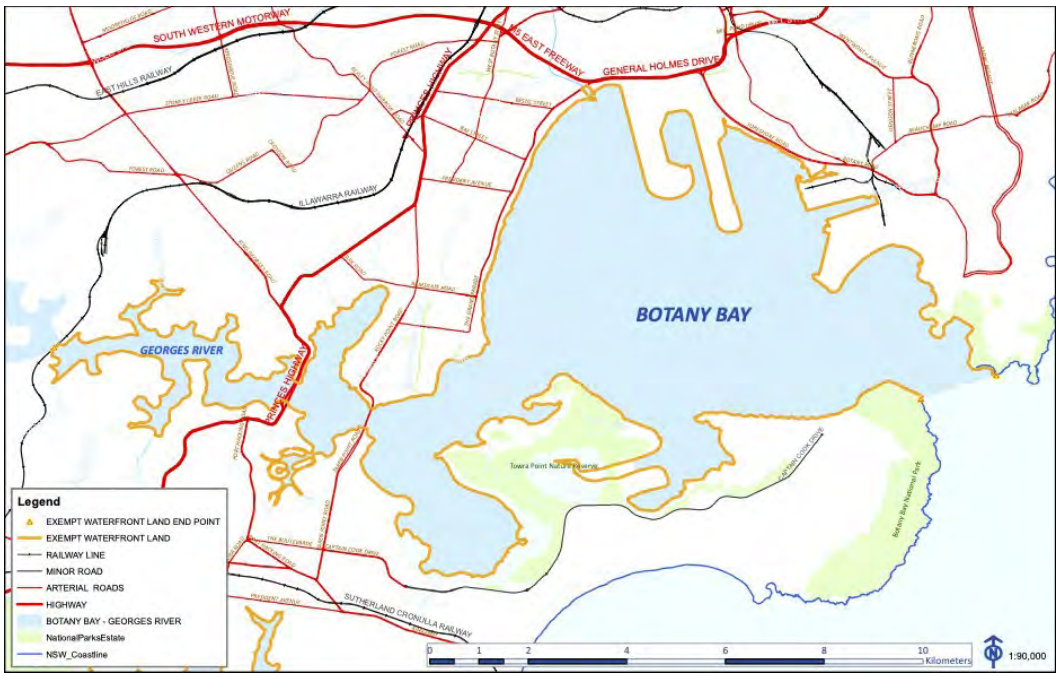
Using your browser zoom in to any of the maps below to help you identify the location of your property.

Alternatively you can access the maps at the below link:
https://www.dpie.nsw.gov.au/water/licensing-and-trade/controlled-activity-approvals/controlled-activity-exemptions

What supporting evidence do I need?

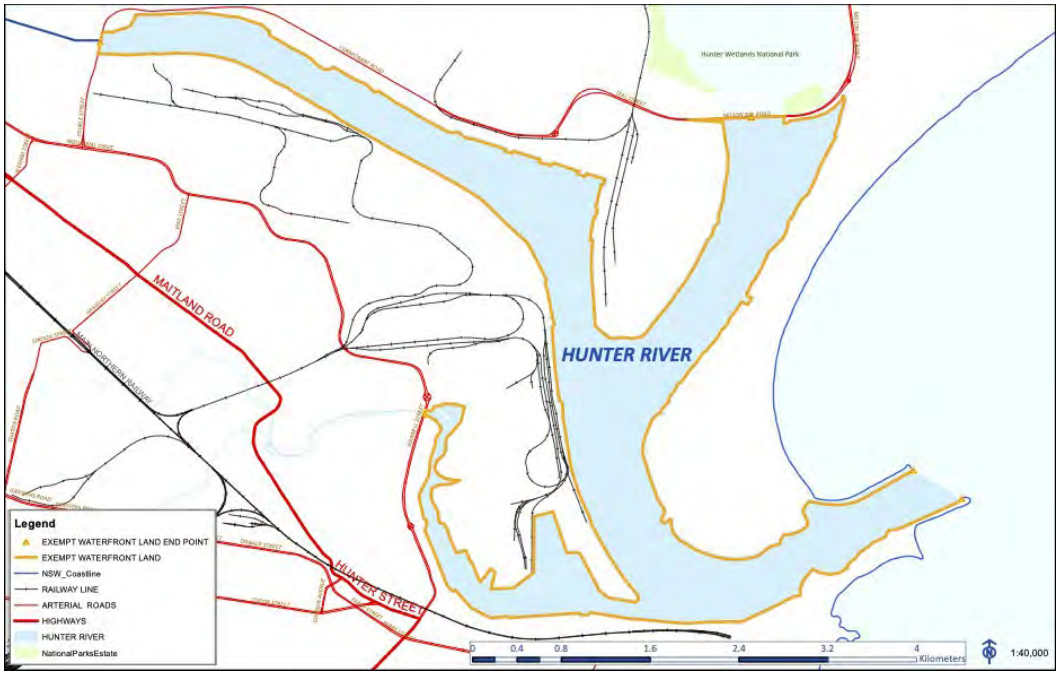
• Saved or printed screenshot of aerial photo of your property
• Saved or printed copy of any maps to identify property boundary
• Saved or printed screenshot of the location of your property on the waterfront land map

Botany Bay



Brisbane Water

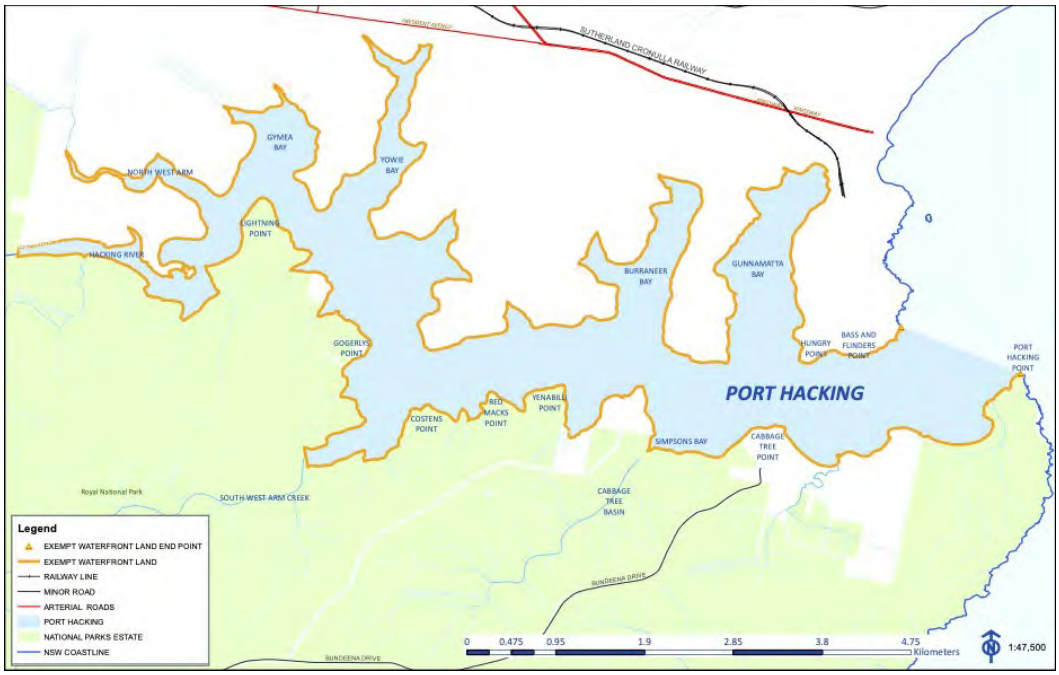
Hunter River



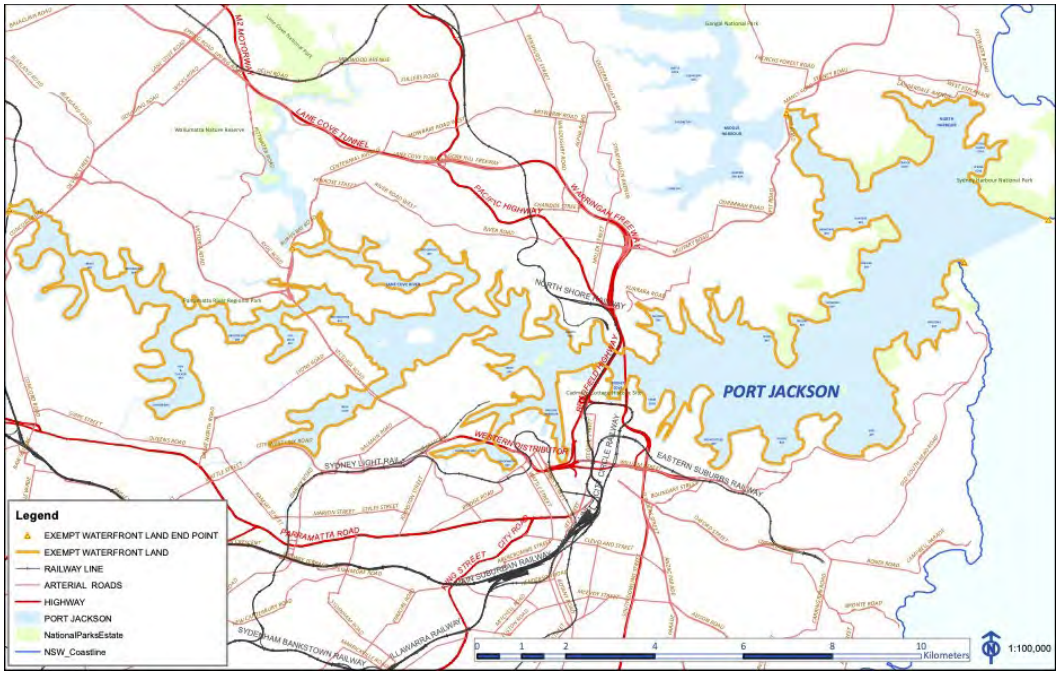
Lake Macquarie

Lake Mulwala

Port Hacking



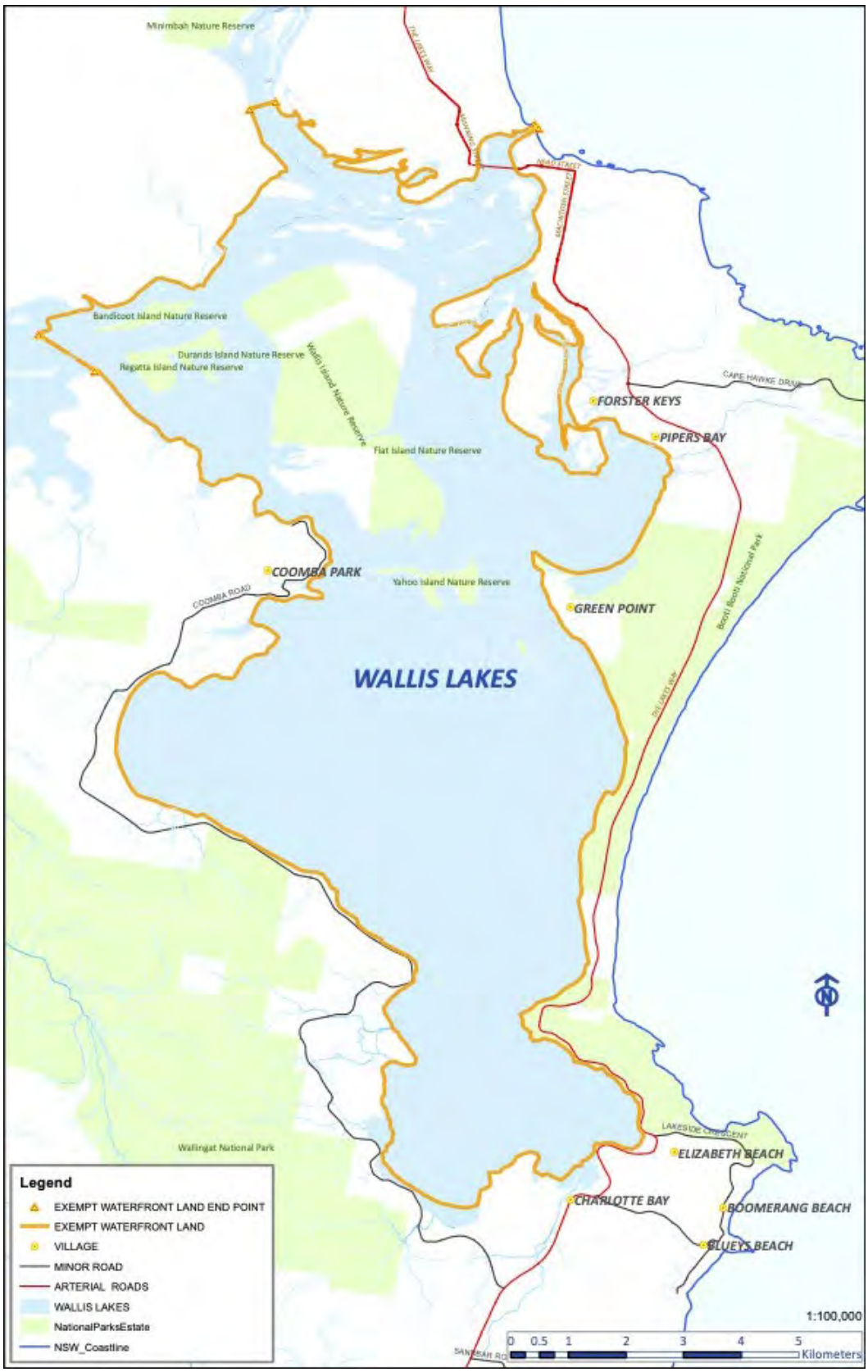
Port Jackson



Port Stephens

Tuggerah Lakes

Wallis Lakes



Question 2a - Hydro Line spatial data map

Open the link provided below for the Hydro Line spatial data map and

enter your property address.

Is there a blue line on your property or within 40m of the proposed work? *

- (●) Yes
- ( ) No

What supporting evidence do I need?

- Saved or printed screenshot of aerial photo of your property
- Saved or printed copy of any maps to identify property boundary
- Saved or printed screenshot of the location of your property on the Hydro Line spatial data map

The Hydroline spatial data is used to determine the Strahler stream order of a watercourse.
https://trade.maps.arcgis.com/apps/webappviewer/index.html?id=07b967fd0bdc4b0099fc5be45b6d1392

Collecting evidence in the field

For this part of the tool, you may need to go to your site to collect evidence and answers.

What to take into the field

The following equipment will be required to complete field work:
- Digital camera
- Note taking equipment - notebook or computer
- Measuring tape or equipment able to measure 50m
- Saved or printed screenshot of aerial photo of your property and the watercourse

If you can't do the field work right now, you can save your answers

To save your answers so far in the e-tool, select 'Yes, save my answers' below and click 'Submit' on the next page.

You will then be emailed a copy of the answers and a link you can use to return to the e-tool when in the field or after your field work is completed.

The link is at the top of the email 'Edit response'.

This is the only point in the tool where you can stop and return to your answers

If you close the tool anywhere else - other than the final 'Submit' page - the data you have entered so far will not be retained.

Can't take this tool into the field?

A PDF version is available at:
https://water.nsw.gov.au/__data/assets/pdf_file/0009/367272/waterfront-land-tool.pdf

Would you like to save your answers? *

- ○ Yes, save my answers so I can return here later
- ◉ No, keep going, I'm ready to answer the field-based questions

Question 3 - Determining stream order

Read the Determining stream order fact sheet at the below link.

Then open the link below to the Hydro Line spatial data map.

Zoom out from your property on the map to work out the stream order of your watercourse.

What is the stream order? *

- ○ 1st or 2nd order stream
- ◉ 3rd order or greater stream

Determining Strahler stream order fact sheet

https://www.industry.nsw.gov.au/__data/assets/pdf_file/0020/172091/Determining-Strahler-stream-order-fact-sheet.pdf

The Hydro Line spatial data is used to determine the Strahler stream order of a watercourse
trade.maps.arcgis.com/apps/webappviewer/index.html?id=07b967fd0bdc4b0099fc5be45b6d1392

What supporting evidence do I need?

- Saved or printed screenshot of aerial photo of your property
- Saved or printed copy of any maps to identify property boundary
- Saved or printed screenshot of the location of your property on the Hydro Line spatial data map
- Saved or printed screenshot of annotated Hydro Line spatial data map showing the determination of Strahler stream order

Question 8 - Determining the high bank

Using the photos and diagrams below, locate the high bank of the watercourse type identified in Question 4b.

Are the proposed works within 40m of the high bank? *

- (●) Yes
- ( ) No

After answering the question, click next at the bottom of the screen.

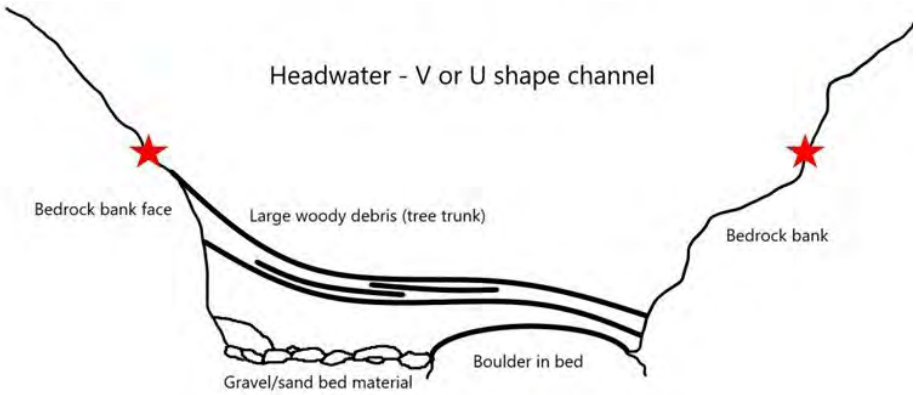
Using photos and diagrams below
Use your browser to zoom in to the photos and diagrams below.

What supporting evidence do I need?

- Record of the measurement from high bank to the nearest location of the proposed works
- Annotated aerial photo of the property showing:
  - o location of the proposed works
  - o location of the watercourse, lake or wetland, and
  - o measured distance to the high bank.
- Current site photos looking up and downstream. Photos should be taken within one month of completing this tool and include a date stamp or metadata and

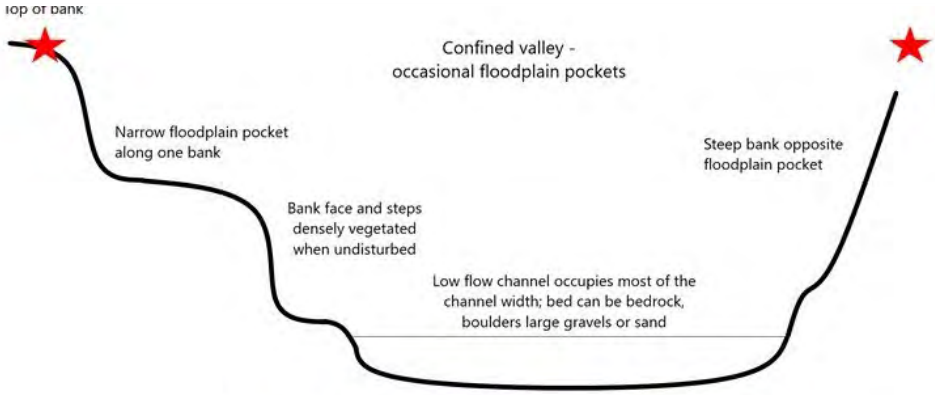
a short location description.
• Saved or printed screenshot of the watercourse type from the Department of Planning and Environment—Water Guide— Determining the high bank of a watercourse
• Written observations of the watercourse including bed, bank and erosion features and flow conditions
• Saved or printed screenshot of aerial photo of your property and the watercourse

Type 1 - Confined Valley Headwater



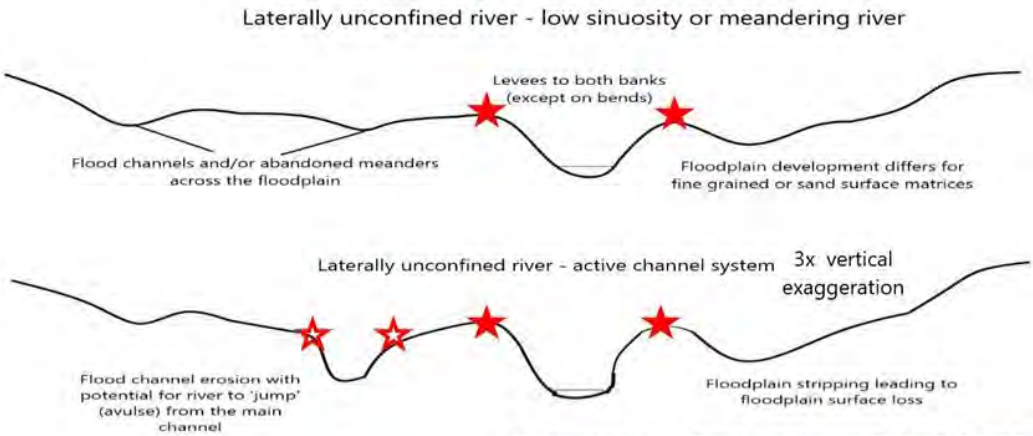
★ Top of High Bank

Type 2 - Confined Valley Floodplain Pockets



★ Top of High Bank

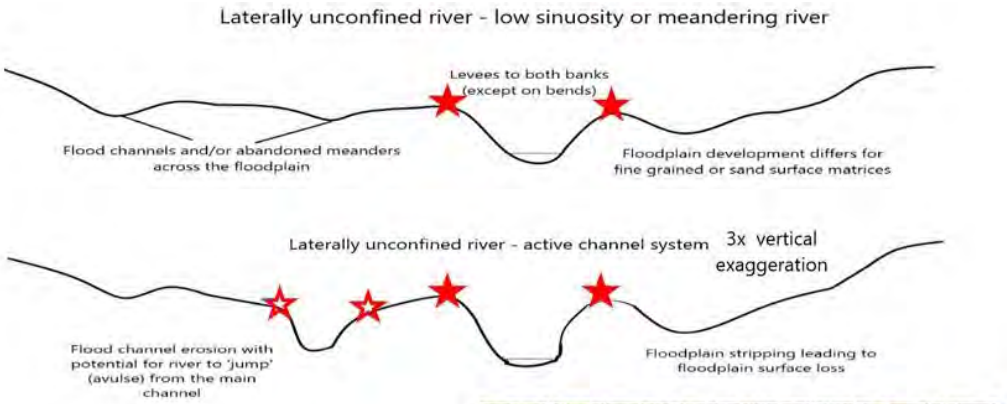
Type 3a - Laterally Unconfined Continuous - Bank Confined



★ Top of High Bank

☆ Top of High Bank when the flood channel has regular flows and/or, river features and/or is a mapped watercourse.

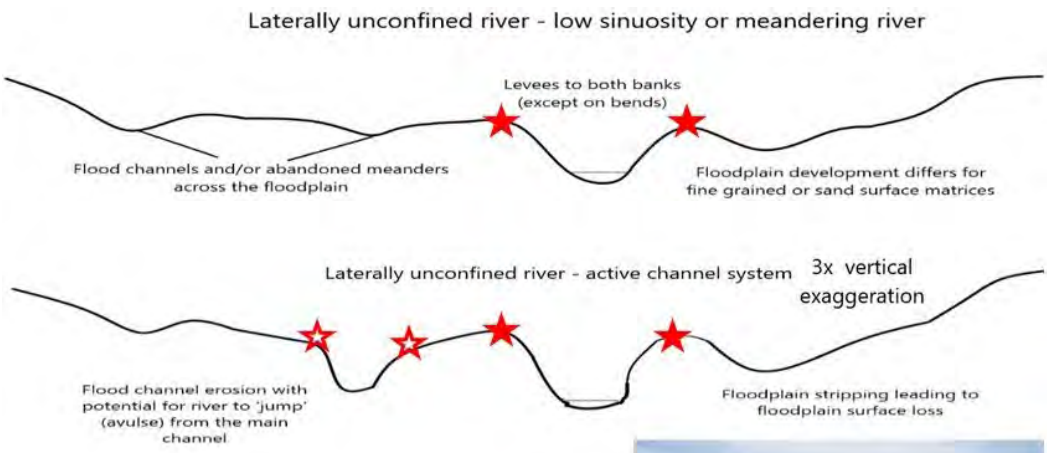
Type 3b - Laterally Unconfined Continuous - Low Sinuosity



★ Top of High Bank

☆ Top of High Bank when the flood channel has regular flows and/or, river features and/or is a mapped watercourse.

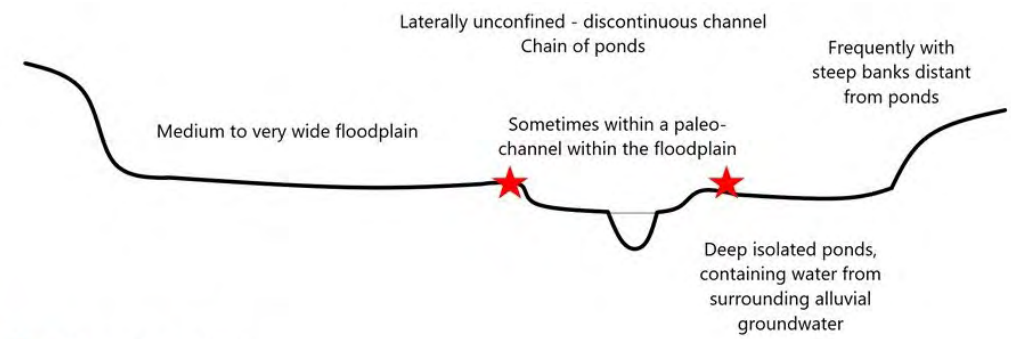
Type 3c - Laterally Unconfined Continuous - Meandering



★ Top of High Bank

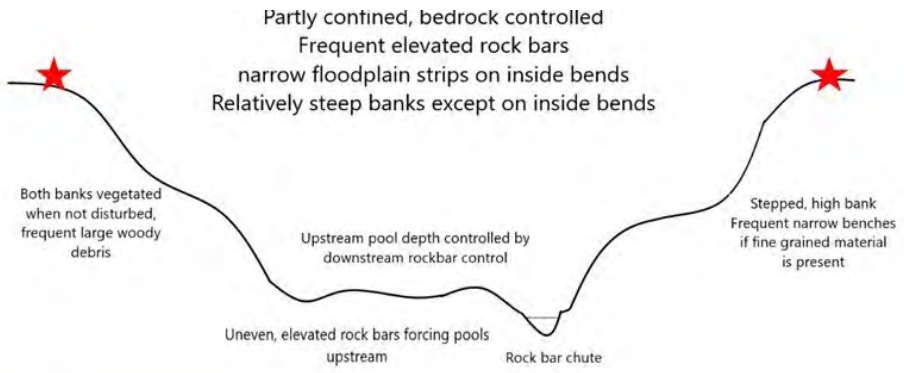
☆ Top of High Bank when the flood channel has regular flows and/or, river features and/or is a mapped watercourse.

Type 4 - Laterally Unconfined Discontinuous



★ Top of High Bank

Type 5 - Partly Confined Valley



★ Top of High Bank

Lakes

★ Top of High Bank is defined by the Mean High Water Mark (MHWM). This is determined by survey.

Wetlands

★ Top of High Bank is defined by the edge of the frequently wet area. This can be identified by a shore area, a change in vegetation type or soil type.

Result 14 - Controlled activity approval likely required

Based on your answers, the result is:

CONTROLLED ACTIVITY APPROVAL LIKELY REQUIRED

Statements

When completing the e-tool you provided the following answers:

- One or more of the following features are on this property or a neighbouring property:
    - o watercourse
    - o lake
    - o wetland
    - o mapped Strahler 3rd order or greater hydro line as defined by the Hydro Line spatial data map
- The proposed works are located within 40m of the high bank of the watercourse

Are ALL of the above statements correct? *

- (●) Yes
- ( ) No (restart tool)

Record keeping and Disclaimer

Please ensure you keep the electronic and/or printed copies of all supporting evidence required for questions answered in this tool and the confirmation email you receive after clicking submit.

NOTE:

- The results given by this tool are generated using the answers you have provided. If any answers are incorrect or incomplete, the result produced may be incorrect.
- This tool is intended for guidance purposes only and cannot be used as evidence of compliance with the Water Management Act 2000.
- Users of this tool will be responsible for making their own assessment of the material and should verify all relevant representations, statements and information with their own professional advisers.
- This is not an approval to undertake work on waterfront land and you will still need to obtain relevant approvals as required under the Water Management Act 2000 (WM Act).
- The use of this tool does not remove the obligation to obtain approval under any other relevant legislation.
- Users should also refer to the disclaimer on the department's website at industry.nsw.gov.au/disclaimer.

If ANY of your assessments identify that a controlled activity approval is required for your proposed works, you must complete the following tasks:

- Confirm if an exemption applies to your site or proposed works by using the Department's Controlled activity exemption e-tool at: https://forms.office.com/pages/responsepage.aspx?id=IYjvljkqHEe4mmewgz3TuaJ8VvZiyYZKiR3x1NniFCZUQ0lWTUZRUVpWMFhHTlBEM05aNFVOVlFSOC4u or refer to exemption

information here: https://www.dpie.nsw.gov.au/water/licensing-and-trade/controlled-activity-approvals/controlled-activity-exemptions

• For matters requiring a development application (DA) from Council, you should lodge your DA as Integrated Development.

• For matters NOT requiring a DA, please refer to the Department of Planning and Environment—Water website for instructions on how to apply for a Controlled Activity Approval: https://www.dpie.nsw.gov.au/water/licensing-and-trade/controlled-activity-approvals/how-to-apply

You MUST click Submit to be emailed a copy of your answers and your result.

Reminder: The e-tool must be completed separately for each individual mapped or visible watercourse on, or near, your property. If you have multiple properties or multiple watercourses on or near your property, submit your response for the first assessment and then re-start the tool from the beginning to assess another watercourse or property. This will ensure each property and watercourse receives its own separate emailed result outcome that you can keep as a record.

Feedback

Please let us know whether you found this tool helpful and what we could do to make it better. Your comments will help us to improve the tool further.

Thankyou for your feedback.

How helpful was this tool?

Very helpful

Additional feedback about this tool

.....

If you have a question or require further information regarding your specific circumstances, please email waterlicensing.servicedesk@dpie.nsw.gov.au

If you wish to undertake another assessment, please click 'Submit' below and then select 'Submit another response'.

Appendix E – Author CVs

BRENDON YOUNG
Project Manager

Profile Summary

Brendon works with AEP in the role of Project Manager and Ecologist/Aquatic Ecologist. He graduated with a Bachelor of Applied Science (Fisheries w/Honours), a Masters in Environmental Management and Graduate Certificate 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.

Academic Qualifications

Charles Sturt University

- Master of Environmental Management (Water Resources) 2022
- Graduate Certificate of Fish Conservation and Management

University of Tasmania

- Bachelor of Applied Science (Fisheries) with Honours

Training, Licences and Professional Memberships

- NSW Class C Driver's Licence
- WHS NSW Construction Induction White Card
- First Aid (Provide First Aid HLTAID011)

Professional Experience

Project Manager/Aquatic Ecologist Anderson Environment & Planning Newcastle NSW	Jan 2024 – Present
Project Lead/Ecologist Anderson Environment & Planning Newcastle NSW	Oct 2023 – Jan 2024
Ecologist Anderson Environment & Planning Newcastle NSW	Sept 2022 – Oct 2023
Department Manager Woolworths Pty Ltd	2013 - 2022
Produce Quality Control Officer Woolworths Pty Ltd	Mar 2019 - Oct 2019

Relevant Project Experience

Ecological Surveys

- Watercourse Assessment with the NRAR Waterfront Land Tool in Huner Valley, Central Coast, Midcoast and Dubbo regions.
- Key Fish Habitat surveys at Karuah River Port Stephens, Hunter River Lochinvar and Chisholm, Manning River Tibbuc and Lachlan River Stubbo.
- Dip netting for *Mogurnda adspersa* in Lochinvar, Tibbuc, Chisholm and Stubbo.

- Seagrass and Mangrove surveys in Port Stephens.
- Targeted, systematic transects for threatened flora species.
- Deployment of Camera Traps, Songmeter and Anabats across central Coast and Hunter Valley regions for targeted survey.
- Spot Assessment Technique surveys: Halloran, Windella, Ourimbah, Chisholm.
- Weed mapping: Taree, Ourimbah, Hunter Valley.

University

- 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.
- Identification of fish, reptiles, insects, and plants to species level through honours research and other projects while studying.

Ecological Assessment

- Riparian and watercourse assessment with the Waterfront Land Tool in the Hunter Valley, Central Coast, Sydney and Hastings regions.
- Preparation of Vegetation Management Plans in the Hunter Valley, Central Coast and Midcoast regions.
- Bushfire Threat Assessment in accordance with PBP 2019 at various sites across the Hunter Valley and Central Coast regions.
- Assist with Arborists assessments in Central Coast, Sydney, Mudgee and Hunter Valley Regions.

Ecological Monitoring

- Primary contributing author for Garden Suburbs Biodiversity Stewardship Site Assessment Report and associated Management Plan.

Publications

- Courtney, A.J., Schemel B.L., Wallace, R., Campbell, M.J., Mayer, D.G. and Young, B. (2005) *Reducing the impact of Queensland's trawl fisheries on protected sea snakes*. FRDC Project No. 2005/053. Queensland Government.

NATALIE BLACK

Senior Ecologist

Profile Summary

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

Natalie Black is a conservation detection dog handler and is currently working with his purpose breed working English Springer Spaniel “Gus” who is currently trained to detect Koala scat, Forest Owl pellets and Cane Toads.

Academic Qualifications

- B.Sc (Hons) Sustainable Resource Management and Marine Science – University of Newcastle, 2001
- Master Planning – University of Technology Sydney, 2007
- Certificate IV Training and Assessment – TAFE, 2012
- BAM Assessor; accreditation number: BAAS19076

Training, Licences and Professional Memberships

- NSW Class C Driver’s Licence
- Provide First Aid HLTAID011
- Evidence Gathering and Legal Process, Australian Institute of Environmental Health
- Conflict Resolution Course (LGSA)
- Report Writing Course (LGSA).
- Powerful Presentation (LGSA)
- NSW Rural Fire Services Bush Fire Assessment
- Relocation of Threatened Species, Botanical Gardens Sydney
- Sustainable Home Assessment Reduction Revolution
- Flora and Fauna Survey Assessments Niche Environment and Heritage

Professional Experience

Senior Environmental Manager / Works Coordinator 2019 – Present

Anderson Environment & Planning

Newcastle NSW

Principal Environmental Planner 2010 - 2019

Black Earth

Newcastle NSW

Senior Lecture 2010 - 2019

Hunter TAFE

Range of Hunter Campuses

Natural Resource Manager and Development Assessment Officer 2003 - 2010

Lismore City Council

Lismore NSW

Fish Passage Expert 2002 - 2003

NSW Department of Primary Industries

Ballina NSW

Conservation Officer 2000 - 2002

NSW Department of Primary Industries

Crows Nest, NSW

Volunteer NSW Fisheries 1998 - 2000

Varied Roles

Port Stephens, NSW

Relevant Project Experience

Ecological Survey examples

- Target surveys for *Thelymitra adorata* Halloran; Wyee, Wadalba;
- Target surveys for *Melaleuca biconvexa* Mardi, , Halloran; Wyee, Wadalba
- Target surveys for *Tetratheca juncea* Hillsborough, Mardi, Thornton, Warners Bay;
- Target surveys for *Rhodamnia rubescens* Hillsborough, Mardi, Thornton, Stuarts Point, South West Rocks,
- Target Survesy for Cumberpalin Snail and Dural Snail, Rouse Hill
- Target Search for seagrass and threatened marine fauna, Stuarts Point, South West Rocks, Lake Macquarie, Peat Island,
- Powerful Owl nest locating and monitoring: Salamander Bay
- Spot Analysis Techniques surveys: Lismore, Wallsend, Salamander Bay, North Arm Cove, Warnervale, Hamlyn Terrace, Wyee, Charlestown, Chisholm, Gillieston Heights, Mount Vincent, Hillsborough;
- Surveys for Squirrel Glider (*Petaurus norfolcensis*) Wadalba, Rouse Hill, Claremount Meadows, Wyee, Hillsobourgh, South West Rocks, Stuart Point;
- Frog Surveys: Lismore, Wallsend, Salamander Bay, North Arm Cove, Warnervale, Hamlyn Terrace, Wyee, Charlestown, Chisholm, Hillsborough Rouse Hill, Kariong, Wadalba,

Ecological Assessment examples

- Accredited Assessor for approved Biodiversity Development Assessment Reports:
  - Teraglin Village, Chain Valley Bay;
  - Railway Road, Warnervale;
  - McFarlane's Road, Chisholm;

- Fairlands Road, Medowie;
- Raymond Terrace Road Chishlm,
- Annangrove Road, Rouse Hill
- Richmond Road, Marsden Park,
- Claremount Meadows,
- Newcastle Golf Course, Fern Bay,
- Newell Highway, Gilgandra
- Narromine Road, Dubbo

- Ecological Assessment Report for Proposed Modification to Approved Western Rail Coal Unloader At Pipers Flat;
- Infrastructure Ecology Reports;
  - Wyee Water Main;
  - Mardi Water Main;
  - Wyee Rising Main;
  - Mardi Rising Main;
- Summerhill Waste Facility Recycling Plant

Ecological Offsets and Monitoring

- Biodiversity Stewardship Agreements including:
  - Hillsborough
  - Blueys Beach,
  - Allandale,
  - South-West Rocks.
- Biodiversity Management Plans / Vegetation Management Plan / Wildlife Management Strategies
  - VMP for Proposed Modification to Approved Western Rail Coal Unloader At Pipers Flat;
  - VMP / WMS / Dewatering Plan for Wyee for 23ha Offset lands
  - VMP Rouse Hill Commercial Development.
  - BMP – Claremount Meadows Commercial Development.

Planning – Approved Review of Environmental Factors

- South West Rocks Installation of Seawall,
- Lake Macquarie upgrade of carpark, boat ramp and jetty,
- Demolition of two (2) jetties Peat Island,
- Stuart Point upgrades to caravan park including boat ramp.
- Wyee Rising Main
- Anambah Recycling Facility

Bushfire Threat Assessments

- Kempsey Correctional Facility for upgrade
- Stuarts Point Caravan Park for upgrades
- Claremount Meadows for a Commercial development included Daycare, and service station
- Batlow for a Service Station
- Lovedale for a change of use to Brewery

Appendix D – Fields sheets and BAM plot data

Plot no:	1	Job:	Lochinvar	Job no:	2699.01	Date:	19.12.2022	Observers:	DK,SM
Mapped Vegetation community:									
Upper stratum	**C [1]**	**Ab [2]**	**Mid stratum**	**C [3]**	**Ab [4]**	**Lower stratum**	**C [5]**	**Ab [6]**	
Casuarina glauca	20	10	Solanum nigrum	0.1	2	Cynodon spp	45	1000	
Corymbia maculata	10	5	Olea europaea	0.5	5	Cyclospermum leptophyllum	0.1	10	
Callistemon salignus	8	2	Parsonsia straminea	1	2	Lachnagrostis aemula	0.1	10	
Eucalyptus punctata	40	30	Pittosporum revolutum	0.5	3	Hypocharies radicata	2	100	
Eucalyptus sp (papery bark), out of area	20	20	Solanum seaforthianum	0.1	1	Plantago lanceolata	5	200	
			Araujia sericifera	0.1	1	Senecio madagascariensis	0.2	50	
			Gomphocarpus fruticosu	0.1	2	Lolium rigidum	0.1	10	
						Onopordum acanthium	2	50	
						Carex appressa	0.2	30	
						Rumex brownii	0.2	20	
						Juncus acutus	5	30	
						Anagallis arvensis	0.1	1	
						Centaurium erythraea	0.1	1	
						Setaria pumila	0.5	30	
						Paspalum dilatatum	0.2	30	
						Cyperus eragrostis	0.2	20	
						Buffalo grass	0.2	20	
						Lobelia purp	0.1	5	
						Bromus sp	0.1	2	
						Juncus usitatus	0.1	10	
						Centella asiacata	1	100	
Total Cover	98			2.4			61		
20mx20m plot = 400m2	Note: 0.1% = 63x63cm, 0.5% = 1.4x1.4m, 1% = 2x2m, 5% = 4x5m, 25% = 10x10m					Ehrharta erecta	0.1	5	
							65		

Arrival time:	12	**Departure time:**		**Weather:**	Overcast, 20 deg	**TWO transect photos (one landscape, one portrait) taken**	☑	**Transect GPS points taken**	☑
Start easting/northing:	355,746	6381081	**End easting/northing:**	**355,790**	**6381050**	**Zone:**	56	**Bearing:**	115

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]	☑			**Leaf litter**	**Live vegetation**	**Bare ground**	**Rocks**	**Other**	**Total**
5 - 9 cm	☑		**1**	70	10	20	0	0	**100**
10 – 19 cm	☑	#0	**2**	70	25	5	0	0	**100**
20 – 29 cm	☑	**Length of logs (m) [10]**	**3**	80	0	20	0	0	**100**
30 – 49cm	#1,1,1,1,1,1,1,1,1		**4**	55	35	10	0	0	**100**
50 -79cm	#	#12	**5**	20	80	0	0	0	**100**
>80cm	#		**Average**	59	30	11	0	0	**100**

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

Trees planted in straight line, no older than 20-25yrs. Evidence of grazing, mostly exotic under storey. Stream running through the centre

Habitat features, comments and incidental fauna observations:

No HBTs, no significant habitat

Plot no:	2	Job:	Lochinvar	Job no:	2699.01	Date:	19.12.2022	Observers:	DK SR
Mapped Vegetation community:									
Upper stratum	**C [1]**	**Ab [2]**	**Mid stratum**	**C [3]**	**Ab [4]**	**Lower stratum**	**C [5]**	**Ab [6]**	
						Paspalum dilataum	25	2000	
						Briza minor	10	1000	
						Hypochaeris radicata	0.2	80	
						Senecio madgas	0.1	30	
						Gnaphalium	0.2	50	
						Cynodon spp	55	10000	
						Sida rhombifolia	0.1	20	
						Plantago lancelata	0.5	200	
						Lachnagrostis aemula	0.1	20	
						Sporobolous elongatus	0.1	10	
						Cyperus sesquifolius	0.2	50	
						Juncus cognatus	0.2	20	
						Centaurium erythraea	0.1	5	
						Verbena boni	0.1	1	
						Cheilanthes sieberi	0.1	1	
						Fimbrystylis dichatoma	0.2	50	
						Eragrostis brownii	0.1	10	
						Cyperus eragrostis	0.1	20	
Total Cover	0			0			92.4		
20mx20m plot = 400m2 Note: 0.1% = 63x63cm, 0.5% = 1.4x1.4m, 1% = 2x2m, 5% = 4x5m, 25% = 10x10m									

Arrival time:	1.3	**Departure time:**		**Weather:**	Overcast, windy,	**TWO transect photos (one landscape, one portrait) taken**	☑	**Transect GPS points taken**	☑
Start easting/northing:	0355861/6381065		**End easting/northing:**		**0355914/6381043**	**Zone:**	56	**Bearing:**	92

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]	☐			**Leaf litter**	**Live vegetation**	**Bare ground**	**Rocks**	**Other**	**Total**
5 - 9 cm	☐		**1**	80	80	5	0	0	**165**
10 – 19 cm	☐	#	**2**	70	65	20	0	0	**155**
20 – 29 cm	☐	**Length of logs (m) [10]**	**3**	85	75	10	0	0	**170**
30 – 49cm	#		**4**	50	55	15	0	0	**120**
50 -79cm	#	#	**5**	65	70	12	0	0	**147**
>80cm	#		**Average**	70	69	12.4	0	0	**151.4**

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

Paddock

Habitat features, comments and incidental fauna observations:

Plot no:	3	Job:	Lochinvar	Job no:	2699.01	Date:	19.12.2022	Observers:	DK
Mapped Vegetation community:									
Upper stratum	**C [1]**	**Ab [2]**	**Mid stratum**	**C [3]**	**Ab [4]**	**Lower stratum**	**C [5]**	**Ab [6]**	
Casuarina glauca	80	50	Moth vine	0.1	1	Ehrharta erecta	5	200	
						Plantago lancelato	0.1	10	
						Paspalum dilatatum	0.1	20	
						Sida rhombifolia	0.1	10	
						Cyclospermum leptophyllum	0.1	1	
						Dichondria repens	0.1	20	
						Onopordum acanthium	0.1	1	
Total Cover	80			0.1			5.6		
20mx20m plot = 400m2 Note: 0.1% = 63x63cm, 0.5% = 1.4x1.4m, 1% = 2x2m, 5% = 4x5m, 25% = 10x10m									

Arrival time:	2.25	**Departure time:**		**Weather:**	Cloudy 22 degree	**TWO transect photos (one landscape, one portrait) taken**	☑	**Transect GPS points taken**	☑
Start easting/northing:	355,913	6380902	**End easting/northing:**	**355,930**	**6380928**	**Zone:**	56	**Bearing:**	15

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]	☑			**Leaf litter**	**Live vegetation**	**Bare ground**	**Rocks**	**Other**	**Total**
5 - 9 cm	☑		**5m**	80	0	20	0	0	**100**
10 – 19 cm	☑	#0	**10m**	70	0	30	0	0	**100**
20 – 29 cm	☑	**Length of logs (m) [10]**	**15m**	60	10	30	0	0	**100**
30 – 49cm	#2		**20m**	80	0	20	0	0	**100**
50 -79cm	#	#0	**25m**	60	10	30	0	0	**100**
>80cm	#		**Average**	70	4	26	0	0	**100**

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

Modified Plot! -> 20x30m - vegetation is only 20m long. Sub-plots adjusted - see above. Stand of casuarina.

Habitat features, comments and incidental fauna observations:

Plot no:	4	Job:	Lochinvar	Job no:	2699.01	Date:	19.12.22	Observers:	DK
Mapped Vegetation community:									
Upper stratum	**C [1]**	**Ab [2]**	**Mid stratum**	**C [3]**	**Ab [4]**	**Lower stratum**	**C [5]**	**Ab [6]**	
Melaleuca ericifolia	30	40				Centaurium erythraea	0.1	20	
						Gnaphalium sp	0.5	200	
						Senecio madgas	0.1	10	
						Briza subaristida	15	300	
						Briza minor	0.1	10	
						Fimbrystylis dichatoma	0.1	20	
						Paspalum dilatatum	0.5	30	
						Hypocharies radicata	0.2	20	
						Sporobolous elongatus	10	300	
						Cynodon sp	45	1000	
						Juncus cognatus	0.1	5	
						Cyperus sp	0.1	2	
						Verbena boni	0.1	2	
						Conyza bonariensis	0.1	5	
						Bothriocloa macra	0.1	2	
						Austrostipa ramosissima	0.1	10	
						Plantago lancelato	0.1	30	
Total Cover	30			0			72.3		
20mx20m plot = 400m2 Note: 0.1% = 63x63cm, 0.5% = 1.4x1.4m, 1% = 2x2m, 5% = 4x5m, 25% = 10x10m									

Arrival time:	3.3	**Departure time:**		**Weather:**	Overcast, windy,	**TWO transect photos (one landscape, one portrait) taken**	☑	**Transect GPS points taken**	☑
Start easting/northing:	355,817	6381431	**End easting/northing:**	**355,794**	**6381738**	**Zone:**	56	**Bearing:**	275

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]	☑			**Leaf litter**	**Live vegetation**	**Bare ground**	**Rocks**	**Other**	**Total**
5 - 9 cm	☑		**5**	30	40	30	0	0	**100**
10 – 19 cm	☑	#	**10**	20	5	75	0	0	**100**
20 – 29 cm	☐	**Length of logs (m) [10]**	**15**	30	5	65	0	0	**100**
30 – 49cm	#		**20**	10	50	40	0	0	**100**
50 -79cm	#	#15m	**25(m)**	30	50	20	0	0	**100**
>80cm	#		**Average**	24	30	46	0	0	**100**

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

Modified plot / 15mx25m. Patch of melaleuca ericifolia? Growing in the middle of paddock. Limited habitat features. Plot modified due to small patch

Habitat features, comments and incidental fauna observations:

Plot no:	5	Job:	Lochinvar	Job no:	2669.01	Date:	19.12.2022	Observers:	Dk
Mapped Vegetation community:									
Upper stratum	**C [1]**	**Ab [2]**	**Mid stratum**	**C [3]**	**Ab [4]**	**Lower stratum**	**C [5]**	**Ab [6]**	
						Paspalum dilatum	5		
						Hypocharis radicata	2		
						Briza subaristada	40	3000	
						Cynodon spp	25	1000	
						Cyperus sesquifolius	0.2	100	
						Juncus cognatus	0.2	100	
						Gnaphalium sp	2	1000	
						Centaurium sp	0.1	10	
						Thimbrystylis dichatoma	0.5	100	
						Senecio madgas	0.1	50	
						Sporobolous elongatus	0.5	50	
						Eragrostis brownii	0.1	2	
						Plantago lancelato	1	100	
Total Cover	0			0			76.7		
20mx20m plot = 400m2 Note: 0.1% = 63x63cm, 0.5% = 1.4x1.4m, 1% = 2x2m, 5% = 4x5m, 25% = 10x10m									

Arrival time:	4.4	**Departure time:**		**Weather:**		**TWO transect photos (one landscape, one portrait) taken**	☑	**Transect GPS points taken**	☑
Start easting/northing:	355,927	6381296	**End easting/northing:**	**355,880**	**6381317**	**Zone:**	56	**Bearing:**	280

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]	☐			**Leaf litter**	**Live vegetation**	**Bare ground**	**Rocks**	**Other**	**Total**
5 - 9 cm	☐		**1**	15	80	5	0	0	**100**
10 – 19 cm	☐	#	**2**	10	80	10	0	0	**100**
20 – 29 cm	☐	**Length of logs (m) [10]**	**3**	5	40	55	0	0	**100**
30 – 49cm	#		**4**	10	80	10	0	0	**100**
50 -79cm	#	#	**5**	10	80	10	0	0	**100**
>80cm	#		**Average**	10	72	18	0	0	**100**

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

Paddock plot

Habitat features, comments and incidental fauna observations:

Plot no:	6	Job:		Job no:		Date:		Observers:
Mapped Vegetation community:								
Upper stratum	**C [1]**	**Ab [2]**	**Mid stratum**	**C [3]**	**Ab [4]**	**Lower stratum**	**C [5]**	**Ab [6]**
Eucalyptus tereticornis	20	2				Gnapalium sp	0.5	50
Eucalyptus eugenoides?	50	3				Sporobolous elongatus	1	100
						Briza subaristida	20	
						Plantago lancelato	1	50
						Senecio madgas	0.2	30
						Cynodon spp	50	
						Hypocharies radicata	1	50
						Paspalum dilatatum	5	100
						Eragrostis brownii	0.5	100
						Juncus cognatus	0.2	50
						Briza minor	0.1	10
						Cyperus spp	0.1	1
						Cotton bush	0.1	1
						Verbena boni	0.1	2
Total Cover	70			0			79.8	
20mx20m plot = 400m2 Note: 0.1% = 63x63cm, 0.5% = 1.4x1.4m, 1% = 2x2m, 5% = 4x5m, 25% = 10x10m								

Arrival time:	6.1	**Departure time:**		**Weather:**	Windy, overcast,	**TWO transect photos (one landscape, one portrait) taken**	☑	**Transect GPS points taken**	☑
Start easting/northing:	0355827/6381581		**End easting/northing:**	**0355854/6381568**		**Zone:**	56	**Bearing:**	108

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]	☐			**Leaf litter**	**Live vegetation**	**Bare ground**	**Rocks**	**Other**	**Total**
5 - 9 cm	☐		**5**	25	75	0	0	0	**100**
10 – 19 cm	☐	#	**10**	25	72	3	0	0	**100**
20 – 29 cm	☐	**Length of logs (m) [10]**	**15**	18	82	0	0	0	**100**
30 – 49cm	#		**20**	30	68	2	0	0	**100**
50 -79cm	#	#	**25**	15	55	30	0	0	**100**
>80cm	#		**Average**	22.6	70.4	7	0	0	**100**

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

Grazed. Stand of remnant canopy in paddock. Four live trees, one stag.

Habitat features, comments and incidental fauna observations:

Plot no:	7	Job:	Lochinvar	Job no:	2669.01	Date:	19.12.22	Observers:	DK, AM
Mapped Vegetation community:									
Upper stratum	**C [1]**	**Ab [2]**	**Mid stratum**	**C [3]**	**Ab [4]**	**Lower stratum**	**C [5]**	**Ab [6]**	
						Juncus cognatus	0.2	50	
						Juncus acutus	65	1000	
						Cyperus Eragrostis	5	100	
						Verbena boniariensis	0.1	20	
						Rumex brownii	0.2	50	
						Onopordum acanthium	0.1	30	
						Centaurium erythraea	0.1	20	
						Cynodon spp	2	100	
						Plantago lanceolato	0.2	50	
						Senecio madgas	0.1	20	
						Hypocharies radicata	0.2	50	
							0.1	30	
						Silybum marianum	0.1	10	
						Lachnagrostis filiformis	0.2	50	
						Paspalum dilatatum	15	1000	
						Conyza bonarienisis	0.1	10	
						Cyclospermum leptophyllum	0.1	1	
						Baumea juncea	0.1	5	
						Empodisma minor	0.1	10	
						Lolium rigidum	0.1	1	
						Fimrostylis dichatoma	0.1	50	
Total Cover	0			0			89.2		
20mx20m plot = 400m2	Note: 0.1% = 63x63cm, 0.5% = 1.4x1.4m, 1% = 2x2m, 5% = 4x5m, 25% = 10x10m						90		

Arrival time:	7	**Departure time:**		**Weather:**		**TWO transect photos (one landscape, one portrait) taken**	☑	**Transect GPS points taken**	☑
Start easting/northing:	355,961	6380975	**End easting/northing:**	**355,909**	**6380995**	**Zone:**	56	**Bearing:**	280

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]	☐			**Leaf litter**	**Live vegetation**	**Bare ground**	**Rocks**	**Other(water)**	**Total**
5 - 9 cm	☐		**1**		80	20			**100**
10 – 19 cm	☐	#	**2**	20	30	50			**100**
20 – 29 cm	☐	**Length of logs (m) [10]**	**3**		100				**100**
30 – 49cm	#		**4**	20	50	30			**100**
50 -79cm	#	#	**5**					100	**100**
>80cm	#		**Average**	20	65	33.33333333	#DIV/0!	100	**#DIV/0!**

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

This a riparian plot, thick spicky Juncus acutus made it difficult to navigate. Tape not straight due to Juncus, bam plot in this location due to presence of Juncus which differs from rest of s

Habitat features, comments and incidental fauna observations:

Eels and striped marsh frogs heard/seen in this area

Plot no: 8		Job: Lochinvar		Job no: 2699.01		Date: 20/12/22		Observers: Angela and Darcy
Mapped Vegetation community:								
Upper stratum	**C [1]**	**Ab [2]**	**Mid stratum**	**C [3]**	**Ab [4]**	**Lower stratum**	**C [5]**	**Ab [6]**
						Eragrostis brownii	1	100
						Sporobolus elongatus	1	100
						Austrostipa ramosissima	10	
						Verbena boniarensis	0.1	5
						Rumex brownii	0.1	10
						Centaurium erythraea	0.1	100
						Briza subaristida	20	1000
						Cynodon dactylon	40	2000
						Hypochaeris radicata	0.3	200
						Briza minor	10	500
						Gnapalium sp	0.3	100
						Senecio madgas	0.1	10
						Juncus cognatus	0.1	10
						Cyperus sesquifolius	0.1	20
						Fimbrystylis dichatoma)	0.1	100
						Plantago lancelato	0.1	10
						Paspalum dilatatum	3	200
						Chilanthes seiberi	0.1	2
						Lachnogrostis aemula	0.1	10
Total Cover	0			0			86.6	
20mx20m plot = 400m2 Note: 0.1% = 63x63cm, 0.5% = 1.4x1.4m, 1% = 2x2m, 5% = 4x5m, 25% = 10x10m								
						85		

Arrival time:	8	**Departure time:**		**Weather:**		**TWO transect photos (one landscape, one portrait) taken**	☑	**Transect GPS points taken**	☑
Start easting/northing:	355,778	6381517	**End easting/northing:**			**Zone:**	56	**Bearing:**	105

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]	☐			**Leaf litter**	**Live vegetation**	**Bare ground**	**Rocks**	**Other**	**Total**
5 - 9 cm	☐		**5**	10	90	0	0	0	**100**
10 – 19 cm	☐	#	**10**	25	75	0	0	0	**100**
20 – 29 cm	☐	**Length of logs (m) [10]**	**15**	40	50	10	0	0	**100**
30 – 49cm	#		**20**	40	50	10	0	0	**100**
50 -79cm	#	#	**25**	25	70	5	0	0	**100**
>80cm	#		**Average**	28	67	5	0	0	**100**

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

Paddock plot

Habitat features, comments and incidental fauna observations:

Plot no:	9	Job: Lochinvar		Job no: 2699.01		Date: 20/12/22		Observers: Angela and Darcy
Mapped Vegetation community:								
Upper stratum	**C [1]**	**Ab [2]**	**Mid stratum**	**C [3]**	**Ab [4]**	**Lower stratum**	**C [5]**	**Ab [6]**
						Ludwigia peploides	2	50
						Hypochaeris radicata	0.2	30
						Cyperus eragrostis	3	100
						Juncus usitatus	20	300
						Galenia pubescens	0.5	50
						Cynodon dactylon	50	1000
						Verbena bonariensis	0.1	5
						Senecio madgas	0.1	10
						Onopordum acanthium	0.1	5
						Paspalum dilatatum	5	200
						Plantago lanceato	0.1	10
						Persicaria sp	0.1	1
						Ranunculus inundatus	0.1	1
						Centaurium erythraea	0.1	20
						Lachnogrostis aemula	1	50
						Briza subaristada	1	100
						Conyza bonariensis	0.1	10
Total Cover	0			0			83.5	
20mx20m plot = 400m2	Note: 0.1% = 63x63cm, 0.5% = 1.4x1.4m, 1% = 2x2m, 5% = 4x5m, 25% = 10x10m							
						85		

Arrival time:		**Departure time:**		**Weather:**		**TWO transect photos (one landscape, one portrait) taken**	☑	**Transect GPS points taken**	☑
Start easting/northing:	355,856	6381260	**End easting/northing:**			**Zone:**	56	**Bearing:**	Na

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]	☐			**Leaf litter**	**Live vegetation**	**Bare ground**	**Rocks**	**Other**	**Total**
5 - 9 cm	☐		**5**	20	80	0	0	0	**100**
10 – 19 cm	☐	#	**20**	5	50	45	0	0	**100**
20 – 29 cm	☐	**Length of logs (m) [10]**	**35**	5	80	15	0	0	**100**
30 – 49cm	#		**50**	20	50	30	0	0	**100**
50 -79cm	#	#	**65**	5	70	25	0	0	**100**
>80cm	#		**Average**	11	66	23	0	0	**100**

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

Dam Plot - 70m by 3m.

Habitat features, comments and incidental fauna observations:

Plot no:	10	Job: Lochinvar		Job no: 2699.01		Date: 20/12/22		Observers: Angela and Darcy
Mapped Vegetation community:								
Upper stratum	**C [1]**	**Ab [2]**	**Mid stratum**	**C [3]**	**Ab [4]**	**Lower stratum**	**C [5]**	**Ab [6]**
Eucalyptus punctata	50	10	Melaleuca bracteata	12	5	Megathyrsus maximus	60	2000
Eucalyptus robusta	5	1	Olea europaea	5	3	Lysimachia arvensis	0.1	10
Euc microcorys	5	1	Pittosporum undulatum	0.1	1	Plantago lancelato	0.1	50
Eucalyptus spp	2	3	Hakea bakeriana	1	1	Milk thistle	0.1	10
			Hakea sericea	1	1	Trifolium repens	0.1	20
						Briza maxima	2	100
						Themeda triandra	0.5	50
						Verbena boni	0.1	20
						Senecio madgas	0.1	10
						Bidens pilosa	0.1	5
						Onopordum acanthium	0.1	5
						Joycea pallida	0.2	30
						Cyndon sp	10	300
						Briza subaristata	0.2	50
						Setaria pumila	0.2	30
						Centaurium erythraea	0.1	10
						Sida rhombifolia	0.1	5
						Sporobolous elongatus	0.2	30
						Chloris gayana	0.2	20
						Whiskey grass	0.1	2
						Foeniculum vulgare	0.1	5
						Juncus usitatus	0.2	50
						Stenotaphrum secundatum	0.5	50
						Rumex brownii	0.1	0.1

Plot no:	10	**Job: Lochinvar**		**Job no: 2699.01**		**Date: 20/12/22**		**Observers: Angela and Darcy**
Mapped Vegetation community:								
Upper stratum	**C [1]**	**Ab [2]**	**Mid stratum**	**C [3]**	**Ab [4]**	**Lower stratum**	**C [5]**	**Ab [6]**
						Poa sp	0.1	20
Total Cover	62			19.1			75.6	
20mx20m plot = 400m2	Note: 0.1% = 63x63cm, 0.5% = 1.4x1.4m, 1% = 2x2m, 5% = 4x5m, 25% = 10x10m							
						85		

Arrival time:		**Departure time:**		**Weather:**		**TWO transect photos (one landscape, one portrait) taken**	☑	**Transect GPS points taken**	☑
Start easting/northing:			**End easting/northing:**			**Zone:**	56	**Bearing:**	180

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]	☑			**Leaf litter**	**Live vegetation**	**Bare ground**	**Rocks**	**Other**	**Total**
5 - 9 cm	☑		**10**	25	75	0	0	0	**100**
10 – 19 cm	☑	#	**30**	25	70	5	0	0	**100**
20 – 29 cm	☑	**Length of logs (m) [10]**	**50**	55	45	0	0	0	**100**
30 – 49cm	#4		**70**	15	65	20	0	0	**100**
50 -79cm	#	#3,	**90**	30	70	0	0	0	**100**
>80cm	#		**Average**	30	65	5	0	0	**100**

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

Disturbed road side plot. Modified ; 100m x 4m

Habitat features, comments and incidental fauna observations:

Plot no:	11	Job: Lochinvar		Job no: 2699.02		Date: 18/04/23		Observers: SJC
Mapped Vegetation community:								
Upper stratum	C [1]	Ab [2]	Mid stratum	C [3]	Ab [4]	Lower stratum	C [5]	Ab [6]
						Sporobolus creber	0.2	
						Paspalum dilatatum	35	
						Cyperus brevifolius	0.1	
						Cynodon sp	2	
						Aster subulatus	0.2	
						Verbena bonariensis	0.1	
						Axonopus fissifolius	5	
						Setaria parviflora	0.3	
						Senecio madagascariensis	0.2	
						Juncus cognatus	0.2	
						Cyperus eragrostis	0.1	
						Cenchrus clandestinum	45	
						Plantago lanceolata	0.2	
						Hypochaeris radicata	0.2	
						Fimbristylis dichotoma	0.1	
						Cyperus sesquiflorus	0.5	
						Sporobolas africanus	0.5	
						Hypochaeris albiflora	0.1	
						Gamochaeta coarctata	0.5	
Total Cover	0			0			90.5	
20mx20m plot = 400m2	Note: 0.1% = 63x63cm, 0.5% = 1.4x1.4m, 1% = 2x2m, 5% = 4x5m, 25% = 10x10m							
						85		

Arrival time:		**Departure time:**		**Weather:**		**TWO transect photos (one landscape, one portrait) taken**	☑	**Transect GPS points taken**	☑
Start easting/northing:			**End easting/northing:**			**Zone:**	56	**Bearing:**	274

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]	☐			**Leaf litter**	**Live vegetation**	**Bare ground**	**Rocks**	**Other**	**Total**
5 - 9 cm	☐		**10**		80	20			**100**
10 – 19 cm	☐	#	**30**		90	10			**100**
20 – 29 cm	☐	**Length of logs (m) [10]**	**50**		85	15			**100**
30 – 49cm	#		**70**		95	5			**100**
50 -79cm	#	#	**90**		90	10			**100**
>80cm	#		**Average**				#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.

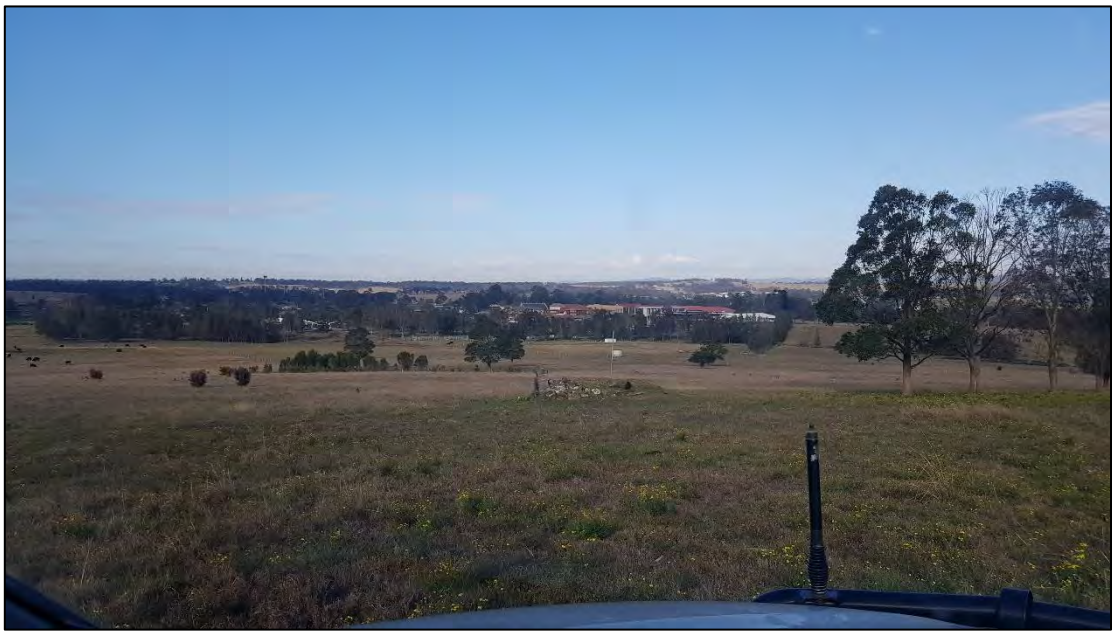
[7] DBH = 1.3m high

[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

Appendix E – Site photographs



Above: Mid-north boundary – Looking south

Below: Mid-east boundary – Looking north

Above: Mid east boundary – Looking south west

Below: Mid east boundary – Looking south toward east boundary

Above: Largest dam in south west of site

Below: Melaleuca spp. in center of site

Above: Centre west of site looking south

Below: Farm shed containing several Nyctophilus geoffroyi individuals

Above: Planted vegetation along riparian zone in the south west of site Below: Predominantly exotic riparian area

Above: Stand of retained PCT 3433 at the southern boundary

Below: Predominantly exotic riparian zone in the south east corner with scattered *Casuarina glauca*

Appendix F – Flora species list

Family	Scientific Name	Common Name
Aizoaceae	*Galenia pubescens**	Galenia
Apiaceae	*Centella asiatica*	Swamp Pennywort
Apiaceae	*Cyclospermum leptophyllum**	Slender Celery
Apiaceae	*Foeniculum vulgare**	Fennel
Apocynaceae	*Araujia sericifera**	Mothvine
Apocynaceae	*Gomphocarpus fruiticosus**	Narrow Leaf Cotton Bush
Apocynaceae	*Parsonsia straminea*	Common Silkpod
Asteraceae	*Bidens pilosa**	Cobbler's Pegs
Asteraceae	*Conyza bonariensis**	Flax-leaf Fleabane
Asteraceae	*Euchiton spp.*	Cudweed
Asteraceae	*Hypochaeris radicata**	Flatweed
Asteraceae	*Oncosiphon piluliferum**	
Asteraceae	*Onopordum acanthium subsp.*	Scotch Thistle
Asteraceae	*Senecio madagascariensis**	Fireweed
Asteraceae	*Silybum marianum**	Variegated Thistle
Casuarinaceae	*Casuarina glauca*	Swamp Oak
Convolvulaceae	*Dichondra repens*	Kidney Weed
Cyperaceae	*Baumea juncea*	
Cyperaceae	*Carex appressa*	Tall Sedge
Cyperaceae	*Cyperus eragrostis**	Umbrella Sedge
Cyperaceae	*Cyperus sesquiflorus**	
Cyperaceae	*Cyperus spp.*	
Cyperaceae	*Fimbristylis dichotoma*	Common Fringe-rush
Fabaceae	*Trifolium repens**	White Clover
Gentianaceae	*Centaurium erythraea**	Common Centaury
Juncaceae	*Juncus acutus**	
Juncaceae	*Juncus cognatus**	
Juncaceae	*Juncus usitatus*	Common Rush
Lobeliaceae	*Lobelia purpurascens*	Whiteroot
Malvaceae	*Sida rhombifolia**	Paddy's Lucerne
Myrtaceae	*Callistemon salignus*	Willow Bottlebrush
Myrtaceae	*Corymbia maculata*	Spotted Gum
Myrtaceae	*Eucalyptus microcorys*	Tallowwood
Myrtaceae	*Eucalyptus punctata*	Grey Gum
Myrtaceae	*Eucalyptus robusta*	Swamp Mahogany
Myrtaceae	*Eucalyptus spp.*	
Myrtaceae	*Eucalyptus tereticornis*	Forest Red Gum
Myrtaceae	*Melaleuca bracteata*	Black Tea-tree
Myrtaceae	*Melaleuca ericifolia*	Swamp Paperbark
Oleaceae	*Olea europaea subsp. cuspidata**	African Olive
Onagraceae	*Ludwigia peploides subsp.*	Water Primrose
Pittosporaceae	*Pittosporum revolutum*	Yellow Pittosporum
Pittosporaceae	*Pittosporum undulatum*	Sweet Pittosporum
Plantaginaceae	*Plantago lanceolata**	Ribwort
Poaceae	*Andropogon virginicus**	Whisky Grass
Poaceae	*Austrostipa ramosissima*	Stout Bamboo Grass

Family	Scientific Name	Common Name
Poaceae	*Bothriochloa macra*	Red Grass
Poaceae	*Briza maxima**	Quaking Grass
Poaceae	*Briza minor**	Shivery Grass
Poaceae	*Briza subaristata**	
Poaceae	*Bromus spp.**	A Brome
Poaceae	*Chloris gayana**	Rhodes Grass
Poaceae	*Cynodon dactylon*	
Poaceae	*Ehrharta erecta**	Panic Veldtgrass
Poaceae	*Eragrostis brownii*	Brown's Lovegrass
Poaceae	*Lachnagrostis aemula*	Blown Grass
Poaceae	*Lachnagrostis filiformis*	Blown Grass
Poaceae	*Lolium rigidum**	Wimmera Ryegrass
Poaceae	*Megathyrsus maximus**	Guinea Grass
Poaceae	*Paspalum dilatatum**	Paspalum
Poaceae	*Poa spp.**	
Poaceae	*Rytidosperma pallidum*	Silvertop Wallaby Grass
Poaceae	*Setaria pumila**	Pale Pigeon Grass
Poaceae	*Sporobolus elongatus*	Slender Rat's Tail Grass
Poaceae	*Stenotaphrum secundatum**	Buffalo Grass
Poaceae	*Themeda triandra*	Kangaroo Grass
Polygonaceae	*Persicaria spp.**	Knotweed
Polygonaceae	*Rumex brownii*	Swamp Dock
Primulaceae	*Lysimachia arvensis var.*	Blue Pimpernel
Proteaceae	*Hakea bakeriana*	
Proteaceae	*Hakea sericea*	Needlebush
Pteridaceae	*Cheilanthes sieberi*	Rock Fern
Ranunculaceae	*Ranunculus inundatus*	River Buttercup
Restionaceae	*Empodisma minus*	Spreading Rope-rush
Solanaceae	*Solanum nigrum**	Black Nightshade, Black-berry
Solanaceae	*Solanum seaforthianum**	Climbing Nightshade
Verbenaceae	*Verbena bonariensis**	Purpletop
Asteraceae	*Hypochaeris radicata**	Flatweed
Asteraceae	*Oncosiphon piluliferum**	
Asteraceae	*Onopordum acanthium subsp.*	Scotch Thistle
Asteraceae	*Senecio madagascariensis**	Fireweed
Asteraceae	*Silybum marianum**	Variegated Thistle
Casuarinaceae	*Casuarina glauca*	Swamp Oak

* Denotes a non-native species

Appendix G – Observed fauna species

OBSERVED FAUNA SPECIES LIST

The following list includes all fauna species that were recorded within the Study Area during the surveys undertaken at the Subject Site.

“Threatened species listed under the BC Act or the EPBC Act are indicated in bold font.

Surveyed Observations used within Site:

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

Bat Records used within Site:

- Observed (O);
- Definitely (D);
- Possible or within Species Group (P); and
- Likely (L).

Survey Equipment used to observe fauna within the Subject Site:

- Anabat (A);
- Songmeter (SM);
- Camera Trap (CT); and
- Harp Trap (HT

Scientific Name	Common Name	NSW status	Comm. status	Records	Observations	Survey Equipment
Amphibia						
Crinia signifera	Common Eastern Froglet			51	W	SM
Paracrinia haswelli	Haswell's Froglet			1	W	SM
Pseudophryne coriacea	Red-backed Toadlet			2		
Uperoleia fusca	Dusky Toadlet			22		
Uperoleia laevigata	Smooth Toadlet			7	W	
Litoria dentata	Bleating Tree Frog			2		
Litoria fallax	Eastern Dwarf Tree Frog			18		
Litoria peronii	Peron's Tree Frog			15		
Litoria phyllochroa	Leaf-green Tree Frog			5		
Litoria revelata	Revealed Frog			5		
Litoria tyleri	Tyler's Tree Frog			4		
Litoria verreauxii	Verreaux's Frog			7	W	SM
Limnodynastes peronii	Brown-striped Frog			8		
Limnodynastes tasmaniensis	Spotted Grass Frog			35		
Reptilia						
Chelodina longicollis	Eastern Snake-necked Turtle			9		
Lampropholis delicata	Dark-flecked Garden Sunskink			6	O	
Lampropholis guichenoti	Pale-flecked Garden Sunskink			2		
Tiliqua scincoides	Eastern Blue-tongue			7		
Morelia spilota	Carpet & Diamond Pythons			1	O	
Pseudechis porphyriacus	Red-bellied Black Snake			25		
Pseudonaja textilis	Eastern Brown Snake			25		
Aves						
Anas superciliosa	Pacific Black Duck			57	OW	SM
Aythya australis	Hardhead			4		
Chenonetta jubata	Australian Wood Duck			58	OW	SM
Cygnus atratus	Black Swan			20		

Scientific Name	Common Name	NSW status	Comm. status	Records	Observations	Survey Equipment
Tachybaptus novaehollandiae	Australasian Grebe			21	O	
Geopelia humeralis	Bar-shouldered Dove			6	O	
Ocyphaps lophotes	Crested Pigeon			43	O	
Spilopelia chinensis	Spotted Turtle-Dove			13		
Podargus strigoides	Tawny Frogmouth			34		
Pelecanus conspicillatus	Australian Pelican			26	O	
Ardea pacifica	White-necked Heron			16		
Bubulcus ibis	Cattle Egret			23	O	
Casmerodius modesta	Eastern Great Egret			16		
Egretta novaehollandiae	White-faced Heron			38	O	
Threskiornis moluccus	Australian White Ibis			3	O	
Threskiornis spinicollis	Straw-necked Ibis			20		
Aquila audax	Wedge-tailed Eagle			12	O	
Lophoictinia isura	Square-tailed Kite	V		2	O (Potential – flying overhead)	
Falco cenchroides cenchroides	Nankeen Kestrel			16	O	
Lewinia pectoralis	Lewin's Rail			2	W	SM
Porphyrio porphyrio	Purple Swamphen			17		
Vanellus miles	Masked Lapwing			51	W	SM
Cacatua galerita	Sulphur-crested Cockatoo			44	OW	SM
Cacatua sanguinea	Little Corella			17	W	SM
Cacatua tenuirostris	Long-billed Corella			7		
Calyptorhynchus lathami	Glossy Black-Cockatoo	V		1	OW	SM
Eolophus roseicapilla	Galah			68	O	
Zanda funereus	Yellow-tailed Black-Cockatoo			10	OW	SM

Scientific Name	Common Name	NSW status	Comm. status	Records	Observations	Survey Equipment
Alisterus scapularis	Australian King-Parrot			29	W	SM
Glossopsitta concinna	Musk Lorikeet			5		
Glossopsitta pusilla	Little Lorikeet	V		10	W	SM
Platycercus elegans	Crimson Rosella			15		
Platycercus eximius	Eastern Rosella			64		
Trichoglossus chlorolepidotus	Scaly-breasted Lorikeet			4		
Trichoglossus haematodus	Rainbow Lorikeet			61	OW	SM
Cacomantis flabelliformis	Fan-tailed Cuckoo			11		
Centropus phasianinus	Pheasant Coucal			20		
Tyto javanica	Eastern Barn Owl			3	O	
Tyto tenebricosa	Sooty Owl	V		18		
Ceyx azureus	Azure Kingfisher			3		
Dacelo novaeguineae	Laughing Kookaburra			57	W	SM
Todiramphus sanctus	Sacred Kingfisher			11		
Eurystomus orientalis	Dollarbird			15		
Cormobates leucophaea	White-throated Treecreeper			22	W	SM
Malurus cyaneus	Superb Fairy-wren			62	OW	SM
Malurus lamberti	Variegated Fairy-wren			15		
Acanthiza pusilla	Brown Thornbill			29	O	
Gerygone mouki	Brown Gerygone			11	O	
Neosericornis citreogularis	Yellow-throated Scrubwren			1	O	
Sericornis frontalis	White-browed Scrubwren			20	O	
Pardalotus punctatus	Spotted Pardalote			31		
Pardalotus striatus	Striated Pardalote			23		
Acanthorhynchus tenuirostris	Eastern Spinebill			16	OW	SM

Scientific Name	Common Name	NSW status	Comm. status	Records	Observations	Survey Equipment
Anthochaera carunculata	Red Wattlebird			9		
Anthochaera chrysoptera	Little Wattlebird			2	W	SM
Caligavis chrysops	Yellow-faced Honeyeater			46		
Manorina melanocephala	Noisy Miner			76	W	SM
Manorina melanophrys	Bell Miner			20	W	
Meliphaga lewinii	Lewin's Honeyeater			4		
Melithreptus brevirostris	Brown-headed Honeyeater			414		
Melithreptus lunatus	White-naped Honeyeater			10		
Myzomela sanguinolenta	Scarlet Honeyeater			13	W	SM
Philemon corniculatus	Noisy Friarbird			29		
Phylidonyris niger	White-cheeked Honeyeater			4	W	SM
Daphoenositta chrysoptera	Varied Sittella	V		8		
Pomatostomus temporalis	Grey-crowned Babbler				OW	
Coracina novaehollandiae	Black-faced Cuckoo-shrike			3		
Colluricincla harmonica	Grey Shrike-thrush			14	OW	SM
Pachycephala pectoralis	Golden Whistler			28	OW	SM
Pachycephala rufiventris	Rufous Whistler			19		
Oriolus sagittatus	Olive-backed Oriole			16		
Cracticus nigrogularis	Pied Butcherbird			48	OW	SM
Cracticus torquatus	Grey Butcherbird			33		
Gymnorhina tibicen	Australian Magpie			128	OW	SM
Strepera graculina	Pied Currawong			30	OW	
Rhipidura albiscapa	Grey Fantail			54	OW	SM

Scientific Name	Common Name	NSW status	Comm. status	Records	Observations	Survey Equipment
Rhipidura leucophrys	Willie Wagtail			52	O	
Corvus coronoides	Australian Raven			79	OW	
Corvus orru	Torresian Crow			42	W	SM
Grallina cyanoleuca	Magpie-lark			79	W	SM
Eopsaltria australis	Eastern Yellow Robin			28	OW	SM
Microeca fascinans	Jacky Winter			5		
Hirundo neoxena	Welcome Swallow			42	O	
Acridotheres tristis	Common Myna			34	W	SM
Sturnus vulgaris	Common Starling			17		
Zosterops lateralis	Silvereye			33	W	SM
Dicaeum hirundinaceum	Mistletoebird			6		
Neochmia temporalis	Red-browed Finch			28	OW	
Mammalia						
Antechinus stuartii	Brown Antechinus			2		
Petaurus breviceps	Sugar Glider			3	W	SM
Petaurus norfolcensis	Squirrel Glider	V		13		
Pseudocheirus peregrinus	Common Ringtail Possum			4	O	
Trichosurus vulpecula	Common Brushtail Possum			19	OW	SM
Macropus giganteus	Eastern Grey Kangaroo			139	O, P, F, W	SM
Wallabia bicolor	Swamp Wallaby			3	OW	
Pteropus poliocephalus	Grey-headed Flying-fox	V	V	122	W	SM
Nyctophilus geoffroyi	Lesser Long-eared Bat			9	O	
Vulpes vulpes	Fox			44	OWF	SM
Oryctolagus cuniculus	Rabbit			19		
Equus caballus	Horse			5	O	
Bos taurus	European cattle			8	O	

Appendix H – BAM-C credit report

BAM Biodiversity Credit Report (Like for like)

Proposal Details

Assessment Id
00037152/BAAS19076/24/00048759

Proposal Name
Lochinvar New England - SBDAR

BAM data last updated *
14/03/2024

Assessor Name
Natalie S Black

Assessor Number
BAAS19076

BAM Data version *
67

Proponent Names

Report Created
12/07/2024

BAM Case Status
Open

Assessment Revision
0

Assessment Type
Part 4 Developments (Small Area)

Date Finalised
To be finalised

BOS entry trigger
BOS Threshold: Area clearing threshold

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

Potential Serious and Irreversible Impacts

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

Species
Nil

Additional Information for Approval

PCT Outside Ibra Added

PCT
4044-Northern Creekflat Eucalypt-Paperbark Mesic Swamp Forest

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
3433-Hunter Coast Foothills Spotted Gum-Ironbark Grassy Forest	Lower Hunter Spotted Gum Ironbark Forest in the Sydney Basin and NSW North Coast Bioregions	0.1	0	1	1
4044-Northern Creekflat Eucalypt-Paperbark Mesic Swamp Forest	Not a TEC	0.9	0	10	10

3433-Hunter Coast Foothills Spotted Gum-Ironbark Grassy Forest	**Like-for-like credit retirement options**					
	Name of offset trading group	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: 3433, 3442, 3443, 3444, 4158	-	3433_3433	No	1	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.

4044-Northern Creekflat Eucalypt-Paperbark Mesic Swamp Forest	**Like-for-like credit retirement options**					
	Class	Trading group	Zone	HBT	Credits	IBRA region
	Coastal Floodplain Wetlands This includes PCT's: 4015, 4023, 4024, 4025, 4026, 4027, 4029, 4034, 4035, 4036, 4037, 4041, 4042, 4044, 4046, 4049, 4050, 4051, 4055, 4059	Coastal Floodplain Wetlands >=70% and <90%	4044_4044	No	10	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.

BAM Biodiversity Credit Report (Like for like)

Species Credit Summary

No Species Credit Data

Credit Retirement Options

Like-for-like credit retirement options

BAM Biodiversity Credit Report (Variations)

Proposal Details

Assessment Id

00037152/BAAS19076/24/00048759

Proposal Name

Lochinvar New England - SBDAR

BAM data last updated *

14/03/2024

Assessor Name

Natalie S Black

Assessor Number

BAAS19076

BAM Data version *

67

Proponent Name(s)

Report Created

12/07/2024

BAM Case Status

Open

Assessment Revision

0

Assessment Type

Part 4 Developments (Small Area)

Date Finalised

To be finalised

BOS entry trigger

BOS Threshold: Area clearing threshold

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

Potential Serious and Irreversible Impacts

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

Species
Nil

Additional Information for Approval

PCT Outside Ibra Added

PCT
4044-Northern Creekflat Eucalypt-Paperbark Mesic Swamp Forest

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
3433-Hunter Coast Foothills Spotted Gum-Ironbark Grassy Forest	Lower Hunter Spotted Gum Ironbark Forest in the Sydney Basin and NSW North Coast Bioregions	0.1	0	1	1.00
4044-Northern Creekflat Eucalypt-Paperbark Mesic Swamp Forest	Not a TEC	0.9	0	10	10.00

3433-Hunter Coast Foothills Spotted Gum-Ironbark Grassy Forest

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: 3433, 3442, 3443, 3444, 4158	-	3433_3433	No	1	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	3433_3433	No	1	IBRA Region: Sydney Basin, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
4044-Northern Creekflat Eucalypt-Paperbark Mesic Swamp Forest	**Like-for-like credit retirement options**					
	Class	Trading group	Zone	HBT	Credits	IBRA region
	Coastal Floodplain Wetlands This includes PCT's: 4015, 4023, 4024, 4025, 4026, 4027, 4029, 4034, 4035, 4036, 4037, 4041, 4042, 4044, 4046, 4049, 4050, 4051, 4055, 4059	Coastal Floodplain Wetlands >=70% and <90%	4044_4044	No	10	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
	Forested Wetlands	Tier 2 or higher threat status	4044_4044	No	10	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

Credit Retirement Options

Like-for-like options

Appendix I – Other legislation

BC Act TEC Assessment

Table A – PCT 3328 Assessment of Association with EEC: *River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions*

Characteristics	Assessment of Vegetation Community – Subject Site
Definition of EEC: *River-Flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions* is the name given to the ecological community associated with silts, clay-loams and sandy loams, on periodically inundated alluvial flats, drainage lines and river terraces associated with coastal floodplains. Floodplains are level landform patterns on which there may be active erosion and aggradation by channelled and overbank stream flow with an average recurrence interval of 100 years or less. It generally occurs below 50 m elevation, but may occur on localised river flats up to 250 m above sea level in the NSW North Coast, Sydney Basin and South East Corner bioregions. The structure of the community may vary from tall open forests to woodlands, although partial clearing may have reduced the canopy to scattered trees. Typically, these forests and woodlands form mosaics with other floodplain forest communities and treeless wetlands, and often they fringe treeless floodplain lagoons or wetlands with semi-permanent standing water. The composition is primarily determined by the frequency and duration of waterlogging and the texture, nutrient and moisture content of the soil. Composition also varies with latitude.	The site is located in Lochinvar and makes part of the Maitland LGA within the Sydney Basin bioregion. Yes – characteristic met
EEC specific assemblage of species: • *Acacia floribunda* • *Acacia parramattensis* • *Acmena smithii* • *Adiantum aethiopicum* • *Angophora floribunda* • *Angophora subvelutina* • *Austrostipa ramosissima* • *Backhousia myrtifolia* • *Breynia oblongifolia* • *Bursaria spinosa* • *Eustrephus latifolius* • *Galium propinquum* • *Geitonoplesium cymosum* • *Geranium solanderi* • *Glycine clandestina* • *Glycine microphylla* • *Glycine tabacina* • *Hardenbergia violacea* • *Hydrocotyle peduncularis* • *Hymenanthera dentata* • *Hypolepis muelleri*	**Upper stratum** present: *Eucalyptus tereticornis* **Mid stratum** present: None with vegetation zone **Ground stratum** present: None with vegetation zone

Characteristics		Assessment of Vegetation Community – Subject Site
• *Casuarina cunninghamiana subsp. cunninghamiana* • *Casuarina glauca* • *Cayratia clematidea* • *Centella asiatica* • *Cheilanthes sieberi subsp. sieberi* • *Clematis aristata* • *Clematis glycinoides* • *Commelina cyanea* • *Cymbopogon refractus* • *Desmodium varians* • *Dichelachne micrantha* • *Dichondra repens* • *Digitaria parviflora* • *Doodia aspera* • *Echinopogon caespitosus var. caespitosus* • *Echinopogon ovatus* • *Einadia hastata* • *Einadia trigonos* • *Entolasia marginata* • *Entolasia stricta* • *Eragrostis leptostachya* • *Eucalyptus amplifolia* • *Eucalyptus baueriana* • *Eucalyptus benthamii* • *Eucalyptus botryoides* • *Eucalyptus elata*	• *Imperata cylindrica var. major* • *Livistona australis* • *Lomandra filiformis* • *Lomandra longifolia* • *Lomandra multiflora subsp. multiflora* • *Melaleuca decora* • *Melaleuca linariifolia* • *Melaleuca styphelioides* • *Melia azedarach* • *Microlaena stipoides var. stipoides* • *Opercularia diphylla* • *Oplismenus aemulus* • *Oxalis perennans* • *Ozothamnus diosmifolius* • *Pandorea pandorana* • *Paspalidium distans* • *Persicaria decipiens* • *Phyllanthus gunnii* • *Plectranthus parviflorus* • *Poranthera microphylla* • *Pratia purpurascens* • *Pteridium esculentum* • *Rubus parvifolius* • *Sigesbeckia orientalis subsp. orientalis* • *Solanum prinophyllum* • *Stephania japonica var. discolor*	

Characteristics		Assessment of Vegetation Community – Subject Site
• *Eucalyptus grandis* • *Eucalyptus longifolia* • *Eucalyptus moluccana* • *Eucalyptus ovata* • *Eucalyptus saligna* • *Eucalyptus tereticornis* • *Eucalyptus viminalis* • *Euchiton sphaericus*	• *Themeda australis* • *Trema aspera* • *Tristaniopsis laurina* • *Vernonia cinerea* • *Veronica plebeia* • *Viola hederacea* • *Wahlenbergia gracilis*	
Local Government Area Distribution: This EEC is known from parts of the Local Government Areas of Port Stephens, Maitland, Singleton, Cessnock, Lake Macquarie, Wyong, Gosford, Hawkesbury, Baulkham Hills, Blacktown, Parramatta, Penrith, Blue Mountains, Fairfield, Holroyd, Liverpool, Bankstown, Wollondilly, Camden, Campbelltown, Sutherland, Wollongong, Shellharbour, Kiama, Shoalhaven, Eastern Capital City Regional, Eurobodalla and Bega Valley but may occur elsewhere in these bioregions. Major examples once occurred on the floodplains of the Hunter, Hawkesbury, Moruya, Bega and Towamba Rivers, although many smaller floodplains and river flats also contain examples of the community. Small areas of *River-Flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions* are contained within existing conservation reserves, including Blue Mountains, Cattai, Dharug, Georges River, Marramarra, Morton, Deua and Wadbilliga National Parks, and Gulguer and Mulgoa Nature Reserves, and these are unevenly distributed throughout the range and unlikely to represent the full diversity of the community. The reserved examples are on localised, sheltered river flats between hills, rather than the large open floodplains that comprised the majority of the original habitat.		Yes – characteristic met
River-Flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions includes and replaces *Sydney Coastal River-Flat Forest Endangered Ecological Community*. *River-Flat Eucalypt Forest on Coastal Floodplains* may adjoin or intergrade with several other endangered ecological communities, which collectively cover all remaining native vegetation on the coastal floodplains of New South Wales. These include: • *Lowland Rainforest on Floodplain in the NSW North Coast bioregion*; • *Subtropical Floodplain Forest of the NSW North Coast bioregion*; • *Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions* (including the formerly listed *Sydney Coastal Estuary Swamp Forest in the Sydney Basin bioregion*);		EECs known to adjoin or intergrade with *River-Flat Eucalypt Forest on Coastal Floodplains* are not present on site. No – characteristic not met

Characteristics	Assessment of Vegetation Community – Subject Site
• *Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner bioregions;* and • *Freshwater Wetlands on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions*. For example, northwards from the Hunter valley, *River-Flat Eucalypt Forest on Coastal Floodplains* may intergrade with, or be replaced by, *Subtropical Floodplain Forest of the NSW North Coast bioregion*. As soil salinity increases, *River-Flat Eucalypt Forest* may adjoin or intergrade with *Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner bioregions*. The boundaries between all of these communities are dynamic and may shift in response to changes in hydrological regimes, fire regimes or land management practices. The Determinations for these communities collectively encompass the full range of intermediate assemblages in transitional habitats.	
Is the PCT associated with this EEC (Yes or No)?	No
Is the PCT EPBC Act listed under a different CEEC or EEC name (Yes or No)?	No
Detailed Justification of Assessment: PCT 3328 is not associated with the BC Act listed EEC: *River-flat eucalypt forest on coastal floodplains of southern New South Wales and eastern Victoria*. The PCT on site does meet some of the above characteristics, however with only one upper stratum species present, there is an overall lack of specific assemblage species present within this vegetation zone. In conclusion PCT 3328 vegetation occurring within the site is not considered to be commensurate with the EEC.	

Table B – PCT 3328 Assessment of Association with EEC: *Hunter Lowland Redgum Forest in the Sydney Basin and New South Wales North Coast Bioregions*

Characteristics	Assessment of Vegetation Community – Subject Site
Definition of EEC: *Hunter Lowland Redgum Forest in the Sydney Basin and NSW North Coast Bioregions* is the name given to the ecological community found on gentle slopes arising from depressions and drainage flats on Permian sediments of the Hunter Valley floor in the Sydney Basin and NSW North Coast Bioregions (sensu Thackway and Cresswell 1995).	Yes – characteristic met
EEC specific assemblage of species: • *Angophora costata* • *Eucalyptus moluccana* • *Eucalyptus punctata*	**Upper stratum** present: *Eucalyptus tereticornis*

Characteristics		Assessment of Vegetation Community – Subject Site
• *Austrodanthonia monticola (Austrodanthonia monticola)* • *Billardiera scandens* • *Breynia oblongifolia* • *Brunoniella australis* • *Cheilanthes sieberi subsp. sieberi* • *Corymbia maculata* • *Cyanthillium cinereum* • *Cymbopogon refractus* • *Daviesia ulicifolia* • *Desmodium varians* • *Dichondra repens* • *Digitaria parviflora* • *Echinopogon caespitosus var. caespitosus* • *Entolasia stricta* • *Eragrostis brownii* • *Eragrostis leptostachya* • *Eucalyptus crebra*	• *Eucalyptus tereticornis* • *Glycine clandestina* • *Imperata cylindrica var. major* • *Jacksonia scoparia* • *Lagenophora stipitata* • *Leucopogon juniperinus* • *Lomandra longifolia* • *Lomandra multiflora subsp. multiflora* • *Microlaena stipoides var. stipoides* • *Panicum simile* • *Paspalidium distans* • *Persoonia linearis* • *Pomax umbellata* • *Pratia purpurascens/Lobelia purpurascens* • *Solanum prinophyllum* • *Themeda australis*	**Mid stratum** present: None within vegetation zone **Ground stratum** present: *Eragrostis brownii*
Local Government Area Distribution: This EEC has been recorded from the local government areas of Maitland, Cessnock and Port Stephens (in the Sydney Basin Bioregion) and Muswellbrook and Singleton (in the NSW North Coast Bioregion) but may occur elsewhere in these bioregions. Currently only a small area (less than 2% of total) of Hunter Lowland Redgum Forest in the Sydney Basin and NSW North Coast Bioregions is included in National Parks and Wildlife Service estate in the Lower Hunter (Werakata) National Park. The majority of the remainder of the community is not on public land.		Yes – characteristic met
Is the PCT associated with this EEC (Yes or No)?		No

Characteristics	Assessment of Vegetation Community – Subject Site
Is the PCT EPBC Act listed under a different CEEC or EEC name (Yes or No)?	No
Detailed Justification of Assessment: PCT 3328 is associated with the BC Act listed EEC: *Hunter Lowland Redgum Forest in the Sydney Basin and New South Wales North Coast Bioregions*. The PCT on site does meet some of the above characteristics. However, with only two species present, there is an overall lack of specific assemblage species present within this vegetation zone. In conclusion PCT 3328 vegetation occurring within the site is not considered to be commensurate with the EEC.	

Table C – PCT 3433 Assessment of Association with EEC*: Lower Hunter Spotted Gum Ironbark Forest in the Sydney Basin and NSW North Coast Bioregions*

Characteristics	Assessment of Vegetation Community – Subject Site
Definition of EEC: *Lower Hunter Spotted Gum Ironbark Forest in the Sydney Basin and NSW North Coast Bioregions* is the name given to the ecological community that occurs principally on Permian geology in the central to lower Hunter Valley. The Permian substrates most commonly supporting the community belong to the Dalwood Group, the Maitland Group and the Greta and Tomago Coal Measures, although smaller areas of the community may also occur on the Permian Singleton and Newcastle Coal Measures and the Triassic Narrabeen Group (NSW Department of Mines 1966, 1969).	The site is located in Lochinvar, within the Maitland LGA and the Sydney Basin Bioregion in NSW. Yes – characteristic met
Soils: The community is strongly associated with, though not restricted to, the yellow podsolic and solodic soils of the Lower Hunter soil landscapes of Aberdare, Branxton and Neath (Kovac and Lawrie 1991). These substrates are said to produce 'moderately fertile' soils (Kovac and Lawrie 1991).	
EEC specific assemblage of species: • *Acacia parvipinnula* • *Aristida vagans* • *Billardiera scandens* • *Bursaria spinosa* • *Leptospermum parvifolium* • *Lissanthe strigosa* • *Lomandra filiformis* • *Lomandra multiflora* • *Macrozamia flexuosa*	**Upper stratum** present: *Corymbia maculata* *Eucalyptus punctata* **Mid stratum** present:

Characteristics		Assessment of Vegetation Community – Subject Site
• *Callistemon linearifolius* • *Cheilanthes sieberi subsp. sieberi* • *Correa reflexa* • *Corymbia maculata* • *Daviesia ulicifolia* • *Denhamia silvestris* • *Dianella revoluta var. revoluta* • *Dichelachne micrantha* • *Entolasia stricta* • *Eragrostis brownii* • *Eucalyptus fibrosa* • *Eucalyptus punctata* • *Glycine clandestina* • *Goodenia rotundifolia* • *Grevillea montana* • *Grevillea parviflora subsp. parviflora* • *Hardenbergia violacea* • *Lepidosperma laterale*	• *Melaleuca decora* • *Melaleuca nodosa* • *Microlaena stipoides* • *Opercularia diphylla* • *Ozothamnus diosmifolius* • *Panicum simile* • *Paspalidium distans* • *Persoonia linearis* • *Phyllanthus hirtellus* • *Platysace ericoides* • *Podolobium ilicifolium* • *Pomax umbellata* • *Pratia purpurascens* • *Pultenaea spinosa* • *Rytidosperma pallidum* • *Themeda triandra* • *Vernonia cinerea var. cinerea*	None within vegetation zone **Ground stratum** present: *Themeda triandra*
Local Government Area Distribution: This EEC is restricted to a range of approximately 65 km by 35 km centred on the Cessnock – Beresfield area in the Central and Lower Hunter Valley (NPWS 2000). Within this range, the community was once widespread. A fragmented core of the community still occurs between Cessnock and Beresfield. Remnants occur within the Local Government Areas of Cessnock, Maitland, Singleton, Lake Macquarie, Newcastle, and Port Stephens but may also occur elsewhere within the bioregion. Outliers are also present on the eastern escarpment of Pokolbin and Corrabare State Forests on Narrabeen Sandstone. This EEC belongs to a complex of ecological communities, but is identified as a distinct assemblage of species. Other assemblages that may include spotted gum as a dominant species, have geographically distinct distributions outside the core area where this community primarily occurs (Cessnock – Beresfield). These other assemblages include: Coastal Foothills		Yes – characteristic

Characteristics	Assessment of Vegetation Community – Subject Site
Spotted Gum – Ironbark Forest, Seaham Spotted Gum – Ironbark Forest and Central Hunter Spotted Gum – Ironbark – Grey Box Forest (NPWS 2000). *Eucalyptus fibrosa, Acaci a parvipinnula* and prickly shrub species occur more frequently or in greater abundance in *Lower Hunter Spotted Gum – Ironbark Forest* than in the other communities above. North of the Hunter River and other parts of the Hunter valley indicate the existence of another distinct assemblage dominated by spotted gums and ironbarks on Carboniferous sediments of the footslopes of the Barrington plateau. *Lower Hunter Spotted Gum – Ironbark Forest in the Sydney Basin Bioregion* belongs to the Hunter - Macleay Dry Sclerophyll Forests vegetation class of Keith (2004).	
Is the PCT associated with this EEC (Yes or No)?	Yes
Is the PCT EPBC Act listed under a different CEEC or EEC name (Yes or No)?	No
Detailed Justification of Assessment: PCT 3433 was determined to be associated with the BC Act listed EEC: *Lower Hunter Spotted Gum Ironbark Forest in the Sydney Basin and NSW North Coast Bioregions*. The PCT on site meets some of the above characteristics, and there is potential for the vegetation assemblage to be deemed a disturbed variant of the EEC. In conclusion PCT 3433 vegetation occurring within the site is considered to be commensurate with the EEC.	

Table D – PCT 4044 Assessment of Association with EEC: *Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions*

Characteristics	Assessment of Vegetation Community – Subject Site
Definition of EEC: *Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions* is the name given to the ecological community associated with humic clay loams and sandy loams, on waterlogged or periodically inundated alluvial flats and drainage lines associated with coastal floodplains. Floodplains are level landform patterns on which there may be active erosion and aggradation by channelled and overbank stream flow with an average recurrence interval of 100 years or less.	Yes – characteristic met

Characteristics		Assessment of Vegetation Community – Subject Site
It generally occurs below 20 m (though sometimes up to 50 m) elevation, often on small floodplains or where the larger floodplains adjoin lithic substrates or coastal sand plains in the NSW North Coast, Sydney Basin and South East Corner bioregions. The structure of the community is typically open forest, although partial clearing may have reduced the canopy to scattered trees. In some areas the tree stratum is low and dense, so that the community takes on the structure of scrub. The community also includes some areas of fernland and tall reedland or sedgeland, where trees are very sparse or absent. Typically, these forests, scrubs, fernlands, reedlands and sedgelands form mosaics with other floodplain forest communities and treeless wetlands, and often they fringe treeless floodplain lagoons or wetlands with semi-permanent standing water. The composition of S*wamp Sclerophyll Forest on Coastal Floodplains* is primarily determined by the frequency and duration of waterlogging and the texture, salinity nutrient and moisture content of the soil. Composition also varies with latitude.		
EEC specific assemblage of species: • *Acacia irrorata* • *Acacia longifolia* • *Acmena smithii* • *Adiantum aethiopicum* • *Allocasuarina littoralis* • *Banksia oblongifolia* • *Banksia spinulosa* • *Baumea articulata* • *Baumea juncea* • *Blechnum camfieldii* • *Blechnum indicum* • *Breynia oblongifolia* • *Callistemon salignus* • *Calochlaena dubia* • *Carex appressa* • *Casuarina glauca* • *Centella asiatica*	• *Glochidion ferdinandi* • *Glycine clandestina* • *Gonocarpus tetragynus* • *Hydrocotyle peduncularis* • *Hypolepis muelleri* • *Imperata cylindrica var. major* • *Isachne globosa* • *Leptospermum polygalifolium subsp. polygalifolium* • *Livistona australis* • *Lomandra longifolia* • *Lophostemon suaveolens* • *Melaeuca ericifolia* • *Melaleuca linariifolia* • *Melaleuca quinquenervia* • *Melaleuca sieberi* • *Melaleuca styphelioides* • *Morinda jasminoides* • *Homalanthus populifolius*	**Upper stratum** present: *Casuarina glauca* **Mid stratum** present: *Melaleuca ericifolia* **Ground stratum** present: None within vegetation zone

Characteristics		Assessment of Vegetation Community – Subject Site
• *Dianella caerulea* • *Dodonaea triquetra* • *Elaeocarpus reticulatus* • *Entolasia marginata* • *Entolasia stricta* • *Eucalyptus botryoides* • *Eucalyptus longifolia* • *Eucalyptus resinifera subsp. hemilampra* • *Eucalyptus robusta* • *Ficus coronata* • *Gahnia clarkei* • *Gahnia sieberiana*	• *Oplismenus aemulus* • *Oplismenus imbecillis* • *Parsonsia straminea* • *Phragmites australis* • *Polyscias sambucifolia* • *Pratia purpurascens* • *Pteridium esculentum* • *Stephania japonica var. discolor* • *Themeda australis* • *Villarsia exaltata* • *Viola banksii* • *Viola hederacea*	
Local Government Area Distribution: This EEC is known from parts of the Local Government Areas of Tweed, Byron, Lismore, Ballina, Richmond Valley, Clarence Valley, Coffs Harbour, Bellingen, Nambucca, Kempsey, Hastings, Greater Taree, Great Lakes and Port Stephens, Lake Macquarie, Wyong, Gosford, Hornsby, Pittwater, Warringah, Manly, Liverpool, Rockdale, Botany Bay, Randwick, Sutherland, Wollongong, Shellharbour, Kiama and Shoalhaven but may occur elsewhere in these bioregions. Major examples once occurred on the floodplains of the Tweed, Richmond, Clarence, Macleay, Hastings and Manning Rivers, although smaller floodplains would have also supported considerable areas of this community. Small areas of this EEC are contained within existing conservation reserves, including Bungawalbin, Tuckean and Moonee Beach Nature Reserves, and Hat Head, Crowdy Bay, Wallingat, Myall Lakes and Garigal National Parks. These occurrences are unevenly distributed throughout the range and unlikely to represent the full diversity of the community.		Located in the Maitland LGA.
This EEC forms part of a complex of forested and treeless wetland communities found throughout the coastal floodplains of NSW. The combination of features that distinguish *Swamp Sclerophyll Forest on Coastal Floodplains* from other EECs on the coastal floodplains include: • Its relatively dense tree canopy dominated by *Eucalyptus robusta*, *Melaleuca quinquenervia* or *E. botryoides, t*he relatively infrequent occurrence of other eucalypts, *Casuarina glauca* or *Lophostemon suaveolens*; • The occasional presence of rainforest elements as scattered trees or understorey plants; and		This description does not represent vegetation on site. Whilst the lack of canopy density may be due to historic clearing, the vegetation zone lacks the complexity and species assemblage diagnostic of this EEC.

Characteristics	Assessment of Vegetation Community – Subject Site
• The prominence of large sedges and ferns in the groundcover. It generally occupies small alluvial flats and peripheral parts of floodplains where they adjoin lithic substrates or coastal sandplains. The soils are usually waterlogged, stained black or dark grey with humus, and show little influence of saline ground water. *Swamp Sclerophyll Forest on Coastal Floodplains* includes and replaces *Sydney Coastal Estuary Swamp Forest in the Sydney Basin bioregion*. It may adjoin or intergrade with several other EECs, which collectively cover all remaining native vegetation on the coastal floodplains of New South Wales. These include: • *Lowland Rainforest on Floodplain in the NSW North Coast bioregion;* • *River-Flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions* (including the formerly listed *Sydney Coastal River-Flat Forest in the Sydney Basin bioregion*); • *Subtropical Floodplain Forest, Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner bioregions*; and • *Freshwater Wetlands on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions*. For example, as soils become less waterlogged, this EEC may adjoin or intergrade with *River-Flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions*. As soil salinity increases it may intergrade with, and be replaced by, *Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner bioregions*. The boundaries between these communities are dynamic and may shift in response to changes in hydrological regimes, fire regimes or land management practices. The Determinations for these communities collectively encompass the full range of intermediate assemblages in transitional habitats.	No - characteristic not met
Is the PCT associated with this EEC (Yes or No)?	No
Is the PCT EPBC Act listed under a different CEEC or EEC name (Yes or No)?	No
Detailed Justification of Assessment: PCT 4044 is not commensurate with the BC Act listed EEC: *Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions*. The PCT on site does meet some of the above characteristics. However, the site does not constitute a flood plain, and no ground stratum and only two diagnostic species are present. Therefore, there is an overall lack of specific assemblage species present within this vegetation zone. In conclusion PCT 4044 vegetation occurring within the site is not considered to be commensurate with the EEC.	

EPBC Act Assessment

A Protected Matters Search of an area of 5km radius of the Subject Site was conducted in June 2024 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 20-30km upstream from 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:

The Protected Matters Search indicates that eight (8) listed Threatened Ecological Communities (TECs) are considered likely to occur within 5km of the Subject Site.

Three (3) Endangered Ecological Communities:

- *Coastal Swamp Oak (Casuarina glauca) Forest of New South Wales and South East Queensland ecological community*;
- *Coastal Swamp Sclerophyll Forest of New South Wales and South East Queensland;* and
- *Kurri sand swamp woodland of the Sydney Basin bioregions*

Five (5) Critically Endangered Ecological Community

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

The following PCT ground-truthed as being present on site is associated with above Threatened Ecological Communities:

- PCT 3328 - *Lower Hunter Red Gum-Paperbark Riverflat Forest*
    - Associated EPBC Act listed TEC: *River-flat eucalypt forest on coastal floodplains of southern New South Wales and eastern Victoria.*

A review of vegetation zones was undertaken against the Conservation Advices for *River-flat eucalypt forest on coastal floodplains of southern New South Wales and eastern Victoria*.

River-flat eucalypt forest on coastal floodplains of southern New South Wales and eastern Victoria

Review of the *Approved Conservation Advice (including listing advice) for the River-flat eucalypt forest on coastal floodplains of southern New South Wales and eastern Victoria* (DoE, 2015) for the potential association with PCT 3328 within the Subject Site indicates the following: "*in order to be considered a Matter of National Environmental Significance under the EPBC Act, areas of the ecological community must meet: the Key diagnostic characteristics (in Section 5.1.1); AND at least the minimum Condition thresholds for Moderate quality (i.e. for class C or D, in Section 1.5.3)*. Key diagnostic characteristics are assessed in **Table A** and minimum condition thresholds are assessed in **Table B.**

Table E – PCT 3328 Assessment of Association with CEEC: River-flat eucalypt forest on coastal floodplains of southern New South Wales and eastern Victoria

Characteristics	Assessment of Vegetation Community – Subject Site
Definition of CEEC: Key diagnostic characteristics for this community are the following: ● Occurs in the South East Corner and Sydney Basin IBRA Bioregions, in eastern Victoria and south eastern New South Wales; ● Occurs within catchments of the eastern and southern watershed of the Great Dividing Range; ● Occurs at elevations up to 250 metres above sea-level (ASL), but most typically below 50 metres ASL; ● Occurs on alluvial landforms related to coastal river floodplains and associated sites where transient water accumulates, including floodplains, river-banks, riparian zones, lake foreshores, creek lines (including the floors of tributary gullies), floodplain pockets, depressions, alluvial flats, fans, terraces, and localised colluvial fans; ● Occurs on alluvial soils of various textures including silts, clay loams, sandy loams, gravel and cobbles. Does not occur on soils that are primarily marine sands, or aeolian sands; ● Occurs as a tall closed-forest, tall open-forest, closed forest, open forest, tall woodland, or woodland. The canopy has a crown cover of at least 20 percent; and ● Has a canopy dominated by one or a combination of the following species: *Angophora floribunda*, *A. subvelutina*, *Eucalyptus amplifolia*, *E. baueriana*, *E. benthamii*, *E. bosistoana*, *E. botryoides*, *E. botryoides* x *E. saligna*, *E. elata*, *E. grandis*, *E. longifolia*, *E. moluccana*, *E. ovata*, *E. saligna*, *E. tereticornis*, *E. viminalis*. The ecological community occurs on alluvial landforms related to coastal river floodplains and associated sites where transient water accumulates, including floodplains, river-banks, riparian zones, lake foreshores, creek lines (including the floors of tributary gullies), floodplain pockets, depressions, alluvial flats, fans, terraces, and localised colluvial fans. Floodplains may be occasionally or more often saturated, water-logged or inundated. The ecological community is typically found below 50 metres above sea-level (m ASL), although it can occur up to 250 m ASL (e.g. on floodplain pockets and plateaus above nick points).	Yes – characteristic met
Soil: The ecological community occurs on alluvial soils of various textures, including silts, clay loams and sandy loams, gravel and cobbles. Alluvial soils are very diverse and usually reflect the properties of their parent material in the upper catchment. They may include in-situ subsoils, fluvial sediments, and colluvial fans where they overlay the alluvial floodplain. The ecological community is typically found on deep (greater than one metre) alluvial soils but may be found	Yes – characteristic met

Characteristics		Assessment of Vegetation Community – Subject Site
on shallower soils on the margins of the floodplain and in smaller narrow alluvial systems. However, the ecological community does not occur on soils that are primarily marine or aeolian sand.		
CEEC specific assemblage of species: Canopy and emergent trees: *Allocasuarina littoralis* *Angophora floribunda* *Angophora subvelutina* *Brachychiton populneum* *Casuarina cunninghamiana* *Casuarina glauca* *Corymbia gummifera Syn. Eucalyptus gummifera* *Elaeocarpus reticulatus* *Eucalyptus amplifolia* *Eucalyptus baueriana* *Eucalyptus benthamii* *Eucalyptus bosistoana* *Eucalyptus botryoides* *Eucalyptus botryoides x saligna* *Eucalyptus croajingolensis* *Eucalyptus cypellocarpa* *Eucalyptus deanei* *Eucalyptus elata* *Eucalyptus eugenioides* *Eucalyptus globoidea* *Eucalyptus globulus Syn. E. maidenii, E. pseudoglobulus*	• *Marsdenia rostrata* • *Rubus parvifolius* • *Rubus rosifolius* • *Smilax australis* • *Stephania japonica* • *Tylophora barbata* • *Veronica plebeian* Understorey grasses: • *Aristida ramosa* • *Aristida vagans* • *Austrostipa ramosissima* • *Cymbopogon refractus* • *Dichelachne micrantha* • *Digitaria parviflora* • *Echinopogon caespitosus* • *Tufted Hedgehoggrass* • *Echinopogon ovatus* • *Entolasia marginata* • *Entolasia stricta* • *Eragrostis leptostachya* • *Hierochloe rariflora* • *Imperata cylindrica* • *Microlaena stipoides*	**Upper stratum** present: *Eucalyptus tereticornis* **Mid stratum** present: None with vegetation zone **Ground stratum** present: None with vegetation zone

Characteristics		Assessment of Vegetation Community – Subject Site
Eucalyptus grandis *Eucalyptus longifolia* *Eucalyptus melliodora* *Eucalyptus moluccana* *Eucalyptus muelleriana* *Eucalyptus ovata* *Eucalyptus paniculata* *Eucalyptus punctata* *Eucalyptus robusta* *Eucalyptus saligna* *Eucalyptus siderophloia* *Eucalyptus tereticornis* *Eucalyptus tricarpa* *Eucalyptus viminalis* *Pittosporum undulatum* Understorey trees and shrubs: • *Acacia binervia* • *Acacia decurrens* • *Acacia filicifolia* • *Acacia floribunda* • *Acacia irrorate* • *Acacia longifolia* • *Acacia mearnsii* • *Acacia melanoxylon* • *Acacia parramattensis* • *Acacia parvipinnula* • *Backhousia myrtifolia*	• *Oplismenus aemulus* • *Oplismenus hirtellus Syn O. imbecillis* • *Paspalidium distans* • *Poa ensiformis* • *Poa meionectes* • *Poa tenera* • *Rytidosperma pilosum* • *Tetrarrhena juncea* • *Themeda triandra* Other understorey herbs, including rushes, sedges and forbs: • *Carex appressa* • *Carex longebrachiata* • *Centella asiatica* • *Commelina cyanea* • *Cyanthillium cinereum Syn. Vernonia cinerea* • *Desmodium gunnii* • *Desmodium varians* • *Dianella caerulea* • *Dianella tasmanica* • *Dichondra repens* • *Einadia trigonos* • *Euchiton japonicus* • *Euchiton sphaericus* • *Gahnia clarkei* • *Gahnia melanocarpa* • *Gahnia radula*	

Characteristics		Assessment of Vegetation Community – Subject Site
• *Breynia oblongifolia* • *Bursaria spinosa* • *Cassinia longifolia* • *Cassinia trinerva* • *Coprosma quadrifida* • *Cyathea australis* • *Einadia hastata Syn. Chenopodium robertianum* • *Goodenia ovata* • *Kunzea* spp. • *Livistona australis* • *Melaleuca biconvexa* • *Melaleuca decora* • *Melaleuca ericifolia* • *Melaleuca linariifolia* • *Melaleuca nodosa* • *Melaleuca squarrosa* • *Melaleuca styphelioides* • *Melia azedarach* • *Melicytus dentatus Syn. Hymenanthera dentata* • *Monotoca elliptica* • *Myrsine howittiana Syn. Rapanea howittiana* • *Brush Muttonwood* • *Notelaea venosa* • *Olearia lirata* • *Olearia viscidula* • *Ozothamnus diosmifolius*	• *Galium leiocarpum Syn. Galium propinquum* • *Geranium homeanum* • *Geranium potentilloides* • *Geranium solanderi* • *Gonocarpus tetragynus* • *Gonocarpus teucrioides* • *Hackelia latifolia Syn. Austrocynoglossum latifolium* • *Hydrocotyle hirta* • *Hydrocotyle laxiflora* • *Hydrocotyle peduncularis* • *Hydrocotyle sibthorpioides* • *Hydrocotyle tripartita* • *Lagenophora stipitate Syn. Lagenifera stipitata* • *Lepidosperma laterale* • *Lobelia purpurascens Syn. Pratia purpurascens* • *Lomandra filiformis* • *Lomandra longifolia* • *Lomandra multiflora* • *Opercularia aspera* • *Opercularia diphylla* • *Oxalis perennans* • *Persicaria* spp. • *Persicaria decipiens* • *Plantago debilis* • *Poranthera microphylla* • *Pseuderanthemum variabile*	

Characteristics		Assessment of Vegetation Community – Subject Site
• *Persoonia linearis* • *Phebalium squamulosum* • *Phyllanthus gunnii* • *Pimelea axiflora* • *Platysace lanceolata* • *Plectranthus parviflorus* • *Pomaderris aspera* • *Prostanthera lasianthos* • *Sannantha pluriflora Syn. Baeckea virgata* • *Syzygium smithii Syn. Acmena smithii* • *Trema tomentosa Syn. Trema aspera* • *Tristaniopsis laurina* Climbers, epiphytes and scramblers: • *Cayratia clematidea* • *Cissus hypoglauca* • *Clematis aristata* • *Clematis glycinoides* • *Eustrephus latifolius* • *Geitonoplesium cymosum* • *Glycine clandestina* • *Glycine microphylla* • *Glycine tabacina* • *Gynochthodes jasminoides Syn. Morinda jasminoides* • *Hardenbergia violacea* • *Pandorea pandorana* • *Parsonsia straminea*	• *Rumex brownii Syn. Rumex alcockii* • *Schoenus apogon* • *Senecio linearifolius* • *Sigesbeckia orientalis* • *Solanum pungetium* • *Solanum prinophyllum* • *Stellaria flaccida* • *Tricoryne elatior* • *Urtica incisa* • *Veronica calycina* • *Viola banksii* • *Viola hederacea* • *Wahlenbergia gracilis* Understorey ferns: • *Adiantum aethiopicum* • *cartilagineum Syn. Oceaniopteris cartilaginea* • *Calochlaena dubia* • *Cheilanthes sieberi* • *Doodia aspera Syn* • *Blechnum neohollandicum* • *Hymenophyllum cupressiforme* • *Hypolepis glandulifera* • *Hypolepis muelleri* • *Pellaea falcata* • *Pteridium esculentum*	

Characteristics	Assessment of Vegetation Community – Subject Site
The ecological community typically forms mosaics with other floodplain forest ecological communities, lowland woodlands and treeless wetlands.	Yes – characteristic met
Local Government Area Distribution: This community is found on the floodplains of the eastern and southern watershed of the Great Dividing Range from central and southern New South Wales to eastern Victoria. This encompasses the area from around Sale on the south-east coast of Victoria to around Raymond Terrace, just north of Newcastle on the New South Wales east coast.	Yes – characteristic met
Is the PCT associated with this CEEC (Yes or No)?	No
Detailed Justification of Assessment: PCT 3328 is not commensurate with the EPBC Act listed CEEC: *River-flat eucalypt forest on coastal floodplains of southern New South Wales and eastern Victoria*. The PCT on site does meet some of the above characteristics, however with only one upper stratum species present, there is an overall lack of specific assemblage species present within this vegetation zone. In conclusion PCT 3328 vegetation occurring within the site is not considered to be commensurate with the CEEC. The development will not require a referral or further action or assessment.	

Table F – *River-flat eucalypt forest on coastal floodplains of southern New South Wales and eastern Victoria* condition thresholds

Category and rationale	Thresholds	AEP commentary
High Condition. Class A1, Large or contiguous patch in high condition >0.5ha	• ≥ 80% of its total perennial understorey vegetation cover is comprised of native species; AND • Ground cover richness ≥ 10 native species per sample plot; AND • ≥ 20 large trees per ha	The patch of PCT 3328 within the Subject Site and adjacent lands is under 0.5ha. **Class A1 thresholds are not met.**
High Condition. Class B1, Small patch in high condition >0.5ha		The patch of PCT 3328 within the Subject Site and adjacent lands is under 0.5ha. **Class B1 thresholds are not met.**
Good condition with arboreal mammals. Class A2 Large or contiguous patch in high condition >0.5ha	• ≥ 50% of its total perennial understorey vegetation cover is comprised of native species; AND • Ground cover richness ≥ 6 native species per sample plot; AND • At least 10 large trees per ha; • AND Evidence of 4 or more species of arboreal mammals detected in the patch	The patch of PCT 3328 within the Subject Site and adjacent lands is under 0.5ha. **Class A2 thresholds are not met.**
Good condition with arboreal mammals. Class B2 Small patch in high condition >0.5ha		The patch of PCT 3328 within the Subject Site and adjacent lands is under 0.5ha. **Class B2 thresholds are not met.**
Good condition. Class B3 Large or contiguous patch in high condition >0.5ha	• ≥ 50% of its total perennial understorey vegetation cover is comprised of native species; AND • Ground cover richness ≥ 6 native species per sample plot; AND • At least 10 large trees3 per ha	The patch of PCT 3328 within the Subject Site and adjacent lands is under 0.5ha. **Class B3 thresholds are not met.**
Good condition. Class C1 Small patch in high condition >0.5ha		The patch of PCT 3328 within the Subject Site and adjacent lands is under 0.5ha. **Class C1 thresholds are not met.**
Moderate condition. Class C2 Large or contiguous patch in high condition >0.5ha	• ≥ 30% of its total perennial understorey vegetation cover is comprised of native species; AND • Ground cover richness ≥ 4 native species per sample plot	The patch of PCT 3328 within the Subject Site and adjacent lands is under 0.5ha. **Class C2 thresholds are not met.**
Conclusion: PCT 3328 as it occurs within the Subject Site does not meet the condition thresholds of the TEC		

As assessed in **Tables E** and **F**, PCT 3328 as it occurs within the Subject Site presents the key diagnostic characteristics of *River-flat eucalypt forest on coastal floodplains of southern New South Wales and eastern Victoria* CEEC, but does not meet the condition thresholds of the TEC.
Therefore, the proposal will not impact *River-flat eucalypt forest on coastal floodplains of southern New South Wales and eastern Victoria CEEC*.

Threatened Species:

Threatened species listed under the EPBC Act considered likely to occur on site were assessed from field inspections/surveys and using the BioNet Atlas search tool within a 100km^2 search area with the Site at its centre. The desktop search indicated a total of 39 listed threatened species that may occur on or within vicinity of the site. Grey-headed Flying Fox was heard during surveys. However, the site does not contain a roost camp and the species was not observed utilising the site. No other listed species were identified during inspections/surveys within the Site. Therefore, no EPBC Act listed species were considered likely to be significantly impacted by the proposal.

Migratory Species:

A total of 13 EPBC Act 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 3328 was identified on site as having the potential to be associated with an EPBC Act listed TEC, further assessment confirmed that its occurrence within the Subject Site is not commensurate with any TEC. Furthermore, no significant impacts on threatened species are expected as a result of the proposal. Therefore, an EPBC Act Referral is not considered as necessary for this proposal.

Water Management Act 2000

The DPIE (Water) administers the WM Act and is required to assess activities carried out on waterfront land. Waterfront land is defined as the bed of any river, lake or estuary, and the land within 40m of the river banks, lake shore or estuary mean high-water mark (NSW Department of Planning, Industry and Environment, 2020). Development occurring within 40m of mapped watercourses of first-order and above will trigger the need for a Controlled Activity Approval (CAA) to be obtained.

To determine the extent of Waterfront Land on site, the production of a Riparian Assessment Report (RAR) has been undertaken, in order to determine the presence of Waterfront Land within the site, ground-truth the exact location of such watercourses and confirm their order (as per the Strahler stream classification system).

Fisheries Management Act 1994

If in-stream works are proposed, such as filling a first-order stream or undertaking any works that may affect the hydrology of second or third-order streams on site, then provisions under Part 7 of the FM Act will be applicable and an Aquatic Assessment Report (AAR) will be required to submitted with the DA. The AAR will determine the presence of Key Fish Habitat (KFH) within the site. KFH can be defined as those aquatic habitats that are important to the sustainability of the recreational and commercial fishing industries, the maintenance of fish (all aquatic invertebrates) populations generally, and the survival and recovery of threatened aquatic species (NSW Department of Primary Industries – Fisheries NSW).

One (1) first order stream bisects the south of the south from west to east, and three (3) farm dams are present in the northern portion of the Site. The construction of culverts and natural channel is proposed to be undertaken when the waterway is under stagnant conditions. However, a sudden flow of the creek may require a temporary diversion channel be put in place as a contingency to allow natural water movement. The first-order stream is not triggering KFH considerations. Therefore, the FM Act will not need further consideration.

State Environmental Planning Policy (Biodiversity and Conservation) 2021

Chapter 4 Koala Habitat Protection 2021 Assessment

The land which comprises the Subject Site does not have an 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 clause applies to land to which this Policy 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.

Review of the information identified that the entirety of the Subject Site Lots 2-6 and 9 DP747391, Lots 12 and 13 DP1219648, located at 898 New England Hwy, 25 Wyndella Rd and 39 Wyndella Rd, Lochinvar, NSW is greater than 1ha and does not have an approved Koala plan of management. Therefore, the SEPP applies. As a result, additional assessments were required to satisfy the Development Assessment Process.

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 2 for the relevant Koala management area, or

ii. is not core Koala habitat,

Site inspections identified that trees belonging to the Koala use trees listed in Schedule 2 for the relevant Koala Management Area were located within the Study Area, five (5) of which are within the Subject Site.

In regards to identifying the site as core Koala habitat, core Koala habitat is defined as;

a. an area of land which has been assessed by a suitably qualified and experienced person as being highly suitable Koala habitat and where Koalas are recorded as being present at the time of assessment of the land as highly suitable Koala habitat, or

b. *an area of land which has been assessed by a suitably qualified and experienced person as being highly suitable Koala habitat and where Koalas have been recorded as being present in the previous 18 years.*

Highly Suitable Koala Habitat is defined as – Where trees within any PCT are the regionally relevant species of those listed in Schedule 2 for the relevant Koala management area.

Koala Investigation Results

As a Koala feed tree was identified within the Study Area, additional assessments were undertaken to determine if Koalas were present on site and to determine if the site was core Koala habitat as per the definitions above.

Survey effort for Koalas included:

- Habitat Assessment (23/08/2022; 30/08/2022; 19/12/2022); and

- Incidental surveys (23/08/2022; 30/08/2022; 19/12/2022; 20/12/2022; 23/01/2023).
- Targeted searches including nocturnal searches on two consecutive nights with call playback (19/12/2022; 20/12/2022);
- Spot Assessment Technique (SAT) surveys including searches around the base of trees within the Subject Site for scats or scratches in the bark of eucalypts (20/12/202);

Surveys failed to identify any sign of Koala utilisation of the site. Desktop assessment of local records in BioNet Atlas showed no Koala records, within approximately 10km of the Study Area in the last 18 years. The Subject Site is bounded by roads, areas of clearing, and rural residential development.

Given that there are no records of Koala within 10km of the Subject Site and no evidence of Koala was found to be present following extensive habitat assessments and SAT surveys, it is considered that the survey above is more than sufficient to determine that there will be low or no impact to Koala as a result of this development and the development should be assessed under a Tier 1 Assessment.

It is considered that the implementation of specific Koala measures is not required given the location of the proposed development, current condition and likely utilisation of the Subject Site by Koala into the future.

Appendix J – SBDAR checklist

BAM Reference	Information	SBDAR Section	Completed
Report			
Introduction - Chapters 2 and 3	Introduction to the biodiversity assessment including: • Brief description of proposed development; • BOS triggers; • Identification of subject land boundary; and • General description of the subject land.	Error! Reference source not found., Error! Reference source not found.**1,** Error! Reference source not found.**, 1.1.4** **Figure 1 – Site Map** **Figure 2 – Location Map**	**Y**
	Sources of information used in the assessment, including reports and spatial data	**1.1.5**	**Y**
	Identification of assessment method applied (i.e., linear or site-based)	**1.3**	**Y**
Landscape - Section 3.1, 3.2 and Appendix E	General description of subject land topographic and hydrological setting, geology and soils	**1.2, 1.2.1, 1.2.2, 1.2.3**	**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** **Appendix C (Riparian Assessment)** **Table 3**	**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** **Table 3**	**Y**
	Areas of geological significance and soil hazard features (as described in BAM Subsections 3.1.3(7.) and 3.1.3(10.)	**1.2.3**	**Y**
Native vegetation, TECs and vegetation	Patch size (in accordance with BAM Subsection 4.3.2)	**1.3.7**	**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)	**1.3.3**	**Y**

BAM Reference	Information	SBDAR Section	Completed
integrity - Chapter 4	Identification of any TEC associated with the PCT (BAM Subsection 4.2.2)	**1.3.8**	**Y**
	Estimate of percent cleared value of dominant PCT (BAM Subsection 4.2.1(5.)	**Table 8**	**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.)	**1.3.3**	**Y**
	Equivalence with mapping units of previous vegetation maps reviewed as part of the assessment (i.e., equivalent mapping units)	**1.3.2**	**Y**
	Vegetation integrity of the PCT(s) on the subject land as individual vegetation zones	**1.3.7** **1.3.8**	**Y**
	Justification for how this was determined (i.e., qualitatively by observing values for the condition attributes set out in Table 2 of the BAM or quantitatively by collecting field data for the condition attributes at a plot in accordance with BAM Subsection 4.3.4)	**1.3.7** **1.3.8**	**Y**
	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): • 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	**N/A**	**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	**1.5.3** **1.6**	**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	**1.5** **Table 18 & 19**	**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)	**1.5** **Table 18, 19 & 20**	**Y**

BAM Reference	Information	SBDAR Section	Completed
	Identification of candidate species credit species that are at risk of an SAII and therefore, must be further assessed (BAM Section 9.1). Note: Candidate species credit species that are not at risk of an SAII and not incidentally recorded on the subject land do not require further assessment.	**2.5.2**	**Y**
	For candidate species credit species that are at risk of an SAII, 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: • justification for determining that a candidate species credit species at risk of an SAII 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 SAII (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. • species polygons identifying the location and area of suitable habitat for each candidate threatened species at risk of an SAII that is recorded on the subject land and is measured by area, OR • 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 SAII 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 SAII (i.e., incidentally observed during site visit)	**2.5.2**	**Y**
	Determination of habitat condition within species polygon/s for each threatened species (measured by area) at risk of an SAII or incidentally observed during the site visit (Step 6 of BAM Section 5.2)	**2.5.2** **Table 22**	**Y**

BAM Reference	Information	SBDAR Section	Completed
	For flora species credit species at risk of an SAII 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	**1.6.4** **Table 26**	**Y**
Avoid and minimise impacts – Chapter 7	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: • 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	**1.6** **Table 22 – 28**	**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	**1.6** **Table 23 & 24**	**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.)	**1.6** **Table 22 – 28**	**Y**
Assessment of Impacts - Chapter 8, Section 8.1 and 8.2	Determine the impacts on native vegetation and threatened species habitat, including: • 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	**1.6** **Table 25 – 28**	**Y**
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.): • techniques, timing, frequency and responsibility • identify measures for which there is risk of failure	**1.6** **Table 23 & 24**	**Y**

BAM Reference	Information	SBDAR Section	Completed
	• evaluate the risk and consequence of any residual impacts • document any adaptive management strategy proposed		
	Identification of measures for mitigating impacts related to: • 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)	**1.6** **Table 23 & 24**	**Y**
	Details of the adaptive management strategy proposed to monitor and respond to impacts on biodiversity values that are uncertain (BAM Section 8.5)	**2.3, 2.4 & 2.5**	**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 SAII and TEC/s for the proposal, and	**1.5**	**Y**
	Report on impacts of the proposal on TEC/s in accordance with BAM Subsection 9.2.1	**N/A**	**Y**
	Report on impacts of the proposal on threatened species and/or threatened populations at risk of an SAII in accordance with BAM Section 9.1	**2.5**	**Y**
	Identification of impacts requiring offset in accordance with BAM Section 9.2	**2.5**	**Y**
	Identification of impacts not requiring offset in accordance with BAM Subsection 9.2.1(3.)	**2.5**	**Y**
	Identification of areas not requiring assessment in accordance with BAM Section 9.3	**1.1**	**Y**
Applying the no net loss standard - Chapter 10	Description of the impact on PCTs/TECs	**2.5**	**Y**
	Description of the impact on threatened species at risk of an SAII or incidentally observed via site visit	**N/A**	**Y**
	Number of ecosystem credits required for impacts on biodiversity values according to BAM Subsection 9	**2.6**	**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 SAII 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.	**2.6**	**Y**

BAM Reference	Information	SBDAR Section	Completed
	Identification of credit class for ecosystem credits and species credits according to BAM Section 10.2 (this can be generated from BAM-C)	**Appendix H**	**Y**
Maps			
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 B**	**Y**
Landscape - Section 3.1, 3.2 and Appendix E	Site Map • 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 • 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 • 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 2**	**Y**
	Map of PCT/vegetation zones within the subject land (as described in BAM Section 4.2(1.)	**Figure 3**	**Y**
	Map the location of floristic vegetation survey plots and vegetation integrity survey plots relative to PCT boundaries	**Figure 4**	**Y**
	Map of TEC distribution on the subject land	**N/A**Error! Reference source not found.	**Y**

BAM Reference	Information	SBDAR Section	Completed
	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 SAII 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**	**Y**
Avoid and minimise impacts – Chapter 7	Map of final proposal footprint, including construction and operation	**Appendix B**	**Y**
	Maps demonstrating indirect impact zones where applicable	**Appendix B**	**Y**
Assessment of Impacts - Chapter 8, Section 8.1 and 8.2	No Maps		**Y**
Mitigation and Management of Impacts - Chapter 8, Section 8.4 and 8.5	No Maps		**Y**
Thresholds for assessing and offsetting the impacts of the proposal - Chapter 9	Map showing the extent of TECs at risk of an SAII within the subject land	**N/A**	**Y**
	Map showing the location of threatened species at risk of an SAII within the subject land	**N/A**	**Y**
	Map showing location of: • impacts requiring offset • impacts not requiring offset • areas not requiring assessment	**Figure 7**	**Y**
Applying the no net loss standard - Chapter 10	No Maps		**Y**
Tables			

BAM Reference	Information	SBDAR Section	Completed
Native vegetation, TECs and vegetation integrity - Chapter 4	Table of current vegetation integrity scores for vegetation zone within the site including: • composition condition score • structure condition score • function condition score	**Table 17**	**Y**
	Report from BAM-C (Small area module) including vegetation integrity scores (BAM Section 4.4)	**Table 17**	**Y**
Chapter 5 and Section 9.1	Table showing ecosystem credit species in accordance with BAM Subsection 5.1.1, and: • 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 18 – 20**	**Y**
	Table detailing species credit species within the subject land at risk of an SAII (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)	**Table 22**	**Y**
Prescribed impacts Chapter 6	Table showing the prescribed impacts.	**Table 24**	**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	**Table 23 & 24**	**Y**
Assessment of Impacts - Chapter 8, Section 8.1 and 8.2	Table showing change in vegetation integrity score for each vegetation zone as a result of identified impacts	**Table 28**	**Y**
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 23 & 24**	**Y**

BAM Reference	Information	SBDAR Section	Completed
Thresholds for assessing and offsetting the impacts of the proposal - Chapter 9	No Tables	**N/A**	**Y**
Applying the no net loss standard - Chapter 10	Table showing biodiversity risk weightings	**Table 29**	**Y**
	Table of BC Act listing status for PCTs and threatened species requiring offset	**Table 31**	**Y**
	Table of PCTs requiring offset and number of ecosystem credits required (Subsection 10.2.1)	**Table 31**	**Y**
	Table of species at risk of an SAII or incidentally observed on site assessed for species credits and the number of credits required	**N/A**	**Y**
	BAM-C credit report	**Appendix H**	**Y**
Data			
Landscape - Section 3.1, 3.2 and Appendix E	All report maps as separate jpeg files / Individual digital shape files of: • 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 • 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 • Species polygon map in jpeg format • Expert reports and any supporting data used to support conclusions of the expert report		**Y**

BAM Reference	Information	SBDAR Section	Completed
	• Field data sheets (if relevant) for threatened species surveys		
Prescribed impacts Chapter 6	• If relevant, digital shape files of prescribed impact feature locations • Prescribed impact features map in jpeg format		**Y**
Avoid and minimise impacts – Chapter 7	Digital shape files of: • 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 SAII within the subject land • threatened species at risk of an SAII 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 K – CVs

ANGELA METCALFE
Ecologist

0478 848 711 | angela@andersonep.com.au | Newcastle NSW

ACADEMIC QUALIFICATIONS

- Bachelor of Environmental Science and Management (Honours) (Ecosystems and Biodiversity) – University of Newcastle, 2020

TRAINING & LICENCES

- NSW Class C Driver's Licence
- WHS NSW Construction Induction White Card
- First Aid (Provide First Aid HLTAID011)
- Chemcert and EPA Ground applicator licence

PROFESSIONAL EXPERIENCE

Ecologist 2021 – Present
Anderson Environment & Planning
Newcastle NSW

Conservation Field Officer 2020
SkyLand Management
Bolwarra Heights NSW

Research Assistant 2019
University of Newcastle
Newcastle NSW

BRENDON YOUNG
Project Manager

Profile Summary

Brendon works with AEP in the role of Project Manager and Ecologist/Aquatic Ecologist. He graduated with a Bachelor of Applied Science (Fisheries w/Honours), a Masters in Environmental Management and Graduate Certificate 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.

Academic Qualifications

Charlse Sturt University

- Master of Environmental Management (Water Resources)
- Graduate Certificate of Fish Conservation and Management

University of Tasmania

- Bachelor of Applied Science (Fisheries) with Honours

Training, Licences and Professional Memberships

- NSW Class C Driver's Licence
- WHS NSW Construction Induction White Card
- First Aid (Provide First Aid HLTAID011)

Professional Experience

Project Manager/Aquatic Ecologist Anderson Environment & Planning Newcastle NSW	Jan 2024 – Present
Project Lead/Ecologist Anderson Environment & Planning Newcastle NSW	Oct 2023 – Jan 2024
Ecologist Anderson Environment & Planning Newcastle NSW	Sept 2022 – Oct 2023
Department Manager Woolworths Pty Ltd	2013 - 2022
Produce Quality Control Officer Woolworths Pty Ltd	Mar 2019 - Oct 2019

Relevant Project Experience

Ecological Surveys

- Watercourse Assessment with the NRAR Waterfront Land Tool in Huner Valley, Central Coast, Midcoast and Dubbo regions.
- Key Fish Habitat surveys at Karuah River Port Stephens, Hunter River Lochinvar and Chisholm, Manning River Tibbuc and Lachlan River Stubbo.
- Dip netting for *Mogurnda adspersa* in Lochinvar, Tibbuc, Chisholm and Stubbo.

- Seagrass and Mangrove surveys in Port Stephens.
- Targeted, systematic transects for threatened flora species.
- Deployment of Camera Traps, Songmeter and Anabats across central Coast and Hunter Valley regions for targeted survey.
- Spot Assessment Technique surveys: Halloran, Windella, Ourimbah, Chisholm.
- Weed mapping: Taree, Ourimbah, Hunter Valley.

University:

- 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.
- Identification of fish, reptiles, insects, and plants to species level through honours research and other projects while studying.

Ecological Assessment

- Riparian and watercourse assessment with the Waterfront Land Tool in the Hunter Valley, Central Coast, Sydney and Hastings regions.
- Preparation of Vegetation Management Plans in the Hunter Valley, Central Coast and Midcoast regions.
- Bushfire Threat Assessment in accordance with PBP 2019 at various sites across the Hunter Valley and Central Coast regions.
- Assist with Arborists assessments in Central Coast, Sydney, Mudgee and Hunter Valley Regions.

Ecological Monitoring

- Primary contributing author for Garden Suburbs Biodiversity Stewardship Site Assessment Report and associated Management Plan.

Publications

- Courtney, A.J., Schemel B.L., Wallace, R., Campbell, M.J., Mayer, D.G. and Young, B. (2005) *Reducing the impact of Queensland's trawl fisheries on protected sea snakes.* FRDC Project No. 2005/053. Queensland Government.

DARCY KILVERT
Senior Ecologist

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ACADEMIC QUALIFICATIONS

- Bachelor of Science (Biology) – University of Newcastle, 2021

TRAINING & LICENCES

- NSW Class C Driver's Licence
- Provide First Aid HLTAID011
- NSW Construction White Card
- Working at Heights certificate
- Chemcert and EPA ground applicator licence

PROFESSIONAL EXPERIENCE

Senior Ecologist / Sydney Office Manager — 2023 - Present
Anderson Environment & Planning
Sydney NSW

Senior Ecologist — 2022 - 2023
Anderson Environment & Planning
Sydney NSW

Ecologist — 2021 – 2022
Anderson Environment & Planning
Newcastle NSW

Senior Field Supervisor — 2018 – 2021
Traditional Aussie Gardens
Newcastle NSW

Field Worker — 2016 – 2018
Newcastle City Council
Newcastle NSW

EMMA O'DWYER-HALL
Ecologist

0423 781 145 | emma@andersonep.com.au | Newcastle NSW

ACADEMIC QUALIFICATIONS

- Bachelor of Environmental Science (Wildlife and Conservation Biology) Deakin University, 2017
- Environmental Science (Honours) Deakin University, 2019

TRAINING & LICENCES

- NSW Class C Driver's Licence and 4WD training
- WHS NSW Construction Induction White Card
- First Aid HLTAID011
- AQF 3

PROFESSIONAL EXPERIENCE

Ecologist 2023 – Present
Anderson Environment & Planning
Newcastle NSW

Research and Ecology Intern 2021
Conservation Ecology Centre (CEC)/ NGO

Field Crew Supervisor- Clerk grade 7/8 2022 – 2023
NSW Department of Primary Industries – Wild European Honeybee Baiting Management (WEHBM)

Technical Officer 2021 – 2022
Vertebrate Research Centre
NSW Department of Primary Industries

Crew member 2020 – 2021
Toolijooa Environmental Restoration/ Bushland Regeneration

Crew member/ Leading hand 2018 – 2020
Flora Victoria Regeneration and Management of Park Lands

Honours Student 2019
Deakin University Honours Program, Research on impact of Fire History on Autumn Calling Frogs in the Otway National Park

ECOLOGICAL EXPERIENCE

- Friends of the helmeted honey eater, Education engagement and revegetation planting
- Friends of the helmeted honey eater, regenerative feeding program
- Deaking Fossil Free, Deakin University campaign for Go Fossil Free
- Wildlife Rescuer, WIRES NSW Honours Projects
- Working in a sea turtle nursery in Costa Rica, Camaronal sea turtle rescue
- Monitoring Tasmanian devils on Maraia Island, Department of Primary industries, Parks, Water and Environment (DPIPWE) / Save the Tasmanian Devil Program

FRANCES O'BRIEN
Project Manager

Profile Summary

Frances is a Senior Ecologist and Lead Botanist with Anderson Environment and Planning, being an Accredited Assessor with over 12 years-experience in environmental impact assessment, environmental education, conservation land management, bush regeneration, wildlife rescue and rehabilitation, environmental sustainability, and environmental law. Frances has a particular interest in native edible and medicinal plants, and often runs educational tours and workshops on this topic.

Academic Qualifications

- Master of Environmental Law (University of Sydney NSW)
- Graduate Diploma of Legal Practice (Australian National University ACT)
- Bachelor of Environment (Climate Science) with Bachelor of Laws (Macquarie University NSW)
- Biodiversity Accredited Assessor Scheme no. 20013

Training, Licences and Professional Memberships

- NSW Class C Driver's Licence
- WHS NSW Construction Induction White Card
- First Aid (Provide First Aid HLTAID011)
- Advanced Plant Identification (University of New South Wales NSW)
- Ecological Consultants Association of NSW member
- Australian Plants Society NSW member
- Australian Association of Bush Regenerators NSW member
- Hunter Wildlife Rescue rescuer and Carer (past)
- Sydney Wildlife Rescuer and Carer (past)
- Hunter Intrepid Landcare – Group Coordinator (past)
- Wahroonga Waterways Landcare - Group Coordinator (past)
- Lane Cove National Park Bushcare volunteer (past)
- Ku-ring-gai Municipal Council Bushcare volunteer (past)

Professional Experience

Senior Ecologist (Lead Botanist) — 2021 – Present
Anderson Environment & Planning
Sydney, NSW

Ecologist / Senior Ecologist — 2018 - 2021
Anderson Environmental & Planning
Newcastle

Senior Scientist - Ecology — 2021
Ecology Team, Sustainability, Ecology and Climate Change Division, SMEC
Newcastle

Senior Conservation Planning Officer — 2021
North-west Planning Team, Biodiversity Conservation Division, Department of Planning and Environment
Dubbo

Environmental Officer — 2014 - 2017
Projects Team, Seventh-day Adventist Aged Care
Greater Sydney, Wahroonga

Relevant Project Experience

Ecological Survey examples

Ecological Communities

- Critically Endangered Ecological Community identification and mapping for Department of Planning and Environment, Northern Tablelands
- Plant Community Type determination through Biodiversity Assessment Method: Sutton Forest, Bundanoon, Tarago, Galambine, Gilgandra, Peak Hill, Goulburn, Wagga Wagga, Cooma, Jindabyne, Pambula, Meroo Meadow, Dunmore, Culcairn, Blueys Beach, South West Rocks, New Italy, Wadalba, Lochinvar, Mt Malumla, Scone, Wahroonga, Rouse Hill, Box Hill, Thornton, Kanwal

Flora

- Targeted surveys for Rhodamnia rubescens: Blueys Beach, Wallsend, Ourimbah
- Targeted surveys for Eucalyptus benthami at Eastern Creek
- Targeted surveys for Rhodomyrtus psidioides at Charlotte Bay
- Targeted surveys for Eucalyptus glaucina at Pokolbin
- Targeted surveys for Hibbertia procumbens at Somersby
- Targeted surveys for Leucochrysum albicans subsp. tricolor at Cooma
- Targeted surveys for Acacia bynoeana and Grevillea parviflora subsp. parviflora at Ellalong

Fauna

- Spot Analysis Technique Surveys: Mount Victoria, Sutton Forest, Bundanoon, Bermagui, Medowie,
- Targeted nocturnal surveys for Greater Glider at Mittagong
- Targeted surveys for Wallum Froglet at Doyalson
- Targeted surveys for Green and Golden Bell Frog at Kooragang

Riparian and Aquatic Assessment

- Hydroline assessment: Galambine, Bundanoon
- Aquatic assessment: Sutton Forest

Ecological Assessment examples

- Accredited Assessor for Biodiversity Development Assessment Reports for:
- Boomerang Drive, Blueys Beach
- Newell Highway Service Station, Gilgandra
- Yallakool Rd, Cooma
- Annangrove Road, Rouse Hill
- Terrigal Rd, Morisset
- Weakleys Dr, Beresfield
- Jensen Rd, Wadalba
- Supporting assessor on Biodiversity Development Assessment Report for New Italy, including early examination of 'Guideline for applying the Biodiversity Assessment Method at severely burnt sites'

Ecological Monitoring examples

- Biodiversity Management Plan monitoring and reporting for:
- Wahroonga Estate, Wahroonga
- Ampol Service Station, Pheasants Nest
- Hue Hue Road, Wyee
- Fal Brook Wildlife Refuge, Mount Royal
- Nelson Road, Nelson
- Various Sydney Water assets, western Blue Mountains region
- Eucalyptus cryptica (previously sp. Catti) health monitoring at Rouse Hill
- Epacris purpurascens, Callistemon linearifolius and Persoonia bargoensis health monitoing at Pheasants Nest
- Powerful Owl roost tree monitoring at Wahroonga

Publications

- O'Brien, Frances (2018) Waterway. ISBN 978-0-244-13152-4. Lulu Publishing.
- Roddis, Marc, O'Brien, Frances (2008) 'Aspects of the biology and behaviour of Ligia exotica - the wharf 'louse''. Metamorphosis Australia 51. December 2008.

KATHLEEN BUSHELL
Ecologist

Profile Summary

Kathleen has worked with AEP in the role of Ecologist since 2022. She graduated with a Bachelor of Science (Hons) majoring in Marine Biology, and Environmental Management. At the University of Newcastle, Kathleen was a research assistant working with threatened species (i.e., Green and Golden Bell Frog) in various projects, and was a casual academic involved in researching Indigenous Conservation Management, predator-prey dynamics, and marine ecology. Kathleen has assisted with teaching at the University of Newcastle, and was an educator with Take 3 for the Sea.

Kathleen's interests and experience includes flora, fauna and fungi survey requirements, ultrasonic survey and call identifications, research, and reporting (including the implementation of the NSW Biodiversity Assessment Method and other legislation).

With these skills and interest Kathleen is involved in a diverse range of projects across AEP including Biodiversity Assessments, Ecological Assessments, Data Analysis and Mapping, Bushfire Threat Assessments, and general implementation and understanding of guidelines and legislations.

Academic Qualifications

- Bachelor of Science (Hons), University of Newcastle, NSW. Marine Biology, and Environmental Science & Management.

Training, Licences and Professional Memberships

- NSW Class C Driver's Licence. Experienced manual and 4WD operator
- WHS NSW Construction Induction White Card
- First Aid (Provide First Aid HLTAID011)
- Geographic Information Systems ArcGIS, QGIS various providers
- SSI Open Water Scuba Licence
- Microchipping fauna
- MMO (Marine Mammal Observer Course)
- Australian Marine Sciences Association (AMSA): Member
- FungiMap: Member

Professional Experience

Ecologist Anderson Environment & Planning Newcastle NSW	2022 – Present
Casual Academic The University of Newcastle Newcastle	2022 - 2022
Research Assistant - GGBF Surveys & Monitoring The University of Newcastle Newcastle	2017 - 2021
LiDAR Data Quality Analysist Anditi Newcastle	2020 - 2021
Educator Take 3 for the Sea Central Coast	2018 - 2021

Relevant Project Experience

Ecological Surveys

- Surveys for fauna species including visual and auditory frog surveys, harp-net and ultrasonic call surveys for microbats, nocturnal surveys for amphibians, mammals and aves;
- Surveys for flora species including targeted hand searches and transects;
- Surveys for fungi including targeted transects;
- Trapping and translocation work with amphibians, mammals, and reptiles;
- Camera trapping, acoustic detection and call playback surveys;
- Habitat assessments for flora, fauna, and fungi species;
- Mark-Recapture Studies (including microchipping) for amphibians and mammals;
- Genetic Surveys (including skin swaps and tissue clipping) for amphibians;
- Behavioural Studies (including breeding behaviour, movement, predator-prey interactions and responses to environmental changes);
- Community Surveys (including assessing species richness, relocation and movement across large scale habitats); and
- Restoration of habitat (including planting and building of habitats).

Ecological Assessment

- Fauna survey and identification utilising camera traps and audio technology;
- Fungi survey and identification;
- Call analysis and identification for threatened microbats and frogs;

- Habitat Quality Assessment (including assessment of vegetation, functions, water quality, weather components);
- Vegetation Surveys (including assessing vegetation composition, diversity and structure);
- Predator and Prey Surveys (including assessing for Gambusia, and incidental observations of predatory species);
- Disease Monitoring (including skin swabs for chytridiomycosis); and
- Anthropogenic Disturbance Assessment (including impacts of human activities such as habitat destruction and reconstruction).

Ecological Monitoring

- Restoration Ecology of the Green and Golden Bell Frog (UoN, Michael Mahony);
- Status of Green and Golden Bell Frogs in Port of Newcastle managed zones of Kooragang Island (UoN, Alex Callen and John Gould);
- Marine ecology surveys to inform the production of Ecological Reports within NSW, and internationally;
- Ecological field survey, covering terrestrial flora and fauna, to inform the production of Ecological Reports within NSW;
- Assessment of sites using the Biodiversity Assessment Method (BAM) for the production of Biodiversity Assessment Reports (BDAR);
- Assessment of development proposals against the provisions of the EPBC Act, Koala Plans of Management, SEPP 44 and SEPP Koala Habitat Protection, Coastal Management SEPP and other associated legislative requirements; and
- Analysis and reporting of frog species relating to conservation and development within Australia.

Additional Project Experience

- GIS analysis and mapping for ecological reports, bushfire threat assessments, stewardship reporting and monitoring, management planning and development pathway planning and constraints assessment.

DR MARIA JEDENSJO
Ecologist

Profile Summary

Maria works with AEP in the role of Ecologist. She has a Doctorate in Natural Science, with a background in the marine environmental fields. Her ecological knowledge is utilised in a diverse array of applications in her current role, with a growing knowledge of environmental legalisation, biodiversity approval pathways, and in the implementation of the NSW Biodiversity Assessment Method. Maria has extensive knowledge of marine biodiversity assessments, statistical analyses, writing grants, publishing scientific papers, teaching, and project management.

Academic Qualifications

- Doctor of Philosophy, 2019 (University of Zurich, Switzerland)
- Master of Science, 2006 (Lund University, Sweden)
- Bachelor of Science, 2004 (Lund University, Sweden)
- Certificate III in Conservation and Ecosystem Management, 2022 (TAFE)

Training, Licences and Professional Memberships

- NSW Class C Driver's Licence
- WHS NSW Construction Induction White Card
- First Aid (Provide First Aid HLTAID011)
- Working With Children Check
- Coxswain Grade 1 (near coastal)
- General purpose hand certificate
- CMAS two-star scuba diver

Professional Experience

Ecologist — 2023 – Present
Anderson Environment & Planning
Newcastle NSW

Marine Mammal Observer — 2007 - 2015
Murdoch University and James Cook University
Perth WA / Brisbane QLD

Research Assistant — 2006 - 2010
University of Queensland, Flinders University and James Cook University
Brisbane QLD / Adelaide SA

Relevant Project Experience

Ecological Surveys and Analyses

- Targeted floral surveys *Cryptostylis hunteriana*
- Camera trapping surveys for ground and arboreal species – analyses

- Developing skills in ecological field surveying and habitat assessments, covering terrestrial flora and fauna
- Boat-based dolphin surveys (small and large boats)
- Aerial dolphin, whale, dugong and turtle surveys (Cessna airplanes)
- Marine mammal ecology and research
- GIS mapping and analysis

Ecological Assessment Reports

- Environmental impact assessment reports (including BDAR, BSSAR, BCAR, EAR, Wildlife Management Strategy Reports, and terrestrial wildlife risk assessments etc.)
- Bushfire Threat Assessment Reports
- Due Diligence Reports
- Fee Proposals

Publications

- Jedensjö, M., Kemper, C. M., Milella, M., Willems, E. P., & Krützen, M. (2020). Taxonomy and distribution of bottlenose dolphins (genus *Tursiops*) in Australian waters: an osteological clarification. Canadian journal of zoology, 98(7), 461-479.
- Parra, G. J., Cagnazzi, D., Jedensjö, M., Ackermann, C., Frere, C., Seddon, J., ... & Krützen, M. (2018). Low genetic diversity, limited gene flow and widespread genetic bottleneck effects in a threatened dolphin species, the Australian humpback dolphin. Biological Conservation, 220, 192-200.
- Jedensjö, M., Kemper, C. M., & Krützen, M. (2017). Cranial morphology and taxonomic resolution of some dolphin taxa (*Delphinidae*) in Australian waters, with a focus on the genus Tursiops. Marine Mammal Science, 33(1), 187-205.
- Beasley, I., Jedensjö, M., Wijaya, G. M., Anamiato, J., Kahn, B., & Kreb, D. (2016). Observations on Australian humpback dolphins (*Sousa sahulensis*) in waters of the Pacific Islands and New Guinea. In Advances in marine biology (Vol. 73, pp. 219-271). Academic Press.
- Parra, G. J., & Jedensjö, M. (2014). Stomach contents of Australian snubfin (*Orcaella heinsohni*) and Indo-Pacific humpback dolphins *(Sousa chinensis*). Marine Mammal Science, 30(3), 1184-98.

NATALIE BLACK
Senior Ecologist

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ACADEMIC QUALIFICATIONS

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

TRAINING & LICENCES

- NSW Class C Driver's Licence
- Provide First Aid HLTAID011
- Evidence Gathering and Legal Process, Australian Institute of Environmental Health
- Conflict Resolution Course (LGSA)
- Report Writing Course (LGSA).
- Powerful Presentation (LGSA)
- NSW Rural Fire Services Bush Fire Assessment
- Relocation of Threatened Species, Botanical Gardens Sydney
- Sustainable Home Assessment Reduction Revolution
- Flora and Fauna Survey Assessments Niche Environment and Heritage

PROFESSIONAL EXPERIENCE

Senior Environmental Manager 2019 – Present
Anderson Environment & Planning
Newcastle NSW

Principal Environmental Planner 2010 – 2019
Black Earth
Newcastle NSW

Natural Resource Manager and Development Assessment Officer 2003 – 2010
Lismore City Council

Jervis Bay Indigenous Fishing Strategy 2002 – 2003
Department of Primary Industries

OSCAR ANDERSON
Ecologist

Profile Summary

Oscar works with AEP in the role of Ecologist. He graduated with a Bachelor of Environmental Science and Management in November 2023. Oscar has worked at AEP since April 2022, and in addition to this has, he has experience in a variety of environmental work including flora and fauna field surveys, reporting, and data management.

Academic Qualifications

- Bachelors degree of Environmental Science and Management, University of Newcastle.

Training, Licences and Professional Memberships

- NSW Class C Driver's Licence
- WHS QLD Construction Induction White Card
- First Aid (Provide First Aid HLTAID011)

Professional Experience

Ecologist — 2022 – Present
Anderson Environment & Planning
Newcastle NSW

Tree Service Groundman — 2021 - 2022
Affordable Tree Services
Newcastle

Relevant Project Experience

- Ecological Surveys
- Camera trapping surveys for ground and arboreal species, including deployment, collection, servicing, and analysis.
- Diurnal bird surveys.
- Frog surveys for threatened species.
- Habitat surveys, including tree hollow identification.
- Installation of nest boxes via rope and ladder access systems.
- Microbat surveys by Anabat deployment, collection, and servicing.
- Nocturnal survey for forest owls, including Powerful Owl, Barking Owl, and Sooty Owl, using stag watching, spotlighting, quiet listening, and call playback.
- Songmeter survey for frogs, forest owls, and birds, including deployment, collection, servicing, and analysis.
- Trapping via Elliot-B traps for squirrel gliders.
- Biodiversity assessment methodology (BAM) plots under supervision
- Threatened orchid and ground cover surveys via 5m transects.
- Threatened Tree and shrub surveys via 10m transects.

Ecological Assessment

- Pilliga Biodiversity Due Diligence:
- Conducted investigations to assess the suitability of a remote site in the Pilliga region for a biodiversity offset agreement.
- Utilized ATVs for access and installed camera traps, ultrasonic recorders, and song-meters across a >400ha site.
- Recorded potential threatened fauna species and conducted floristic surveys along grid transects and areas with significant changes in vegetation communities.
- Compiled field results into a Biodiversity Due Diligence report.
- Identified suitable areas for offsetting or potential VMP efforts, communicating findings with the client.

Ecological Monitoring

- Wyee Nest Box Monitoring:
- Inspection of over 450 nest boxes throughout the Wyee-Doyalson area in the Central Coast Region.
- Aimed to mitigate the impact of residential development on threatened Squirrel Glider populations and other arboreal fauna species.
- Collaborated with the council to enhance connectivity and refuge corridors.
- Tasks included constructing or acquiring nest boxes, salvaging appropriate hollows from clearance activities, climbing and installing nest boxes, conducting routine fauna monitoring, servicing nest boxes, and generating compliance reports.

SAMUEL RAYFIELD
Ecologist

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ACEDEMIC QUALIFICATIONS

- Introduction to Anatomy & Physiology, Individual Determinants of Health – Latrobe University, 2020
- Bachelor of Communication – University of Newcastle, 2016

TRAINING & LICENCES

- NSW Class C Driver's Licence
- Provide First Aid HLTAID011
- WHS NSW Construction Induction White Card
- Working at Heights Certificate
- Operate four wheel drive vehicle on unsealed roads

PROFESSIONAL EXPERIENCE

Ecologist 2022 – Present
Anderson Environment & Planning
Newcastle NSW

Bush Regenerator 2020
Litoria Ecological Restoration Services

Bush Regenerator 2018 – 2020
Toolijooa Environmental Restoration

Bush Regenerator 2016 – 2017
Newcastle City Council

ECOLOGICAL EXPERIENCE

- University of Newcastle Field Assistance 2018 – 2016
- Hunter Intrepid Landcare 2019 – 2020

THOMAS STEPHENS
Project Manager

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ACADEMIC QUALIFICATIONS

- Bachelor of Environmental Science and Management (Sustainability) – University of Newcastle, 2021
- Currently undertaking Diploma of Arboriculture (AQF5), Expected completion July 2024

TRAINING & LICENCES

- NSW Class C Driver's Licence
- Provide First Aid HLTAID011
- NSW Construction White Card
- Work Safely at Heights
- Tree Access Systems Level 1

PROFESSIONAL EXPERIENCE

Ecologist 2022 – Present
Anderson Environment & Planning
Newcastle NSW

Ecologist 2022 – 2022
Active Green Services
NSW

Ecologist and Bushfire Consultant 2021 – 2022
Firebird EcoSultants
Newcastle NSW

ECOLOGICAL EXPERIENCE

- Industry Placement 2020 – 2021

National Parks and Wildlife Service NSW