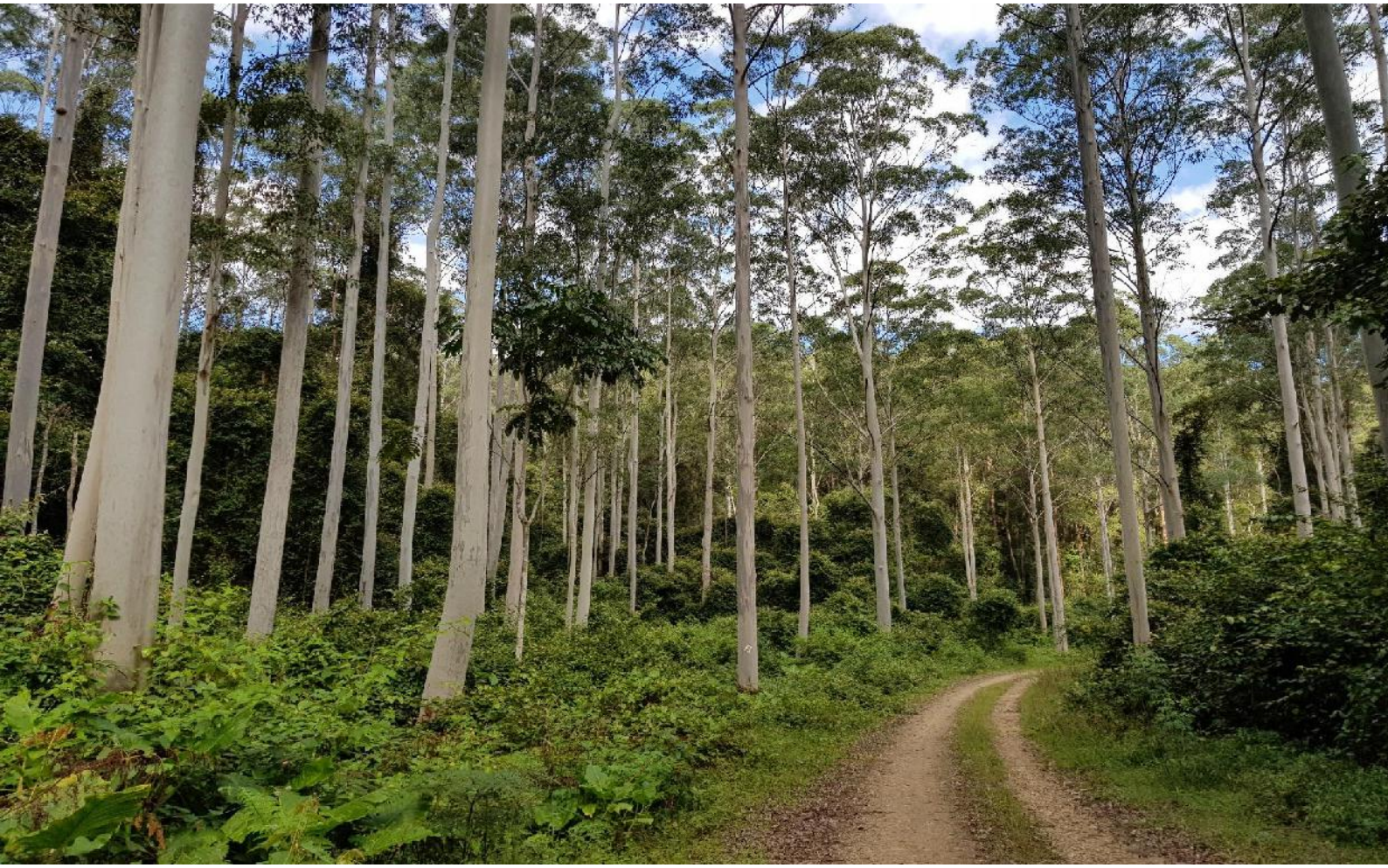
HABITAT
ENVIRONMENTAL SERVICES

Biodiversity Development Assessment Report

442 Louth Park Road, Louth Park NSW

HBT0019_BDAR_V1.0

17/10/2022



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Document No: HBT0019_BDAR_V1.0

17/10/2022

BAAS Case Number: 00030538/BAAS18041/22/00030542

Prepared for

Newquest Property Pty Ltd c/o Perception Planning Pty Ltd

Prepared by

Habitat Environmental Services Pty Ltd

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

Signature: 

Assessor: Dr. Gilbert Whyte
Date: 14/10/22
BAM Assessor Accreditation no: BAAS18041

Document Control

Version	Description	Date
2.1	Final Report	17/10/2022

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Contents

1 Introduction

1.1 Background

Habitat Environmental Services Pty Ltd (Habitat) was engaged by Newquest Property Pty Ltd c/o Perception Planning Pty Ltd to prepare a Biodiversity Development Assessment Report (BDAR) to support the proposed development of Lot 1 (DP 221762), located at 442 Louth Park Road, Louth Park NSW (hereafter referred to as the Study Area), as shown in **Figure 1**.

This assessment has been undertaken in accordance with the NSW Biodiversity Assessment Method 2020 (BAM) (DPIE 2020a) under the *Biodiversity Conservation Act 2016* (NSW) (BC Act) and the *Biodiversity Conservation Regulation 2017* (BC Regulation).

The following terms are used throughout this report:

- Study Area: Lot 1 (DP 221762) located at 442 Louth Park Road, Louth Park NSW.
- Development Site: The area within the Study Area to be directly impacted by the proposed development.
- Locality: Land within a 5-kilometre (km) radius of the Study Area.

1.2 Site Description

The Study Area is approximately 11.37 hectares (ha) and is located within Louth Park, approximately 4 kilometers (km) south of the city of Maitland (**Figure 1**). Louth Park occurs within the Maitland City Council Local Government Area (LGA). The site is zoned as *R5 – Large Lot Residential* under the Maitland Local Environmental Plan (LEP 2011).

The Study Area lies to the east of a recently constructed residential area (**Figure 2**). Entry to the site is achieved via Louth Park Road to the north and Collaroy Parade to the west. Lands to the west are predominantly comprised of cleared agricultural land and residential development. Areas of bushland mainly occur to the east.

The topography within the site is relatively flat with a slight northern aspect. Low-lying areas occur in the northern portion. A first order stream flows in a northern direction outside the eastern boundary. This stream traverses the northern portion of the Study Area (outside the proposed development area).

The vegetation within the Study Area is comprised of a mosaic of forest patches and cleared grassland. Forested areas contain large trees, although these areas also show evidence of recent regeneration (mainly comprised of small trees and shrubs). The composition of the vegetation indicates that much of the site was cleared historically. The current landowners have also undertaken assisted bush regeneration works to reinstate native vegetation (further discussed in **Section 3**).

1.3 Proposed Development

Approval for subdivision of the southern portion of the Study Area will be sought from Maitland City Council via a Development Application (DA). The layout of the proposed development is illustrated on **Figure 3**.

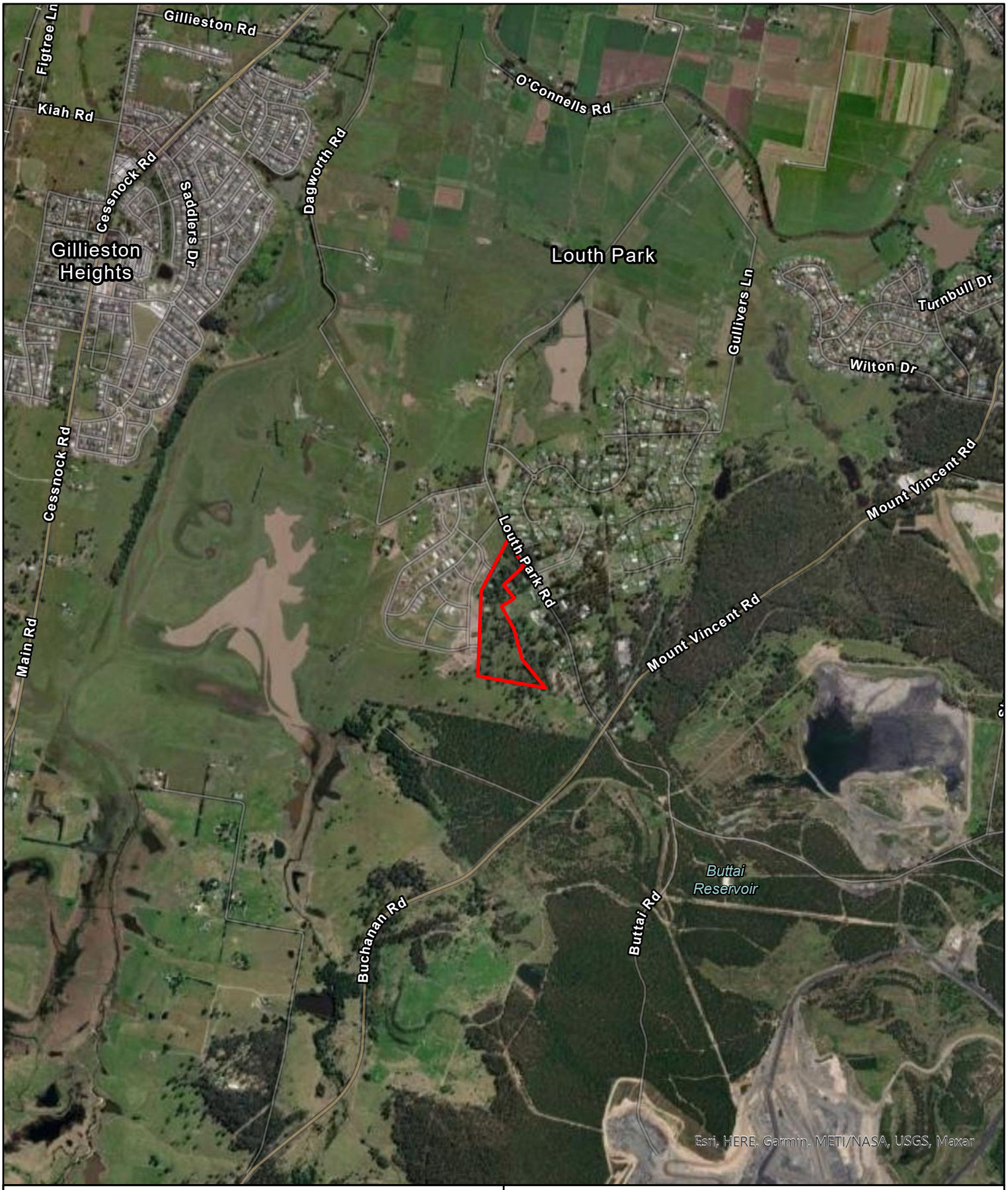
The northern portion of the Study Area contains an existing dwelling and existing access from Louth Park Road to the north. This area will be retained following completion of the proposed development. Access to the Development Site will be achieved via construction of an access from Collaroy Parade to the west.

1.4 Scope

This BDAR aims to quantify impacts of the proposed development upon biodiversity values according to the Biodiversity Assessment Method 2020 (DPIE 2020a), including threatened biota listed under the NSW *Biodiversity Conservation Act 2016* (BC Act). The assessment includes:

- **Stage 1 – Biodiversity Assessment** –Mapping of Plant Community Types (PCTs) including Endangered Ecological Communities (EECs), an assessment of the potential occurrence of threatened species and their habitats, and the potential occurrence of candidate threatened species returned by the BAM Calculator (BAM-C).
- **Stage 2 – Impact Assessment** – Identification of potential impacts of the proposed development, avoidance and mitigation measures, and biodiversity offset requirements based upon residual impacts.

The Biodiversity Accredited Assessor System (BAAS) Case number for the Project is 00030538/BAAS18041/22/00030542.



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Kilometers

Legend

Study Area

Figure 1 - Locality Map

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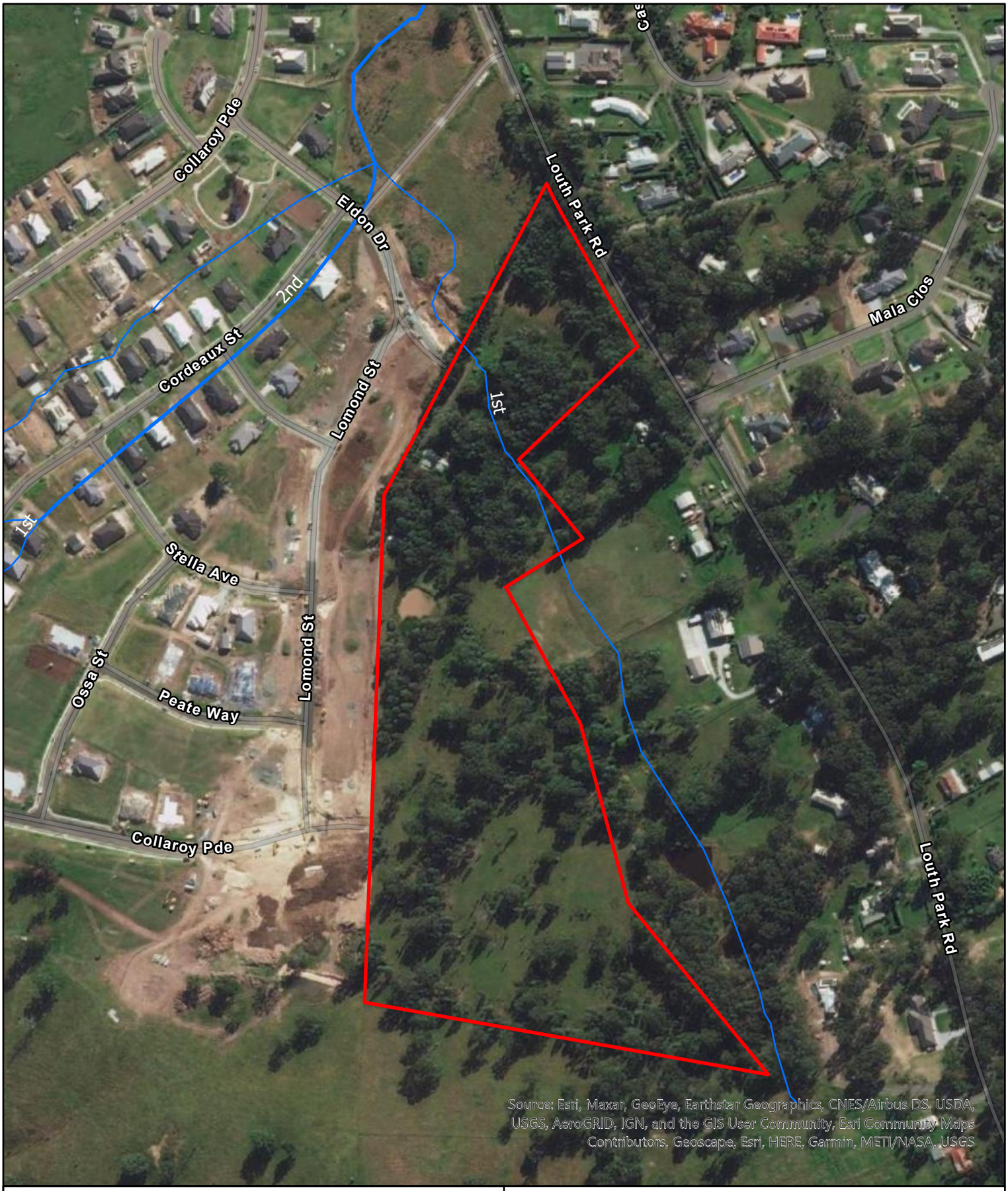

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Meters

Legend

Study Area

Stream_Order

1st

2nd

Figure 2 - Study Area

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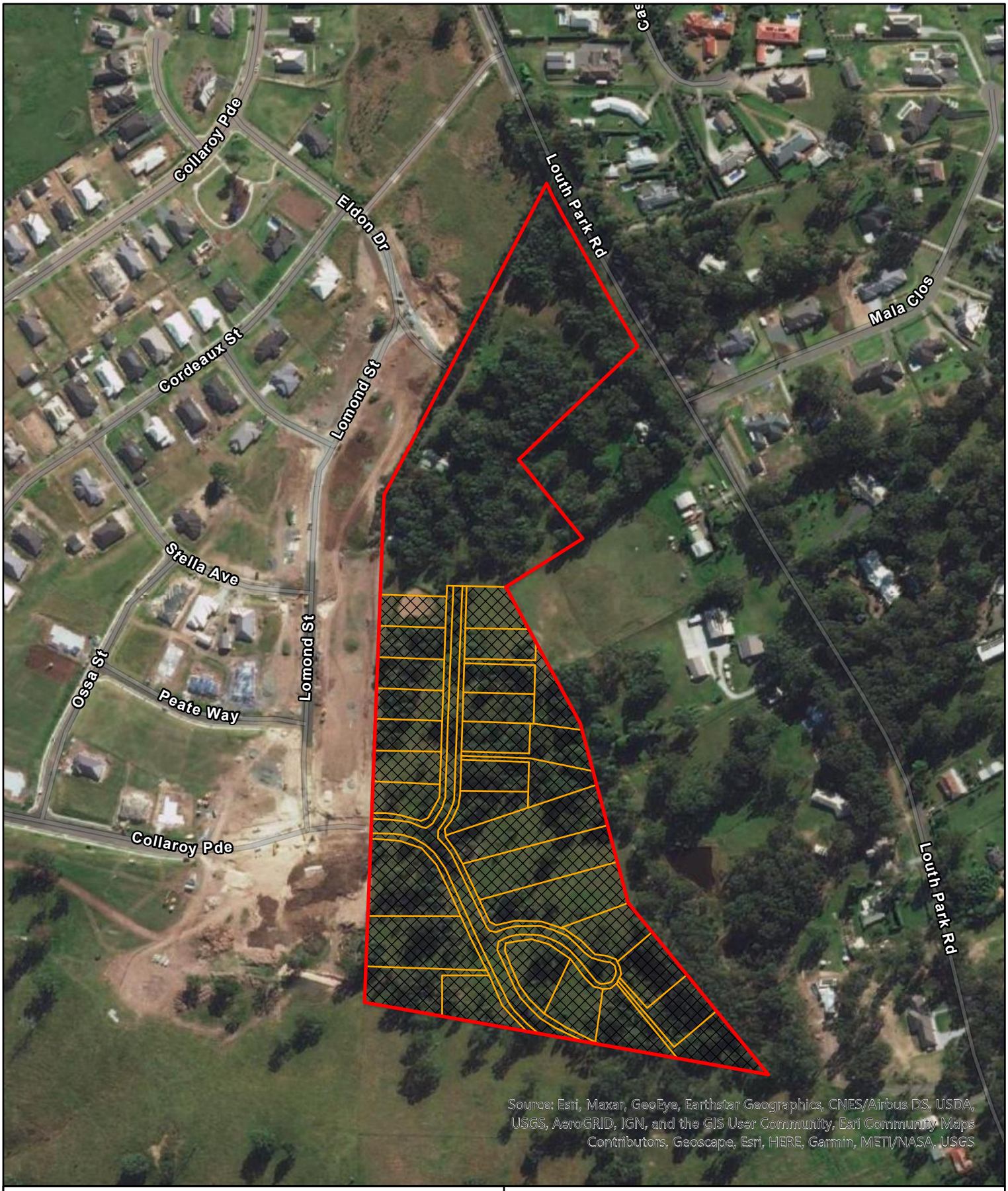

0 35 70 140 210 280 350

Meters

Legend

- Study Area
- Development Site
- Development Design

Figure 3 - Proposed Development

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1.5 Information Sources

The following sources of information were used to inform the assessment:

- The NSW DPE, BioNet Atlas (DPE 2022a) for previous records of threatened species, populations, and ecological communities within a 5-km radius of the Study Area.
- Regional Vegetation Mapping Projects:
    - *Lower Hunter and Central Coast Regional vegetation survey 2018 (VIS_ID 2227)*
- The NSW DPE, BioNet Vegetation Classification Database (DPE 2022b) for identification and allocation of Plant Community Types (PCTs) to vegetation zones on site.
- The NSW DPE, BioNet Threatened Biodiversity Data Collection (DPE 2022c), Threatened Species Profiles (DPE 2022d) and Final Determinations (DPE 2022e) for information on threatened species, populations, and ecological communities.

1.6 Legislative Context

The assessment was undertaken in accordance and consideration of the following Acts and Policies:

- Biodiversity Assessment Method (BAM) (DPIE 2020a).
- *Biodiversity Conservation Act 2016* (NSW) (BC Act).
- *Biodiversity Conservation Regulation 2017* (NSW) (BC Regulation).
- *Biosecurity Act 2015* (NSW).
- *Coastal Management Act 2016*.
- *Environmental Planning and Assessment Act 1979* (NSW) (EP&A Act).
- *State Environmental Planning Policy (Biodiversity and Conservation) 2021*
- *State Environmental Planning Policy (Resilience and Hazards) 2021*
- *Water Management Act 2000* (NSW) (WM Act).
- *Local Land Services Act 2013* (LLS Act)
- *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).
- Maitland Local Environmental Plan 2011
- Maitland Development Control Plan 2011 (Amended 21 July 2016)

Information pertaining to the above list is presented in the following subsections.

1.6.1 Biodiversity Conservation Act 2016 (NSW)

The NSW BC Act together with the NSW BC Regulation outlines the framework for addressing impacts on biodiversity from development and clearing. The framework details a pathway to avoid, minimise and offset impacts on biodiversity from development through the Biodiversity Offset Scheme (BOS).

Entry into the NSW Biodiversity Offset Scheme (BOS) is triggered by developments, projects and activities that meet criteria or certain thresholds for significant impacts on biodiversity in accordance with Section 6.3 of the BC Act.

Criteria to which the BOS applies include the following:

- Local Development (assessed under Part 4 of the *Environmental Planning and Assessment Act 1979*) that triggers the BOS Threshold or is "likely to significantly affect threatened species" (based on a test of significance pursuant to Section 7.3 of the BC Act). The BOS Threshold has two parts, and is triggered by the following:
    - Clearing of vegetation that exceeds an area threshold (based on the minimum lot size), or
    - Impacts are predicted to occur within an area mapped on the NSW Biodiversity Values Map (BV Map) (DPE 2022f).
- State Significant Development (SSD) and State Significant Infrastructure projects (SSI), unless "the Secretary of the Department of Planning, Industry and Environment and the environment agency head determine that the project is not likely to have a significant impact".
- Biodiversity certification proposals.
- Clearing of native vegetation in urban areas and areas zoned for environmental conservation that exceeds the BOS threshold and does not require development consent.
- Clearing of native vegetation that requires approval by the Native Vegetation Panel under the *Local Land Services Act 2013*.
- Activities assessed and determined under Part 5 of the EP&A Act (generally, proposals by government entities) if proponents choose to 'opt in' to the Scheme.

Conclusion

The minimum lot size of the Study Area (Lot 1 DP 221762) is 0.15 ha. The vegetation clearing threshold that triggers entry to the BOS is 0.25 ha. Approximately 7.54 ha of vegetation clearing will be required for the proposed development; therefore, a BDAR is required to support the DA.

1.6.2 Biosecurity Act 2015

Under the *Biosecurity Act 2015* (NSW) all plants are regulated with a general biosecurity duty "to prevent, eliminate or minimise any biosecurity risk they may pose. Any person who deals with any plant, who knows (or ought to know) of any biosecurity risk, has a duty to ensure the risk is prevented, eliminated or minimised, so far as is reasonably practicable." Under the Act, a biosecurity impact "is an adverse effect on the economy, environment, or the community that arises, or has the potential to arise, from a biosecurity matter." This legislation is addressed in **Section 7.2**.

1.6.3 Water Management Act 2000

Controlled activities carried out in, on or under waterfront land are regulated by the *Water Management Act 2000* ("WM Act"). 'Waterfront land' is defined as the bed of any river, lake or estuary, and the land within 40 m of the riverbanks, lake shore or estuary mean high water mark.

A mapped watercourse (1st order stream) flows in a northern direction outside the western boundary of the Development Site. No development will occur within the Vegetated Riparian Zone (VRZ) of this watercourse. As such, the proposed development does not constitute a 'controlled activity' in accordance with the WM Act. Consideration of indirect impacts to aquatic and riparian habitat is provided in **Section 5**. Mitigation measures are detailed in **Section 5.4**.

1.6.4 State Environmental Planning Policy (Biodiversity and Conservation) 2021

Chapter 4 - Koala Habitat Protection (2021)

Chapter 4 of the SEPP contains provisions aimed to encourage the conservation and management of areas of natural vegetation that provide habitat for Koalas to support a permanent free-living population over their present range and reverse the current trend of Koala population decline.

The chapter applies to each Local Government Area listed under Schedule 2 of the SEPP. Maitland City Council LGA is listed under Schedule 2; therefore, the chapter applies. As such, a suitably qualified and experienced person assessed the site to determine if the land contains 'Core Koala Habitat' as defined by the SEPP. See **Section 7.3** for a summary of the Koala habitat assessment.

Part 10.6 Wetlands Protection Area

The objectives of Part 10.6 of the SEPP in relation to wetlands are as follows

- To preserve, protect and encourage the restoration and rehabilitation of wetlands.
- To maintain and restore the health and viability of wetlands.
- To prevent the fragmentation of wetlands.
- To preserve the scenic qualities of wetlands.

To ensure that wetlands continue to perform their natural ecological functions (such as the provision of wetland habitat, the preservation of water quality, the control of flooding and erosion).

The Development Site does not contain or adjoin Wetland Protection Area; therefore, Part 10.6 of the SEPP does not apply.

1.6.5 State Environmental Planning Policy (Resilience and Hazards) 2021

The State Environmental Planning Policy (Resilience and Hazards) 2021 (Resilience and Hazards SEPP) consolidates, transfers and repeals the provisions of three (3) SEPPs into a single environmental planning instrument, including: the SEPP (Coastal Management) 2018 (Coastal Management SEPP), SEPP 33 – Hazardous and Offensive Development (SEPP 33), and SEPP 55 – Remediation of Land (SEPP 55). The Resilience and Hazards SEPP aims to promote the protection and improvement of key environmental assets for their intrinsic value and the social and economic benefits they provide. Relevant chapters of the Resilience and Hazards SEPP are considered below:

Chapter 2 – Coastal Management

The aim of this Chapter is to promote an integrated and coordinated approach to land use planning in the coastal zone in a manner consistent with the objects of the Coastal Management Act 2016, including the management objectives for each coastal management area, by:

- Managing development in the coastal zone and protecting the environmental assets of the coast.
- Establishing a framework for land use planning to guide decision-making in the coastal zone.
- Mapping the 4 coastal management areas that comprise the NSW coastal zone for the purpose of the definitions in the *Coastal Management Act 2016*.

The Coastal Management Chapter incorporates the provisions of the now repealed Coastal Management SEPP which commenced on 3 April 2018 and consolidated the provisions of: SEPP 14 (Coastal Wetlands), SEPP 26 (Littoral Rainforests) and SEPP 71 (Coastal Protection).

The Coastal Management Chapter defines the four coastal management areas in accordance with the Coastal Management Act and details mapping and specifies assessment criteria that are tailored for each coastal management area. Councils and other consent authorities must apply these criteria when assessing proposals for development that fall within one or more of the mapped areas.

The four coastal management areas are:

- Coastal wetlands and littoral rainforests area – areas which display the characteristics of coastal wetlands or littoral rainforests that were previously protected by SEPP 14 and SEPP 26.
- Coastal vulnerability area – areas subject to coastal hazards such as coastal erosion and tidal inundation.
- Coastal environment area – areas that are characterised by natural coastal features such as beaches, rock platforms, coastal lakes and lagoons and undeveloped headlands. Marine and estuarine waters are also included.
- Coastal use area – land adjacent to coastal waters, estuaries and coastal lakes and lagoons.

The Study Area does not contain areas mapped as any of the four coastal management areas above. As such, the *Coastal Management Act 2016* does not apply to this development.

1.6.6 Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)

Under the EPBC Act, an approval is required for actions that are likely to have a significant impact on Matters of National Environmental Significance (MNES). An action includes a project, development, undertaking, activity or series of activities. When a person proposes to take an action, which they believe may need approval under the EPBC Act, they must refer the proposal to the Australian Government Minister for the Environment. The Act identifies the following nine MNES:

- World Heritage properties
- National heritage places
- Wetlands of international importance (Ramsar Convention)
- Listed threatened species and communities
- Migratory species listed under international agreements
- Great Barrier Reef Marine Park
- Commonwealth marine areas
- Nuclear actions
- Water resources in respect to CSG and large coal mines

While this BDAR is not required to address MNES, the proponent is required to address the EPBC Act as part of a development application to Council. Listed threatened species and communities are relevant to the proposed development. A summary of this assessment is presented in **Section 7.1**.

1.6.7 Maitland Local Environmental Plan 2011

The Study Area is located within the Maitland City Council LGA. The Maitland Environmental Plan 2011 (LEP) controls development within the Study Area through zoning and development controls. These controls are described in greater detail by the supporting Maitland Development Control Plan 2011 (DCP).

1.6.8 Maitland Development Control Plan 2011

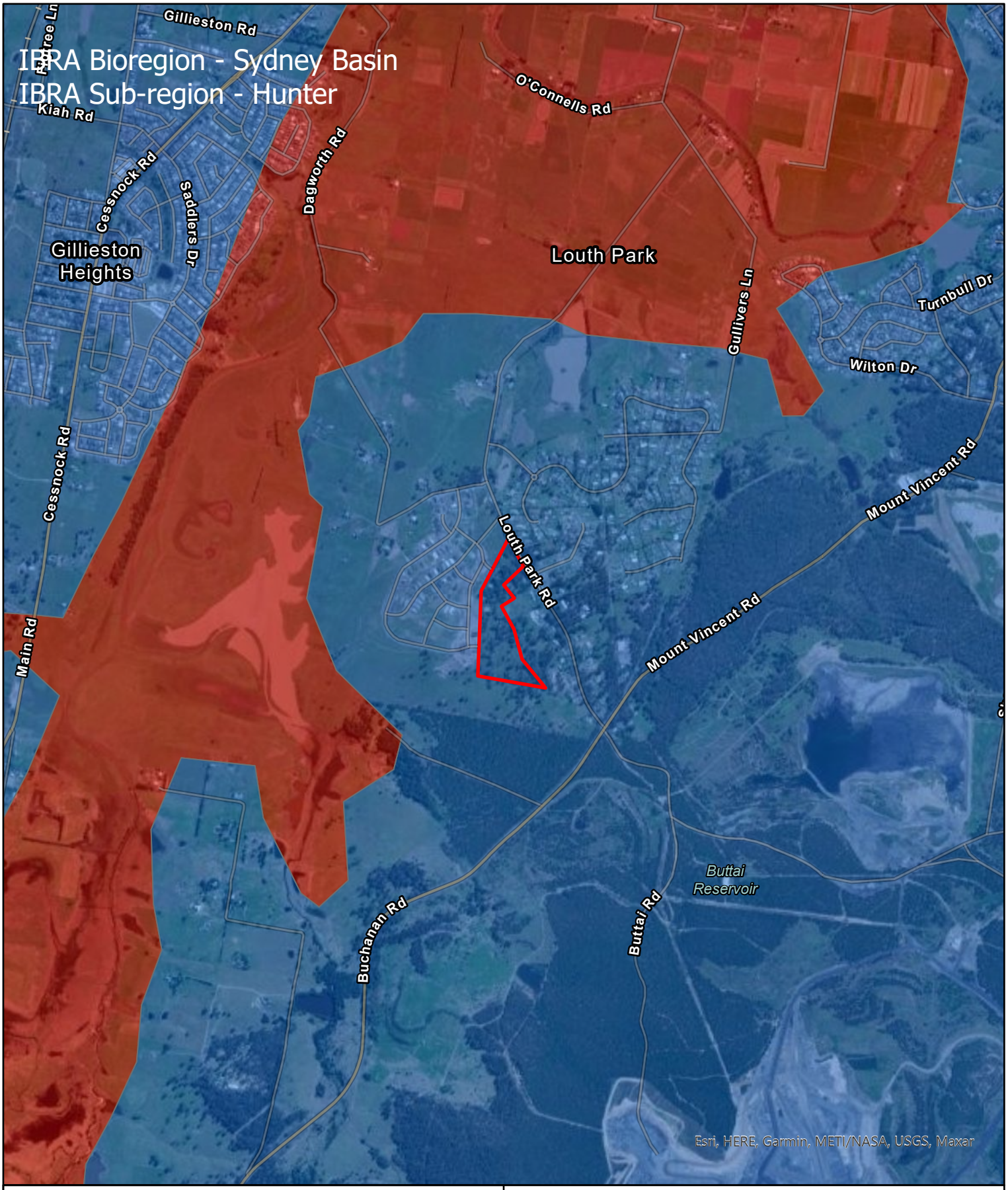
The Maitland Development Control Plan 2011 supports the LEP by providing additional detail and guidance on addressing biodiversity issues associated with development. Part B of DCP contains relevant Environmental Guidelines. These guidelines have been considered during the preparation of this assessment.

2 Landscape Features

The landscape features detailed in Section 3 of the BAM (DPIE 2020a), which are applicable to the Study Area are described in **Table 1**.

Table 1 Landscape Features

Landscape Features	Information
IBRA Region	Sydney Basin
IBRA Sub Region	Hunter
Local Government Area (LGA)	Maitland City Council Local Government Area
Mitchell Landscape	Newcastle Coastal Ramp (DECC, 2002; Mitchell 2002) - Undulating lowlands and low to steep hills on complex patterns of faulted and gently folded Carboniferous conglomerate, lithic sandstone, felspathic sandstone, and mudstone, general elevation 50 to 275m, local relief 40 to 150m. Stony red texture-contrast soils on steep slopes, yellow and brown texture-contrast soils on lower slopes and deep dark clay loams along streams. Mitchells Landscape mapping is shown on **Figure 4**.
Rivers, streams and estuaries	A mapped watercourse (1st order stream) flows in a northern direction outside the western boundary of the Development Site (see **Figure 2**). No development will occur within the Vegetated Riparian Zone (VRZ) of this watercourse (10m either side of the top of bank).
Wetlands	No Coastal wetlands mapped on the Coastal Wetlands and Littoral Rainforests Area Map (DPE 2022) occur within the Study Area.
Connectivity of different areas of habitat	The vegetation within Study Area has good internal connectivity. External connectivity is limited to small patches of forest to the north and west. Residential or cleared areas exist to the south, west and north-west of the site.
Areas of geological significance and soil hazard features	The Study Area is not located with an area identified as having any particular geological significance. No mapping was identified that would indicate the site contains any soil hazard features.
Areas of outstanding biodiversity value	There are no areas of "outstanding biodiversity value" (in accordance with Section 3.1.3 of the BAM (DPIE 2020a) mapped within the Development Site or Study Area.
Geology and Soils	The Soil Landscapes of the Newcastle 1:100,000 Sheet (Mathei 1995) indicates that one soil landscape occurs within the Study Area: **Beresfield Soil Landscape** – This landscape is described as undulating low hills and rises on Permian sediments in the East Maitland Hills region. Slope gradients range 3–15%, local relief to 50 m, elevation is 20–50 m. Partially cleared tall open-forest. Landscape Variant—bea—steeper upper slopes (15–<25%). Soils—moderately deep (<120 cm), moderately well to imperfectly drained Yellow Podzolic Soils (Dy2.21), Brown Podzolic Soils (Db1.21) and brown Soloths (Db2.41) occur on crests with moderately deep (<120 cm), well-drained Red Podzolic Soils (Dr2.21) and red Soloths (Dr2.41) on upper slopes, moderately well to imperfectly drained brown Soloths (Db2.41, Db1.41) and yellow Soloths (Dy3.41) on sideslopes and deep (>200 cm), imperfectly to poorly drained Yellow Podzolic Soils (Dy2.21), yellow Soloths (Dy2.41, Dy3.41) and Gleyed Podzolic Soils (Dg2.41) on lower slopes.
Native Vegetation Cover	Native Vegetation was assessed as per Section 3.2 of the BAM 2020 (DPIE 2020a). Native vegetation constitutes 48.29% (243.67 ha) of the projected 1,500 m site buffer (504.57 ha) associated with the Study Area. Native Vegetation Cover is therefore classed as **>30-70%.** The native vegetation extent is shown in **Figure 5.**



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Kilometers

Legend

Study Area

landscapeN

Lower Hunter Channels and Floodplains

Newcastle Coastal Ramp

Figure 4 - Landscape Assessment

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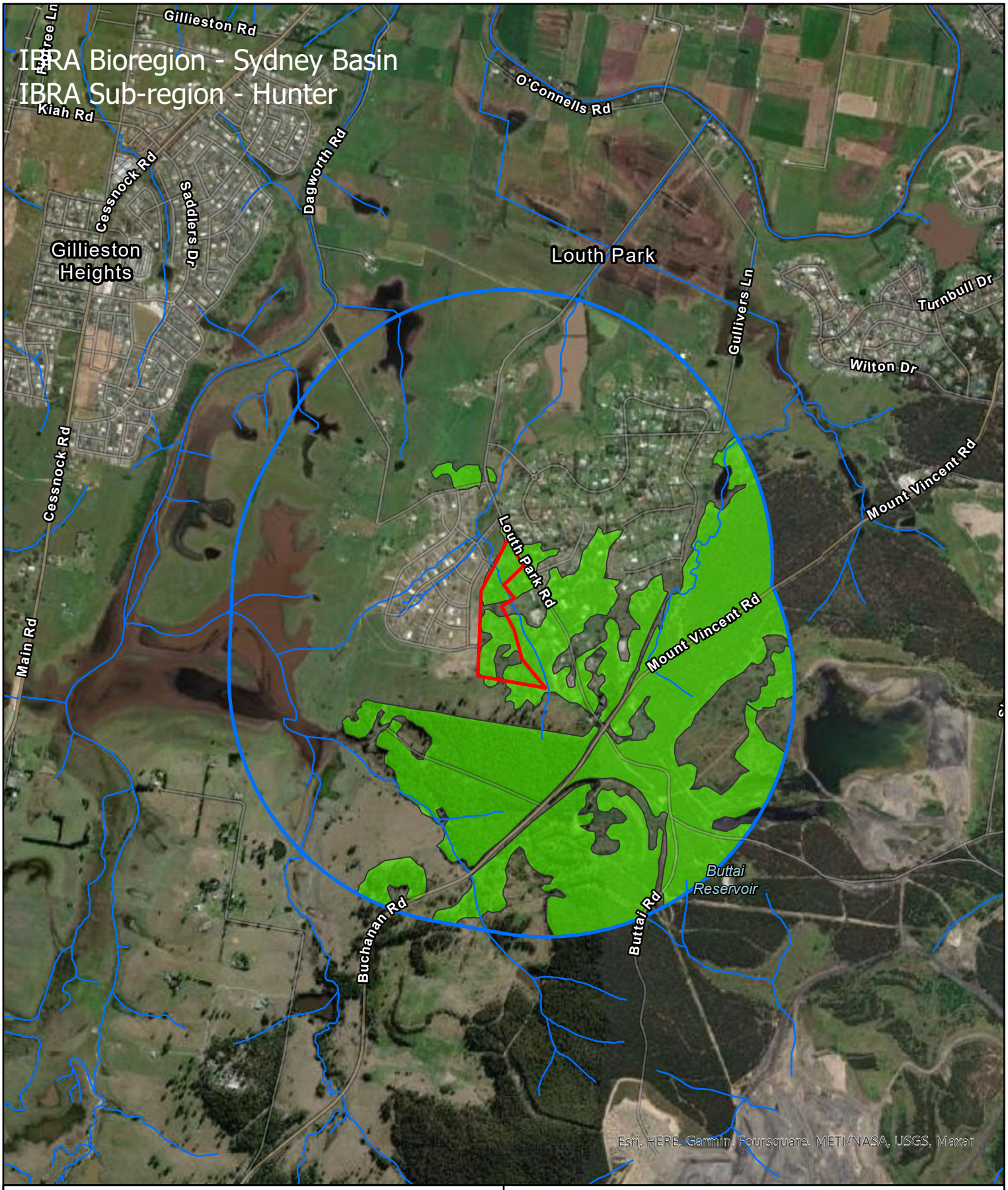

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Kilometers

Legend

- Study Area
- Native Vegetation Extent (243.67 ha - 48.29%)
- 1500m Buffer (504.57 ha)
- Mapped Watercourses (Six Maps 2022)

Figure 5 - Native Vegetation Extent

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3 Native Vegetation

3.1 Methodology

3.1.1 Data Review

Regional vegetation mapping projects for the area were reviewed to assist with the determination of Plant Community Types (PCTs) within the Study Area. Review of the *Lower Hunter and Central Coast Regional vegetation survey 2018* (NPWS 2003) indicates that the vegetation within the Study Area is mapped as *Lower Hunter Spotted Gum Ironbark Forest* (Mu17). Vegetation to the north of the Study Area is mapped as *Alluvial Tall Moist Forest* (Mu5).

3.1.2 Vegetation Mapping Surveys

A vegetation survey was conducted across the Study Area on 31 January 2022. The boundaries of PCTs were mapped using a combination of rapid data points (RDP) and walking transects, using the polygons produced through aerial photo interpretation (API) to assist in targeting survey effort. RDPs involved collecting waypoints over the Study Area using a handheld GPS unit and recording dominant species, structure and condition. Walking transects involved verifying polygons where homogenous in floristic composition and condition, as well as walking vegetation ecotones and using the recorded tracks to define vegetation community boundaries. The RDPs and survey tracks were then overlaid on an aerial photograph and used to delineate and/or clarify vegetation boundaries.

3.1.3 Plant Community Type and Determination

Each vegetation community identified within the Study Area was assigned to the closest equivalent PCT from those listed in the BioNet Vegetation Classification database (DPE 2022b). The closest equivalent PCT for each vegetation community was determined through a comparison of the floristic descriptions of PCTs in the database with the plot / transect data collected from the Study Area. In addition to floristic and structural similarity, the landscape position, soil type and other diagnostic features of the vegetation communities on the site were compared to the descriptions in the database to determine the most suitable PCT. Threatened ecological communities (TECs) as defined in NSW and Commonwealth legislation were also identified if present.

3.1.4 Vegetation Zones

Vegetation zones were identified and delineated in the Study Area in accordance with Section 4.3 of the BAM (DPIE 2020a). A vegetation zone is defined in the BAM as a relatively homogenous area that is the same vegetation type and broad condition.

3.1.5 Vegetation Integrity

Following stratification of the Study Area into vegetation zones, plots/transects were undertaken to collect site condition data for the composition, structure and function attributes listed in **Table 2** in accordance with Section 4.3 of the BAM (DPIE 2020a).

Table 2 Components of Vegetation Integrity

Growth form groups	Function attributes
• Tree (TG) • Shrub (SG) • Grass and grass-like (GG) • Forb (FG) • Fern (EG) • Other (OG)	• Number of large trees • Tree regeneration (presence/absence) • Tree stem size class (presence/absence) • Total length of fallen logs • Litter cover • High threat exotic vegetation cover (HTE) • Hollow-bearing trees (HBT)

The number of plots/transects undertaken across the site meets the minimum number of transects required for each vegetation zone area as detailed in Section 4.3.4, Table 3 of the BAM (DPIE 2020a). Five plots were sampled (see **Figure 6**).

3.1.6 Floristic Identification and Nomenclature

Floristic identification and nomenclature were based on Harden (1992, 1993, 2000 and 2002) with subsequent revisions as published on PlantNet (http://plantnet.rbgsyd.nsw.gov.au).

3.2 Results

3.2.1 Floristic Diversity

A total of 107 plant species were detected during the vegetation assessment. These were comprised of 76 native species and 31 exotic species. The diversity of plant species was relatively low compared to the diversity expected to occur in good condition bushland. The diversity of plant species within survey plots ranged from 30 species (Q01) to eight species (Q02). This lack of diversity is attributed to the history of vegetation clearing that has occurred within the site. The composition of the flora is typical of regenerating vegetation.

3.2.2 Plant Community Types

Two PCTs were identified within the Study Area:

- *PCT 1600 - Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter*.
- *PCT 1598 - Forest Red Gum grassy open forest on floodplains of the lower Hunter*

PCT 1600 was found to occur in two condition states (moderate and cleared). PCT 1598 was found to occur in one condition state. Information pertaining to each vegetation zone is presented in **Table 3**.

Table 3 Vegetation Zones

Vegetation Zone	Condition	Area within Development Site
Vegetation Zone 01: PCT 1600 - Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter (Moderate Condition).	**Moderate**: This vegetation has an intact canopy layer. The shrub layer and ground layer is regenerating.	4.03 ha
Vegetation Zone 02: PCT 1600 - Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter (Cleared).	**Low:** This vegetation has been cleared and generally lacks canopy trees. The shrub layer is largely absent. The groundcover is predominantly exotic.	3.14 ha
Vegetation Zone 03: PCT 1598 - Forest Red Gum grassy open forest on floodplains of the lower Hunter (Moderate Condition)	**Moderate**: This vegetation has an intact canopy layer. The shrub layer and ground layer is regenerating.	0.37 ha

Floristic descriptions with justification for the allocation of PCT 1600 and PCT 1598 are presented in **Table 4** and **Table 5**. Photographs of each vegetation zone are also provided in **Plates 1-4**.

Table 4 Plant Community Type Information – PCT 1600

Criteria	Information
PCT	PCT 1600 - Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter
Vegetation Formation and Class	Dry Sclerophyll Forest (Shrub/grass sub-formation) Hunter-Macleay Dry Sclerophyll Forest
Survey Effort	Required: 2 BAM plots per vegetation zone. Conducted: 2 BAM plots per vegetation zone (Q1 & Q5).
Floristic description	The canopy is dominated by *Corymbia maculata* (Spotted Gum) and *Eucalyptus fibrosa* (Broad-leaved Ironbark). Canopy species that occur to a lesser extent included *Eucalyptus paniculata* (Grey Ironbark) and *Eucalyptus acmenoides* (Red Mahogany). The dominant shrub species include *Cassinia aculeata* (Dogwood), *Acacia parvipinnula* (Silver-stemmed Wattle), *Daviesia ulicifolia* (Gorse Bitter Pea), *Breynia oblongifolia* (Coffee Bush) and *Pittosporum undulatum* (Sweet Pittosporum). The groundcover is dominated by grasses and herbs. The dominant grass species were *Microlaena stipoides var. stipoides* (Weeping Grass), *Cymbopogon refractus* (Barbed Wire Grass), and *Themeda australis* (Kangaroo Grass). Occasional herbs included *Commelina cyanea, Cyanthillium cinerea, Lobelia purpurascens* (Whiteroot), *Glycine tabacina, Dianella revoluta* (Blueberry Lily), *Chrysocephalum apiculatum* (Yellow Buttons) and *Dichondra repens* (Kidney Weed). Several exotic species were also observed. The dominant exotic species were *Setaria parviflora* (Pigeon Grass), *Paspalum dilatatum* (Paspalum), *Plantago lanceolata* (Lamb's Tongues) and *Sida rhombifolia* (Paddy's Lucerne). These species were more prevalent in cleared areas (Vegetation Zone 02).
Condition within Study Area	Two vegetation zones (moderate and cleared) occur within the Development Site as described previously in **Table 3.** Both vegetation zones contain a moderate to high coverage of environmental weeds (exotic species), but few Priority Weeds. All vegetation within the site is in a state of regeneration.
Justification for PCT selection	The vegetation within this zone most closely resembles a Dry Sclerophyll Forest within the Shrub/grass sub-formation due to the dominance of a eucalypt canopy, an abundance of sclerophyllous (hard-leaved) shrubs in the understorey and a groundcover consisting of grasses and herbs. Within this formation, the vegetation is most closely aligned with PCT 1600 due to an open canopy dominated by *Corymbia maculata* (Spotted Gum) and *Eucalyptus fibrosa* (Broad-leaved Ironbark). Although the shrub layer is sparse and regenerating, key diagnostic species are also present.
Status	BC Act: The better-quality areas of the site (Vegetation Zone 2) are commensurate with *Lower Hunter Spotted Gum Ironbark Forest in the Sydney Basin and NSW North Coast Bioregions,* which is listed as an Endangered Ecological Community (EEC) under the BC Act. Justifications for this determination are as follows: • The vegetation occurs within the Cessnock - Beresfield area in the Central and Lower Hunter Valley. • This canopy of the community is dominated by *Corymbia maculata* (Spotted Gum) and *Eucalyptus fibrosa* (Broad-leaved Ironbark), which are key diagnostic species. • Key diagnostic shrub species such as *Acacia parvipinnula* (Silver-stemmed Wattle), *Daviesia ulicifolia* (Gorse Bitter Pea) and *Breynia oblongifolia* (Coffee Bush) occur. EPBC Act: None

Criteria	Information
SAII	No
PCT % Cleared	71%

Plate 1 **PCT 1600 (Moderate Condition)**

Plate 2 **PCT 1600 (Low Condition)**

Table 5 **Plant Community Type Information – PCT 1598**

Criteria	Information
PCT	PCT 1598 - Forest Red Gum grassy open forest on floodplains of the lower Hunter
Vegetation Formation and Class	Forested Wetlands Coastal Floodplain Wetlands
Survey Effort	Required: 1 plot/transect Conducted: 1 plot/transect
Floristic description	The canopy is dominated by *Eucalyptus tereticornis* (Forest Redgum) and *Eucalyptus moluccana* (Grey Box). The shrub layer is dominated by *Acacia falcata* (Hickory Wattle), *Pittosporum undulatum* (Sweet Pittosporum), *Ozothamnus diosmifolius* (White Dogwood) and *Breynia oblongifolia* (Coffee Bush). The groundcover is dominated by grasses and herbs. The dominant grass species were *Microlaena stipoides var. stipoides* (Weeping Grass), *Cymbopogon refractus* (Barbed Wire Grass), and *Entolasia marginata* (Bordered Panic). Occasional herbs included *Commelina cyanea, Cyanthillium cinerea, Lobelia purpurascens* (Whiteroot) and *Dichondra repens* (Kidney Weed). Several exotic species were also observed. The dominant exotic species were *Setaria parviflora* (Pigeon Grass), *Paspalum dilatatum* (Paspalum), *Plantago lanceolata* (Lamb's Tongues), *Sida rhombifolia* (Paddy's Lucerne) and *Hypochaeris radicata* (Cat's Ear).

Criteria	Information
Condition within Study Area	One vegetation zone was defined within the Study Area as described previously in **Table 3.**
Justification for PCT selection	The vegetation within this zone most closely resembles a Forested Wetland. It occurs in areas of the site that are prone to flooding and is dominated by *Eucalyptus tereticornis* (Forest Redgum). Within this formation, the vegetation is most representative of PCT 1598 due to the presence of an open canopy dominated by *Eucalyptus tereticornis* (Forest Redgum)**.** Key diagnostic species in the shrub layer include *Breynia oblongifolia* (Coffee Bush). Key diagnostic groundcover species include *Microlaena stipoides var. stipoides* (Weeping Grass) and *Cymbopogon refractus* (Barbed Wire Grass).
Status	BC Act: The moderate condition areas of the PCT within the Study Area are commensurate with *Hunter Lowland Redgum Forest in the Sydney Basin and New South Wales North Coast Bioregions* which is listed as an Endangered Ecological Community (EEC) under the BC Act. Justifications for this determination are as follows: • The vegetation occurs within the Beresfield area in the Lower Hunter Valley. • This canopy of the community is dominated by *Eucalyptus tereticornis* and *Eucalyptus moluccana* (Grey Box), which are key diagnostic species. • Key diagnostic shrub and groundcover species also occur.
	EPBC Act: None
SAII	No
PCT % Cleared	0.00%

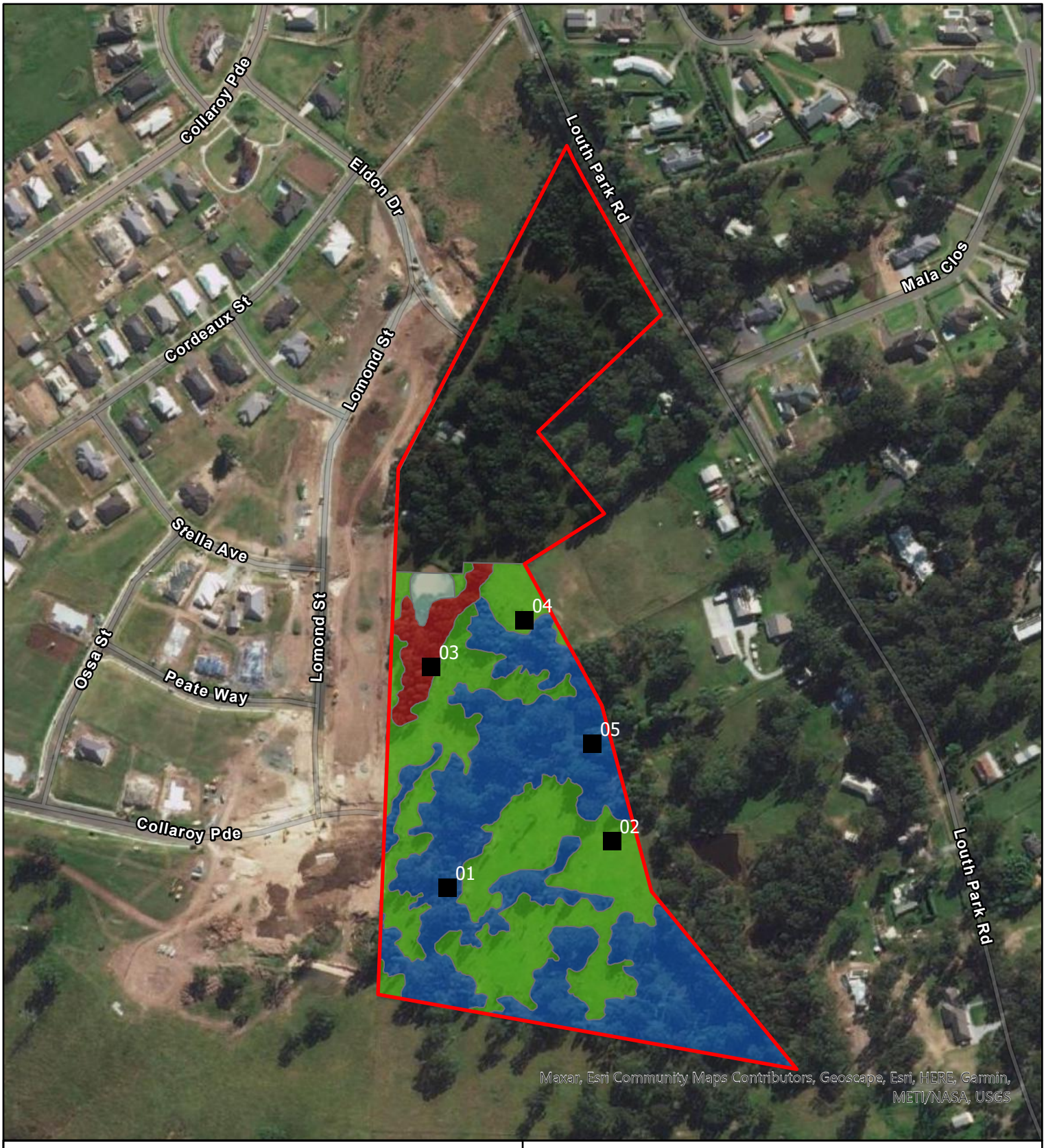
Plate 3 **PCT 1598 (Moderate Condition)**

3.2.3 Aquatic Habitat

A constructed dam occurs in the central portion of the Study Area. Emergent vegetation within the waterbody is limited to the edges where dense rushes and aquatic plants occur. The dominant plant species in the dam is *Eleocharis equisetina*. *Juncus effusus* also occurs at lesser densities. Low occurrences of floating plant species including *Ludwigia peploides* (Water Primrose) and *Ottelia ovalifolia subsp. ovalifolia* (Swamp Lily) were also observed.

A photograph of the dam is shown in **Plate 4**.

Plate 4 **Constructed dam in the central portion of the Study Area.**



0 35 70 140 210 280 350

Meters

Legend

- Study Area

PCT

- Constructed Dam
- PCT 1598 - Forest Red Gum grassy open forest on floodplains of the lower Hunter (Moderate Condition - VZ 03)
- PCT 1600 - Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter (Cleared - VZ 02)
- PCT 1600 - Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter (Moderate Condition - VZ 01)
- Retained Area
- Plots

Figure 6 - Plant Community Types

HABITAT ENVIRONMENTAL SERVICES

3.2.5 Assessment of Patch Size

The patch size for the native forest vegetation within the Study Area was assessed as >100 ha as this vegetation is connected to larger intact areas of native forest vegetation extending to the east (gaps in the connective vegetation across existing roads are less than 100 m).

3.2.6 Vegetation Integrity Score

The current vegetation integrity score of the vegetation zones to be impacted by the proposed development are outlined in **Table 6.**

Table 6 Vegetation Integrity

Zone	PCT	Condition class	Area (ha)	Condition scores (Current Score)			Vegetation integrity score
				Composition	Structure	Function	
1	1600	Moderate	4.03	69.5	56.5	72.5	65.8
2	1600	Cleared	3.14	14.6	12.1	9.5	11.9
5	1598	Moderate	0.37	70.9	79.9	42.4	62.1

4 Threatened Species

4.1 Habitat Assessment

To inform the assessment of suitable habitat for threatened species and populations within the Study Area, a database search of the NSW DPE BioNet Atlas (DPE 2022a) was conducted. Results of the database search and 'likelihood of occurrence' assessment are provided in **Appendix A**.

4.1.1 Habitat Assessment – Threatened Flora

The majority of threatened plant species returned by the NSW DPE BioNet Atlas (DPE 2022a) were determined to have a low 'likelihood of occurrence' (**Appendix A**). The Study Area contains a mosaic of patches of native forest with moderate vegetation integrity and cleared areas (containing scattered trees and shrubs) with low vegetation integrity. The forested areas are considered to represent the better-quality habitat for threatened flora species. In these areas, an intact native canopy of mature *Corymbia maculata* (Spotted Gum) and *Eucalyptus fibrosa* (Broad-leaved Ironbark) is present. The midstorey is regenerating and contains a relatively low diversity of shrub species. The groundcover is predominantly exotic in most areas native species is generally low and typical of regenerating bushland.

Due to historical management of the midstorey and groundcover, the vegetation does not represent highly suitable habitat for locally occurring threatened flora.

4.1.2 Habitat Assessment – Threatened Fauna

The majority of threatened fauna species returned by the NSW DPE BioNet Atlas (DPE 2022a) were determined to have a low 'likelihood of occurrence' due to a lack of suitable habitat within the Development Site (**Appendix A**). The vegetation has been historically managed, as such there is a low abundance of shrub cover, which would otherwise provide shelter and foraging habitat for terrestrial fauna. Few habitat logs occur, and the low diversity of plant species limits the availability of foraging resources.

4.1.3 Hollow-bearing Trees

A total of 12 hollow-bearing trees were detected throughout the Study Area. The hollows in these trees were all observed to be within the small (<5cm) to medium range (5-20cm). The trees represent breeding and roosting habitat for several species of arboreal mammals and birds. Given the small size of the hollows, species such as Large Forest Owls are unlikely to utilise these as breeding habitat.

A summary of information pertaining to the hollow-bearing trees detected within the Study Area is presented in **Table 7**. The location of each tree is shown in **Figure 7**.

Table 7 Hollow-bearing Tree Information

Tree No.	Tree Species	DBH (cm)	Height (m)	Hollow Size Class		
				Large (>20cm)	Medium (5-20cm)	Small (<5cm)
1	*Corymbia maculata*	110	25	-	1	-
2	*Dead Tree (Stag)*	40	15	-	1	-
3	*Dead Tree (Stag)*	80	15	-	-	1
4	*Eucalyptus fibrosa*	90	25	-	-	1
5	*Dead Tree (Stag)*	70	20	-	-	1
6	*Corymbia maculata*	120	25	-	1	-
7	*Corymbia maculata*	140	20	-	1	-
8	*Dead Tree (Stag)*	70	10	-	1	1
9	*Dead Tree (Stag)*	120	20	-	-	1
10	*Dead Tree (Stag)*	60	10	-	-	1
11	*Dead Tree (Stag)*	40	8	-	-	1
12	*Corymbia maculata*	60	20	-	-	1

0 35 70 140 210 280 350

Meters

Legend

- Study Area
- Habitat Trees

Figure 7 - Habitat Tree Survey

HABITAT ENVIRONMENTAL SERVICES

4.1.5 Ecosystem Credit Species

The following assessment of habitat suitability for ecosystem credit species was conducted in accordance with Section 6.2 of the BAM. Ecosystem credits represent threatened species that can reliably be predicted to occur based on the type and condition of vegetation within the Development Site. Targeted surveys are not required for ecosystem credit species.

Step 1: Identify threatened species for assessment

A list of predicted ecosystem credit species for the Study Area was reviewed in the BAM calculator, according to PCTs present on the subject land. Predicted Species Report is within **Appendix B**.

Step 2: Assessment of the habitat constraints and vagrant species on the subject land

The potential for ecosystem credit species to occur on the Study Area was assessed according to species specific habitat requirements, as detailed in **Table 8**. Where habitat features were not present due to the degraded condition of the site vegetation, ecosystem credit species were determined to not be predicted species and no further assessment was required within these vegetation zones.

Table 8 Ecosystem Credit Species

Scientific name	Common name	Confirmed Predicted Species	Justification
Artamus cyanopterus cyanopterus	Dusky Woodswallow	Yes	Suitable habitat present.
Callocephalon fimbriatum	Gang-gang Cockatoo	Yes	Suitable habitat present.
Calyptorhynchus lathami	Glossy Black-Cockatoo	Yes	Suitable habitat present.
Chthonicola sagittata	Speckled Warbler	Yes	Suitable habitat present.
Climacteris picumnus victoriae	Brown Treecreeper (eastern subspecies)	Yes	Suitable habitat present.
Daphoenositta chrysoptera	Varied Sittella	Yes	Suitable habitat present.
Dasyurus maculatus	Spotted-tailed Quoll	Yes	Suitable habitat present.
Falco subniger	Black Falcon	Yes	Suitable habitat present.
Falsistrellus tasmaniensis	Eastern False Pipistrelle	Yes	Suitable habitat present.
Glossopsitta pusilla	Little Lorikeet	Yes	Suitable habitat present.
Grantiella picta	Painted Honeyeater	No	Mistletoes are not present at a density of greater than five per hectare
Haliaeetus leucogaster	White-bellied Sea-Eagle	Yes	Suitable habitat present.
Hieraaetus morphnoides	Little Eagle	Yes	Suitable habitat present.
Hirundapus caudacutus	White-throated Needletail	Yes	Suitable habitat present.

Scientific name	Common name	Confirmed Predicted Species	Justification
Lathamus discolor	Swift Parrot (Foraging)	Yes	Suitable habitat present.
Lophoictinia isura	Square-tailed Kite	Yes	Suitable habitat present.
Melanodryas cucullata cucullata	Hooded Robin (south-eastern form)	Yes	Suitable habitat present.
Melithreptus gularis gularis	Black-chinned Honeyeater (eastern subspecies)	Yes	Suitable habitat present.
Micronomus norfolkensis	Eastern Coastal Free-tailed Bat	Yes	Suitable habitat present.
Miniopterus australis	Little Bent-winged Bat	Yes	Suitable habitat present.
Miniopterus orianae oceanensis	Large Bent-winged Bat	Yes	Suitable habitat present.
Neophema pulchella	Turquoise Parrot	Yes	Suitable habitat present.
Ninox connivens	Barking Owl	Yes	Suitable habitat present.
Ninox strenua	Powerful Owl	Yes	Suitable habitat present.
Petaurus australis	Yellow-bellied Glider	Yes	Suitable habitat present.
Petroica boodang	Scarlet Robin	Yes	Suitable habitat present.
Pomatostomus temporalis temporalis	Grey-crowned Babbler (eastern subspecies)	Yes	Suitable habitat present.
Pteropus poliocephalus	Grey-headed Flying Fox	Yes	Suitable habitat present.
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	Yes	Suitable habitat present.
Scoteanax rueppellii	Greater Broad-nosed Bat	Yes	Suitable habitat present.
Stagonopleura guttata	Diamond Firetail	Yes	Suitable habitat present.
Tyto novaehollandiae	Masked Owl (foraging)	Yes	Suitable habitat present.

4.1.6 Species Credit Species

Step 1: Identify threatened species for assessment

A preliminary list of Candidate species credit species for the Development Site was reviewed in the BAM calculator. Species credits pertain to threatened species that cannot reliably be predicted to occur by the vegetation present. A Candidate Species Report is presented within **Appendix B**.

Step 2: Assessment of the habitat constraints and vagrant species on the subject land

The potential for Candidate species credit species to occur on the Development Site was assessed according to species-specific habitat requirements as detailed in **Table 9**.

Step 3: Identify candidate species credit species for further assessment

Several species credit species were excluded as candidate species due to their geographic or habitat constraints not being met by the Development Site, and no further assessment of these species was required (**Table 9**).

Table 9 Species Credit Species

Scientific name	Common name	Confirmed Candidate Species	Justification
Acacia bynoeana	Bynoe's Wattle	Yes	Suitable habitat present.
Anthochaera phrygia	Regent Honeyeater	No	**Habitat Constraints** – Development Site not mapped as important habitat.
Aprasia parapulchella	Pink-tailed Legless Lizard	No	**Habitat Constraints -** No rocky areas or habitat within 50m of rocky areas.
Burhinus grallarius	Bush Stone-curlew	Yes	Suitable habitat present.
Callistemon linearifolius	Netted Bottle Brush	Yes	Suitable habitat present.
Callocephalon fimbriatum	Gang-gang Cockatoo	Yes	Suitable habitat present.
Calyptorhynchus lathami	Glossy-black Cockatoo	Yes	Suitable habitat present.
Cercartetus nanus	Eastern Pygmy-possum	Yes	Suitable habitat present.
Chalinolobus dwyeri	Large-eared Pied Bat	No	**Habitat Constraints –** No cliffs present. Study Area not within two km of rocky areas containing caves, overhangs, escarpments, outcrops, or crevices, or within two km of old mines or tunnels.
Cryptostylis hunteriana	Leafless Tongue Orchid	No	**Vagrant -** Species is not recorded previously within the Hunter IBRA Sub-region.
Cynanchum elegans	White-flowered Wax Plant	Yes	Suitable habitat present.
Delma impar	Striped Legless Lizard	Yes	Suitable habitat present
Diuris praecox	Rough Doubletail	Yes	Suitable habitat present.
Diuris tricolor	Pine Donkey Orchid	Yes	Suitable habitat present.
Eucalyptus castrensis	Singleton Mallee	Yes	Suitable habitat present.
Eucalyptus glaucina	Slaty Red Gum	Yes	Suitable habitat present.
Eucalyptus parramattensis subsp. decadens	-	Yes	Suitable habitat present.
Eucalyptus pumila	Pokolbin Mallee	Yes	Suitable habitat present.
Grevillea parviflora subsp. parviflora	Small-flower Grevillea	Yes	Suitable habitat present.
Haliaeetus leucogaster	White-bellied Sea-Eagle	No	**Habitat Constraints** – Development Site does not contain living or dead mature trees within suitable vegetation within 1km of a rivers, lakes, large dams or creeks, wetlands and coastlines

Scientific name	Common name	Confirmed Candidate Species	Justification
Hieraaetus morphnoides	Little Eagle	Yes	Suitable habitat present.
Hoplocephalus bitorquatus	Pale-headed Snake	No	**Vagrant -** Species is not recorded previously within the Hunter IBRA Sub-region.
Lathamus discolor	Swift Parrot	No	**Habitat Constraints –** The Development Site is not within an area mapped as "important habitat" for this species.
Litoria aurea	Green and Golden Bell Frog	Yes	Suitable habitat present.
Litoria brevipalmata	Green-thighed Frog	Yes	Suitable habitat present.
Lophoictinia isura	Square-tailed Kite	Yes	Suitable habitat present.
Miniopterus australis	Little Bent-winged Bat	No	**Habitat Constraints (breeding) -** No Caves, tunnels, mines, culverts or structure known for breeding occur within the Development Site.
Monotaxis macrophylla	Large-leaved Monotaxis	Yes	Suitable habitat present.
Myotis macropus	Southern Myotis	Yes	Suitable habitat present.
Ninox connivens	Barking Owl	No	**Habitat Constraints (breeding) -** No hollow-bearing trees with hollows greater than 20cm diameter and greater than 4m from the ground.
Ninox strenua	Powerful Owl	No	**Habitat Constraints (breeding) -** No hollow-bearing trees with hollows greater than 20cm diameter.
Ozothamnus tesselatus	-	Yes	Suitable habitat present.
Persoonia pauciflora	North Rothbury Persoonia	No	**Geographic Limitations -** Study Area does not occurs within 10km of Rothbury
Petauroides volans	Greater Glider	Yes	Suitable habitat present.
Petaurus norfolkensis	Squirrel Glider	Yes	Suitable habitat present.
Petrogale penicillata	Brush-tailed Rock-wallaby	No	**Habitat Constraints -** Study Area is not within 1 km of rocky escarpments, gorges, steep slopes, boulder piles, rock outcrops or cliff lines.
Phascogale tapotafa	Brush-tailed Phascogale	Yes	Suitable habitat present.
Phascolarctos cinereus	Koala (Breeding)	Yes	Suitable habitat present.
Planigale maculata	Common Planigale	No	**Vagrant -** Species is not recorded previously within the Hunter IBRA Sub-region.
Pomaderris queenslandica	Scant Pomaderris	Yes	Suitable habitat present.
Prostanthera cineolifera	Singleton Mintbush	Yes	Suitable habitat present.
Pteropus poliocephalus	Grey-headed Flying-fox	Yes	**Habitat Constraints -** No evidence of breeding camps within the Study Area
Pterostylis chaetophora	-	Yes	Suitable habitat present.

Scientific name	Common name	Confirmed Candidate Species	Justification
Rutidosis heterogama	Heath Wrinklewort	Yes	Suitable habitat present.
Thesium australe	Austral Toadflax	No	**Habitat Degraded –** Few native species were detected in the groundcover of each vegetation zone. The habitat is considered to be too degraded to support a population of this species. **Potential Vagrant** – Only 2 records with Hunter Sub Region.
Tyto novaehollandiae	Masked Owl	No	**Habitat Constraints (breeding) -** No hollow-bearing trees with hollows greater than 20cm diameter.
Vespadelus troughtoni	Eastern Cave Bat	No	**Habitat Constraints (breeding) -** No Caves, tunnels, mines, culverts or structure known for breeding occur within the Development Site.

4.2 Threatened Species Surveys

Step 4: Determine presence or absence of candidate species credit species.

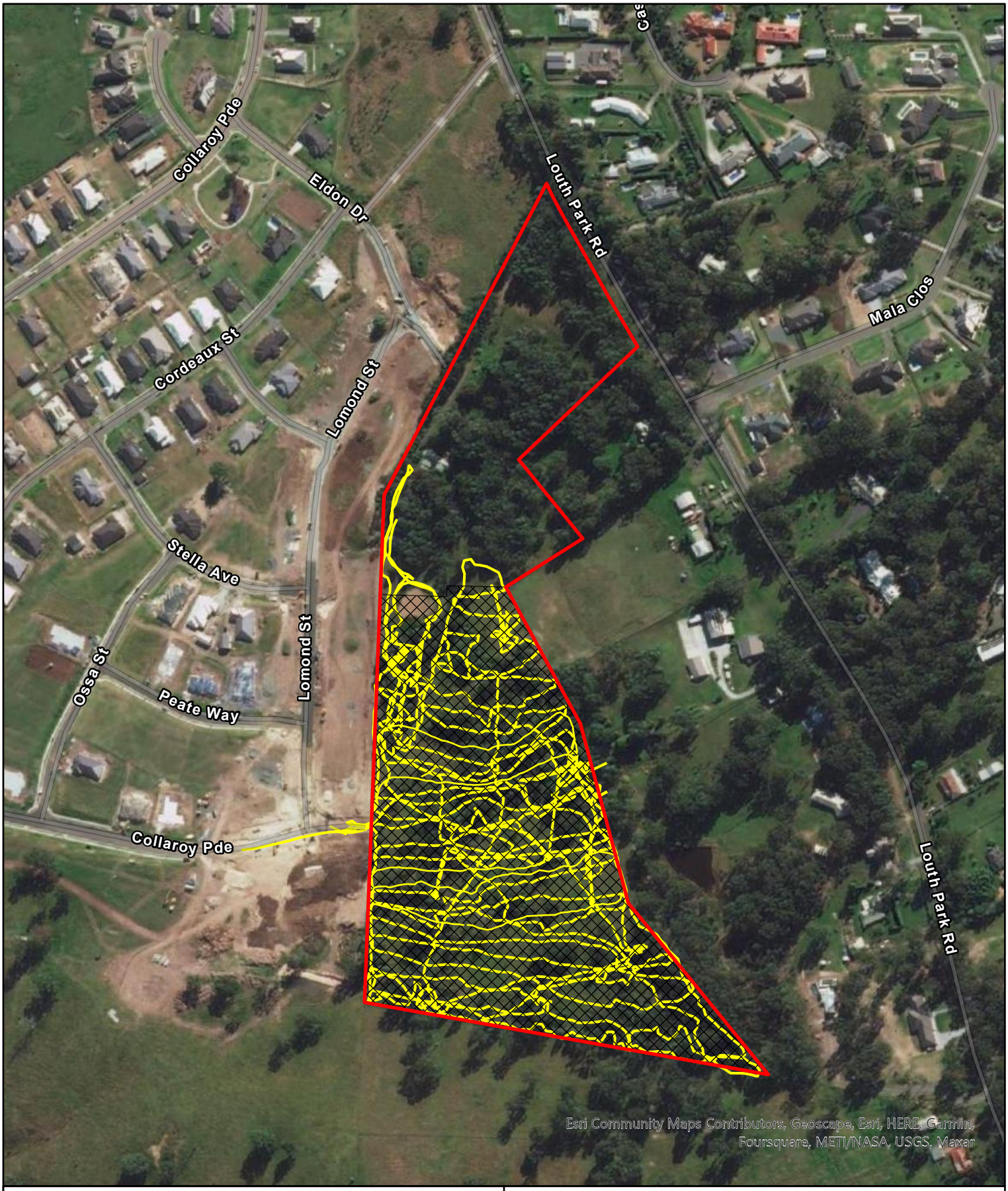
4.2.1 Flora Surveys

The candidate threatened flora species were surveyed in accordance with the *NSW Guide to Surveying Threatened Plants* (DPIE 2020b). Targeted survey for candidate threatened plant species was undertaken on in accordance with the recommended survey period for each species (31/01/22, 30/08/22 and 13/10/22). A summary of the timing of the surveys conducted for each candidate threatened plant species is presented in **Table 10.**

A combination of parallel transects surveys and random meanders were conducted across the site in each of these survey events as shown in **Figure 8**, **Figure 9** and **Figure 10**. During these surveys, all plant species were recorded.

Table 10 Targeted Surveys for Species Credit Species (Flora)

Scientific name	Common name	Survey Window (BAM-C)	Surveys Undertaken
Acacia bynoeana	Bynoe's Wattle	All Year	**Targeted Survey** 31/01/22 30/08/22 13/10/22
Callistemon linearifolius	Netted Bottle Brush	Oct-Jan	**Targeted Survey** 31/01/22 13/10/22
Cynanchum elegans	White-flowered Wax Plant	All Year	**Targeted Survey** 31/01/22 30/08/22 13/10/22
Diuris praecox	Rough Doubletail	Aug	**Targeted Survey** 30/08/22
Diuris tricolor	Pine Donkey Orchid	Sep-Oct	**Targeted Survey** 13/10/22
Eucalyptus castrensis	Singleton Mallee	All Year	**Targeted Survey** 31/01/22 30/08/22 13/10/22
Eucalyptus glaucina	Slaty Red Gum	All Year	**Targeted Survey** 31/01/22 30/08/22 13/10/22
Eucalyptus parramattensis subsp. decadens	-	All Year	**Targeted Survey** 31/01/22 30/08/22 13/10/22
Eucalyptus pumila	Pokolbin Mallee	All Year	**Targeted Survey** 31/01/22 30/08/22 13/10/22
Grevillea parviflora subsp. parviflora	Small-flower Grevillea	Aug-Nov	**Targeted Survey** 30/08/22 13/10/22
Monotaxis macrophylla	Large-leaved Monotaxis	Aug-Feb	**Targeted Survey** 31/01/22 30/08/22 13/10/22
Ozothamnus tesselatus	*Ozothamnus tesselatus*	Sep-Oct	**Targeted Survey** 13/10/22
Pomaderris queenslandica	Scant Pomaderris	All Year	**Targeted Survey** 31/01/22 30/08/22 13/10/22
Prostanthera cineolifera	Singleton Mintbush	Sep-Oct	**Targeted Survey** 13/10/22
Pterostylis chaetophora	-	Sep-Nov	**Targeted Survey** 13/10/22
Rutidosis heterogama	Heath Wrinklewort	All Year	**Targeted Survey** 31/01/22 30/08/22 13/10/22



0 35 70 140 210 280 350

Meters

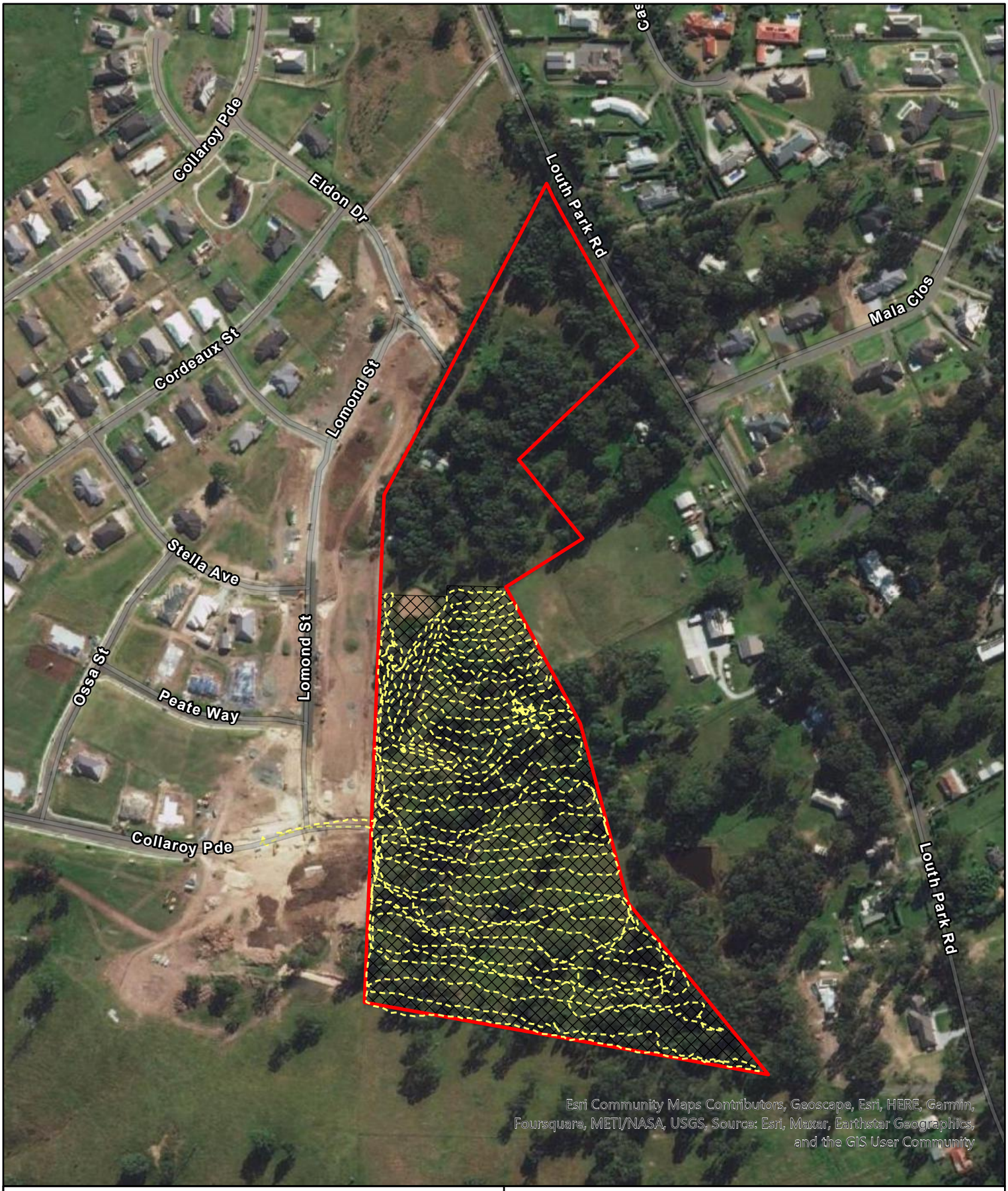
Study Area

Development Site

Threatened Flora Search (31/01/2022)

Figure 8 - Threatened Flora Survey (31/01/22)

HABITAT ENVIRONMENTAL SERVICES



0 35 70 140 210 280 350

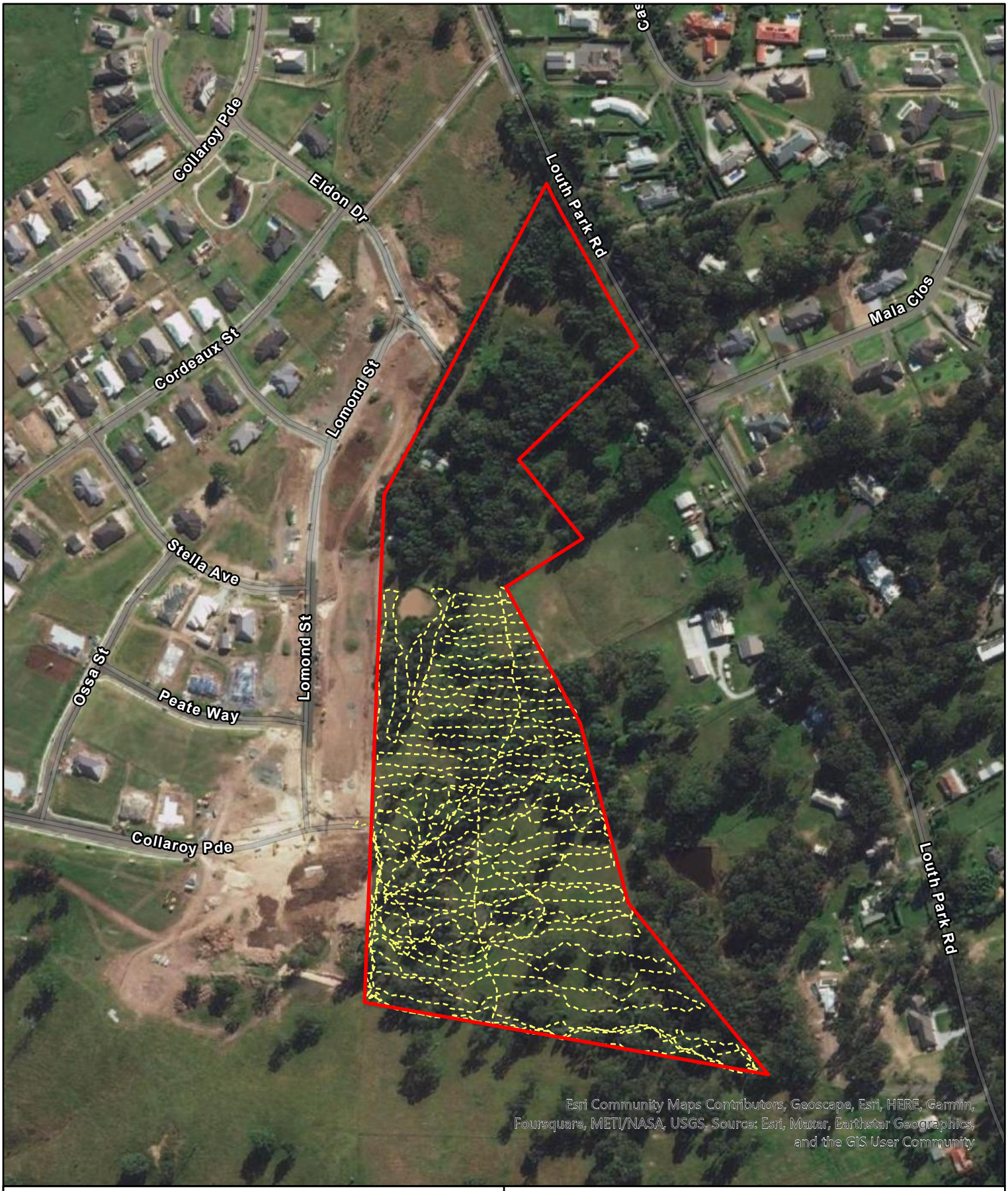
Meters

Legend

- Study Area
- Development Site
- Threatened Flora Track (31/08/22)

Figure 9 - Threatened Flora Survey (31/08/22)

HABITAT ENVIRONMENTAL SERVICES



0 35 70 140 210 280 350

Meters

Legend

Study Area

Threatened Flora Search (13/10/22)

Figure 10 - Threatened Flora Survey (13/10/22)

HABITAT ENVIRONMENTAL SERVICES

4.2.5 Fauna Survey Methods

Remote Cameras

A total of five infrared remote trigger cameras were installed arboreally within the Development Site from 28/03/22 to 11/04/22 (14 consecutive nights). Cameras were baited with an oats, peanut butter, honey mixture in a mesh canister, and the surrounding area (including the tree trunk) was sprayed with honey water. Cameras were re-baited after the first seven days of the survey period. Images were analyzed to identify species captured on camera.

Spotlighting

Spotlighting surveys were conducted on the 31/01/22 and from 28/03/22 to 31/03/22 using a high-powered headtorch to search for all types of nocturnal fauna. Spotlighting was undertaken via random meanders for 60-minutes each night. Call playback for the Squirrel Glider, Koala, ands Large Forest Owl species was also conducted to incite a response following spot lighting.

Koala Surveys

Two Spot Assessment Technique (SAT) surveys (Phillips and Callaghan, 2011) were conducted within vegetation dominated by Koala Feed Trees (mainly Broad-leaved Ironbark) on 31/01/22. This technique involves the selection of a center tree (survey point) that is selected according to the following criteria:

- A tree of any species beneath which one or more Koala fecal pellets have been observed.
- A tree in which a Koala is observed.
- Any other tree known or considered to be potentially important for Koalas.

For each SAT survey, a minimum of 30 trees (including the center tree) with a DBH of 100 mm, or greater, are then surveyed for Koala scats. Surveys involve the inspection of the ground surface within 100 cm from the base of the tree. If fecal scats are identified, the survey concludes, and the surveyor moves to the next closest tree until the 30 trees are surveyed.

Microchiropteran Bats

Two Anabat™ bat-call detectors were used to detect Microchiropteran bats within the Development Site. Surveys for Microchiropteran bats were targeting the Southern Myotis, with Anabats placed at near the constructed dam and in areas containing hollow-bearing trees from 28/03/22 to 11/04/22 (14 consecutive nights).

Hollow-dependent Birds

Within the Study Area, stag-watching and owl call-playback was conducted on the 31/01/22 and from 28/03/22 to 31/03/22. During these surveys, larger hollows (Habitat trees 1, 2, 6, 7 & 8) identified as being potentially suitable for nocturnal birds were stag-watched from dusk (30-minutes prior to last light). After stag-watching was completed, owl call-playback was conducted. Calls of large forest owls

(Powerful Owl, Masked Owl, Barking Owl and Sooty Owl) and the Bush Stone-curlew were broadcast through a megaphone to attract individuals or to incite a response. After an initial listening period of 15-minutes, recorded calls of threatened species were broadcast for 5-minutes each, followed by 1-2 minutes of stationary spotlighting. Directly after the final broadcast, a quiet listening period of 5 minutes was conducted followed by a 30-minute spotlighting survey.

Raptor Nest Surveys

Surveys for raptor nests were undertaken opportunistically during all field surveys. Trees were visually inspected from the ground for the presence of stick nests. The ground around the base of trees was also inspected for the presence of droppings or the remains of prey (bones, feathers etc.). A targeted survey for nests of the White-bellied Sea-Eagle and Little Eagle was also undertaken on 13/10/22.

Amphibians

Amphibian surveys (transect searches) were undertaken around the constructed dam on the 31/01/22 and from 28/03/22 to 31/03/22. Nocturnal surveys involved quiet listening periods where species were identified through aural detection of species-specific calls along with spotlighting searches within emergent vegetation. A dip net was also used to collect and identify tadpole species on each night of the survey.

A summary of survey type and survey timing for each candidate threatened fauna species is presented in **Table 11.** The locations of where each of the surveys were undertaken is presented in **Figure 11**.

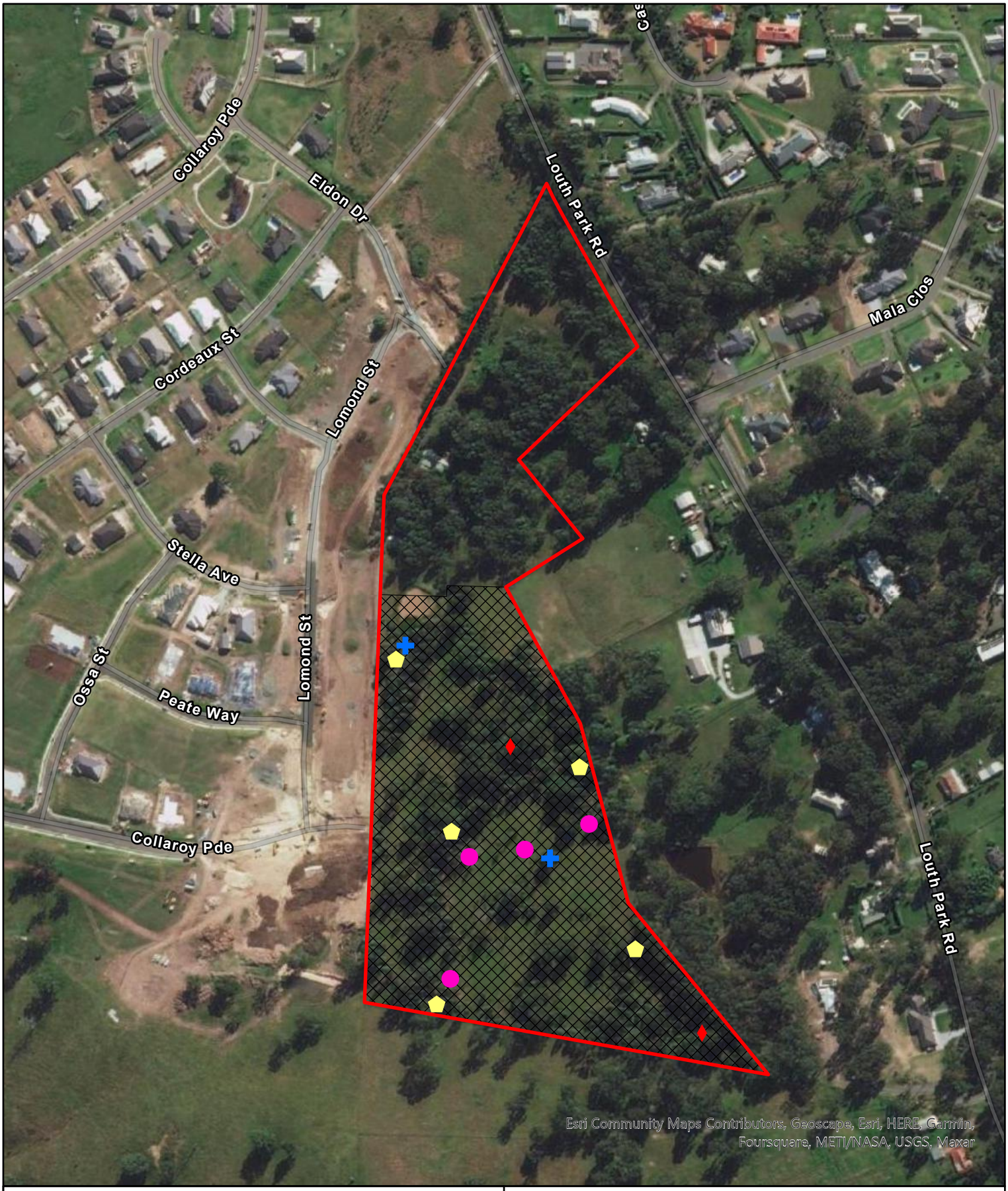
Diurnal Reptile Surveys

Reptile species were identified opportunistically during all field surveys. Rocks and logs were flipped and inspected. A diurnal reptile survey targeting *Delma impar* (Striped Legless Lizard) was undertaken on 13/10/22. During this survey, habitat logs and rocks throughout the Development Site were flipped and inspected.

Table 11 Targeted Surveys for Species Credit Species (Fauna)

Scientific name	Common name	Survey Window (BAM-C)	Surveys Undertaken
Burhinus grallarius	Bush Stone-curlew	All Year	**Spotlighting** 31/01/22 28/03/22-31/03/22
Callocephalon fimbriatum	Gang Gang Cockatoo	Oct-Jan	**Stag-watching** 31/01/22 28/03/22-31/03/22
Calyptorhynchus lathami	Glossy-black Cockatoo	Jan-Sep	**Stag-watching** 31/01/22 28/03/22-31/03/22
Cercartetus nanus	Eastern Pygmy-possum	Oct-Mar	**Remote Cameras** 28/03/22-11/04/22 **Spotlighting** 31/01/22 28/03/22
Delma impar	Striped Legless Lizard	Sep-Dec	**Opportunistic Surveys** 31/01/22 28/03/22-31/03/22 **Diurnal Reptile Search** 13/10/22
Haliaeetus leucogaster	White-bellied Sea-Eagle	Jul-Dec	**Raptor Nest Surveys** 31/01/22 28/03/22-31/03/22 13/10/22
Hieraaetus morphnoides	Little Eagle	Aug-Oct	**Raptor Nest Surveys** 31/01/22 28/03/22-31/03/22 13/10/22
Litoria aurea	Green and Golden Bell Frog	Nov-Mar	**Spotlighting & Dip Netting** 31/01/22 28/03/22-31/03/22
Litoria brevipalmata	Green-thighed Frog	Sep-Apr	**Spotlighting & Dip Netting** 31/01/22 28/03/22-31/03/22
Myotis macropus	Southern Myotis	Oct-Mar	**Anabat** 28/03/22 to 11/04/22 (14 consecutive nights).
Petauroides volans	Greater Glider	All Year	**Remote Cameras** 28/03/22-11/04/22 **Spotlighting & Stag-watching** 31/01/22 28/03/22-31/03/22
Petaurus norfolkensis	Squirrel Glider	All Year	**Remote Cameras** 28/03/22-11/04/22 **Spotlighting & Stag-watching** 31/01/22 28/03/22-31/03/22
Phascogale tapotafa	Brush-tailed Phascogale	Dec-Jun	**Remote Cameras** 28/03/22-11/04/22 **Spotlighting & Stag-watching** 31/01/22 28/03/22-31/03/22
Phascolarctos cinereus	Koala (Breeding)	All Year	**Koala Surveys** 2 SATs 31/01/22 **Remote Cameras** 28/03/22-11/04/22 **Spotlighting** 31/01/22

Scientific name	Common name	Survey Window (BAM-C)	Surveys Undertaken
			28/03/22-31/03/22
Pteropus poliocephalus	Grey-headed Flying-fox	All Year	**Spotlighting** 31/01/22 28/03/22-31/03/22



0 35 70 140 210 280 350

Meters

Study Area
Development Site
Anabat
Remote Infared Camera
Koala SAT
Stag-Watching Locations

Figure 11 - Threatened Fauna Survey

HABITAT ENVIRONMENTAL SERVICES

4.2.6 Fauna Survey Results

A total of 32 fauna species were detected during the fauna surveys. These were comprised of 11 birds, 17 mammals, one reptile and three amphibians (**Table 12**). The majority of the species detected are common within the locality. Six threatened species were detected:

- Grey-crowned Babbler (*Pomatostomus temporalis temporalis*) – Individuals of this species were observed foraging in forested areas in the eastern portion of the Development Site on 31/01/22. Five individuals were observed. A search for nests was conducted and none were found. It was determined that this species is not currently breeding within the site.
- Six Microchiropteran Bat species were detected via Anabat™:
    - Eastern Bent-wing Bat (*Miniopterus orianae oceanensis*)
    - Eastern Coastal Free-tail Bat (*Micronomus norfolkensis*)
    - Little Bent-wing Bat (*Miniopterus australis*)
    - Southern Myotis (*Myotis macropus*)

  The above listed species are all insectivorous species that are likely to be utilizing the habitat within the Development Site as foraging habitat. All of the species may roost in tree hollows; however, the Eastern Bent-wing Bat and Little Bent-wing Bat predominately breed/roost in caves. No caves or suitable breeding habitat for these species occurs within or near the Development Site.
- Squirrel Glider (*Petaurus norfolcensis*) – One individual of this species was detected via remote camera in the southern portion of the Development Site. Foraging habitat occurs throughout the forested areas of the site. The hollow-bearing trees also represent breeding habitat for the species.

The Southern Myotis and Squirrel Glider are identified by the BAM as Species Credit Species (further discussed in **Section 5.2**). The other threatened species are identified as Predicted Species for which no further assessment is required.

Table 12 Fauna Survey Results

Common Name	Species Name	Conservation Status
Birds		
Australian Magpie	*Gymnorhina tibicen*	-
Australian Raven	*Corvus coronoides*	-
Eastern Rosella	*Platycercus eximius*	-
Eastern Yellow Robin	*Eopsaltria australis*	-
Grey-crowned Babbler	*Pomatostomus temporalis temporalis*	Vulnerable (BC Act)
King Parrot	*Alisterus scapularis*	-
Laughing Kookaburra	*Dacelo novaeguineae*	-
Noisy Friarbird	*Philemon corniculatus*	-
Noisy Miner	*Manorina melanocephala*	-
White-faced Heron	*Egretta novaehollandiae*	-
Willy Wagtail	*Rhipidura leucophrys*	-
Mammals		
Black Rat	*Rattus rattus*	-
Brown Antechinus	*Antechinus stuartii*	-
Brush-tailed Possum	*Trichosurus vulpecula*	-
Chocolate Wattled Bat	*Chalinolobus morio*	-
Eastern Bent-wing Bat	*Miniopterus orianae oceanensis*	Vulnerable (BC Act)
Eastern Coastal Free-tail Bat	*Micronomus norfolkensis*	Vulnerable (BC Act)
Eastern Grey Kangaroo	*Macropus giganteus*	-
Eastern Horseshoe-bat	*Rhinolophus megaphylus*	-
Feather-tail Glider	*Acrobates pygmaeus*	-
Gould's Wattled Bat	*Chalinolobus gouldii*	-
Little Bent-wing Bat	*Miniopterus australis*	Vulnerable (BC Act)
Ride's freetail bat	*Ozimops ridei*	-
Southern Myotis	*Myotis macropus*	Vulnerable (BC Act)
Squirrel Glider	*Petaurus norfolcensis*	Vulnerable (BC Act)
Sugar Glider	*Petaurus breviceps*	-
Unidentified Long-eared Bat	*Nyctophilus spp.*	-
White-striped Freetail Bat	*Austronomus australis*	-
Reptiles		
Lace Monitor	*Varanus varius*	-
Amphibians		
Broad-palmed Frog	*Litoria latopalmata*	-
Eastern Dwarf Tree Frog	*Litoria fallax*	
Striped Marsh Frog	*Limnodynastes peronii*	

5 Avoiding and Minimising Impacts

Avoidance and minimisation measures considered for the proposed development are outlined in the following sections.

5.1 Impacts on Native Vegetation and Threatened Species Habitat

Steps to avoid, minimise and mitigate impacts to native vegetation, threatened species, populations and their habitat were considered in selecting a development design with the least biodiversity impact. The development design was selected to avoid better condition areas of native vegetation in the northern portion of the Study Area.

Appropriate mitigation measures have been detailed in **Section 5.4** to further minimise any indirect impacts to biodiversity values within the site and the environment.

5.2 Assessment of Impacts

The Project will impact approximately 7.54 ha of native vegetation. The vegetation equates to three vegetation zones, and the future value of each attribute (composition, structure, and function) and the vegetation integrity score for all vegetation zones will be zero (**Table 13**).

Table 13 Impacts on Native Vegetation

Zone	PCT	Condition class	Impact Area (ha)	Current VI Score	Future VI Score
1	1600	Moderate	4.03	65.8	0
2	1600	Cleared	3.14	11.9	0
3	1598	Moderate	0.37	62.1	0

5.3 Indirect Impacts

The proposed development has the potential for edge effects on the adjoining vegetation. Potential indirect impacts resulting from the development include:

- Increased weed invasion and potential spread or introduction of pathogens from the site to adjacent vegetation.
- Accidental incursions during clearing.
- Reduced viability of adjoining habitats due to increased noise, dust or light spill.

These potential indirect impacts may have an effect on vegetation adjacent to the Study Area. Provided appropriate mitigation measures and management plans are enforced, the proposed

development is unlikely to indirectly impact threatened species, ecological communities, and their habitats during construction and operational phases.

5.4 Prescribed Biodiversity Impacts

The following are prescribed impacts which need to be considered as per Section 8.3 of the BAM (DPIE 2020a).

Impacts of the development on the habitat of threatened species or ecological communities associated with significant geological features, human made structure or non-native vegetation.

The habitat within the Development Site for threatened species and ecological communities is not associated with significant geological features, human made structure or non-native vegetation.

Mitigation measures to minimise any indirect impacts to biodiversity values within the Study Area are detailed in **Section 5.4**.

Impacts of the development on the connectivity of different habitat which facilitates movement of threatened species.

The vegetation within the Study Area occurs in a fragmented state. The predominant surrounding land use is mainly residential development and cleared agricultural land. The Study Area is also located on the periphery of a broader patched of vegetation (located to the south-east) and is unlikely to be used as an important corridor between higher quality areas. The vegetation to be removed is therefore unlikely to be important to facilitating the movement of locally occurring fauna species between patches of native vegetation in the locality**.**

Impact of the development on movement of threatened species that maintains their life cycle

As discussed above, the proposed development would have limited impacts on the movement of threatened species in the locality. While a small area of native vegetation is proposed to be removed, movement corridors within the local area would largely be maintained with the retention of a large area of intact native forest to the east.

Impacts of the development on water quality, bodies and hydrological processes that sustain threatened species or ecological communities.

A constructed dam in the northern portion of the Study Area will be impacted by the project. The dam represents foraging habitat for the Southern Myotis. No mapped watercourses occur within the Development Site. Impacts to water quality will be minimised through the implementation of mitigation measures outlined in **Section 5.4**.

Impact of wind turbine strikes on protected animals

Not applicable to the current application.

Impacts of vehicle strikes on threatened species or on animals that are part of a TEC

Given the nature of the proposed development, impacts of vehicle strikes on threatened species or animals are unlikely. To minimise potential impacts from increased movement of vehicles during the construction phase appropriate mitigation measures will be enforced, as outlined below in **Section 5.5**.

5.5 Mitigation Measures

The measures outlined in **Table 14** are proposed to minimise and avoid potential impacts associated with the proposed development.

Table 14 Mitigation Measures

Impact	Action and Outcome	Responsibility	Timing
Direct impacts			
Clearing of native vegetation	• Avoid and minimise clearing impacts to native vegetation where possible. • Clearly delineate the boundaries of the project footprint to prevent any unnecessary clearing beyond its extent. This includes the installation of appropriate fencing along the eastern extent of the Study Area. Fencing should prohibit entry into the retained vegetation area and the minimise indirect impacts during construction such as the movement of dust and rubbish into the forest and wetland. • Ensure vehicle and equipment parking areas and stockpile areas are identified and positioned to avoid areas containing ecological value. Stockpiling must not occur within, or in close proximity (5m) to, areas of native vegetation retained under the proposed development. • Appropriate signage such as 'no go zone' or 'environmental protection area' should be installed surrounding the area of retained native vegetation and wetlands. • Clearly identify and communicate the location of any 'no go zones' in site inductions. • Tree protection measures will be implemented to protect retained trees surrounding the Study Area. Tree protection measures should consider allowances for Tree Protection Zones in accordance with AS4970 (Standards Australia, 2009).	Construction site manager	Prior to and during vegetation clearing
Removal of hollow-bearing trees	• Limit removal of trees to that required within the Development Site. • A pre-clearing protocol will be implemented during clearing works • Pre-clearance surveys will be undertaken to determine if any fauna are utilizing hollow-bearing trees. • A suitably qualified and trained fauna handler will be present during hollow-bearing tree clearing to relocate displaced fauna.	Construction site manager	Prior to and during vegetation clearing
Impacts to surface and groundwater quality and quantity due to sediment run-off and/or contaminant runoff into adjacent watercourses	• Source controls such as sediment fences, mulching and jute matting will be utilised where appropriate. • Site-based vehicles will carry spill kits. • Erosion and sediment control will be required for the development in accordance with Managing Urban Stormwater: Soils and Construction (Landcom, 2004) prior to commencement of construction. • Limit the use of pesticides in the project footprint where possible to avoid contamination of nearby watercourses/wetland areas.	Construction site manager	During vegetation clearing, construction and operation

Impact	Action and Outcome	Responsibility	Timing
Vehicle collision with fauna	• Speed limits within the Study Area should be limited to 20 km/hr. • This limit should be clearly signed at all entry points to site. • The Study Area should be separated from vegetated areas throughout the construction and operational phases of the development. This separation should be achieved through physical barriers including fencing and appropriate signage.	Construction site manager	During construction and operation
Indirect Impacts			
Transfer of weeds and pathogens to and from site	• The fungal pathogens *Phytophora cinnamomi* and Myrtle Rust (*Puccinia psidii*) are known to occur in the LGA, however, it is unknown if they occur within the Development Site. These pathogens can have devastating impacts on native plant communities and inhabiting fauna if not properly managed. • Appropriate wash down facilities will be available to clean vehicles and equipment prior to arrival on-site and prior to departure. • Ensure soil and seed material is not transferred. • Weed infestations within the construction footprint are to be identified and mapped prior to construction.	Construction site manager	During vegetation clearing, construction, and operation
Noise, vibration, lighting, waste and air pollution impacts to adjacent sensitive habitat areas	• Increased human activity (from workers and traffic levels) directly adjacent to sensitive habitat areas may cause disturbance to flora and fauna species in adjoining habitat. • Impacts from construction and operational activities, such as disturbance to an animal's normal behavior patterns due to noise, vibration, lighting or dust may cause areas of previously suitable habitat to become sub-optimal and may cause fauna species to vacate areas of previously suitable habitat. • Measures to mitigate impacts on flora and fauna from noise, vibration, waste, light and air pollution such as: • Enforce 'carry-in, carry-out' policy regarding rubbish and waste materials generated on-site during construction to avoid waste materials entering adjacent vegetation. • Restriction of public access and associated impacts from domestic pets, waste dumping and damage to adjoining vegetation must be enforced pre, during and post construction. • Fence sensitive areas to delineate 'no go' zones. • Levels of lighting within the site will be reduced to a minimal level to reduce any adverse effects upon the essential behavioral patterns of light-sensitive fauna. • Lighting should comply with Australian Standard AS4282 (INT) 1997 – Control of Obtrusive Effects of Outdoor Lighting. • Noise minimisation practices in accordance with DPIE recommendations.	Construction site manager	During construction and operation

Impact	Action and Outcome	Responsibility	Timing
	• Dust control measures such as covering loads where required; amending operations under excessive wind conditions including ceasing operations if required; use of water tankers as required, to control dust; rehabilitation through vegetation of surfaces to be left unsealed; and, truck wheel washes or other dust removal measures.		

6 Impact Summary

6.1 Serious and Irreversible Impacts

No species at risk of Serious and Irreversible Impacts (SAIIs) are to be impacted as a result of the proposed development. As such no SAIIs assessments were completed in accordance with Section 9.1 of the BAM (DPIE 2020a).

6.2 Impacts on Native Vegetation

This section provides an assessment of the impacts requiring offsetting in accordance with Section 10.1 of the BAM (DPIE 2020a).

The proposed development will result in the clearing of 7.54 ha of native vegetation (PCT 1600 and PCT 1598). In accordance with the BAM (Section 9.2.1) assessors must determine an offset for all impacts of proposals on PCTs that are associated with a vegetation zone that has a vegetation integrity score of:

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

A summary of the impacts on native vegetation and the required ecosystem credits is provided in **Table 15**.

Table 15 Ecosystem Credit Requirements

Zone	PCT	Condition class	Impact Area (ha)	Current VI Score	Future VI Score	Credits Required
1	1600	Moderate	4.03	65.8	0	133
2	1600	Cleared	3.14	11.9	0	0
3	1598	Moderate	0.37	62.1	0	11

6.3 Impacts on Threatened Species

The proposed development will result in the removal of habitat for two Species Credit Species:

- Southern Myotis (*Myotis macropus*) – detected via Anabat™
- Squirrel Glider (*Petaurus norfolcensis*) – detected via remote camera

The Southern Myotis was identified via Anabat recording in the northern portion of the Development Site. The habitat polygon for the species was defined as all vegetation zones for PCTs which the species is associated with under the *Threatened Biodiversity Data Collection* that occur within 200 m of the foraging habitat (constructed dam) as shown in **Figure 12**.

The Squirrel Glider was detected via remote camera in the southern portion of the Development Site. The species polygon was defined as all vegetation zones containing suitable habitat (forested areas containing Eucalypt and Acacia species and hollow-bearing trees) as shown in **Figure 13**. Vegetation Zone 2 was excluded given that this habitat is considered to be unsuitable for the species.

A summary of species credit requirements for impacts to each of these species is presented respectively in **Table 16** and **Table 17.**

Table 16 Southern Myotis Credit Requirements

Zone	PCT	Condition class	Impact Area (ha)	Current Habitat Score	Future Habitat Score	Credits Required
1	1600	Moderate	1.34	65.8	0	44
2	1600	Cleared	1.09	11.9	0	6
3	1598	Moderate	0.37	62.1	0	11
					Total	61

Table 17 Squirrel Glider Species Credit Requirements

Zone	PCT	Condition class	Impact Area (ha)	Current VI Score	Future VI Score	Credits Required
1	1600	Moderate	4.03	65.8	0	133
2	1600	Cleared	0	11.9	0	0
3	1598	Moderate	0.37	62.1	0	11
					Total	144

The Biodiversity Credit Report (Like-for-like and Variations) detailing credit retirement options is provided in **Appendix C**.

0 35 70 140 210 280 350

Meters

- Study Area
- Southern Myotis Record (Anabat)
- Southern Myotis Foraging Habitat
- Southern Myotis 200m Buffer
- Southern Myotis Species Polygon

Figure 12 - Habitat Polygon - Southern Myotis

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0 35 70 140 210 280 350

Meters

Legend

- Study Area
- Squrrel Glider Record (Remote Camera)
- Squirrel Glider Species Polygon

Figure 13 - Habitat Polygon - Squirrel Glider

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7 Legislative Review

7.1 Environment Protection and Biodiversity Conservation Act 1999

The EPBC Act requires that developments or undertakings that are likely to have a significant impact on MNES be referred for a determination as to whether they are a controlled action that requires approval under the EPBC Act.

Of the nine MNES listed under the Act, the one (1) MNES considered relevant to the Study Area was potential impacts on marginal habitat for listed threatened species and ecological communities. Impacts to EPBC listed species and ecological communities are likely to be negligible; therefore, referral to the Commonwealth Minister for the Environment is not recommended.

7.2 Biosecurity Act

A total of 31 exotic plant species were detected within the Study Area. Five of these species are priority weed species listed under the NSW *Biosecurity Act 2015*:

- *Chrysanthemoides monolifera* (Bitou Bush)
- *Lantana camara* (Lantana)
- *Olea europaea subsp. cuspidata* (African Olive)
- *Opuntia aurantiaca* (Tiger Pear)
- *Opuntia stricta* (Common Prickly Pear)

Mitigation measures are presented previously in **Table 14** to reduce the potential for spread of these species during the construction phase.

7.3 Koala Habitat Protection

The Study Area is located within the Maitland City Council LGA, which is listed within Schedule 1 of Chapter 4 (Koala Habitat Protection 2021) of the Biodiversity and Conservation SEPP (2021). The Koala Habitat Protection SEPP 2021 was therefore deemed applicable for the Study Area. As such, an assessment of Koala habitat suitability was conducted in accordance with the SEPP including the determination of Highly Suitable Koala Habitat and records of Koalas. These are defined as the following:

- Highly Suitable Koala Habitat – Where 15% or greater of the total number of trees within any PCT are the regionally relevant species of those listed in Schedule 2 of the Koala SEPP 2021, the site meets the definition of highly suitable Koala habitat
- Core Koala Habitat – is defined as:
  - 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
  - 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 within 2.5kms during the previous 18 years. Historical koala occupation of the site area is determined by considering Koala records within the last 18 years

As such, an assessment of 'Highly Suitable Koala Habitat' and 'Core Koala Habitat' under the Koala SEPP 2021 is detailed below.

Presence of Highly Suitable Koala Habitat

The following Koala use tree species (Central Coast Koala Management Area) were detected within the Development Site:

- *Casuarina glauca* (Swamp Oak)
- *Corymbia gummifera* (Red Bloodwood)
- *Corymbia maculata* (Spotted Gum)
- *Eucalyptus acmenoides* (Red Mahogany)
- *Eucalyptus capitellata* (Brown Stringybark)
- *Eucalyptus crebra* (Narrow-leaved Ironbark)
- *Eucalyptus fibrosa* (Broad-leaved Ironbark)
- *Eucalyptus grandis* (Flooded Gum)
- *Eucalyptus longifolia* (Woolybutt)
- *Eucalyptus moluccana* (Grey Box)
- *Eucalyptus paniculata* (Grey Ironbark)
- *Eucalyptus tereticornis* (Forest Red Gum)
- *Melaleuca quinquenervia* (Broad-leaved Paperbark)

In Vegetation Zones 1 and 3, some of the above listed species constitute over 15% of the total number of trees. As such, these Vegetation Zones constitute "Highly Suitable Koala Habitat" under the Koala SEPP 2021.

Presence of Core Koala Habitat

No Koalas, or evidence of Koalas, were recorded within the Development Site during the site assessment. Two records of Koalas (2017 & 2000) occur within 2.5 km of the Study Area; however, the record from 2017 has an accuracy of 1,320 m (BioNet records with a locational accuracy of more than 1,000 m are not to be considered under the SEPP) and the record from 2017 is greater than 18 years ago. As such, the vegetation does not meet the definition of 'Core Koala Habitat' under the Koala SEPP 2021.

Impact Assessment

The vegetation within the Study Area occurs in a highly modified and fragmented state. More intact areas of bushland occur to the east. It is likely that a resident population of Koalas would utilise the habitat within the Study Area intermittently as part of a broader network of habitats within locality.

Based on the above, the proposed development is unlikely to cause a significant impact to the Koala.

8 References

Department of Environment and Climate Change (DECC) (2002). Descriptions for NSW (Mitchell) Landscapes, Version 2. Based on descriptions compiled by Dr. Peter Mitchell.

Department of the Environment and Energy (2020). Light Pollution Guidelines National Light Pollution Guidelines for Wildlife Including marine turtles, seabirds and migratory shorebirds.

Department of Planning, Industry and Environment (DPIE) (2018). Coastal Wetlands and Littoral Rainforest Area Map. Published by the Environment, Energy and Science, Department of Planning, Industry and Environment, Parramatta, NSW. Available at: https://webmap.environment.nsw.gov.au/PlanningHtml5Viewer/?viewer=SEPP_CoastalManagement

Department of Planning, Industry and Environment (DPIE) (2020a). Biodiversity Assessment Method. Published by the Environment, Energy and Science, Department of Planning, Industry and Environment, Parramatta, NSW.

Department of Planning, Industry and Environment (DPIE) (2020b). Surveying threatened plants and their habitats - NSW survey guide for the Biodiversity Assessment Method. Published by Environment, Energy and Science, Department of Planning, Industry and Environment, Parramatta, NSW.

Department of Planning and Environment (DPE) (2022a). BioNet Atlas of NSW. Available at: http://www.bionet.nsw.gov.au/

Department of Planning and Environment (DPE) (2022b). BioNet Vegetation Classification. Available at: https://www.environment.nsw.gov.au/research/Visclassification.htm

Department of Planning and Environment (DPE) (2022c). BioNet Threatened Biodiversity Data Collection. Available at: https://www.environment.nsw.gov.au/threatenedSpeciesApp/

Department of Planning and Environment (DPE) (2022d). Threatened Biodiversity Profile Search. Available at: https://www.environment.nsw.gov.au/threatenedspeciesapp/

Department of Planning and Environment (DPE) (2022e). NSW Threatened Species Scientific Committee – Final Determinations. Available at: https://www.environment.nsw.gov.au/topics/animals-and-plants/threatened-species/nsw-threatened-species-scientific-committee/determinations/final-determinations

Department of Planning and Environment (DPE) (2022f). Biodiversity Assessment Method – Important Area Mapping. Available at: https://webmap.environment.nsw.gov.au/Html5Viewer291/index.html?viewer=BAM_ImportantAreas

Department of Spatial Services (DSS) Six Maps Available at: https://maps.six.nsw.gov.au/

Harden, G.J. (ed.) (1992). Flora of New South Wales, Volume 3, NSW University Press, Sydney.

Harden, G.J. (ed.) (1993). Flora of New South Wales, Volume 4, NSW University Press, Sydney.

Harden, G.J. (ed) (2000). Flora of New South Wales, Volume 1, NSW University Press, Sydney.

Harden, G.J. (ed.) (2002). Flora of New South Wales, Volume 2, NSW University Press, Sydney.

Landcom (2004). Managing Urban Stormwater: Soils and Construction. 4th edition, NSW Government, March 2004.

Mathei, L.E., 1995, Soil Landscapes of the Newcastle 1:100,000 Sheet, NSW Department of Land and Water Conservation, Sydney.

National Parks and Wildlife Service (2003). Lower Hunter Central Coast Region Environmental Management Strategy (LHCCREMS) - 2003 Lower Hunter and Central Coast Vegetation Community Map. National Parks and Wildlife Service.

Appendix A – Threatened Species Database Search

A list of threatened species, populations and ecological communities that have been reported or modelled to occur from within a five-kilometre radius of the Study Area was obtained from the DPIE BioNet Atlas: (http://www.bionet.nsw.gov.au/).

The table below summarises the likelihood of threatened species occurring within the Study Area based on the habitat requirements of each species.

Definition of the likelihood of occurrence criteria are as follows:

- Known – species identified within the site during surveys;
- High – species known from the area (DPIE BioNet Atlas records), suitable habitat (such as roosting and foraging habitat) present within the site;
- Moderate – species may be known from the area, potential habitat is present within the site;
- Low – species not known from the area and/or marginal habitat is present within the site; and
- Nil – habitat requirements not met for this species within the site

Species	Status		Bionet Records	Habitat	LoO	Summary
	BC	EPBC				
Acacia bynoeana **Bynoe's Wattle**	E1	V	1	The species is endemic to central eastern NSW, currently known from only 30 locations, many of only 1-5 plants. Grows mainly in heath/ dry sclerophyll forest on sandy soils, prefers open, sometimes slightly disturbed sites such as trail margins, road edges, and in recently burnt open patches.	Low	No suitable habitat within the Subject Site. Few records within the locality. **Not recorded during site assessment.**
Eucalyptus parramattensis subsp. decadens	V	V	17	Generally occupies deep, low-nutrient sands, often those subject to periodic inundation or where water tables are relatively high. It occurs in dry sclerophyll woodland with dry heath understorey. It also occurs as an emergent in dry or wet heathland. Often where this species occurs, it is a community dominant.	Low	No suitable habitat within the Subject Site. **Not recorded during site assessment.**
Grevillea parviflora subsp. parviflora **Small-flower Grevillea**	V	V	2	The species distribution is between Moss Vale/Bargo and the lower Hunter Valley, with most occurrences in Appin, Wedderburn, Picton and Bargo. The habitat for the species is broad including heath, shrubby woodland and open forest on light clay or sandy soils, and often in disturbed areas such as on the fringes of tracks.	Low	Habitat is considered to be too degraded. Few records within the locality. **Not recorded during site assessment.**
Pterostylis chaetophora	E1,P,2	E	1	Recorded in Queensland and NSW. In NSW it is currently known from 18 scattered locations in a relatively small area between Taree and Kurri Kurri, extending to the south-east towards Tea Gardens and west into the Upper Hunter, with additional records near Denman and Wingen. There are also isolated records from the Sydney region. The species occurs in two conservation reserves, Columbey National Park and Wingen Maid Nature Reserve. The preferred habitat is seasonally moist, dry sclerophyll forest with a grass and shrub understorey.	Low	Habitat is considered to be too degraded. Few records within the locality. **Not recorded during site assessment.**
Rhodomyrtus psidioides	E4A	-	2	Occurs from Broken Bay, approximately 90 km 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 c. 120 km inland in the Hunter and Clarence River catchments and along	Nil	No suitable habitat within the Subject Site. Few records within the locality.

Species	Status		Bionet Records	Habitat	LoO	Summary
	BC	EPBC				
Native Guava				the Border Ranges in NSW. Pioneer species found in littoral, warm temperate and subtropical rainforest and wet sclerophyll forest often near creeks and drainage lines.		**Not recorded during site assessment.**
Tetratheca juncea **Black-eyed Susan**	V	V	17	Regarded as extinct within the Sydney area, current range from Wyong north to Bulahdelah and inland 50km to edge of Sugarloaf Range. Occurs predominately in areas of over 1000 mm annual rainfall, within dry sclerophyll forest, and sometimes heath and moist forest, with a preference for Coastal Plains Smooth-barked Apple Woodland and Coastal Plains Scribbly Gum Woodland.	Low	Habitat is considered to be too degraded. Few records within the locality. **Not recorded during site assessment.**
Anseranas semipalmata **Magpie Goose**	V,P		1	The Magpie Goose is still relatively common in the Australian northern tropics, but had disappeared from south-east Australia by 1920 due to drainage and overgrazing of reed swamps used for breeding. Since the 1980s there have been an increasing number of records in central and northern NSW. Vagrants can follow food sources to south-eastern NSW. Mainly found in shallow wetlands (less than 1 m deep) with dense growth of rushes or sedges. Equally at home in aquatic or terrestrial habitats; often seen walking and grazing on land; feeds on grasses, bulbs and rhizomes.	Low	Foraging habitat available in constructed dam, but few records in the locality. **Not recorded during site assessment.**
Artamus cyanopterus cyanopterus **Dusky Woodswallow**	V,P	-	2	Primarily inhabit dry, open eucalypt forests and woodlands, including mallee associations, with an open or sparse understorey of eucalypt saplings, acacias and other shrubs, and ground-cover of grasses or sedges and fallen woody debris. It has also been recorded in shrublands, heathlands and very occasionally in moist forest or rainforest. Also found in farmland, usually at the edges of forest or woodland.	Low	Foraging habitat available, few records in the locality. **Not recorded during site assessment.**
Calyptorhynchus lathami	V,P,2	-	2	Widespread but uncommon from coast to southern tablelands and central western plains. Feeds almost exclusively on the seeds of Allocasuarina species. Prefers woodland and open forests, rarely away from Allocasuarina. Roost in leafy canopy trees, preferably eucalypts, usually <1 km from feeding	Low	Foraging habitat available, few records in the locality.

Species	Status		Bionet Records	Habitat	LoO	Summary
	BC	EPBC				
				site. Nests in large (approx. 20 cm) hollows in trees, stumps or limbs, usually in Eucalypts.		
Glossy Black-Cockatoo						**Not recorded during site assessment.**
Chthonicola sagittata	V,P	-	2	Within NSW most frequently reported from the hills and tablelands of the Great Dividing Range, rarely from the coast. The species inhabits a wide range of Eucalypt-dominated communities with a grassy understorey, a sparse shrub layer, often on rocky ridges or in gullies. Sedentary and requires large, relatively undisturbed remnants to persist in an area. Forages on the ground for seeds and insects, and nests in a slight hollow in the ground or at the base of low dense plants.	Low	Foraging habitat available, few records in the locality.
Speckled Warbler						**Not recorded during site assessment.**
Circus assimilis	V,P	-	3	The Spotted Harrier occurs throughout the Australian mainland, except in densly forested or wooded habitats of the coast, escarpment and ranges, and rarely in Tasmania. Individuals disperse widely in NSW and comprise a single population.Occurs in grassy open woodland including Acacia and mallee remnants, inland riparian woodland, grassland and shrub steppe. It is found most commonly in native grassland, but also occurs in agricultural land, foraging over open habitats including edges of inland wetlands.	Low	Foraging habitat available, few records in the locality.
Spotted Harrier						**Not recorded during site assessment.**
Climacteris picumnus victoriae	V,P	-	1	Small grey-brown bird with black streaking on the lower breast/belly and black bars on the undertail. Inhabits Box-Gum woodlands and dry open forest of inland slopes and plains. Preferred woodlands dominant by stringybarks or other rough-barked eucalypts. Forages in trees and on the ground. Endemic to eastern Australia, occurring from the coast to inland plains and western slopes of the great dividing range. Nests in tree or stump hollows greater than 6cm.	Low	Foraging habitat available, few records in the locality.
Brown Treecreeper (eastern subspecies)						**Not recorded during site assessment.**

Species	Status		Bionet Records	Habitat	LoO	Summary
	BC	EPBC				
Daphoenositta chrysoptera **Varied Sittella**	V,P	-	4	Sedentary, occurs across NSW from the coast to the far west. Inhabits eucalypt forests and woodlands, especially rough-barked species and mature smooth-barked gums with dead branches, mallee and Acacia woodland. Sensitive to habitat isolation and loss of structural complexity, and adversely affected by dominance of Noisy Miners. Cleared agricultural land is potentially a barrier to movement. Builds a cup-shaped nest of plant fibres and cobwebs in an upright tree fork high in the living tree canopy, and often re-uses the same fork or tree in successive years.	Low	Foraging habitat available, few records in the locality. **Not recorded during site assessment.**
Ephippiorhynchus asiaticus **Black-necked Stork**	E1,P	-	5	Primarily inhabits permanent freshwater wetlands and surrounding vegetation including swamps, floodplains, watercourses and billabongs, freshwater meadows, wet heathland, farm dams and shallow floodwaters. Will also forage in inter-tidal shorelines, mangrove margins and estuaries. Feeds in shallow, still water. This species breeds during summer, nesting in or near a freshwater swamp.	Low	Foraging habitat available, few records in the locality. **Not recorded during site assessment.**
Falco subniger **Black Falcon**	V	-	2	The Black Falcon is widely, but sparsely, distributed in New South Wales, mostly occurring in inland regions. Some reports of 'Black Falcons' on the tablelands and coast of New South Wales are likely to be referable to the Brown Falcon. In New South Wales there is assumed to be a single population that is continuous with a broader continental population, given that falcons are highly mobile, commonly travelling hundreds of kilometres (Marchant & Higgins 1993). The Black Falcon occurs as solitary individuals, in pairs, or in family groups of parents and offspring.	Low	Foraging habitat available, few records in the locality. **Not recorded during site assessment.**
Glossopsitta pusilla **Little Lorikeet**	V,P	-	13	The species occurs from the coast to western slopes of the Great Dividing Range and inhabits dry, open eucalypt forests and woodlands. Occurrence is positively associated with patch size, and with components of habitat complexity including canopy cover, shrub cover, ground cover, logs, fallen branches and litter. Feed primarily on profusely-flowering eucalypts and a variety of other species including melaleucas and mistletoes. On the western slopes and tablelands *Eucalyptus albens and E. melliodora* are particularly important food sources for pollen and nectar respectively. Mostly nests in small (opening approx. 3cm) hollows in living, smooth-barked eucalypts, especially *Eucalyptus viminalis*, *E. blakelyi* and *E. dealbata*. Most breeding records are from the western slopes.	**Moderate**	Broadly suitable habitat within the Subject Site. Records within the locality. **Not recorded during site assessment.**

Species	Status		Bionet Records	Habitat	LoO	Summary
	BC	EPBC				
Haliaeetus leucogaster **White-bellied Sea-Eagle**	V,P	-	18	The White-bellied Sea-Eagle is found in coastal habitats (especially those close to the sea-shore) and around terrestrial wetlands in tropical and temperate regions of mainland Australia and its offshore islands. Feed mainly on fish and freshwater turtles, but also waterbirds, reptiles, mammals and carrion. Breeding habitat consists of mature tall open forest, open forest, tall woodland, and swamp sclerophyll forest close to foraging habitat. Nest trees are typically large emergent eucalypts and often have emergent dead branches or large dead trees nearby which are used as 'guard roosts'. Nests are large structures built from sticks and lined with leaves or grass.	Low	No suitable habitat **Not recorded during site assessment.**
Hieraaetus morphnoides **Little Eagle**	V,P	-	1	Occurs throughout NSW except most densely forested parts of the Dividing Range escarpment. Occupies habitats rich in prey within open eucalypt forest, woodland or open woodland. Sheoak or acacia woodlands and riparian woodlands of interior NSW are also used. For nest sites it requires a tall living tree within a remnant patch, where pairs build a large stick nest in winter and lay in early spring.	Low	Foraging habitat available, few records in the locality. **Not recorded during site assessment.**
Irediparra gallinacea **Comb-crested Jacana**	V,P	-	3	Occurs on freshwater wetlands in northern and eastern Australia, mainly in coastal and subcoastal regions, from the north-eastern Kimberley Division of Western Australia to Cape York Peninsula then south along the east coast to the Hunter region of NSW. Inhabit permanent freshwater wetlands, either still or slow-flowing, with a good surface cover of floating vegetation, especially water-lilies, or fringing and aquatic vegetation.	Nil	No suitable habitat within the Subject Site. One record within the locality. **Not recorded during site assessment.**
Lathamus discolor **Swift Parrot**	E1,P,3	CE	4	A migratory species that travels to the mainland from March to October, the species breeds in Tasmania from September to January. Principal over-winter habitat is box-ironbark communities on the inland slopes and plains. *Eucalyptus robusta, Corymbia maculata* and *C. gummifera* dominated coastal forests are also important habitat.	Low	Foraging habitat available, few records in the locality. **Not recorded during site assessment.**
Lophoictinia isura	V,P,3	-	4	Found in a variety of timbered habitats including dry woodlands and open forests. Shows a particular preference for timbered watercourses. In arid north-western NSW, has been observed in stony country with a ground cover of	Nil	No suitable habitat within the Subject Site. Few records within the locality.

Species	Status		Bionet Records	Habitat	LoO	Summary
	BC	EPBC				
Square-tailed Kite				chenopods and grasses, open acacia scrub and patches of low open eucalypt woodland. Breeding is from July to February.		**Not recorded during site assessment.**
Neophema pulchella **Turquoise Parrot**	V,P,3	-	1	The Turquoise Parrot's range extends from southern Queensland through to northern Victoria, from the coastal plains to the western slopes of the Great Dividing Range.Lives on the edges of eucalypt woodland adjoining clearings, timbered ridges and creeks in farmland.	Low	Foraging habitat available, few records in the locality. **Not recorded during site assessment.**
Ninox connivens **Barking Owl**	V,P,3	-	2	Occurs from coast to inland slopes and plains, though is rare in dense, wet forests east of the Great Dividing Range and sparse in higher parts of the tablelands and in the arid zone. Inhabits eucalypt woodlands, open forest, swamp woodlands, and, especially in inland areas, timber along watercourses. Roosts along creek lines in dense, tall understorey foliage (e.g. in Acacia and Casuarina), or dense eucalypt canopy. Nests in hollows of large, old eucalypts including Eucalyptus camaldulensis, Eucalyptus albens, Eucalyptus polyanthemos and Eucalyptus blakelyi. Birds and mammals important prey during breeding. Territories range from 30 to 200 hectares.	Low	Foraging habitat available, few records in the locality. **Not recorded during site assessment.**
Ninox strenua **Powerful Owl**	V,P,3	-	8	The Powerful Owl inhabits a range of vegetation types, from woodland and open sclerophyll forest to tall open wet forest and rainforest. The Powerful Owl requires large tracts of forest or woodland habitat but can occur in fragmented landscapes as well. The species breeds and hunts in open or closed sclerophyll forest or woodlands and occasionally hunts in open habitats. It roosts by day in dense vegetation comprising species such as Turpentine *Syncarpia glomulifera*, Black She-oak *Allocasuarina littoralis*, Blackwood *Acacia melanoxylon*, Rough-barked Apple *Angophora floribunda*, Cherry Ballart *Exocarpus cupressiformis* and a number of eucalypt species.	Low	Broadly suitable foraging habitat within the Subject Site. No suitable nesting Habitat within the Subject Site. Records within the locality. **Not recorded during site assessment.**

Species	Status		Bionet Records	Habitat	LoO	Summary
	BC	EPBC				
Oxyura australis **Blue-billed Duck**	V,P		1	The Blue-billed Duck is endemic to south-eastern and south-western Australia. It is widespread in NSW, but most common in the southern Murray-Darling Basin area. Birds disperse during the breeding season to deep swamps up to 300 km away. It is generally only during summer or in drier years that they are seen in coastal areas. The Blue-billed Duck prefers deep water in large permanent wetlands and swamps with dense aquatic vegetation. The species is completely aquatic, swimming low in the water along the edge of dense cover. It will fly if disturbed, but prefers to dive if approached.	Nil	No suitable habitat within the Subject Site. No records within the locality. **Not recorded during site assessment.**
Petroica boodang **Scarlet Robin**	V,P		1	The Scarlet Robin is found from south east Queensland to south east South Australia and also in Tasmania and south west Western Australia. In NSW, it occurs from the coast to the inland slopes. After breeding, some Scarlet Robins disperse to the lower valleys and plains of the tablelands and slopes. Some birds may appear as far west as the eastern edges of the inland plains in autumn and winter. The Scarlet Robin lives in dry eucalypt forests and woodlands. The understorey is usually open and grassy with few scattered shrubs. This species lives in both mature and regrowth vegetation. It occasionally occurs in mallee or wet forest communities, or in wetlands and tea-tree swamps. Scarlet Robin habitat usually contains abundant logs and fallen timber: these are important components of its habitat. The Scarlet Robin breeds on ridges, hills and foothills of the western slopes, the Great Dividing Range and eastern coastal regions; this species is occasionally found up to 1000 metres in altitude.	Nil	No suitable habitat within the Subject Site. No records within the locality. **Not recorded during site assessment.**
Pandion cristatus	V,P,3	-	2	Favour coastal areas, especially the mouths of large rivers, lagoons and lakes. Feed on fish over clear, open water. Breed from July to September in NSW. Nests are made high up in dead trees or in dead crowns of live trees, usually within one kilometre of the sea.	Low	No suitable nesting habitat within the Subject Site. Records within the locality.

Species	Status		Bionet Records	Habitat	LoO	Summary
	BC	EPBC				
Eastern Osprey						**Not recorded during site assessment.**
Pomatostomus temporalis temporalis **Grey-crowned Babbler (eastern subspecies)**	V,P	-	31	The Grey-crowned Babbler has two distinctive subspecies that intergrade to the south of the Gulf of Carpentaria. West of here the subspecies rubeculus, formerly considered a separate species (Red-breasted Babbler) is still widespread and common. The eastern subspecies (temporalis occurs from Cape York south through Queensland, NSW and Victoria and formerly to the south east of South Australia. Inhabits open Box-Gum Woodlands on the slopes, and Box-Cypress-pine and open Box Woodlands on alluvial plains. Woodlands on fertile soils in coastal regions.	**Present**	Suitable habitat within the Subject Site. **Detected during site assessment.**
Rostratula australis **Australian Painted Snipe**	E1,P	E	1	Normally found in permanent or ephemeral shallow inland wetlands, either freshwater or brackish. The species nests on the ground amongst tall reed-like vegetation near water. Habitat for the species includes the fringes of swamps, dams and nearby marshy areas with cover of grasses, lignum, low scrub or open timber.	Nil	No suitable habitat within the Subject Site. No records within the locality. **Not recorded during site assessment.**
Sternula albifrons **Little Tern**	E1,P	C,J,K	1	Migrating from eastern Asia, the Little Tern is found on the north, east and south-east Australian coasts, from Shark Bay in Western Australia to the Gulf of St Vincent in South Australia. In NSW, it arrives from September to November, occurring mainly north of Sydney, with smaller numbers found south to Victoria. It breeds in spring and summer along the entire east coast from Tasmania to northern Queensland, and is seen until May, with only occasional birds seen in winter months. Almost exclusively coastal, preferring sheltered environments; however may occur several kilometres from the sea in harbours, inlets and rivers (with occasional offshore islands or coral cay records).	Nil	No suitable habitat within the Subject Site. No records within the locality. **Not recorded during site assessment.**
Stictonetta naevosa	V,P		14	The Freckled Duck is found primarily in south-eastern and south-western Australia, occurring as a vagrant elsewhere. It breeds in large temporary swamps created by floods in the Bulloo and Lake Eyre basins and the Murray-Darling system, particularly along the Paroo and Lachlan Rivers, and other rivers within the Riverina. The duck is forced to disperse during extensive	Nil	No suitable habitat within the Subject Site. No records within the locality.

Species	Status		Bionet Records	Habitat	LoO	Summary
	BC	EPBC				
Freckled Duck				inland droughts when wetlands in the Murray River basin provide important habitat. The species may also occur as far as coastal NSW and Victoria during such times. Prefer permanent freshwater swamps and creeks with heavy growth of Cumbungi, Lignum or Tea-tree. During drier times they move from ephemeral breeding swamps to more permanent waters such as lakes, reservoirs, farm dams and sewage ponds.		**Not recorded during site assessment.**
Tyto novaehollandiae	V,P,3	-	2	Occurs across NSW except NW corner. Most common on the coast. Inhabits dry eucalypt woodlands from sea level to 1100 m. Roosts and breeds in large (>40cm) hollows and sometime caves in moist eucalypt forested gullies. Hunts along the edges of forests and roadsides. Home range between 500 ha and 1000 ha. Prey mostly terrestrial mammals but arboreal species may also be taken.	Low	Broadly suitable foraging habitat within the Subject Site. Few records within the locality.
Masked Owl						**Not recorded during site assessment.**
Tyto tenebricosa	V,P,3	-	1	Occurs in the coastal, escarpment and tablelands regions of NSW. More common in the north and absent from the western tablelands and further west. Inhabits tall, moist eucalypt forests and rainforests, and are strongly associated with sheltered gullies, particularly those with tall rainforest understorey. Roosts in tree hollows, amongst dense foliage in gullies or in caves, recesses or ledges of cliffs or banks. Nest in large (>40cm wide, 100cm deep) tree hollows in unlogged/unburnt gullies within 100m of streams or in caves.	Nil	No suitable habitat within Subject Site.
Sooty Owl						**Not recorded during site assessment.**
Chalinolobus dwyeri	V,P	V	2	The species occurs from the coast to the western slopes of the divide. The largest numbers of records are from sandstone escarpment country in the Sydney Basin and Hunter Valley. The species roosts in caves and mines and	**Present**	Suitable foraging habitat present. No breeding habitat

Species	Status		Bionet Records	Habitat	LoO	Summary
	BC	EPBC				
Large-eared Pied Bat				most commonly recorded from dry sclerophyll forests and woodlands. In southern Sydney appears to be largely restricted to the interface between sandstone escarpments and fertile valleys.		**Recorded during site assessment (Anabat)**
Falsistrellus tasmaniensis **Eastern False Pipistrelle**	V,P	-	17	The species occurs on southeast coast and ranges. Prefers tall (>20m) and wet forest with dense understorey. Absent from small remnants, preferring continuous forest but can move through cleared landscapes and may forage in open areas. Roosts include hollow trunks of Eucalypts, underneath bark or in buildings. Forages in gaps and spaces within forest, with large foraging range (12km foraging movements recorded).	Low	Foraging habitat only. No breeding habitat. **Not recorded during site assessment.**
Micronomus norfolkensis **Eastern Coastal Free-tailed Bat**	V,P	-	29	The Eastern Freetail-bat is found along the east coast from south Queensland to southern NSW. Occur in dry sclerophyll forest, woodland, swamp forests and mangrove forests east of the Great Dividing Range. Roost maily in tree hollows but will also roost under bark or in man-made structures.	**Present**	Suitable foraging habitat present. No breeding habitat **Recorded during site assessment (Anabat)**
Miniopterus australis **Little Bent-winged Bat**	V,P	-	60	East coast and ranges of Australia from Cape York in Queensland to Wollongong in NSW. Moist eucalypt forest, rainforest, vine thicket, wet and dry sclerophyll forest, Melaleuca swamps, dense coastal forests and banksia scrub. Generally found in well-timbered areas. Little Bentwing-bats roost in caves, tunnels, tree hollows, abandoned mines, stormwater drains, culverts, bridges and sometimes buildings during the day, and at night forage for small insects beneath the canopy of densely vegetated habitats.	**Present**	Suitable foraging habitat present. No breeding habitat **Recorded during site assessment (Anabat)**
Miniopterus orianae oceanensis	V,P	-	35	Eastern Bentwing-bats occur along the east and north-west coasts of Australia. Caves are the primary roosting habitat, but also use derelict mines, storm-water tunnels, buildings and other man-made structures.	**Moderate**	Foraging habitat only. No breeding habitat.

Species	Status		Bionet Records	Habitat	LoO	Summary
	BC	EPBC				
Large Bent-winged Bat						**Not recorded during site assessment.**
Myotis macropus **Southern Myotis**	V,P	-	24	The Southern Myotis is found in the coastal band from the north-west of Australia, across the top-end and south to western Victoria. It is rarely found more than 100 km inland, except along major rivers. Generally roost in groups of 10 - 15 close to water in caves, mine shafts, hollow-bearing trees, storm water channels, buildings, under bridges and in dense foliage. Forage over streams and pools catching insects and small fish by raking their feet across the water surface.	**Present**	Suitable habitat present. **Recorded during site assessment (Anabat).**
Petaurus norfolcensis **Squirrel Glider**	V,P	0	17	The species is widely though sparsely distributed in eastern Australia, from northern Queensland to western Victoria. Inhabits mature or old growth Box, Box-Ironbark woodlands and River Red Gum forest west of the Great Dividing Range and Blackbutt-Bloodwood forest with heath understorey in coastal areas. Prefers mixed species stands with a shrub or Acacia midstorey.	**Present**	Suitable habitat present. **Recorded during site assessment (Remote Camera).**
Phascolarctos cinereus **Koala**	E2,V,P	V	2	Fragmented distribution throughout eastern Australia from north-east Queensland to the Eyre Peninsula in South Australia. In NSW it mainly occurs on the central and north coasts with some populations in the west of the Great Dividing Range. Inhabit eucalypt woodlands and forests feeding on the foliage of more than 70 eucalypt species and 30 non-eucalypt species, but in any one area will select preferred browse species.	Low	Broadly suitable habitat within the Subject Site. Few records within the locality. **Not recorded during site assessment.**
Pteropus poliocephalus **Grey-headed Flying-fox**	V,P	V	70	Generally this species is found within 200 km of the eastern coast of Australia, from Rockhampton in Queensland to Adelaide in South Australia. Inhabit subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops. Roosting camps are generally located within 20 km of a regular food source and are commonly found in gullies, close to water, in vegetation with a dense canopy.	**Moderate**	Broadly suitable foraging habitat within the Subject Site. No roosts present. **Not recorded during site assessment.**
Saccolaimus flaviventris **Yellow-bellied Sheathtail-bat**	V,P	-	4	Migrates from tropics to SE Aus in summer. Forages across a range of habitats including those with and without trees, from wet and dry sclerophyll forest, open woodland, Acacia shrubland, mallee, grasslands and desert. Seasonal movements are unknown.	Low	Foraging habitat only. No breeding habitat. **Not recorded during site assessment.**

Species	Status		Bionet Records	Habitat	LoO	Summary
	BC	EPBC				
Scoteanax rueppellii **Greater Broad-nosed Bat**	V,P	-	13	The species is found mainly in the gullies and river systems that drain the Great Dividing Range, from north-eastern Victoria to the Atherton Tableland. It extends to the coast over much of its range. In NSW it is widespread on the New England Tablelands, however does not occur at altitudes above 500 m. Inhabits a variety of habitats from woodland to wet and dry sclerophyll forests and rainforest, also remnant paddock trees and timber-lined creeks.	Low	Foraging habitat only. No breeding habitat. **Not recorded during site assessment.**
Vespadelus troughtoni **Eastern Cave Bat**	V,P	-	11	Very little is known about the biology of this uncommon species. A cave-roosting species that is usually found in dry open forest and woodland, near cliffs or rocky overhangs; has been recorded roosting in disused mine workings, occasionally in colonies of up to 500 individuals. Occasionally found along cliff-lines in wet eucalypt forest and rainforest.	Low	Broadly suitable foraging habitat within the Subject Site. One record within the locality. **Not recorded during site assessment.**
Litoria aurea **Green and Golden Bell Frog**	E1,P	V	4	Large populations in NSW are located around the metropolitan areas of Sydney, Shoalhaven and mid north coast (one an island population). There is only one known population on the NSW Southern Tablelands. Inhabits marshes, dams and stream-sides, particularly those containing bullrushes (*Typha* spp.) or spikerushes (*Eleocharis* spp.). Optimum habitat includes water-bodies that are unshaded, free of predatory fish such as Plague Minnow (*Gambusia holbrooki*), have a grassy area nearby and diurnal sheltering sites available.	Low	No suitable habitat within the Subject Site. No records within the locality. **Not recorded during site assessment.**
Caretta caretta **Loggerhead Turtle**	E1,P	E	1	Large sea turtle to 1.5 m in length with an elongated heart-shaped shell. The species is found in tropical and temperate waters off the Australian coast.	Nil	No suitable habitat within the Subject Site. No records within the locality. **Not recorded during site assessment.**

Appendix B – Predicted and Candidate Species Reports

BAM Predicted Species Report

Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00030538/BAAS18041/22/00030542	442 Louth Park Road	14/10/2022
Assessor Name	Report Created	BAM Data version *
Gilbert Whyte	17/10/2022	55
Assessor Number	Assessment Type	BAM Case Status
BAAS18041	Part 4 Developments (General)	Open
Assessment Revision	BOS entry trigger	Date Finalised
0	BOS Threshold: Area clearing threshold	To be finalised

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

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

Common Name	Scientific Name	Vegetation Types(s)
Barking Owl	Ninox connivens	1598-Forest Red Gum grassy open forest on floodplains of the lower Hunter
		1600-Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter
Black Falcon	Falco subniger	1598-Forest Red Gum grassy open forest on floodplains of the lower Hunter
Black-chinned Honeyeater (eastern subspecies)	Melithreptus gularis gularis	1600-Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter
Brown Treecreeper (eastern subspecies)	Climacteris picumnus victoriae	1598-Forest Red Gum grassy open forest on floodplains of the lower Hunter
		1600-Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter
Diamond Firetail	Stagonopleura guttata	1600-Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter
Eastern Coastal Free-tailed Bat	Micronomus norfolkensis	1600-Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter
Eastern False Pipistrelle	Falsistrellus tasmaniensis	1600-Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter

Gang-gang Cockatoo	Callocephalon fimbriatum	1600-Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter
Glossy Black-Cockatoo	Calyptorhynchus lathami	1600-Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter
Greater Broad-nosed Bat	Scoteanax rueppellii	1600-Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter
Grey-crowned Babbler (eastern subspecies)	Pomatostomus temporalis temporalis	1600-Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter
Grey-headed Flying-fox	Pteropus poliocephalus	1600-Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter
Hooded Robin (south-eastern form)	Melanodryas cucullata cucullata	1598-Forest Red Gum grassy open forest on floodplains of the lower Hunter
		1600-Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter
Large Bent-winged Bat	Miniopterus orianae oceanensis	1600-Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter
Little Bent-winged Bat	Miniopterus australis	1600-Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter
Little Eagle	Hieraaetus morphnoides	1600-Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter
Little Lorikeet	Glossopsitta pusilla	1598-Forest Red Gum grassy open forest on floodplains of the lower Hunter
		1600-Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter
Masked Owl	Tyto novaehollandiae	1600-Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter
Powerful Owl	Ninox strenua	1600-Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter
Regent Honeyeater	Anthochaera phrygia	1600-Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter
Scarlet Robin	Petroica boodang	1598-Forest Red Gum grassy open forest on floodplains of the lower Hunter
		1600-Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter
Speckled Warbler	Chthonicola sagittata	1598-Forest Red Gum grassy open forest on floodplains of the lower Hunter
		1600-Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter

Spotted-tailed Quoll	Dasyurus maculatus	1598-Forest Red Gum grassy open forest on floodplains of the lower Hunter
		1600-Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter
Square-tailed Kite	Lophoictinia isura	1600-Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter
Swift Parrot	Lathamus discolor	1600-Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter
Turquoise Parrot	Neophema pulchella	1600-Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter
Varied Sittella	Daphoenositta chrysoptera	1598-Forest Red Gum grassy open forest on floodplains of the lower Hunter
		1600-Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter
White-bellied Sea-Eagle	Haliaeetus leucogaster	1598-Forest Red Gum grassy open forest on floodplains of the lower Hunter
		1600-Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter
White-throated Needletail	Hirundapus caudacutus	1598-Forest Red Gum grassy open forest on floodplains of the lower Hunter
		1600-Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter
Yellow-bellied Glider	Petaurus australis	1600-Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter
Yellow-bellied Sheathtail-bat	Saccolaimus flaviventris	1600-Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter

Threatened species Manually Added

None added

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

Common Name	Scientific Name	Plant Community Type(s)
Painted Honeyeater	Grantiella picta	1600-Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter

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

Refer to BAR for detailed justification

Common Name	Scientific Name	Justification in the BAM-C
Painted Honeyeater	Grantiella picta	Refer to BAR

BAM Candidate Species Report

Proposal Details

Assessment Id 00030538/BAAS18041/22/00030542	Proposal Name 442 Louth Park Road	BAM data last updated * 14/10/2022
Assessor Name Gilbert Whyte	Report Created 17/10/2022	BAM Data version * 55
Assessor Number BAAS18041	Assessment Type Part 4 Developments (General)	BAM Case Status Open
Assessment Revision 0	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.

List of Species Requiring Survey

Name	Presence	Survey Months
Acacia bynoeana Bynoe's Wattle	No (surveyed)	☑ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☑ Aug ☐ Sep ☑ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Burhinus grallarius Bush Stone-curlew	No (surveyed)	☑ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☑ Aug ☐ Sep ☑ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Callistemon linearifolius Netted Bottle Brush	No (surveyed)	☑ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☑ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?

Callocephalon fimbriatum Gang-gang Cockatoo	No (surveyed)	☑ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Calyptorhynchus lathami Glossy Black-Cockatoo	No (surveyed)	☐ Jan ☐ Feb ☑ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Cercartetus nanus Eastern Pygmy-possum	No (surveyed)	☐ Jan ☐ Feb ☑ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Cynanchum elegans White-flowered Wax Plant	No (surveyed)	☑ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☑ Aug ☐ Sep ☑ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Delma impar Striped Legless Lizard	No (surveyed)	☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☑ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Diuris praecox Rough Doubletail	No (surveyed)	☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☑ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?

Diuris tricolor Pine Donkey Orchid	No (surveyed) *Survey months are outside of the months specified in Bionet.	☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☑ Oct ☐ Nov ☐ Dec ☑ Survey month outside the specified months?
Eucalyptus castrensis Singleton Mallee	No (surveyed)	☑ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☑ Aug ☐ Sep ☑ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Eucalyptus glaucina Slaty Red Gum	No (surveyed)	☑ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☑ Aug ☐ Sep ☑ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Eucalyptus parramattensis subsp. decadens Eucalyptus parramattensis subsp. decadens	No (surveyed)	☑ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☑ Aug ☐ Sep ☑ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Eucalyptus pumila Pokolbin Mallee	No (surveyed)	☑ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☑ Aug ☐ Sep ☑ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Grevillea parviflora subsp. parviflora Small-flower Grevillea	No (surveyed) *Survey months are outside of the months specified in Bionet.	☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☑ Aug ☐ Sep ☑ Oct ☐ Nov ☐ Dec ☑ Survey month outside the specified months?

Haliaeetus leucogaster White-bellied Sea-Eagle	No (surveyed)	☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☑ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Hieraaetus morphnoides Little Eagle	No (surveyed)	☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☑ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Litoria aurea Green and Golden Bell Frog	No (surveyed)	☐ Jan ☐ Feb ☑ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Litoria brevipalmata Green-thighed Frog	No (surveyed)	☐ Jan ☐ Feb ☑ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Monotaxis macrophylla Large-leafed Monotaxis	No (surveyed)	☑ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☑ Aug ☐ Sep ☑ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Myotis macropus Southern Myotis	Yes (surveyed)	☐ Jan ☐ Feb ☑ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?

Ozothamnus tesselatus Ozothamnus tesselatus	No (surveyed) *Survey months are outside of the months specified in Bionet.	☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☑ Oct ☐ Nov ☐ Dec ☑ Survey month outside the specified months?
Petauroides volans Greater Glider	No (surveyed)	☐ Jan ☐ Feb ☑ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Petaurus norfolcensis Squirrel Glider	Yes (surveyed)	☐ Jan ☐ Feb ☑ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Phascogale tapoatafa Brush-tailed Phascogale	No (surveyed)	☐ Jan ☐ Feb ☑ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Phascolarctos cinereus Koala	No (surveyed)	☑ Jan ☐ Feb ☑ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Pomaderris queenslandica Scant Pomaderris	No (surveyed)	☑ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☑ Aug ☐ Sep ☑ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?

Prostanthera cineolifera Singleton Mint Bush	No (surveyed) *Survey months are outside of the months specified in Bionet.	☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☑ Oct ☐ Nov ☐ Dec ☑ Survey month outside the specified months?
Pterostylis chaetophora Pterostylis chaetophora	No (surveyed) *Survey months are outside of the months specified in Bionet.	☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☑ Oct ☐ Nov ☐ Dec ☑ Survey month outside the specified months?
Rutidosis heterogama Heath Wrinklewort	No (surveyed)	☑ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☑ Aug ☐ Sep ☑ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?

Threatened species Manually Added

Common Name	Scientific Name
Squirrel Glider	Petaurus norfolcensis

Threatened species assessed as not on site

Refer to BAR for detailed justification

Common name	Scientific name	Justification in the BAM-C
Austral Toadflax	Thesium australe	Habitat degraded Species is vagrant
Barking Owl	Ninox connivens	Habitat constraints
Brush-tailed Rock-wallaby	Petrogale penicillata	Habitat constraints
Common Planigale	Planigale maculata	Species is vagrant
Eastern Cave Bat	Vespadelus troughtoni	Habitat constraints
Grey-headed Flying-fox	Pteropus poliocephalus	Habitat constraints
Large Bent-winged Bat	Miniopterus orianae oceanensis	Habitat constraints
Large-eared Pied Bat	Chalinolobus dwyeri	Habitat constraints

Leafless Tongue Orchid	Cryptostylis hunteriana	Species is vagrant
Little Bent-winged Bat	Miniopterus australis	Habitat constraints
Masked Owl	Tyto novaehollandiae	Habitat constraints
North Rothbury Persoonia	Persoonia pauciflora	Refer to BAR
Pale-headed Snake	Hoplocephalus bitorquatus	Species is vagrant
Pink-tailed Legless Lizard	Aprasia parapulchella	Geographic limitations
Powerful Owl	Ninox strenua	Habitat constraints
Regent Honeyeater	Anthochaera phrygia	Refer to BAR
Square-tailed Kite	Lophoictinia isura	Habitat constraints
Swift Parrot	Lathamus discolor	Refer to BAR

Appendix C – Biodiversity Credit Reports

BAM Biodiversity Credit Report (Like for like)

Proposal Details

Assessment Id
00030538/BAAS18041/22/00030542

Proposal Name
442 Louth Park Road

BAM data last updated *
14/10/2022

Assessor Name
Gilbert Whyte

Assessor Number
BAAS18041

BAM Data version *
55

Proponent Names

Report Created
17/10/2022

BAM Case Status
Open

Assessment Revision
0

Assessment Type
Part 4 Developments (General)

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

None added

PCTs With Customized Benchmarks

PCT
No Changes

Predicted Threatened Species Not On Site

Name
Grantiella picta / Painted Honeyeater

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

BAM Biodiversity Credit Report (Like for like)

Name of Plant Community Type/ID	Name of threatened ecological community	Area of impact	HBT Cr	No HBT Cr	Total credits to be retired
1598-Forest Red Gum grassy open forest on floodplains of the lower Hunter	Hunter Lowland Redgum Forest in the Sydney Basin and New South Wales North Coast Bioregions	0.4	0	11	11
1600-Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter	Not a TEC	3.1	0	0	0
1600-Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter	Lower Hunter Spotted Gum Ironbark Forest in the Sydney Basin and NSW North Coast Bioregions	4.0	0	133	133

1598-Forest Red Gum grassy open forest on floodplains of the lower Hunter

Like-for-like credit retirement options

Name of offset trading group	Trading group	Zone	HBT	Credits	IBRA region
Hunter Lowland Redgum Forest in the Sydney Basin and New South Wales North Coast Bioregions This includes PCT's: 1591, 1598, 1603, 1605, 1691, 1692, 1749	-	1598_Mod	No	11	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.

1598-Forest Red Gum grassy open forest on floodplains of the lower Hunter

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

Like-for-like credit retirement options

Class	Trading group	Zone	HBT	Credits	IBRA region
Hunter-Macleay Dry Sclerophyll Forests This includes PCT's: 1178, 1589, 1600, 1601	Hunter-Macleay Dry Sclerophyll Forests >=70% and <90%	1600_Low	No	0	Hunter, Ellerston, Karuah Manning, Kerrabee, Liverpool Range, Peel, Tomalla, Upper Hunter, Wyong and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

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

Like-for-like credit retirement options

Name of offset trading group	Trading group	Zone	HBT	Credits	IBRA region

	Lower Hunter Spotted Gum Ironbark Forest in the Sydney Basin and NSW North Coast Bioregions This includes PCT's: 1590, 1592, 1593, 1600, 1602	-	1600_Mod	No	133	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.

Species Credit Summary

Species	Vegetation Zone/s	Area / Count	Credits
Myotis macropus / Southern Myotis	**1598_Mod, 1600_Low, 1600_Mod**	2.8	61.00
Petaurus norfolcensis / Squirrel Glider	**1598_Mod, 1600_Mod**	4.4	144.00

Credit Retirement Options

Like-for-like credit retirement options

	Spp	IBRA subregion
Myotis macropus / Southern Myotis	**Myotis macropus /** Southern Myotis	Any in NSW

Petaurus norfolcensis / Squirrel Glider	Spp	IBRA subregion
	Petaurus norfolcensis / Squirrel Glider	Any in NSW

BAM Credit Summary Report

Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00030538/BAAS18041/22/00030542	442 Louth Park Road	14/10/2022
Assessor Name	Report Created	BAM Data version *
Gilbert Whyte	17/10/2022	55
Assessor Number	BAM Case Status	Date Finalised
BAAS18041	Open	To be finalised
Assessment Revision	Assessment Type	BOS entry trigger
0	Part 4 Developments (General)	BOS Threshold: Area clearing threshold

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

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

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

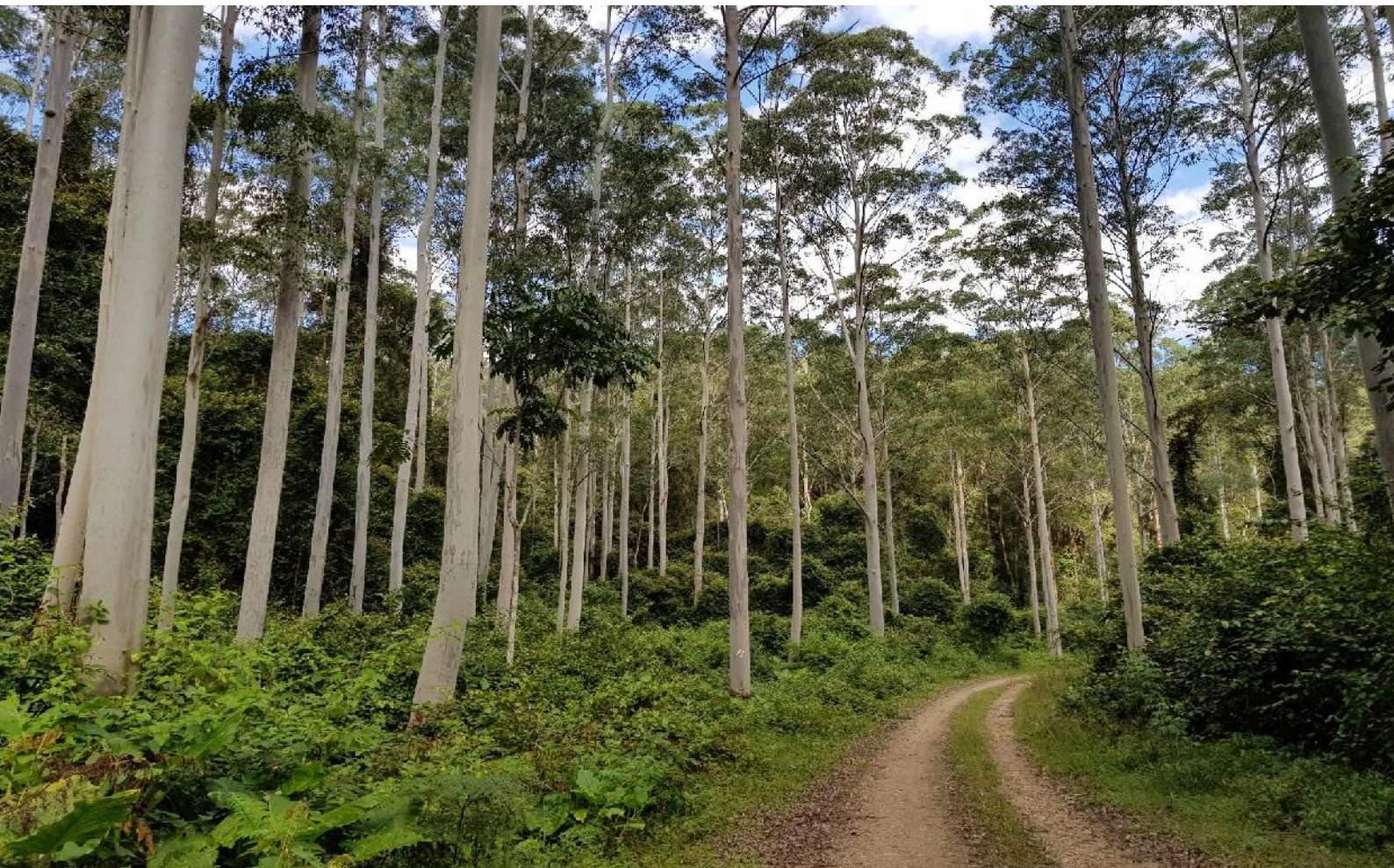
Forest Red Gum grassy open forest on floodplains of the lower Hunter												
1	1598_Mod	Hunter Lowland Redgum Forest in the Sydney Basin and New South Wales North Coast Bioregions	62.1	62.1	0.37	PCT Cleared - 0%	High Sensitivity to Gain	Endangered Ecological Community	Not Listed	2.00		11
											Subtotal	**11**
Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter												
2	1600_Low	Not a TEC	11.9	11.9	3.1	PCT Cleared - 71%	High Sensitivity to Gain			2.00		0
											Subtotal	**0**

Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter												
3	1600_Mod	Lower Hunter Spotted Gum Ironbark Forest in the Sydney Basin and NSW North Coast Bioregions	65.8	65.8	4	PCT Cleared - 71%	High Sensitivity to Gain	Endangered Ecological Community	Not Listed	2.00		133
											Subtotal	**133**
											Total	**144**

Species credits for threatened species

Vegetation zone name	Habitat condition (Vegetation Integrity)	Change in habitat condition	Area (ha)/Count (no. individuals)	Sensitivity to loss (Justification)	Sensitivity to gain (Justification)	BC Act Listing status	EPBC Act listing status	Potential SAII	Species credits
Myotis macropus / Southern Myotis (Fauna)									
1598_Mod	62.1	62.1	0.37			Vulnerable	Not Listed	False	11
1600_Low	11.9	11.9	1.1			Vulnerable	Not Listed	False	6
1600_Mod	65.8	65.8	1.3			Vulnerable	Not Listed	False	44
								Subtotal	**61**
Petaurus norfolcensis / Squirrel Glider (Fauna)									
1598_Mod	62.1	62.1	0.37			Vulnerable	Not Listed	False	11
1600_Mod	65.8	65.8	4			Vulnerable	Not Listed	False	133
								Subtotal	**144**

Appendix D – BAM Plot Datasheets



BAM Site – Field Survey Form

Site Sheet no:

		Survey Name	Zone ID	Recorders			
Date	31 01 22	LOUTH PARK	1	GILBERT WHYTE			
Zone	Datum	Plot ID	Q01	Plot dimensions	400 m^2	Photo #	✓
Easting	Northing	IBRA region	SYD BASIN	Midline bearing from 0 m	012°		
364146	6372039						
Vegetation Class		HUNTER MACLEAY DSF				Confidence: H M L	
Plant Community Type		1600_mod		EEC: Y		Confidence: H M L	

Record easting and northing at 0 m on midline. Dimensions (Shape) of 0.04 ha base plot.

BAM Attribute (400 m^2 plot)		Sum values
Count of Native Richness	Trees	3
	Shrubs	4
	Grasses etc.	11
	Forbs	9
	Ferns	1
	Other	2
Sum of Cover of native vascular plants by growth form group	Trees	32
	Shrubs	6.7
	Grasses etc.	50.4
	Forbs	2.8
	Ferns	0.2
	Other	1.1
High Threat Weed cover		0.7

BAM Attribute (1000 m^2 plot)		
DBH	# Tree Stems Count	# Stems with Hollows
80 + cm		
50 – 79 cm	11	
30 – 49 cm	✓	
20 – 29 cm	✓	
10 – 19 cm	✓	
5 – 9 cm	✓	
< 5 cm	✓	n/a
Length of logs (m) (≥10 cm diameter, >50 cm in length)	11M 111 – 8M.	

Counts apply when the **number of tree stems** within a size class is ≤ 10. Estimates can be used when > 10 (eg. 10, 20, 30..., 100, 200, 300...). For a **multi-stemmed tree** only the largest living stem is included in the count/estimate. **Tree stems must be living.**

For **hollows**, count only the presence of a stem containing hollows. For a **multi-stemmed tree**, only the largest stem is included in the count/estimate. **Stems may be dead and may be shrubs.**

BAM Attribute (1 x 1 m plots)	Litter cover (%)	Bare ground cover (%)	Cryptogam cover (%)	Rock cover (%)
Subplot score (% in each)	30 40 60 60 60	✓	✓	✓
Average of the 5 subplots	50			

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots centred at 5, 15, 25, 35, 45 m along the plot midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Assessors may also record the cover of rock, bare ground and cryptogams.

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

Morphological Type		Landform Element		Landform Pattern		Microrelief	
Lithology		Soil Surface Texture		Soil Colour		Soil Depth	
Slope		Aspect		Site Drainage		Distance to nearest water and type	

Plot Disturbance	Severity code	Age code	Observational evicence:
Clearing (inc. logging)			MODERATE CONDITION
Cultivation (inc. pasture)			- MATURE CANOPY
Soil erosion			- SPARSE SHRUB LAYER (REGEN)
Firewood / CWD removal			- LOW WOODY DEBRIS.
Grazing (identify native/stock)			
Fire damage			
Storm damage			
Weediness			
Other			

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

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

400 m² plot: Sheet _ of _	Survey Name	Plot Identifier	Recorders
Date 31 01 21	LOUTH PARK	Q01	GILBERT WHITE

GF Code	*Top 3 native species in each growth form group: Full species name mandatory* *All other native and exotic species: Full species name where practicable*	N, E or HTE	Cover	Abund	stratum	voucher
T	CORYMBIA MACULATA	N	25	10		
T	EUCALYPTUS PANICULATA	N	5	5		
S	CASSINIA ACULEATA	N	5	10		
S	ACACIA PARVIPINNULA	N	0.2	1		
S	DAVIESIA ULICIFOLIA	N	0.5	5		
G	PANICUM SIMILE	N	0.1	5		
G	ARISTIDA RAMOSA	N	2	100		
G	LOMANDRA FILIFORMIS	N	0.1	5		
G	ERAGROSTIS BROWNII	N	0.1	10		
G	CYMBOPOGON REFRACTUS	N	10	5000		
G	MICROLAENA STIPOIDES	N	10	5000		
G	LOMANDRA MULTIFLORA	N	1	20		
G	DICHELACHNE MICRANTHA	N	20	1000		
G	ECHINOPOGON CAESPITOSUS	N	2	100		
F	COMMELINA CYNEA	N	0.2	20		
F	CYANTHILLIUM CINEREA	N	0.2	10		
F	LOBELIA PURPURASCENS	N	0.5	20		
O	GLYCINE TABACINA	N	1	50		
F	DIANELLA REVOLUTA	N	0.2	5		
O	GLYCINE CLANDESTINA	N	0.1	5		
F	CHRYSOCEPHALUM APICULATUM	N	0.5	100		
E	CHEILANTHES SIEBERI	N	0.2	10		
G	THEMEDA AUSTRALIS	N	5	1000		
F	EINADIA HASTATA	N	0.1	10		
F	DICHONDRA REPENS	N	0.5	100		
—	SETARIA PARVIFLORA	E	2	1000		
—	PLANTAGO LANCEOLATA	E	2	500		
—	SIDA RHOMBIFOLIA	E	5	500		
—	HYPOCHAERIS RADICATA	E	2	100		
—	VERBENA BONARIENSIS	E	0.5	50		
—	SENECIO MADAGASCARIENSIS	HTW	0.1	5		
—	LANTANA CAMARA	HTW	0.5	1		
—	BIDENS PILOSA	HTW	0.1	2		
F	OXALIS PERRENANS	N	0.1	2		
G	FIMBRISTYLIS DICHOTOMA	N	0.1	2		
F	TRICORYNE SIMPLEX	N	0.1	5		
—	CYPERUS BRENIFOLIUS	N	0.1	1		
S	PITTOSPORUM UNDULATUM	N	1	1		
T	EUCALYPTUS CREBRA	N	2	1		
		N				

GF Code: see Growth Form definitions in Appendix 1 **N:** native, **E:** exotic, **HTE:** high threat exotic **GF – circle code** if 'top 3'.

Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover); ***Note:*** *0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m*

Abundance: 1, 2, 3, ..., 10, 20, 30, ... 100, 200, ..., 1000, ...

BAM Site – Field Survey Form

Site Sheet no:

Date	31 01 22	Survey Name	LOUTH PARK 2	Recorders	GILBERT WHYTE
Zone	Datum	Plot ID	Q02	Plot dimensions	400 m^2 Photo # ✓
Easting	Northing	IBRA region	SYD BASIN	Midline bearing from 0 m	183°
Vegetation Class		HUNTER MCLAEY (DRAINED GRASSLAND)			Confidence: H M L
Plant Community Type		1600_LOW		EEC: N	Confidence: H M L

Record easting and northing at 0 m on midline. Dimensions (Shape) of 0.04 ha base plot.

BAM Attribute (400 m^2 plot)		Sum values
Count of Native Richness	Trees	0
	Shrubs	0
	Grasses etc.	5
	Forbs	2
	Ferns	1
	Other	0
Sum of Cover of native vascular plants by growth form group	Trees	0
	Shrubs	0
	Grasses etc.	11.7
	Forbs	10.1
	Ferns	0.2
	Other	0
High Threat Weed cover		51

BAM Attribute (1000 m^2 plot)		
DBH	# Tree Stems Count	# Stems with Hollows
80 + cm	0	0
50 – 79 cm	0	0
30 – 49 cm	0	
20 – 29 cm	0	
10 – 19 cm	0	
5 – 9 cm	0	
< 5 cm	0	n/a
Length of logs (m) (≥10 cm diameter, >50 cm in length)	0	

Counts apply when the **number of tree stems** within a size class is ≤ 10. Estimates can be used when > 10 (eg. 10, 20, 30..., 100, 200, 300...). For a **multi-stemmed tree** only the largest living stem is included in the count/estimate. **Tree stems must be living.**

For **hollows**, count only the presence of a stem containing hollows. For a **multi-stemmed tree**, only the largest stem is included in the count/estimate. **Stems may be dead and may be shrubs.**

BAM Attribute (1 x 1 m plots)	Litter cover (%)					Bare ground cover (%)	Cryptogam cover (%)	Rock cover (%)
Subplot score (% in each)	2	2	2	2	2			
Average of the 5 subplots	2							

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots centred at 5, 15, 25, 35, 45 m along the plot midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Assessors may also record the cover of rock, bare ground and cryptogams.

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

Morphological Type		Landform Element		Landform Pattern		Microrelief	
Lithology		Soil Surface Texture		Soil Colour		Soil Depth	
Slope		Aspect		Site Drainage		Distance to nearest water and type	

Plot Disturbance	Severity code	Age code	Observational evidence:
Clearing (inc. logging)			CLEARED (MANAGED)
Cultivation (inc. pasture)			
Soil erosion			
Firewood / CWD removal			
Grazing (identify native/stock)			
Fire damage			
Storm damage			
Weediness			
Other			

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

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

400 m² plot: Sheet _ of _	Survey Name	Plot Identifier	Recorders
Date: 31 01 22	LOUTH PARK	Q02	GILBERT WHITE

GF Code	Top 3 native species in each growth form group: Full species name mandatory All other native and exotic species: Full species name where practicable	N, E or HTE	Cover	Abund	stratum	voucher
G	CYMBOPOGON REFRACTUS	N	10	1000		
G	BOTHRIOCHLOA MACRA	N	1	100		
F	HYPERICUM GRAMINEUM	N	0.1	5		
G	LOMANDRA MULTIFLORA	N	0.1	1		
G	CYNODON DACTYLON	N	0.5	200		
G	FIMBRISTYLIS DICHOTOMA	N	0.5	200		
F	CHEILANTHES SIEBERI	N	0.2	50		
F	CENTELLA ASIATICA	N	10	10,000		
—	SIDA RHOMBIFOLIA	E	2	1000		
—	SETARIA PARVIFLORA	E	5	10,000		
—	SENECIO MADAGASCARIENSIS	HTW	1	200		
—	ERAGROSTIS CILIANENSIS	E	20	10,000		
—	VERBENA BONARIENSIS	E	0.5	100		
—	AXONOPUS FISSIFOLIUS	HTW	50	100,000		
—	CONYZA BONARIENSIS	E	0.2	10		
—	HYPOCHAERIS RADICATA	E	1	200		
—	PLANTAGO LANCEOLATA	E	1	200		
—	CYPERUS BRENIFOLIUS	E	0.1	2		

GF Code: see Growth Form definitions in Appendix 1 **N**: native, **E**: exotic, **HTE**: high threat exotic **GF – circle code** if 'top 3'.

Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover); ***Note:*** *0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m*

Abundance: 1, 2, 3, ..., 10, 20, 30, ... 100, 200, ..., 1000, ...

BAM Site – Field Survey Form

Site Sheet no:

		Survey Name	Zone ID	Recorders			
Date	31 01 22	LOWTH PARK	3	GILBERT WHYTE			
Zone	Datum	Plot ID	Q03	Plot dimensions	400 m^2	Photo #	✓
56	GDA 94						
Easting	Northing	IBRA region	SYD BASIN	Midline bearing from 0 m	015°		
364130	6372219						

Vegetation Class	FORESTED WETLAND.		Confidence: (H) M L
Plant Community Type	1598 (HUNTER LOWLAND R)	EEC: Y	Confidence: (H) M L

Record easting and northing at 0 m on midline. Dimensions (Shape) of 0.04 ha base plot.

BAM Attribute (400 m^2 plot)		Sum values
Count of Native Richness	Trees	2
	Shrubs	4
	Grasses etc.	6
	Forbs	5
	Ferns	1
	Other	1
Sum of Cover of native vascular plants by growth form group	Trees	52
	Shrubs	3.2
	Grasses etc.	63.2
	Forbs	2
	Ferns	0.2
	Other	0.2
High Threat Weed cover		0.4

BAM Attribute (1000 m^2 plot)		
DBH	# Tree Stems Count	# Stems with Hollows
80 + cm		
50 – 79 cm		
30 – 49 cm	✓	
20 – 29 cm	✓	
10 – 19 cm	✓	
5 – 9 cm	✓	
< 5 cm	✓	n/a
Length of logs (m) (≥10 cm diameter, >50 cm in length)	0m	

Counts apply when the **number of tree stems** within a size class is ≤ 10. Estimates can be used when > 10 (eg. 10, 20, 30..., 100, 200, 300...). For a **multi-stemmed tree**, only the largest living stem is included in the count/estimate. **Tree stems must be living.**

For **hollows**, count only the presence of a stem containing hollows. For a **multi-stemmed tree**, only the largest stem is included in the count/estimate. **Stems may be dead and may be shrubs.**

BAM Attribute (1 x 1 m plots)	Litter cover (%)					Bare ground cover (%)	Cryptogam cover (%)	Rock cover (%)
Subplot score (% in each)	60	40	10	10	10	✓	✓	✓
Average of the 5 subplots	26							

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots centred at 5, 15, 25, 35, 45 m along the plot midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Assessors may also record the cover of rock, bare ground and cryptogams.

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

Morphological Type		Landform Element		Landform Pattern		Microrelief	
Lithology		Soil Surface Texture		Soil Colour		Soil Depth	
Slope		Aspect		Site Drainage		Distance to nearest water and type	

Plot Disturbance	Severity code	Age code	Observational evidence:
Clearing (inc. logging)			
Cultivation (inc. pasture)			SMALL DRAINAGE CHANNEL FLOWING
Soil erosion			NORTH INTO CONSTRUCTED DAM.
Firewood / CWD removal			
Grazing (identify native/stock)			LOW WOODY DEBRIS.
Fire damage			
Storm damage			
Weediness			
Other			

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

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

400 m² plot: Sheet _ of _	Survey Name	Plot Identifier	Recorders
Date 31 01 22	LOWTH PARK	Q03	GILBERT WHYTE

GF Code	Top 3 native species in each growth form group: Full species name mandatory All other native and exotic species: Full species name where practicable	N, E or HTE	Cover	Abund	stratum	voucher
T	EUCALYPTUS TERETICORNIS	N	50	20		
T	EUCALYPTUS MOLLUCANA	N	2	1		
S	ACACIA FALCATA	N	0.5	5		
S	PITTOSPORUM UNDULATUM	N	2	2		
S	OZOTHAMNUS DIOSMIFOLIUS	N	0.5	20		
S	BREYNIA OBLONGIFOLIA	N	0.2	1		
G	ENTOLASIA MARGINATA	N	0.2	50		
F	EINADIA HASTATA	N	0.1	1		
F	CYANTHILLIUM CINEREA	N	0.2	5		
F	LOBELIA PURPURASCENS	N	1	100		
F	WAHLENBERGIA GRACILIS	N	0.5	10		
G	DICHELACHNE MICRANTHA	N	10	1000		
G	CYMBOPOGON REFRACTUS	N	10	1000		
G	MICROLAENA STIPOIDES	N	40	10,000		
G	CYNODON DACTYLON	N	1	500		
G	ERAGROSTIS BROWNII	N	2	1000		
O	GLYCINE CLANDESTINA	N	0.2	10		
E	CHEILANTHES SIEBERI	N	0.2	10		
F	DICHONDRA REPENS	N	0.2	50		
	EXOTIC SPECIES					
—	JUNCUS EFFUSUS	E	0.1	1		
—	ERAGROSTIS CILIANENSIS	E	0.5	50		
—	PLANTAGO LANCOLATA	E	0.1	10		
—	HYPOCHAERIS RADICATA	E	0.2	20		
—	SENECIO MADAGASCARIENSIS	HTW	0.2	5		
—	BIDENS PILOSA	HTW	0.2	5		
—	CONYZA BONARIENSIS	E	1	20		

GF Code: see Growth Form definitions in Appendix 1 **N**: native, **E**: exotic, **HTE**: high threat exotic **GF – circle code** if 'top 3'.

Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover); ***Note:*** *0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m*

Abundance: 1, 2, 3, ..., 10, 20, 30, ... 100, 200, ..., 1000, ...

BAM Site – Field Survey Form

Site Sheet no:

		Survey Name	Zone ID	Recorders			
Date	31 01 22	LOUTH PRL	1600_2	GILBERT WHYTE			
Zone	Datum	Plot ID	Q04	Plot dimensions	400m²	Photo #	
56	GDA 94						
Easting	Northing	IBRA region	SVA BASIN	Midline bearing from 0 m	348°		
364206	6372258						
Vegetation Class		HUNTER MACLEAY DRF				Confidence: H M L	
Plant Community Type		1600 (LOW)		EEC: N		Confidence: H M L	

Record easting and northing at 0 m on midline. Dimensions (Shape) of 0.04 ha base plot.

BAM Attribute (400 m² plot)		Sum values
Count of Native Richness	Trees	1
	Shrubs	1
	Grasses etc.	5
	Forbs	2
	Ferns	0
	Other	0
Sum of Cover of native vascular plants by growth form group	Trees	2
	Shrubs	5
	Grasses etc.	28.1
	Forbs	1.5
	Ferns	0
	Other	0
High Threat Weed cover		2.5

BAM Attribute (1000 m² plot)		
DBH	# Tree Stems Count	# Stems with Hollows
80 + cm	0	0
50 – 79 cm	0	0
30 – 49 cm		
20 – 29 cm		
10 – 19 cm		
5 – 9 cm	✓	
< 5 cm	✓	n/a
Length of logs (m) (≥10 cm diameter, >50 cm in length)	7m	

Counts apply when the **number of tree stems** within a size class is ≤ 10. Estimates can be used when > 10 (eg. 10, 20, 30..., 100, 200, 300...). For a **multi-stemmed tree**, only the largest living stem is included in the count/estimate. **Tree stems must be living.**

For **hollows**, count only the presence of a stem containing hollows. For a **multi-stemmed tree**, only the largest stem is included in the count/estimate. **Stems may be dead and may be shrubs.**

BAM Attribute (1 x 1 m plots)	Litter cover (%)					Bare ground cover (%)	Cryptogam cover (%)	Rock cover (%)
Subplot score (% in each)	2	2	2	2	2	✓	✓	✓
Average of the 5 subplots	2							

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots centred at 5, 15, 25, 35, 45 m along the plot midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Assessors may also record the cover of rock, bare ground and cryptogams.

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

Morphological Type		Landform Element		Landform Pattern		Microrelief	
Lithology		Soil Surface Texture		Soil Colour		Soil Depth	
Slope		Aspect		Site Drainage		Distance to nearest water and type	

Plot Disturbance	Severity code	Age code	Observational evidence:
Clearing (inc. logging)			
Cultivation (inc. pasture)			CLEARED AREA. - MIX NATIVE/EXOTIC
Soil erosion			
Firewood / CWD removal			
Grazing (identify native/stock)			GROUNDCOVER.
Fire damage			
Storm damage			
Weediness			
Other			

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

Age: R=recent (<3yrs), NR=no: recent (3-10yrs), O=old (>10yrs)

400 m² plot: Sheet _ of _	Survey Name	Plot Identifier	Recorders
Date: 31 01 22	LOUTH PARK	QD04	GILBERT WHYTE

GF Code	Top 3 native species in each growth form group: Full species name mandatory All other native and exotic species: Full species name where practicable	N, E or HTE	Cover	Abund	stratum	voucher
T	EUC FIBROSA	N	2	2		
S	ACACIA DEALBATA	N	5	5		
G	CYMBOPOGON REFRACTUS	N	20	10,000		
G	SPOROBOLUS CREBER	N	2	500		
G	THEMEDA AUSTRALIS	N	5	1000		
F	TRICORYNE SIMPLEX	N	1	50		
F	COMMELINA CYANEA	N	0.5	20		
—	SIDA RHOMBIFOLIA	E	0.2	5		
—	GAMOCHAETA AMERICANA	E	0.2	10		
—	ERAGROSTIS CILIANENSIS	E	30	100,000		
—	SETARIA PARVIFLORA	E	5	1000		
—	COMPHRENA CELOSIOIDES	E	0.2	5		
—	SENECIO MADAGASCARIENSIS	HTW	0.5	20		
—	CONYZA BONARIENSIS	E	0.5	20		
—	PLANTAGO LANCEOLATA	E	1	50		
—	DICHELACHNE CRINITA	E	0.1	5		
—	AXONOPUS FISSIFOLIUS	HTW	2	50		
G	CYNODON DACTYLON	N	1	50		

GF Code: see Growth Form definitions in Appendix 1 **N**: native, **E**: exotic, **HTE**: high threat exotic **GF – circle code** if 'top 3'.

Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover); ***Note:*** *0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m*

Abundance: 1, 2, 3, ..., 10, 20, 30, ... 100, 200, ..., 1000, ...

BAM Site – Field Survey Form

Site Sheet no:

		Survey Name	Zone ID	Recorders			
Date	31 01 22	LOWTH PARK	Q05	GILBERT WHYTE			
Zone: 56	Datum: GDA 94	Plot ID	Q05	Plot dimensions	400m²	Photo #	✓
Easting: 364263	Northing: 6372158	IBRA region	SYD BASIN	Midline bearing from 0 m	242°		
Vegetation Class		HUNTER MACLEAY DSF				Confidence: H M L	
Plant Community Type		1600 - (NOD)		EEC: Y		Confidence: H M L	

Record easting and northing at 0 m on midline. Dimensions (Shape) of 0.04 ha base plot.

BAM Attribute (400 m² plot)		Sum values
Count of Native Richness	Trees	2
	Shrubs	5
	Grasses etc.	8
	Forbs	7
	Ferns	1
	Other	3
Sum of Cover of native vascular plants by growth form group	Trees	30
	Shrubs	6.2
	Grasses etc.	38.3
	Forbs	6.2
	Ferns	0.2
	Other	1.2
High Threat Weed cover		1

BAM Attribute (1000 m² plot)		
DBH	# Tree Stems Count	# Stems with Hollows
80 + cm		
50 – 79 cm	1	
30 – 49 cm	✓	
20 – 29 cm	✓	
10 – 19 cm	✓	
5 – 9 cm	✓	
< 5 cm	✓	n/a
Length of logs (m) (≥10 cm diameter, >50 cm in length)	5m. + 10 + 20 - 35m.	

Counts apply when the **number of tree stems** within a size class is ≤ 10. Estimates can be used when > 10 (eg. 10, 20, 30 ..., 100, 200, 300...). For a **multi-stemmed tree**, only the largest living stem is included in the count/estimate. **Tree stems must be living.**

For **hollows**, count only the presence of a stem containing hollows. For a **multi-stemmed tree**, only the largest stem is included in the count/estimate. **Stems may be dead and may be shrubs.**

BAM Attribute (1 x 1 m plots)	Litter cover (%)	Bare ground cover (%)	Cryptogam cover (%)	Rock cover (%)
Subplot score (% in each)	5 5 5 20 20			
Average of the 5 subplots	11			

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots centred at 5, 15, 25, 35, 45 m along the plot midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Assessors may also record the cover of rock, bare ground and cryptogams.

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

Morphological Type		Landform Element		Landform Pattern		Microrelief	
Lithology		Soil Surface Texture		Soil Colour		Soil Depth	
Slope		Aspect		Site Drainage		Distance to nearest water and type	

Plot Disturbance	Severity code	Age code	Observational evidence:
Clearing (inc. logging)			
Cultivation (inc. pasture)			LOW-LYING - DENSE GRASS COVER
Soil erosion			
Firewood / CWD removal			
Grazing (identify native/stock)			
Fire damage			
Storm damage			
Weediness			
Other			

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

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

400 m² plot: Sheet _ of _	Survey Name	Plot Identifier	Recorders
Date: 31 01 22	LOUTH PARK	Q05	GILBERT WHYTE

GF Code	Top 3 native species in each growth form group: Full species name mandatory All other native and exotic species: Full species name where practicable	N, E or HTE	Cover	Abund	stratum	voucher
T	CORYMBIA MACULATA	N	10	1		
T	EUCALYPTUS ACMENOIDES	N	20	3		
S	ACACIA DEALBATA	N	2	5		
S	PITTOSPORUM UNDULATUM	N	2	2		
S	CASSINIA ACULEATA	N	2	5		
G	LOMANDRA MULTIFLORA	N	0.2	2		
S	BREYNIA OBLONGIFOLIA	N	0.1	1		
O	GLYCINE TABACINA	N	0.2	10		
G	ECHINOPOGON CAESPITOSUS	N	0.5	20		
F	TRICORYNE SIMPLEX	N	0.2	10		
G	MICROLAENA STIPOIDES	N	30	100,000		
G	CYMBOPOGON REFRACTUS	N	5	1000		
F	CHRYSOCEPHALUM APICULATUM	N	0.5	100		
F	LOBELIA PURPURASCENS	N	0.5	50		
F	COMMELINA CYNEA	N	2	1000		
F	DICHONDRA REPENS	N	2	1000		
F	SOLANUM PRINOPHYLLUM	N	0.5	2		
F	CHEILANTHES SIEBERI	N	0.2	10		
O	GLYCINE CLANDESTINA	N	0.5	50		
O	PANDOREA PANDORANA	N	0.5	10		
—	BIDENS PILOSA	HTN	0.1	5		
—	SENECIO MADAGASCARIENSIS	HTN	0.2	10		
—	LANTANA CAMARA	HTN	0.2	1		
G	CYNODON DACTYLON	N	0.2	50		
G	CAREX INVERSA	N	0.2	50		
S	LISSANTHE STRIGOSA	N	0.1	1		
G	THEMEDA AUSTRALIS	N	2	10		
—	HYPOCHAERIS RADICATA	E	0.5	20		
—	WATSONIA MERIANA	E	0.1	1		
—	SETARIA PARVIFLORA	E	0.5	20		
—	CONYZA SUMATRIENSIS E	E	0.1	1		
—	PLANTAGO LANCEOLATA	E	0.5	50		
—	ERHARTA ERECTA HTW	HTW	0.5	0.5	200	
—	CONYZA BONARIENSIS	E	0.2	5		
—	SIDA RHOMBIFOLIA	E	15	1,000		
	WAHLENBERGIA GRACILIS	N	0.5	10		
	FIMBRISTYLIS DICHOTOMA	N	0.2	50		

GF Code: see Growth Form definitions in Appendix 1 **N:** native, **E:** exotic, **HTE:** high threat exotic **GF – circle code** if 'top 3'.

Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover); ***Note:*** *0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m*

Abundance: 1, 2, 3, ..., 10, 20, 30, ... 100, 200, ..., 1000, ...

400 m² plot: Sheet _ of _	Survey Name	Plot Identifier	Recorders
Date: 31 01 22	LOUTH PARK -	N/A	GILBERT & HYDE

GF Code	Top 3 native species in each growth form group: Full species name mandatory All other native and exotic species: Full species name where practicable	N, E or HTE	Cover	Abund	stratum	voucher
	CORYMBIA MACULATA					
	EUCALYPTUS PANICULATA					
	BURSARIA SPINOSA					
	ACACIA PARVIPINNULA					
	CASSINIA ACULEATA					
	PITTOSPORUM UNDULATUM					
	DAVIESIA ULICIFOLIA					
	BREYNIA ORBONGIFOLIA					
	ACACIA ELONGATA					
	OZOTHAMNUS DIOSMIFOLIUS					
	DICHONDRA REPENS					
	MICROLAENA STIPOIDES					
	DICHELACHNE MICRANTHA					
	CYMBOPOGON REFRACTUS					
	FIMBRISTYLIS DICHOTOMA					
	ARISTIDA VAGANS					
	ECHINOPOGON CAESPITOSUM					
	LOMANDRA MULTIFLORA					
	PANICUM EFFUSUM					
	ENTOLASIA STRICTA					
	LOBELIA PURPURASCENS					
	SOLANUM PRINOPHYLLUM					
	COMMELINA CYANEA					
	GLYCINE TABACINA					
	GLYCINE CLANDESTINA					
	ARTHROPODIUM MILLIFLORUM					
	CHEILANTHES SIEBERI					
	THEMEDA AUSTRALIS					
	BIDENS PILOSA					
	LANTANA CAMARA					
	CONYZA SUMATRIENSIS					
	VERBENA BONARIENSIS					
	GOMPHOCARPUS FRUTICOSIS					
	SETARIA PARVIFLORA					
	SENECIO MADAGASCARIENSIS					
	CHLORIS GAYANA					
	CYNODON DACTYLON					
	PASPALUM DILATATUM					
	PLANTAGO LANCEOLATA					
	SIDA RHOMBIFOLIA					
	SENECIO VULGARIS					
	TARAXICUM OFFICINALE					
	WATSONIA MERIANA					
	BIDENS SUBALTERNANS					
	IMPERATA CYLINDRICA					
	NOTELAEA VENOSA					
	HARMSIORCHIA VIOLACEA					
	PANDOREA PANDORANA					
	EUCALYPTUS FIBROSA					
	OLEA EUROPEA CUSPIDATA					
	OPUNTIA AURANTIACA					
	INDIGOFERA AUSTRALIS					
	PARSONSIA STRAMINEA					
	ERAGROSTIS CILIANENSIS					
	DIANELLA REVOLUTA					
	SPOROBOLUS CREBER					
	GOODENIA ROTUNDIFOLIA					
	CYANTHILIUM CINEREA					
	LISSANTHE STRIGOSA					
	ACACIA FALCATA					
	CENTELLA ASIATICA					
	GAMOCHAETA AMERICANA					
	ACACIA LONGIFOLIA					
	CHRYSANTHEMOIDES MONILIFERA					
	EXOCARPUS CUPRESSIFORMIS					
	AXONOPUS FISSIFOLIUS					
	HYPERICUM GRAMINEUM					
	NEPHROLEPIS CORDIFOLIA					
	OCNA SERRULATA					
	CHRYSOCEPHALUM APICULATUM					
	OPUNTIA STRICTA.					
	PRUNUS SP.					
	ACACIA DEALBATA					
	ANGOPHORA BAKERI					
	EUCALYPTUS TERETICORNIS					
	ACACIA DECORA					
	ELEOCHARIS EQUISETINA					
	JUNCUS EFFUSUS					
	CASUARINA GLAUCA					
	EUCALYPTUS MOLUCCANA.					

GF Code: see Growth Form definitions in Appendix 1 **N**: native, **E**: exotic, **HTE**: high threat exotic **GF – circle code** if 'top 3'.

Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover); ***Note:*** *0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m*

Abundance: 1, 2, 3, ..., 10, 20, 30, ... 100, 200, ..., 1000, ...

400 m² plot: Sheet _ of _	Survey Name	Plot Identifier	Recorders
Date: 31 01 22	LOCH PARK ROAD		GILLESPIE WHYTE.

GF Code	Top 3 native species in each growth form group: Full species name mandatory All other native and exotic species: Full species name where practicable	N, E or HTE	Cover	Abund	stratum	voucher
	MELALEUCA QUINQUENERVIA					
	LEPTOSPERMUM POLYGALIFOLIUM					
	CALLISTEMON LINEARIS					
	ACACIA ULICIFOLIA					
	LUDWIGIA PEPLOIDES.					
	EUCALYPTUS LONGIFOLIA					
	CORYMBIA GUMMIFERA					
	EUCALYPTUS GRANDIS					
	PULTENAEA RETUSA					
	EUCALYPTUS CAPITELLATA					
	PELLAEA FALCATA					
	(SMILACEA) RHYTIDOSPERMA SP.					

GF Code: see Growth Form definitions in Appendix 1 **N**: native, **E**: exotic, **HTE**: high threat exotic **GF – circle code** if 'top 3'.

Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover); ***Note:*** *0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m*

Abundance: 1, 2, 3, ..., 10, 20, 30, ... 100, 200, ..., 1000, ...

HABITAT
ENVIRONMENTAL SERVICES

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