# ADDENDUM: SIGNIFICANT BIODIVERSITY ASSESSMENT REPORT

PLANS AND DOCUMENTS
referred to in the PDA
DEVELOPMENT APPROVAL

Approval no: DEV2023/1413

Date: 19 December 2024

Queensland Government

'Tarnbrae'
New Beith Pty Ltd

3 July 2024

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# CONTENTS

# 1 INTRODUCTION

The following report has been prepared for land described as New Beith Road, New Beith. Figure 1 shows a current aerial photograph of the 'Tarnbrae' development site.

The report has been prepared as an addendum to the Significant Biodiversity Assessment Report (Saunders-Havill Group, Issue C, 19 December 2022) (SBAR). The SBAR and the Addendum should be read together to provide a complete picture of the assessment of biodiversity values.

The Addendum has been prepared by Litoria Consulting on behalf of New Beith Pty Ltd to address Items 14 - 18 in Economic Development Queensland's (EDQ)[1] Further Issues Letter (14 November 2023). The Further Issues Letter is associated with a Priority Development Area (PDA) assessable development application for the Tarnbrae Greater Flagstone Residential Development (EDQ Reference: DEV2023/1413), referred to in this report as Tarnbrae.

The Addendum is divided into the following sections:

- Introduction;
- Background;
- Target species overview;
- Assessment methods;
- Assessment results; and
- Summary.

[1] Department of State Development, Infrastructure, Local Government and Planning.

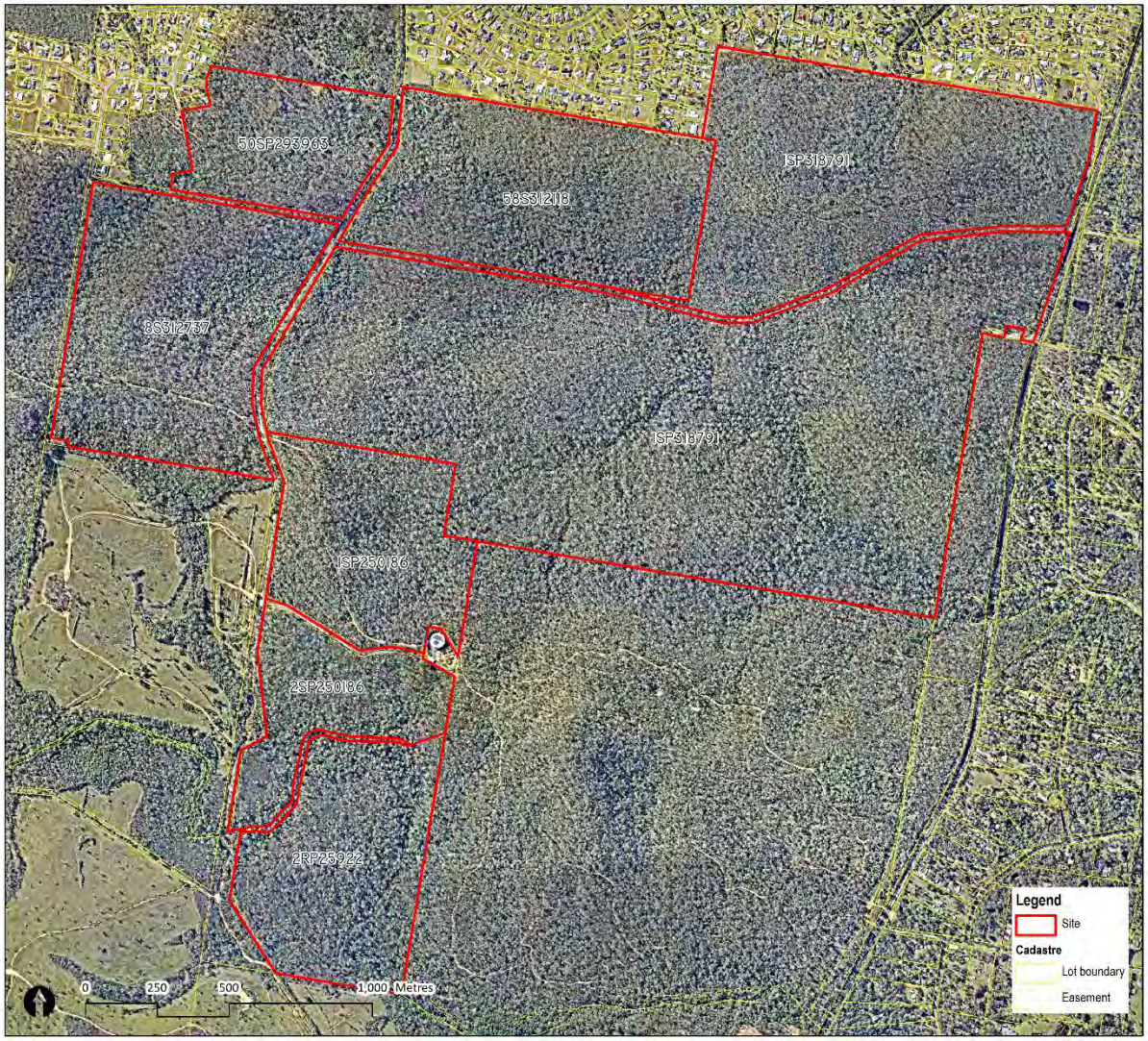


FIGURE 1: DIGITAL AERIAL PHOTOGRAPH OF THE SITE (NEARMAP 2023).

# 2 BACKGROUND

The following section of the report describes the background to the Addendum and the assessments undertaken as part of this report. It is divided into the following subsections:

- Site description; and,
- Assessment and reporting.

## 2.1 SITE DESCRIPTION

The site, also known as 'Tarnbrae', is located on New Beith Road, New Beith, in the Logan City Council local government area in Queensland (Qld). The site is located approximately 30 km south west of the Brisbane City central business district (CBD) and 45km inland from the coast. The site is comprised of the following properties:

- Lot 50 on SP293963;
- Lot 8 on S312737;
- Lot 58 on S312118;
- Lot 1 on SP318791;
- Lot 1 on SP250186;
- Lot 2 on SP250186; and,
- Lot 2 on RP25922.

The total area of the lots is approximately 597 ha. It is located in the Logan City Council local government area and is within the Greater Flagstone Priority Development Area (PDA).

The existing land use is forestry, with the land currently containing native vegetation. The surrounding land use is a combination of residential development and areas of native vegetation, including native forest practice (Figure 2). The approved forestry use has led to much of the older vegetation (i.e., larger trees) being historically removed. In addition to the historical clearing associated with the forestry use, the site also contains areas of disturbance from 4WD and motorbike access. The latter recreational uses have been undertaken by local residents without the permission of the current landowners.

Current State vegetation mapping, including the Vegetation Management Regulated Vegetation Management Map (version 7.01) (Department of Resources 2023) and the Vegetation Management Regional Ecosystem Map (version 13.00) (Department of Resources 2024) indicates that the site contains a range of regional ecosystems (REs) identified as:

- Category B (remnant) vegetation; and,

- Category X vegetation[2].

Each of the REs which are mapped as occurring on the site are listed and described in Table 1. Figure 3 shows the current Vegetation Management Regional Ecosystem Map (version 13.00) (Department of Resources 2023). The current Vegetation Management Regulated Vegetation Management Map (version 7.01) (Department of Resources 2023) is contained in Appendix 1.

TABLE 1: MAPPED REGIONAL ECOSYSTEM DESCRIPTIONS (QUEENSLAND HERBARIUM 2023).

| RE | Description |
|---|---|
| 12.3.7 (Category B) | Narrow fringing woodland of *Eucalyptus tereticornis*, *Casuarina cunninghamiana* subsp. *cunninghamiana* +/- *Melaleuca viminalis*. Other species associated with this RE include *Melaleuca bracteata*, *M. trichostachya*, *M. linariifolia*. North of Brisbane *Waterhousea floribunda* commonly occurs and may at times dominate this RE. *Melaleuca fluviatilis* occurs in this RE in the north of the bioregion. *Lomandra hystrix* often present in stream beds. Occurs on fringing levees and banks of rivers and drainage lines of alluvial plains throughout the region. Riverine. (BVG1M: 16a). |
| 12.3.11 (Category B) | *Eucalyptus tereticornis* +/- *E. siderophloia* and *Corymbia intermedia* open forest to woodland. *Corymbia tessellaris*, *Lophostemon suaveolens* and *Melaleuca quinquenervia* frequently occur and often form a low tree layer. Other species present in scattered patches or low densities include *Angophora leiocarpa*, *E. exserta*, *E. grandis*, *E. latisinensis*, *E. tindaliae*, *E. racemosa* and *Melaleuca sieberi*. *Corymbia trachyphloia* and/or *C. citriodora* subsp. *variegata* may dominate on areas of Pleistocene alluvia. *Eucalyptus seeana* may be present south of Landsborough and *Livistona decora* may occur in scattered patches or low densities in the Glenbar SF and Wongi SF areas. Occurs on Quaternary alluvial plains and drainage lines along coastal lowlands. Rainfall usually exceeds 1000mm/y. Contains Palustrine. (BVG1M: 16c). |
| 12.9-10.2 (Category B) | *Corymbia citriodora* subsp. *variegata* open forest or woodland usually with *Eucalyptus crebra*. Other species such as *Eucalyptus tereticornis*, *E. moluccana*, *E. acmenoides* and *E. siderophloia* may be present in scattered patches or in low densities. Understorey can be grassy or shrubby. Shrubby understorey of *Lophostemon confertus* (whipstick form) often present in northern parts of bioregion. Occurs on Cainozoic and Mesozoic sediments. Not a Wetland. (BVG1M: 10b). |
| 12.9-10.7 (Category B) | *Eucalyptus crebra* +/- *E. tereticornis*, *Corymbia tessellaris*, *Angophora leiocarpa*, *E. melanophloia* woodland. Occurs on Cainozoic and Mesozoic sediments. Not a Wetland. (BVG1M: 13c). |
| 12.9-10.7a (Category B) | *Eucalyptus siderophloia*, *Corymbia intermedia* +/- *E. tereticornis* and *Lophostemon confertus* open forest. Occurs on Cainozoic and Mesozoic sediments in near coastal areas. Not a Wetland. (BVG1M: 12a). |
| 12.9-10.12 (Category B) | Mixed woodland to open forest usually containing *Corymbia intermedia*, *Angophora leiocarpa* and at least a presence of *Eucalyptus seeana*. Other |

[2] Vegetation that is not mapped as a category A area, category B area, category C area or a category R area.

| RE | Description |
|---|---|
| | commonly associated species include *E. siderophloia*, *E. tereticornis*, *E. racemosa* subsp. r*acemosa* and *C. citriodora* subsp. v*ariegata*. *E. seeana* and *Lophostemon suaveolens* are often present as sub-canopy or understorey trees. Occasional *Melaleuca quinquenervia* on lower slopes. Occurs on Cainozoic and Mesozoic sediments. Not a Wetland. (BVG1M: 9g). |
| 12.9-10.19a (Category B) | *Corymbia henryi* and/or *Eucalyptus fibrosa* subsp. *fibrosa* open forest. Other commonly associated species include, *Corymbia citriodora* subsp. *variegata*, *E. carnea*, *E. siderophloia*, *E. crebra* and *E. major*. Occurs in coastal areas on Cainozoic and Mesozoic sediments. Not a Wetland. (BVG1M: 10b). |

Although a detailed botanical survey was not undertaken as part of the current scope of work, observations were recorded as part of the fauna survey work. Results indicated that:

- Native vegetation areas could be generally described as mid-dense open forest with an ecologically dominant layer (EDL) comprised predominantly of *Eucalyptus* spp. with a subcanopy and shrub layer that generally consisted of *Allocasuarina* sp. and/or *Acacia* sp.
- Areas of the Vegetation Management Regulated Vegetation Management Map (version 7.01) (Department of Resources 2023) are mapped as Category X (non-remnant vegetation) which contains regrowth[3] of *Allocasuarina* sp. and *Acacia* sp. For information purposes, where relevant, we have referred to the Biodiversity Status of Pre-clearing Regional Ecosystems Map (version 13.0) (Department of Environment and Science 2023) mapping to assess vegetation in the areas mapped Category X. The preclearing REs are shown in Figure 4, and a copy of the State mapping is contained in Appendix 1.
- Several waterways are present on the site, with the two main waterway systems being Flagstone Creek, which runs through Lot 2 SP250186 and 2 RP25922, and Abrade Creek, which runs through the centre of the site from north west (Lot 50 SP293963 and Lot 8 on S312737) to south east (Lot 1 SP318791).

[3] Does not refer to Category C vegetation (high value regrowth).

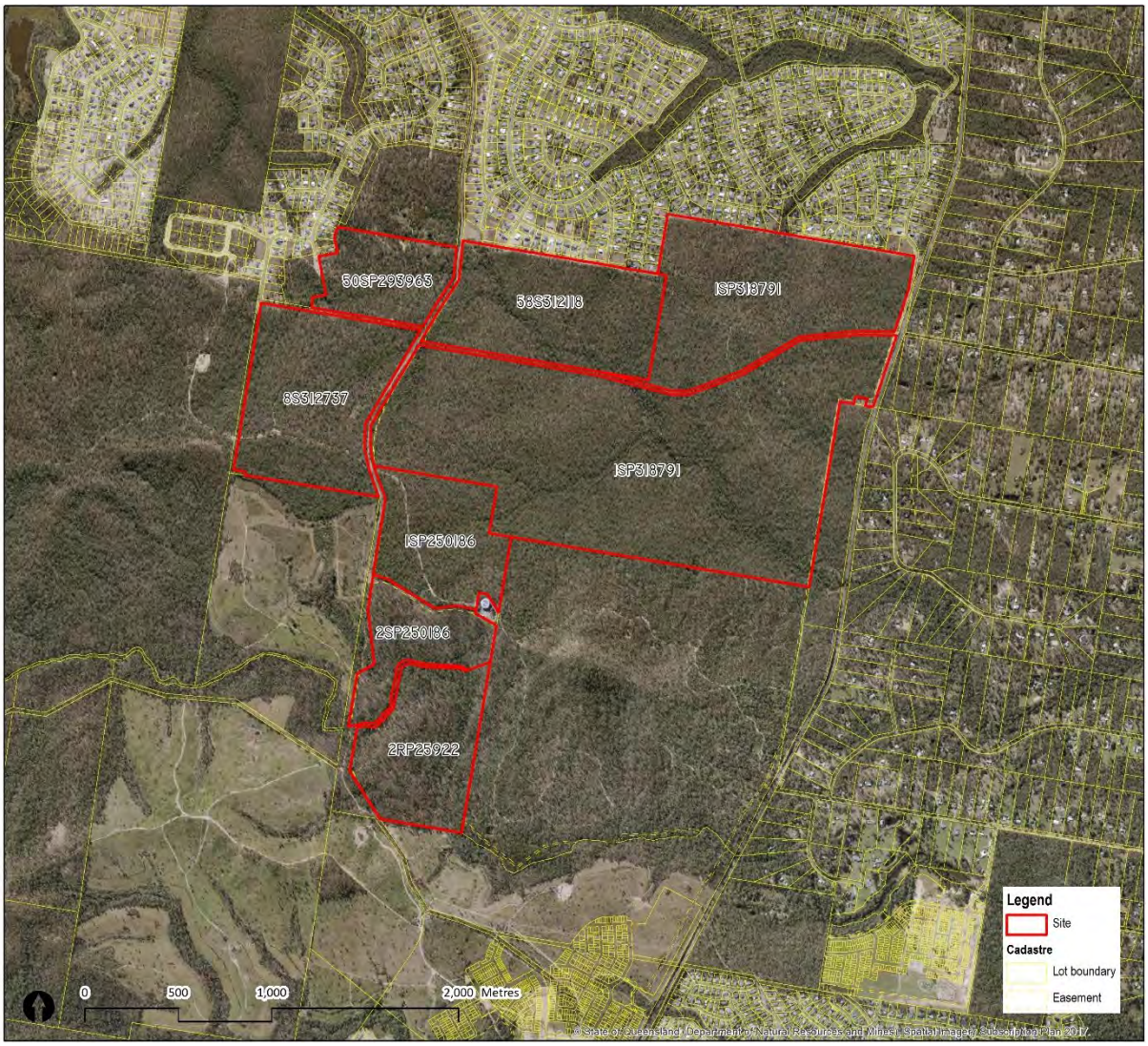


**FIGURE 2: LANDSCAPE CONTEXT DIGITAL AERIAL PHOTOGRAPH OF THE SITE (STATE OF QUEENSLAND 2017, NEARMAP 2023).**

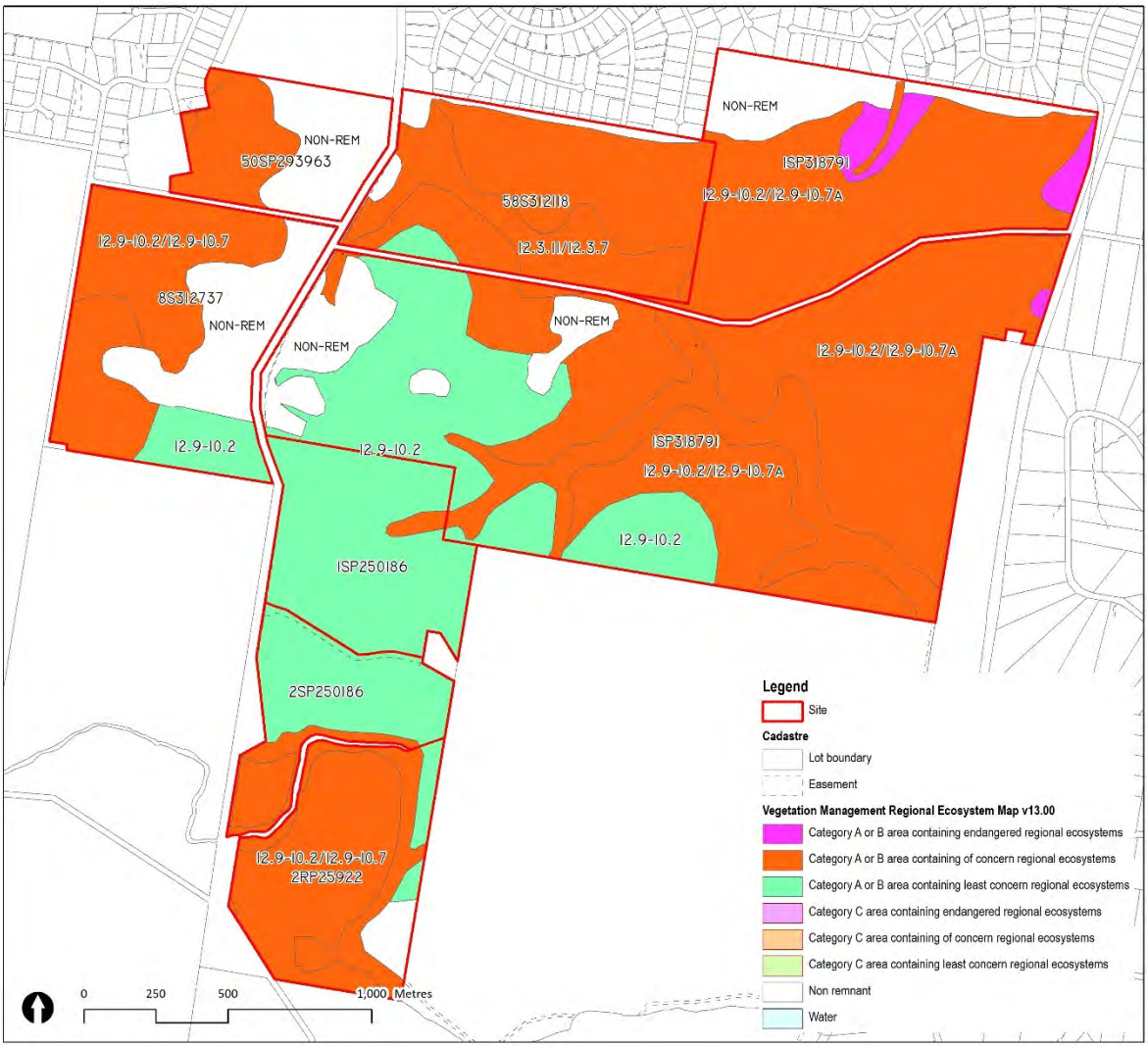


**FIGURE 3: VEGETATION MANAGEMENT REGIONAL ECOSYSTEM MAP VERSION 13.00 DECEMBER 2023 (DEPARTMENT OF RESOURCES 2024).**

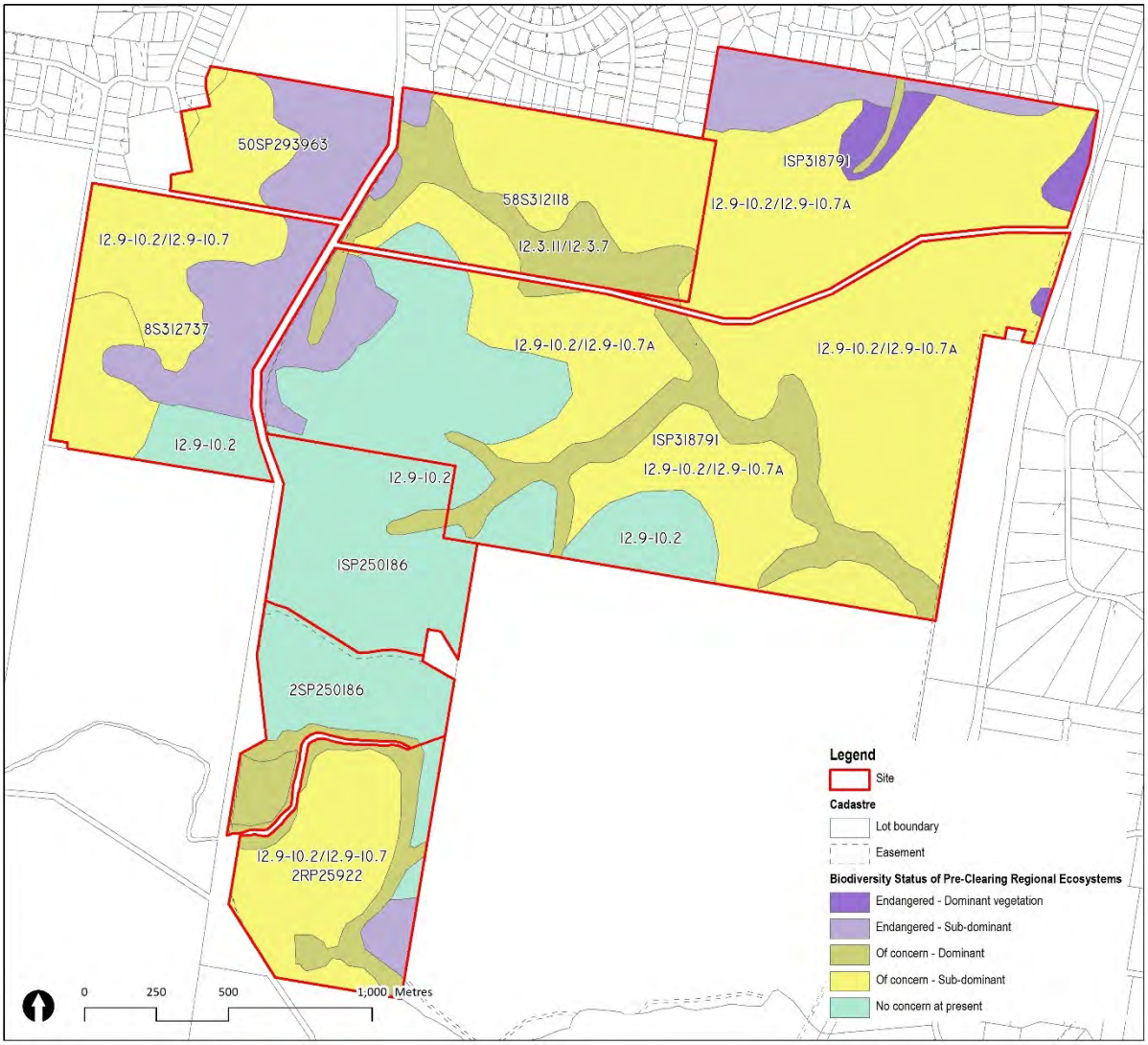


**FIGURE 4: BIODIVERSITY STATUS OF PRE-CLEARING REGIONAL ECOSYSTEMS VERSION 13.00 MAY 2023 (DEPARTMENT OF ENVIRONMENT AND SCIENCE 2023).**

## 2.2 ASSESSMENT AND REPORTING HISTORY

Numerous assessments and reporting have been undertaken for the site. This has included flora and fauna assessments necessary to address both State (EDQ) and Commonwealth (*Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act) requirements. The relevant previous assessment and reporting that has formed the basis for the current Addendum include:

- Natural Environment Site Strategy (Saunders-Havill Group, Issue F, 2020);
- Significant Biodiversity Assessment Report (Saunders-Havill Group, Issue C, 19 December 2022); and,
- Context Plan (Saunders-Havill Group, Drawing Ref: 8905 P Rev. L – SK 01, 06/02/2024).

The Natural Environment Site Strategy (Saunders-Havill Group, Issue F, 2020) (NESS) was prepared for the site in response to the MCU approval (EDQ Reference: DEV2013/455). It was endorsed on 6 March 2020.

A development application for Reconfiguring a Lot (EDQ Reference: DEV2023/1413) was lodged with the State in 2023, which was accompanied by a Significant Biodiversity Assessment Report (Saunders-Havill Group, Issue C, 19 December 2022) (SBAR). On 14 November 2023, EDQ issued a Further Issues Letter, outlining additional information that would be required to complete the assessment of the application.

A Context Plan (Saunders-Havill Group, Drawing Ref: 8905 P Rev. L – SK 01, 06/02/2024) was prepared for the site which was informed by an ecological assessment outlined in the SBAR. The plan provides details on the proposed master-planned community including areas of Environmental Open Space along creek corridors.

In accordance with the endorsed Natural Environment Site Strategy (Saunders-Havill Group, Issue F, 2020) (NESS) and EDQ Further Issues Letter, targeted survey and/or detailed assessment is required for the following *Nature Conservation Act 1992* (Qld) (NC Act) listed threatened species:

- Glossy Black-Cockatoo (eastern) (*Calyptorhynchus lathami lathami*) – Vulnerable;
- Powerful Owl (*Ninox strenua*) – Vulnerable;
- Tusked Frog (*Adelotus brevis*) – Vulnerable; and,
- Koala (*Phascolarctos cinereus*) – Endangered.

The purpose of the Addendum is to:

- Review State-approved guidance material and literature for the Glossy Black-Cockatoo (eastern) (*Calyptorhynchus lathami lathami*), Powerful Owl (*Ninox strenua*), Tusked Frog (*Adelotus brevis*) and Koala (*Phascolarctos cinereus*);
- Survey for the presence or otherwise of the aforementioned species in accordance with the relevant guidance material and/or best practice methods; and,
- Provide the results of the survey/s in order to respond to the EDQ Further Issues Letter.

# 3 LAND USE

## 3.1 HISTORICAL LAND USE

The Tarnbrae site has a longstanding history of native forest practice and cattle breeding overseen by multigenerational family operators. Commencing in the early 1880s, this site is understood to be one of the first earlier private properties used for this purpose in the New Beith district.

The site has been used for the extraction of timber resources, which includes various tree species such as ironbark, bloodwood and other eucalypt species. These trees have been harvested for various uses including sawmill logs, electricity poles, bridges and wharves, fencing and landscaping timber and indoor applications. The evolution of harvesting techniques transpired from manual methodologies, including axes and hand crosscut saws until the mid-20th century, to contemporary practices involving chainsaw felling, bulldozer snigging, and heavy log loaders.

Historically, harvesting has been conducted through targeted timber extraction, tailored to specific purchase orders, with subsequent re-harvesting in these areas over time. In addition, various areas of the site were cleared specifically for crop cultivation; however, due to the poor quality of the soil and the absence of irrigation infrastructure, crop production was limited.

Evidence of the historical use of the land has been documented through archival photographs shown in Figure 5 – Figure 7. These photographs depict the extraction of large trees on the Tarnbrae site and provide visual evidence of the site's historical landscape which appears to have low density vegetation.

FIGURE 5: TIMBER HAULAGE ON LOT 50 ON SP293963 (FACING SOUTH ACROSS ABRADE CREEK; C. 1936 – 1942).

FIGURE 6: TIMBER HAULAGE ON LOT 1 ON SP318791 (ALONG NEW BEITH ROAD; C. 1960'S).

**FIGURE 7: CATTLE BULLOCK TEAM HAULING TIMBER (DATE UNKNOWN; LIKELY BEFORE 1920'S).**

## 3.2 CURRENT LAND USE

Presently, the Tarnbrae site is still used as a native forest practice for the extraction of timber resources and is intermittently for cattle grazing when required. Harvesting is still undertaken through targeted timber extraction, using contemporary equipment and practices (refer to Figure 8 and Figure 9).

The increasing urban development surrounding the site has resulted in adverse anthropogenic impacts on the land, including illegal dumping, vehicle trespass for recreational use (e.g., dirt bikes and 4WD cars) and vandalism. These impacts, along with the reduced cattle grazing and stochastic events (i.e., bushfire) have likely contributed to the degradation of the land as well as an increase in the density of regrowth vegetation, including native species and pest species (i.e., Lantana).

Situated adjacent to the western boundary of the site is another property (Lot 11 on S31466; 448 ha) that is owned and operated by the applicant (New Beith Pty Ltd) as a native forest practice.

FIGURE 8: TIMBER HAULAGE AND LOG LOADER.

FIGURE 9: EXTRACTED TIMBER.

# 4 TARGET SPECIES OVERVIEW

The following sections provide an overview of the ecology of the four (4) target species, as well as the known threats to survival:

- Glossy Black-Cockatoo (eastern) (*Calyptorhynchus lathami lathami*);
- Powerful Owl (*Ninox strenua*);
- Tusked Frog (*Adelotus brevis*); and,
- Koala (*Phascolarctos cinereus*).

## 4.1 GLOSSY BLACK-COCKATOO

### 4.1.1 SPECIES ECOLOGY

The Glossy Black-Cockatoo (GBC) is a small black-brown cockatoo with a widespread distribution, ranging from Gympie to the South East Queensland (SEQ) border, inland to Augathella and Tambo. The species prefers woodland areas dominated by she-oak *Allocasuarina*, or open sclerophyll forests and woodlands with a stratum of *Allocasuarina* beneath *Eucalyptus*, *Corymbia* or *Angophora* (Glossy Black Conservancy 2010). The GBC is also known to utilise appropriate remnant woodlands, and individual or small pockets of *Allocasuarina* and *Casuarina* feed trees in urban areas (Glossy Black Conservancy 2010).

The GBC feed almost exclusively on the seeds of nine *Allocasuarina* and *Casuarina* species throughout their range, and show a strong fidelity to particular feed trees, returning to selected trees over consecutive years, and can fly more than 10 km from roosting or nesting sites to feeding areas (Cameron 2006, Glossy Black Conservancy 2010). Recent studies indicate that the GBC feeds preferentially on larger trees, with nutritional profitability of the cones as the main determinant for tree selection, as such, they are selective (Cameron and Cunningham 2006, North, Lamont et al. 2020).

An obligate hollow nester, the GBC requires large old trees (living or dead), usually eucalypts, for breeding (Cameron 2006). As such, nesting sites are mainly in areas containing large old trees. Evidence suggests that GBC prefer to nest in vertical or near vertical spouts (chimney style hollows), most often in senescent trees or stags, with a minimum hollow entry diameter of 15cm (Cameron 2006, Hourigan 2012, Birdlife Australia 2020). GBC show a strong preference for hollows occurring in trees with a DBH > 60cm (Cameron 2006). The same nest will be used in successive seasons, and the GBC will most often be found nesting in close proximity to nests of other breeding pairs (Hourigan 2012).

### 4.1.2 THREATS

The main threat associated with the decline of this species is the removal, degradation and fragmentation of habitat in which *Allocasuarina* or *Casuarina* are dominant or sub-dominant tree species (Cameron and Cunningham 2006, Glossy Black Conservancy 2010).

Severe drought and fire cause further habitat loss and degradation (Cameron et. al 2021). Climate change may significantly impact resource availability and breeding success through altered rainfall patterns and the increased likelihood of heatwaves and droughts (Department of Climate Change 2022). Grazing and invasive weeds are currently minor threats to the habitat of GBC (Department of Climate Change 2022).

A major aspect of habitat loss is the removal of large hollow-bearing trees for nesting due to land clearing (i.e., for timber harvesting, tree-thinning, urbanisation), which can exacerbate other threats including intraspecific competition, nest predation and transmission of diseases (Department of Climate Change 2022). Trees may take centuries to develop suitable nest hollows, therefore, if the recruitment of such trees is reduced, this will also diminish future breeding opportunities (Glossy Black Conservancy 2010).

In terms of threats that are currently present on the Tarnbrae site:

- There is evidence of current and historical clearing, as the site is used as a native forest practice, therefore reduced hollow abundance is an ongoing threat;
- The site is adjacent to or adjoins existing urban development and roads; and
- The site is dominated by invasive shrub species in some areas of the site which may increase competition with native species for recruitment.

## 4.2 POWERFUL OWL

### 4.2.1 SPECIES ECOLOGY

The Powerful Owl is the largest owl species in Australia, within the Strigidae family (Hawk Owls), and occurs from the Victorian and South Australian border to Eungella in Queensland. The species has been recorded in various habitat including open forest and woodland, regrowth vegetation and in suburban areas adjacent to bushland (McNabb 1996, Sonnenburg 2002).

Powerful Owls are sedentary with home ranges varying from 300 to 1,500 hectares, with the size of the home range related to habitat type and the availability and density of prey (McNabb 1996, Sonnenburg 2002, Webster, Humphries et al. 2004). The species commonly roosts in dense vegetation of mid-storey trees (e.g., she-oaks, acacias, paperbarks) and breeds in open or closed sclerophyll forests and woodland, with a preference for dense gullies (McNabb 1996, Sonnenburg 2002, Webster, Humphries et al. 2004). Powerful Owls require large hollows for nesting (>35 cm entrance diameter, 50 – 200 cm deep and usually a minimum of 6 m above ground), and many of its prey species are also hollow-dependent (NSW Scientific Committee 2008, Mott n.d.). Research indicates that while a territory may encompass multiple roost sites and one or more nesting sites, Powerful Owls exhibit strong fidelity to their nesting sites (Sonnenburg 2002, Webster, Humphries et al. 2004).

In the drier lowland forests where the Common Ringtail Possum is the major prey item, Powerful Owls occur and breed in heavily logged forests when the important riparian

forest area used for nesting and roosting are protected in wide streamside corridors. This suggests that the Powerful Owl can occur in patches which are comprised of a mosaic of logged and unlogged habitats.

Breeding typically occurs during winter months, between May and June, and two eggs are laid in wood debris lined hollows (Sonnenburg 2002). The eggs hatch after 35 to 38 days and owlets fledge at ten weeks of age (Sonnenburg 2002, Webster, Humphries et al. 2004). The young remain dependant for eight months before dispersing to establish new territories in February and March

The Powerful Owl is a crepuscular and nocturnal bird that hunts medium-sized mammals. They capture their prey from canopy branches and shrubs, but their main prey types may vary from one location to another. They have also been known to forage along forest margins (Sonnenburg 2002, Webster, Humphries et al. 2004). In extensive forests, almost every part of the forest will be visited by owls at some time, therefore, it is important to identify areas within a site that are of more or less importance to the owl, rather than seeking a non-existent dichotomy between areas where they are present or absent (Loyn, McNabb et al. 2011).

### 4.2.2 THREATS

The main threat to the Powerful Owl is habitat loss, including loss of hollow-bearing trees (NSW Scientific Committee 2008). The loss of mature elements is also inferred to affect prey species, including hollow dwelling species, which reduces food availability (NSW Scientific Committee 2008, Logan City Council n.d.). Other potential threats include predation on fledgling owls, inappropriate fire regimes, vehicle strike and interaction with poisoned prey, overhead wires and barbed-wire fences (NSW Scientific Committee 2008, Logan City Council n.d.).

In terms of threats that are currently present on the Tarnbrae site:

- There is evidence of current and historical clearing, as the site is used as a native forest practice, therefore reduced hollow abundance is an ongoing threat;
- The site is adjacent to or adjoins existing urban development and roads; and
- There is a presence of feral animal species including foxes and dogs.

## 4.3 TUSKED FROG

### 4.3.1 SPECIES ECOLOGY

The Tusked Frog is a medium sized terrestrial frog with a disjunct distribution. In SEQ, the species has disappeared from the New England Tableland and Bunya Mountains and has suffered declines in the Scenic Rim; however, it is widespread in the lowlands and foothills east of the Great Dividing Range (Rowland 2013).

The Tusked Frog is sexually dimorphic, with adult females typically smaller than adult males. The species inhabits a variety of habitats including rainforest, wet eucalypt forest and sometimes dry eucalypt forest where it can be found in close proximity to suitable breeding habitat (Rowland 2013). Females also have different habitat preferences to males; with males typically preferring habitats near water and females open forest-woodlands away from water (Katsikaros and Shine 1997). This species typically breeds in ponds or slow-moving streams; however, breeding has been recorded in dams and ornamental ponds in urban and peri-urban environments and in open grazing country (Eyre 1999). Eggs are laid under sheltered areas, including leaf litter (Logan City Council n.d.).

### 4.3.2 THREATS

It has been identified that the species has the capacity to occupy highly disturbed areas; however, the viability of these populations is unknown (Hines, Mahony et al. 1999, Brisbane City Council 2010). Key threatening processes that may have contributed to the decline in Tusked Frog populations include the impacts of chytrid fungi and predation and competition by introduced predators including Cane Toads and fish such as *Gambusia holbrooki* (Berger, Speare et al. 1998, Hines, Mahony et al. 1999, Brisbane City Council 2010).

Habitat loss, fragmentation and modification through agricultural and urban development are major threats that reduce amphibian abundance / diversity, create barriers to dispersal and degrade waterways / riparian habitat (Brisbane City Council 2010). Climate change exacerbate these threats and impact the species through changes in rainfall patterns and temperatures (Brisbane City Council 2010).

In terms of threats that are currently present on the Tarnbrae site:

- There is evidence of current and historical clearing, as the site is used as a native forest practice, therefore reduced habitat availability is an ongoing threat;
- The site is adjacent to or adjoins existing urban development and roads;
- Evidence of human disturbance including erosion and sedimentation from recreational dirt bikes has been observed on site; and
- There is a presence of Cane Toads across the site, which are an exotic predatory species.

## 4.4 KOALA

### 4.4.1 SPECIES ECOLOGY

The Koala is a wide-ranging and mainly arboreal marsupial endemic to Australia. Within Queensland, they occur as far north as the Wet Tropics to SEQ, where they are most frequently sighted. In many locations, Koala populations are of low density, widespread and fragmented (Department of Agriculture Water and the Environment 2022).

The Koala has a specialist diet mainly consisting of eucalypt foliage and can be found in forest, woodland and riparian woodlands typically dominated by *Eucalyptus* species and in areas with high soil fertility (Department of Agriculture Water and the Environment 2022). Habitat utilised by the Koala is often defined as remnant and regrowth vegetation containing *Eucalyptus, Lophostemon, Melaleuca* and *Corymbia* species (Department of Agriculture Water and the Environment 2022). Non-food trees, particularly large shady trees, are also an essential resource, as Koalas use them to thermoregulate and avoid predators (Department of Agriculture Water and the Environment 2022).

Biophysical habitat attributes for the Koala include places that contain the resources necessary for individual foraging, survival (including predator avoidance), growth, reproduction, and movement (Department of Agriculture Water and the Environment 2022). This includes forests or woodlands and a safe intervening ground matrix for travelling between trees and patches to forage, shelter and reproduce (Department of Agriculture Water and the Environment 2022). Koalas shift between locations for habitat resources; therefore, an area may constitute Koala habitat even if Koala is not present at a given time (Department of Agriculture Water and the Environment 2022).

The home range for the Koala is highly variable, with known ranges from 2 ha in the Central Mackay Coast bioregion to 169.5 ha in the Mulga Lands bioregion, including areas where both natural and built features occur. Studies indicate a predominance of short-range movements; however, longer movements, up to 20 km, may be common (Department of Agriculture Water and the Environment 2022). The amount of habitat required to support a population varies by location. It is influenced by factors such as habitat quality, spacing of trees in the landscape and the availability and use of climate refugia (Department of Agriculture Water and the Environment 2022). Decreased connectivity can contribute to local population extinction, and intact landscapes with shifting habitat suitability (i.e., disturbance) may have adverse impacts on long-term metapopulation persistence (Department of Agriculture Water and the Environment 2022).

Habitat quality for Koalas is influenced by the presence and density of preferred food species, food trees' nutritional foliar chemistry, shelter trees, vegetation structure and the safety or hostility of the ground matrix used for dispersal (Department of Agriculture Water and the Environment 2022). At the landscape level, Koala presence is determined by the total amount of available habitat, habitat quality, patch size, form and spatial configuration within the wider landscape (Department of Agriculture Water and the Environment 2022).

### 4.4.2 THREATS

The main threat associated with the decline of this species is ongoing habitat loss and degradation (Department of Agriculture Water and the Environment 2022). Land clearing in Queensland has impacted habitat across the Koala's range. Clearing for urban expansion is concentrated along the eastern seaboard fringe of Queensland and New South Wales, a stronghold for Koala populations, which is causing localised impacts on the

Koala (Department of Agriculture Water and the Environment 2022). The key causes of pressure on the species, include:

- Loss of climatically suitable habitat;
- Increased frequency and severity of drought, fire, and heatwaves;
- Decline in foliage nutrition;
- Clearing and degradation of Koala habitat;
- Mortality from vehicles and dogs; and,
- Disease (*Chlamydia percorum*).

In terms of threats that are currently present on the Tarnbrae site:

- There is evidence of current and historical clearing, as the site is used as a native forest practice, therefore reduced habitat availability (shelter and food) is an ongoing threat;
- Mortality from vehicles and dogs is currently a risk present on the site due to proximity to residential development and roads and the confirmed presence of feral dogs (refer to the SBAR, Section 4.4 Fauna Assessment); and
- Koalas were confirmed on site; therefore, it is possible that the koalas may be at risk of stress effects due to current use (i.e., native forest practice), presence of predators (dogs and foxes), and proximity to urban development.

# 5 ASSESSMENT METHODS

The following section of the report describes desktop and field survey methods to determine the presence or absence and habitat suitability of the target species. Assessment methods consisted of direct and indirect detection methods, as well as habitat assessment methods. The following section consists of:

- Desktop assessment methods; and
- Field assessment methods.

## 5.1 DESKTOP ASSESSMENT

A desktop assessment was conducted by reviewing relevant State mapping and databases, supplemented by air photo interpretation and spatial analysis using GIS. The desktop assessment informed the likelihood of occurrence and habitat assessment for target species. This section is divided into the following subsections:

- Likelihood of occurrence;
- Air photo interpretation; and
- LiDAR analysis.

### 5.1.1 LIKELIHOOD OF OCCURRENCE

Prior to field investigations, an assessment of the likelihood[4] of the targeted species utilising or occupying the site was undertaken based on a heuristic decision-based approach (Appendix 2) incorporating known habitat associations and preferences of each species according to expert knowledge by Litoria ecologists and published accounts of each species. Likelihood categories into which each species was divided included:

- **Confirmed:** Species observed or recorded from the site based on systematic survey or opportunistic observations by Litoria ecologists, or based on credible anecdotal observations by other sources ($p(x) = 100\%$[5]);
- **Likely:** Site contains known or potential habitats for the species and species recorded from similar habitats in locality of the site ($p(x) > 50\%$);
- **Possible:** Site contains known or potential habitats for the species; however, species not recorded from locality of the site, or vice versa ($p(x) \cong 50\%$); and

[4] This assessment is a decision-making tool only. It is intended to provide guidance on whether MNES could potentially utilise the site and whether this should be investigated further (i.e., through on-site investigations), and is not intended to provide a definitive conclusion as to the use of the site by each of the MNES.

[5] $p(x)$ – represents the probability ($p$) that a given species (x) could occupy or utilise the site.

- **Unlikely:** Site does not contain known or potential habitats for the species and/or species not recorded from locality of the site ($p(x) < 50\%$).

The assessment was supported by relevant State guidance material, published research, mapping and field investigations results from the SBAR.

The assessment reviewed published records of the species within a 10km radius by referring to both the State Government's WildNet database (Department of Environment and Science 2023) and Atlas of Living Australia (National Research Infrastructure for Australia 2023). Species records were used to assess the presence of the species on or nearby the site.

Potential habitat models created by the Queensland Herbarium were obtained for the target species to assess potential habitat within and surrounding the subject site. These models were based on the Potential Habitat Modelling (PHM) Methodology developed by the Queensland Herbarium (2021) which utilises maximum entropy modelling (Maxent), species occurrence records, multiple environmental variables (e.g., broad vegetation group, temperature and terrain ruggedness) and statistical models to predict the distribution of species habitat. Where available, potential habitat models were limited by a threshold of habitat quality and mapped to those areas containing 2019 remnant vegetation mapping.

For the Koala, only pre-clearing potential habitat models were available. Therefore, data was clipped to Category B (remnant) vegetation on the Vegetation Management Regulated Vegetation Management Map (version 7.01) (Department of Resources 2023) in order to assess remaining potential habitat[6] surrounding the site.

### 5.1.2 AIR PHOTO INTERPRETATION

A review of recent and historical aerial imagery was undertaken to determine the history of clearing activities on the site. A series of images were downloaded for assessment from QImagery – the Queensland Government's online collection of photographs (State of Queensland 2023). Digital imagery from 1944 until present day was rectified using ArcGIS and reviewed to ascertain relative age of the vegetation and the intensity and location of timber harvesting on the site over time.

### 5.1.3 LIDAR ANALYSIS

LiDAR data was obtained to accurately determine vegetation height and cover, together with topography of the land and drainage features. LiDAR data (point cloud) was extracted from eight classified 2021 LiDAR (8) point cloud tiles that intersected the site (State of Queensland (Department of Resources) 2023). The spatial resolution of the data

[6] Pre-clearing potential habitat models clipped to 2023 remnant vegetation mapping do not reflect accurate potential habitat models applied at a threshold for individual species. The purpose of this analysis is to indicate locations of potential habitat that is currently present.

included a point density of one point every 20 centimetres, which yielded a total of 360 million points across the entire area.

The data was processed in ArcGIS to generate:

- A 1m resolution digital terrain model (DTM); and
- A 1m resolution vegetation structural information (vegetation height and vegetation density).

The DTM provided high resolution information regarding site topography, including the location of gullies and waterways as well as slope and aspect to inform the selection of biodiversity plots.

The vegetation structural data provided high resolution information regarding height and density to support observations regarding vegetation composition, RE status and the intensity of historic timber harvesting. The vegetation height mapping generated from LiDAR was processed at a high resolution (1m) such that the heights of individual trees could be ascertained for targeted field assessments.

The LiDAR-derived DTM is sufficiently resolved that the location of individual trees removed via historical timber harvesting of the land can be discerned via spatial analysis of 'divots' within the DTM and via the absence of tall trees in the same location using the vegetation height raster.

## 5.2 FIELD ASSESSMENT

Ecological surveys were carried out by Saunders Havill Group (SHG) between 2018 – 2022. Further surveys were carried out by Litoria Consulting and OWAD Environment in 2023, to specifically address the endorsed Natural Environment Site Strategy (Saunders-Havill Group, Issue F, 2020) (NESS) and EDQ Further Issues Letter.

In accordance with the NESS and EDQ Further Issues Letter, targeted survey was undertaken by Litoria Consulting and OWAD Environment for the GBC[7], Powerful Owl, Tusked Frog and Koala.

A summary of the timeline of the surveys undertaken, and the survey methods used by each consultant are described in Table 2.

TABLE 2: SURVEY TIMELINE AND METHODS SUMMARY.

| Survey | Survey Methods |
|---|---|
| Saunders Havill Group – February to April 2018 | • Observational survey<br>• Ground-truthing of vegetation communities |

[7] Breeding is poorly understood in GBC in SEQ, with few known nests and no routine nest monitoring. The breeding season is thought to last from March to August (Glossy Black Conservancy 2022). Due to the limited understanding of GBC breeding and completion of survey outside of the breeding season, breeding activity survey was not undertaken by Litoria Consulting. As such, only searches for foraging and a hollow suitability assessment was undertaken.

| Survey | Survey Methods |
|---|---|
| | • Active diurnal searches over eight (8) days<br>• Flying-fox roost searches (incl. spotlighting)<br>• Motion sensor cameras over 12 days<br>• Koala assessment (Spot Assessment Technique) |
| Saunders Havill Group – May to June 2021 | • Motion sensor cameras over 18 days<br>• Targeted bird surveys over five (5) mornings (80 person hours)<br>• Koala assessment (Spot Assessment Technique)<br>• Search for scats, tracks and other traces<br>• Opportunistic and incidental observations |
| Saunders Havill Group – July to August 2022 | • Scoping for flowering eucalypt trees via GPS over one (1) day and incidentally throughout the survey period<br>• Crepuscular bird survey over four (4) mornings and six (6) evenings (20 survey hours)<br>• Motion sensor cameras over two (2) rounds (14 days per round)<br>• Six (6) spotlighting transects (3 hours of survey per 2 km transect)<br>• Search for scats, tracks and habitat features |
| OWAD Environment – September 2023 | • Koala and Quoll targeted surveys conducted over three (3) days with a team of two (2) qualified ecologists and three (3) purpose-bred professional field detection dogs certified by the Australian Canine Detection Certification Council<br>• Opportunistic and incidental observations |
| Litoria Consulting – November to December 2023 | • Spotlighting and call playback over three (3) nights<br>• eDNA biodiversity assessment<br>• Assessment of GBC foraging signs<br>• Hollow survey<br>• Opportunistic and incidental observations |

Targeted fauna surveys were carried out by Litoria Consulting during November – December 2023 by four (4) tertiary-qualified Ecologists using various fauna surveying techniques for each of the target species. The methods that were applied were consistent with relevant State-approved guidelines, species-specific survey methods and/or Ecological Monitoring System Australia (EMSA) Ecological Field Monitoring Protocols Manual modules. The purpose of these surveys was to assess and identify the presence and distribution of the target species and their respective habitat. Habitat assessments, direct assessments, and indirect assessments were undertaken to assess species and habitats. The comprehensive approach to assessment reduces the likelihood of Type II error[8].

[8] i.e., survey incorrectly concludes that there is no presence, effect or difference when one actually exists (failure to detect).

Table 3 provides a detailed summary of the field assessment methods undertaken by Litoria and OWAD Environment. The methods are described in detail in the following sections:

- Survey design;
- Call playback;
- Spotlighting;
- Wildlife detection dogs;
- Assessment of foraging signs;
- eDNA biodiversity assessment;
- Hollow survey; and,
- Incidental observations.

TABLE 3: DESKTOP AND FIELD ASSESSMENT SURVEY (LITORIA AND OWAD ENVIRONMENT) TIMELINE AND METHODS.

| Method | Assessment type | Dates (2023) | Location | Approximate hours or km |
|---|---|---|---|---|
| Call playback and nocturnal spotlighting | Targeted; direct | 6-7, 11 December | Biodiversity plots 2, 3 and 5 (refer to Figure 10, Section 5.2.1) | 20 hrs |
| Wildlife detection dogs | Targeted; direct / indirect | 11-13 September | Refer to OWAD Environment Report (Appendix 3) | 41 km |
| Assessment of foraging signs | Targeted; indirect | 27-30 November 6-7, 11, 13 December | Biodiversity plots 1 – 13, refer to (refer to Figure 10, Section 5.2.1) | 26 hrs |
| eDNA biodiversity assessment | Targeted; indirect | 27-30 November 6-7, 11, 13 December | Refer to Figure 17 | N/A |
| Hollow survey | Habitat assessment | 27-30 November 6-7, 11, 13 December | Biodiversity plots 1 – 13, refer to (refer to Figure 10, Section 5.2.1) | 26 hrs |
| Opportunistic and incidental observations | Non-targeted; direct / indirect | November 27-30 December 6-7, 11, 13 | N/A | >150 hrs |

Overall, the field investigations undertaken by Litoria Consulting and OWAD Environment include:

- Spotlighting conducted in three (3), 2 ha biodiversity plots by Litoria Consulting;
- Over 40 km of targeted survey by detection dogs (OWAD Environment);
- Over 45 hours of targeted fauna survey (Litoria Consulting survey only); and,
- Over 150 hours of incidental fauna observations and habitat assessment throughout the survey period (Litoria Consulting survey only).

### 5.2.1 SURVEY DESIGN

The purpose of the field investigations was to conduct targeted species surveys for the GBC[7], Powerful Owl, Tusked Frog and Koala. Survey areas were located in areas containing potential habitat for each of the species, whilst also capturing varying environmental values to reflect the site in entirety.

Using the methods described in the EMSA Plot Selection and Layout Module, at least one (1) 200 x 100 m biodiversity plot was surveyed in each RE (where practicable) to conduct targeted species survey. The biodiversity plot locations were informed by a desktop review of SHG botanical field investigations results, historical aerial photography, LiDAR data, REs, broad condition state (i.e., 'remnant', 'regrowth' or 'non-remnant') and hydrology. Multiple plots were surveyed to capture the variability across the site.

Due to site constraints (e.g., weed infestation, topography, vegetation density), certain areas of the site could not be accessed. This included the majority of Lot 2 on SP250186 and Lot 2 on RP25922, within the southern extent of the site, which was impenetrable due to the density and extent of *Acacia* spp. regrowth vegetation[9]. Photographic evidence of the regrowth is shown in Figure 11 - Figure 13.

The survey area, or sample size, across the 597 ha site was calculated using a 95% confidence level and 10% margin of error. This calculation resulted in a 25 ha survey area, which equates to 13 two-hectare (2 ha) biodiversity plots that were distributed across the sampling units (refer Appendix 4 for the data sheet regarding the calculation of sample size from the Australian Bureau of Statistics (Australian Bureau of Statistics 2023)). As such, the subset of the site contained within biodiversity plots is more likely to be representative of the site in its entirety. The locations of the biodiversity plots are shown in Figure 10. The location of the biodiversity plots in relation to the vegetation height information derived from LIDAR is shown in Figure 28 (Section 6.1.3).

As outlined in Table 2, the surveys undertaken by Litoria Consulting were separate from those undertaken by Saunders Havill Group (i.e., were completed for different purposes). The biodiversity plots used by Litoria Consulting were dedicated to targeted species surveys. The different survey locations used by Litoria Consulting and Saunders Havill Group are demonstrated in Figure 14.

[9] Excluding a cleared access track, approximately 2.5 m wide.

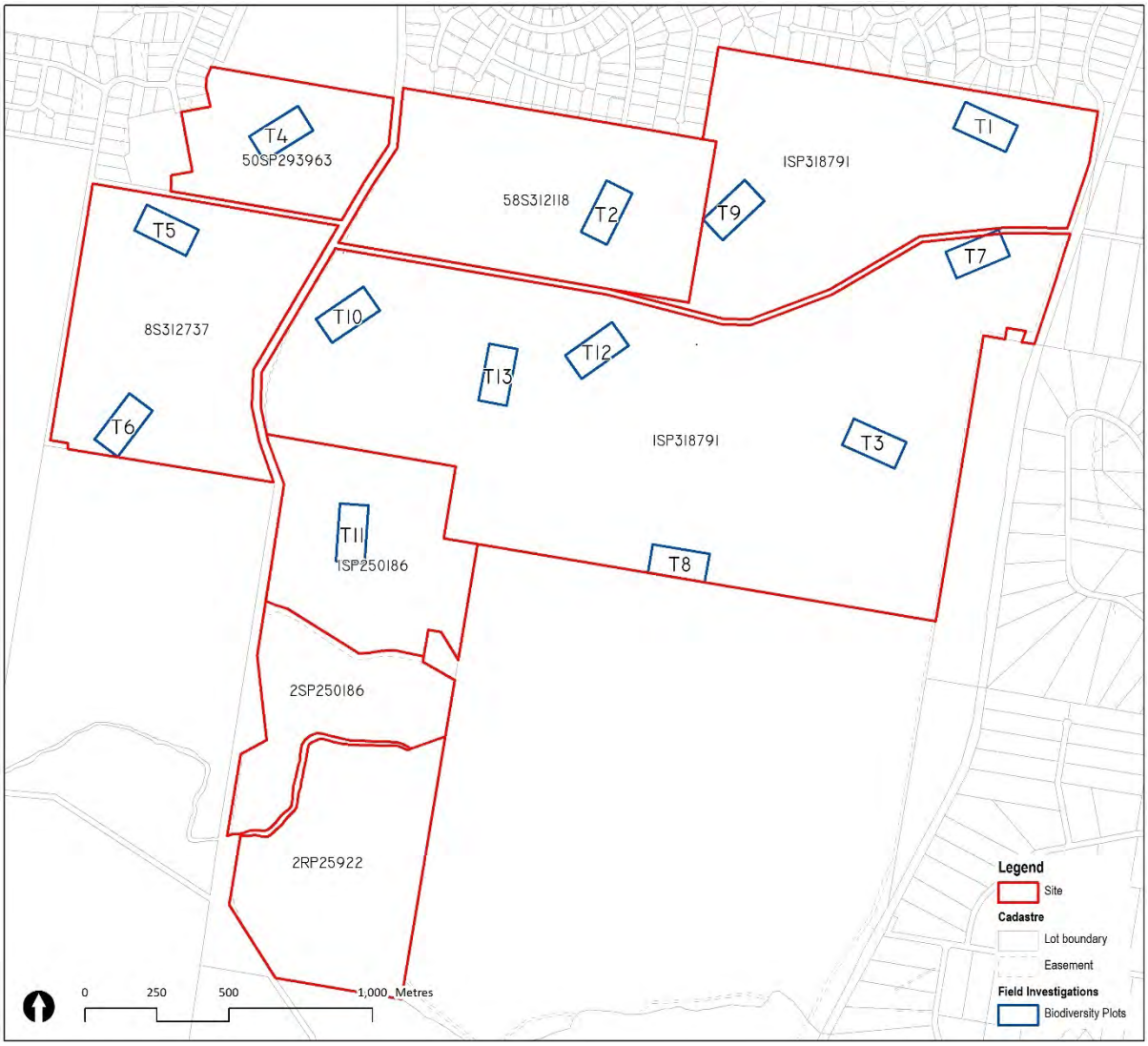


FIGURE 10: BIODIVERSITY PLOT TRANSECT LOCATIONS.

FIGURE 11: REGROWTH IN THE SOUTHERN EXTENT OF THE SITE.

FIGURE 12: REGROWTH IN THE SOUTHERN EXTENT OF THE SITE.

FIGURE 13: REGROWTH IN THE SOUTHERN EXTENT OF THE SITE.

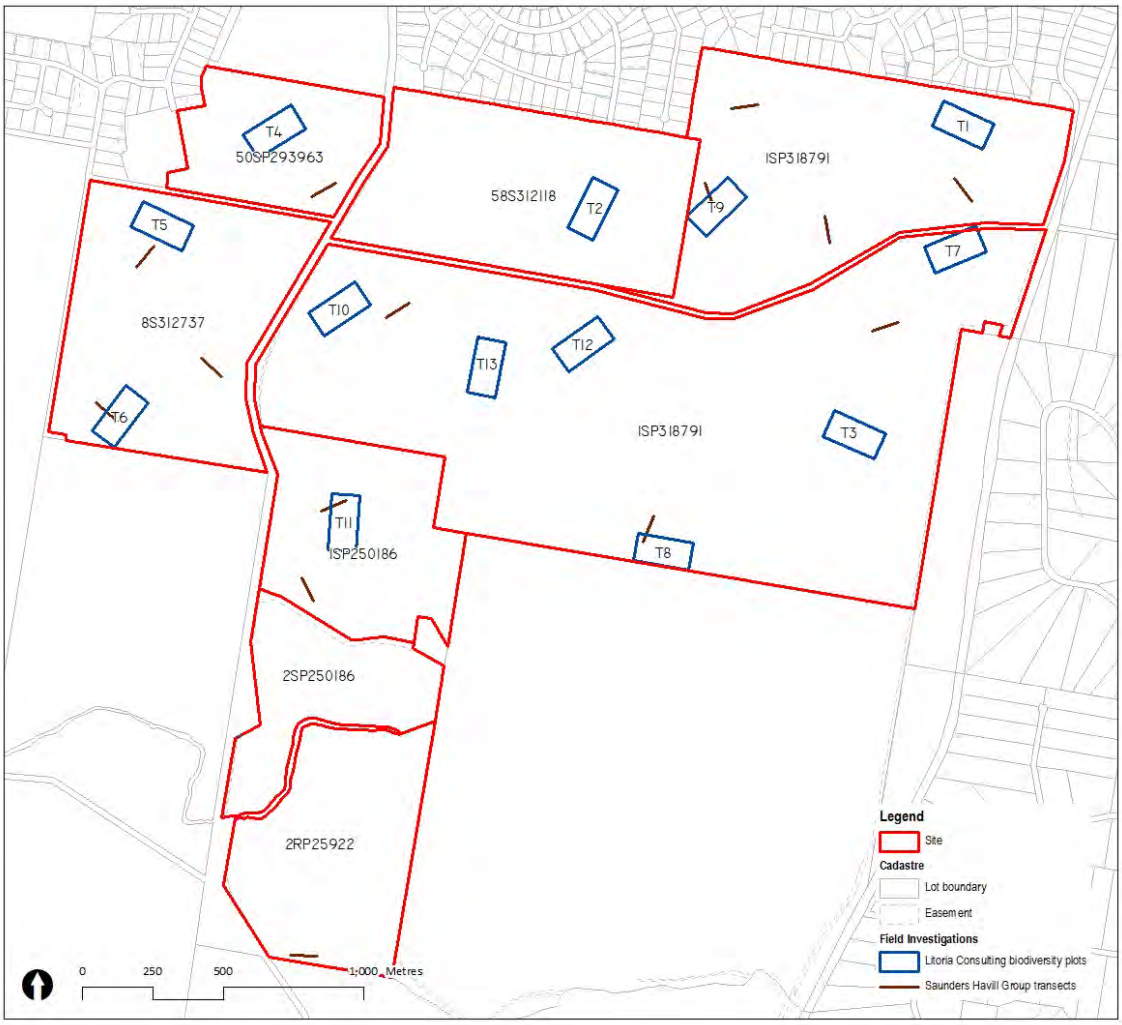


**FIGURE 14: LITORIA CONSULTING AND SAUNDERS HAVILL GROUP SURVEY LOCATIONS.**

### 5.2.2 CALL PLAYBACK

Call playback is a recommended survey technique for the Powerful Owl and the Tusked Frog. Call playback was undertaken in accordance with the EMSA Vertebrate Fauna Module, *Terrestrial Vertebrate Fauna Survey Guidelines for Queensland* (Eyre, Ferguson et al. 2022), as well as specific guidelines for the Tusked Frog and Powerful Owl.

Considering the spotlighting undertaken by Saunders-Havill Group in 2022 and in addition to that survey effort, targeted survey was conducted in three (3) of the biodiversity plots co-located with potential core habitat features for both species, i.e., dense gullies for the Powerful Owl (Loyn, McNabb et al. 2011) and near watercourses for the Tusked Frog. The three (3) plots were located approximately 1 km apart along Abrade Creek[10]. Refer to Figure 15 for the mapped locations of transects where call playback was completed.

[10] Due to site access constraints (i.e., dense acacia regrowth), targeted survey was not conducted along Flagstone Creek.

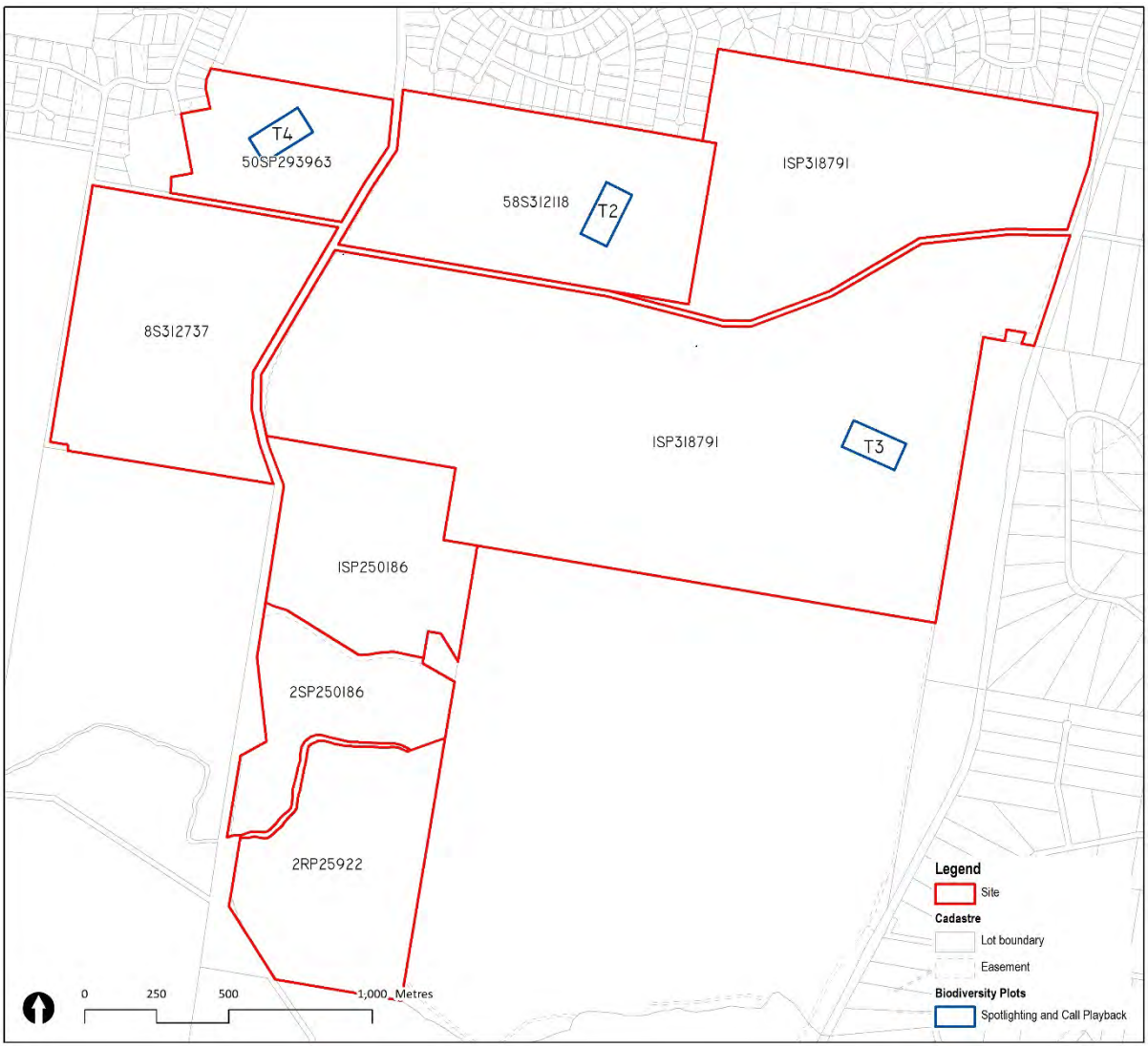


**FIGURE 15: CALL PLAYBACK AND SPOTLIGHTING BIODIVERSITY TRANSECT LOCATIONS.**

## TUSKED FROG

State government targeted species survey guidelines for the Tusked Frog *Adelotus Brevis Targeted Species Survey Guidelines* (Rowland 2013) was utilised to inform the survey technique. Call playback was undertaken at the midpoint of biodiversity plots over three (3) different nights during summer 2023 (i.e., three visits to each plot over six nights). A listening period of two (2) minutes was established prior to call playback commencing. Tusked Frog calls were broadcast from a loudspeaker connected to an MP3 player. The following sequence for call playback was used:

- Call playback for approximately three (3) minutes for Tusked Frog, followed by at least three (3) minutes of listening.
- Call playback for approximately three (3) minutes for Tusked Frog, followed by at least five (5) minutes of listening.
- Call playback for approximately three (3) minutes for Tusked Frog, followed by at least two (2) minutes of listening.

The survey effort for the Tusked Frog (including both call playback and eDNA sampling as discussed later in the report in Section 5.2.6) was scheduled around and during rainfall events. This is supported by rainfall data from the closest rainfall tower to the site (Jingle Downs) from the Bureau of Meteorology (Bureau of Meteorology 2023). Refer to Appendix 5 for visualisation of monthly rainfall during survey.

#### POWERFUL OWL

As directed by the State Department, the *Victorian Approved Survey Standards for Powerful Owl* were utilised to inform the survey technique (Loyn, McNabb et al. 2011). Call playback was undertaken at the midpoint of biodiversity plots over three (3) different nights during summer 2023 (i.e., three visits to each plot over six nights). A listening period of two (2) minutes was established prior to call playback commencing. Powerful Owl calls were broadcast from a loudspeaker connected to an MP3 player. The following sequence for call playback was used:

- Call playback for approximately five (5) minutes for Powerful Owl, followed by at least three (3) minutes of listening.
- Call playback for approximately five (5) minutes for Powerful Owl, followed by at least five (5) minutes of listening.
- Call playback for approximately five (5) minutes for Powerful Owl, followed by at least two (2) minutes of listening.

### 5.2.3 SPOTLIGHTING

Spotlighting is a recommended survey technique for the Powerful Owl. Targeted survey was undertaken in accordance with the EMSA Vertebrate Fauna Module and the Victorian *Approved Survey Standards for Powerful Owl* (Loyn, McNabb et al. 2011).

Targeted survey was conducted in three (3) of the biodiversity plots located in potential core habitat for the Powerful Owl (e.g., dense gullies) (Loyn, McNabb et al. 2011). Three (3) plots surveyed were located approximately 1 km apart along Abrade Creek[11]. Refer to Figure 15 for the mapped locations of transects where spotlighting was completed.

Spotlighting was undertaken within the biodiversity plot following call playback. The biodiversity plot was traversed by two (2) observers for a total of 60 minutes (30 minutes per observer). Spotlighting was undertaken using a 12-volt 50-Watt xenon spotlight with red coloured filter. Opportunistic records of other fauna species were also recorded.

[11] Due to site access constraints (i.e., dense acacia regrowth), targeted survey was not conducted along Flagstone Creek.

### 5.2.4 WILDLIFE DETECTION DOGS

Due to the limitations of the Spot Assessment Technique (SAT)[12] used for the SBAR, including confirmation bias and 'false negatives' (Type II error[8]), a Koala survey was undertaken in 2023 by OWAD Environment with a team of ecologists and three (3) professional detection dogs certified by the Australian Canine Detection Certification Council for Koala and Quoll scat determination to minimise the risk of Type II error[8] (Cristescu, Foley et al. 2015, Youngentob, Marsh et al. 2021). The use of Koala detection dogs has been supported by peer-reviewed literature and is known to enhance the effectiveness of ground-based surveys in locating live koalas compared to human observers (Cristescu, Miller et al. 2020). Although detection dogs share similar limitations regarding survey biases (i.e., individual or environmental conditions), their use was deemed valuable given their ability to mitigate these limitations, often to a lesser extent than other survey methods (Cristescu, Miller et al. 2020).

In the 2023 Koala survey, an opportunistic assessment of vegetated areas of the site was conducted over three (3) consecutive days, with the aim to cover the greatest land area on the site within the survey days.

Refer to the *Koala Survey Report – Tarnbrae* (Appendix 3) for the detailed assessment methods. Refer to Figure 16 for a map extract from the report that displays the location of search tracks.

[12] As the SAT method has multiple survey limitations and is not based on current best-practice, it is not used in this Addendum, therefore, Koala Activity Level Classification which forms part of the SAT method, is not addressed.

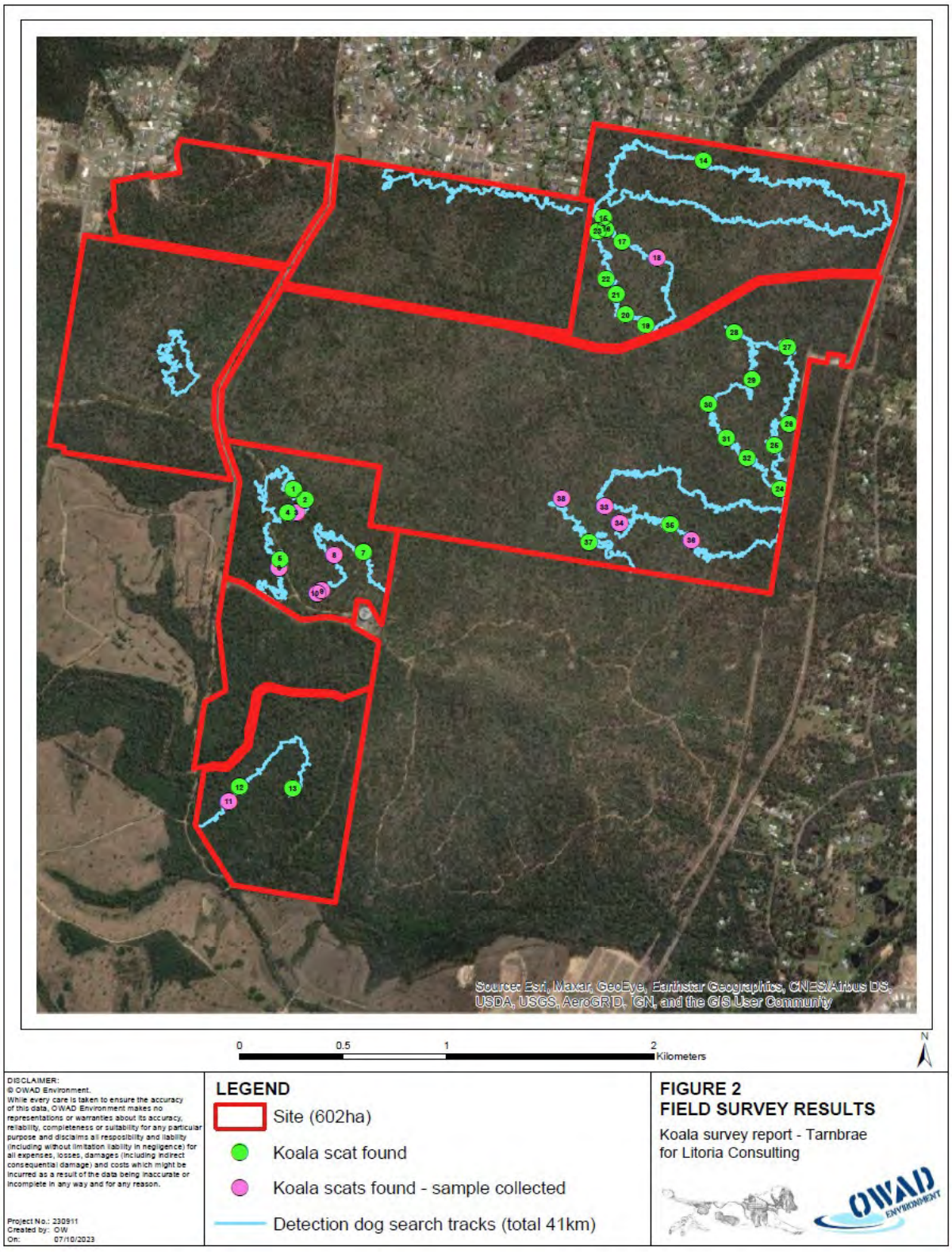


**FIGURE 16: EXTRACT FROM THE KOALA SURVEY REPORT - TARNBRAE, DISPLAYING KOALA SCAT LOCATIONS AND DETECTION DOG SEARCH TRACKS (APPENDIX 3).**

### 5.2.5 ASSESSMENT OF FORAGING SIGNS

Targeted survey for the GBC was undertaken by searching for evidence of feeding on she-oak seed pods under *Allocasuarina* and *Casuarina* trees. Evidence of foraging (discarded, chewed she-oak seed cones / orts) was detected by conducting targeted searches through each of the 13 biodiversity plots. Each plot was surveyed for approximately 120 person minutes (i.e., 2 observers, 60 minutes each). Where evidence of foraging was observed, additional survey effort / time was spent searching. Opportunistic searches were also undertaken whilst traversing the site, particularly in areas dominated by feed tree species.

### 5.2.6 EDNA BIODIVERSITY ASSESSMENT

Survey via eDNA sampling was utilised to determine species presence / diversity across the site. A biodiversity assessment was conducted using eDNA metabarcoding to identify all species that have left DNA traces in a water sample. eDNA can be more effective for species detection in aquatic (and some terrestrial) systems than traditional sampling techniques (Alexander Eiler, Anders Löfgren et al. 2018). The eDNA metabarcoding technique was used alongside traditional survey methods to maximise species detection and reduce Type II error[8] (Eyre, Ferguson et al. 2022).

Water samples were collected at six (6) locations on site, as shown in Figure 17, including:

- An upstream and downstream location of Abrade Creek;
- Two (2) drainage lines; and,
- Two (2) constructed dams.

At each location, three (3) replicate samples were collected by passing water through a 1.2 $\mu$m disc filter. Samples were preserved after filtration to minimise DNA degradation. Samples were stored out of sunlight and refrigerated before being transported to the EnviroDNA laboratory for processing. Samples then underwent laboratory analysis, which includes a metabarcoding analysis of extracted DNA.

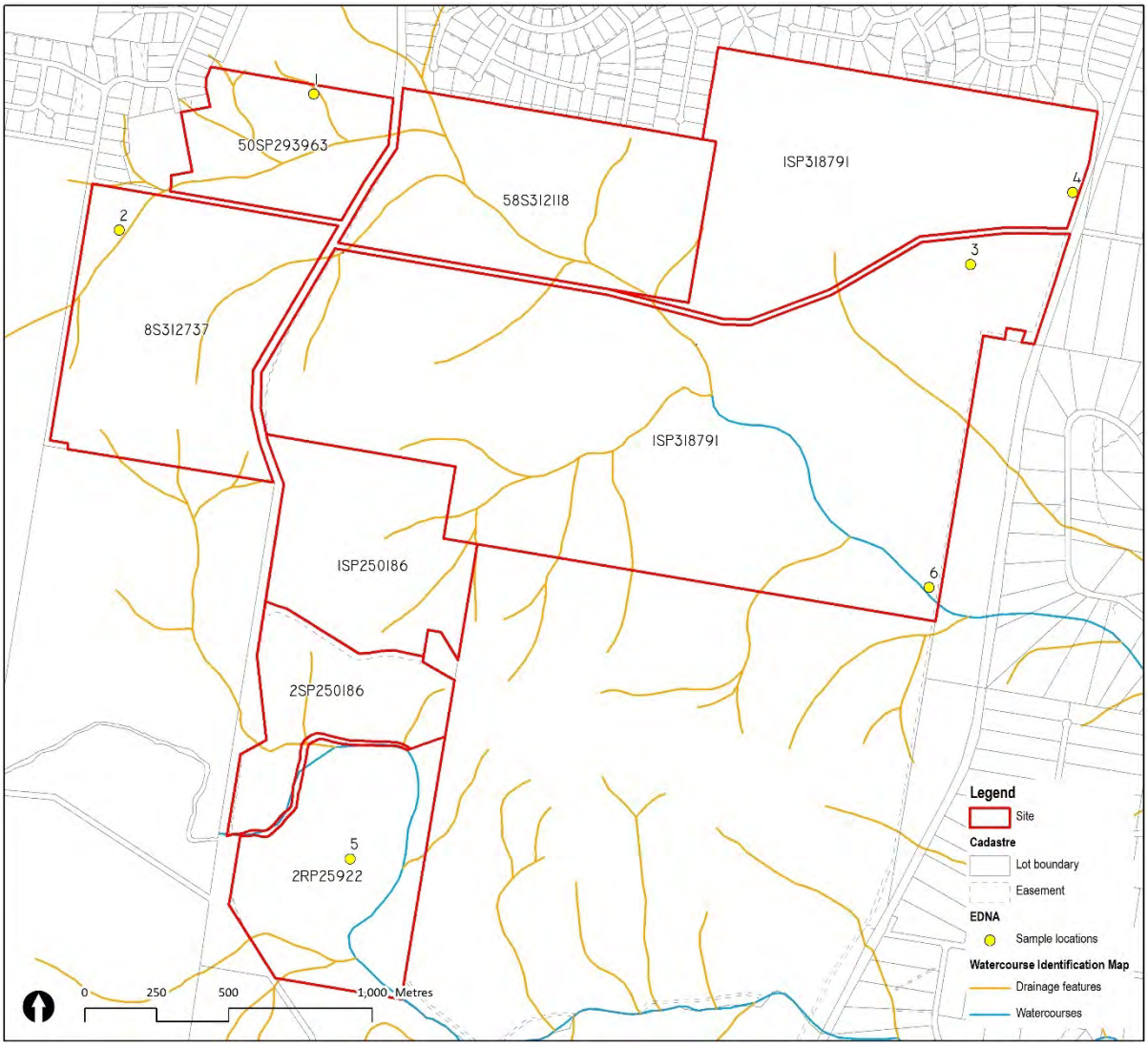


**FIGURE 17: EDNA SAMPLE LOCATIONS AND INDICATIVE WATERWAY LOCATIONS FROM THE WATERCOURSE IDENTIFICATION MAP (DEPARTMENT OF RESOURCES 2023).**

### 5.2.7 HOLLOW SURVEY

To evaluate habitat suitability, a detailed hollow assessment was undertaken. The number of hollows and their characteristics were determined through a count survey within each of the 13 biodiversity plots, with at least two (2) observers traversing each 200 m transect. During the survey, tree height and diameter at breast height (DBH), as well as characteristics of observed hollows (i.e., size, type of hollow, location on tree) were recorded. As described in Section 5.2.1, biodiversity transects were located in both areas containing tall, mature vegetation and heavily logged areas.

Field results were assessed to determine the relationship between tree height and hollow density inside transects. Average tree height inside each 2 ha biodiversity plot (as derived from LiDAR), was compared with the number of hollows encountered in each transect. This information was presented in a graph and the linear relationship was assessed to determine if hollow density was correlated with average tree height (i.e., age of vegetation).

In addition, an analysis was conducted on the vegetation type and characteristics of hollow-bearing trees across transects, to determine if any significant relationships between vegetation types and hollow tree characteristics could be determined. This was assessed for GBC nest hollows, Powerful Owl nest hollows, and prey species nest hollows.

### 5.2.8 INCIDENTAL OBSERVATIONS

Opportunistic and incidental fauna observations were recorded whilst undertaking the targeted assessments, including direct observations of fauna as well as fauna habitat features such as nests, hollows, fauna scratches and other fauna traces.

# 6 ASSESSMENT RESULTS

The following section of the report describes the results of the detailed assessments. It is divided into the following subsections:

- Desktop assessment; and
- Field assessment.

## 6.1 DESKTOP ASSESSMENT

The following subsections describe the results of the:

- Likelihood of occurrence assessment;
- Air photo interpretation; and
- LiDAR analysis.

### 6.1.1 LIKELIHOOD OF OCCURRENCE

The likelihood of occurrence assessment indicated that three (3) of the target species were likely to utilise the site based on the surrounding records, habitat modelling and known potential habitat on the site. One (1) species has been confirmed as part of previous surveys. The results for each of the species are discussed below.

#### GLOSSY BLACK-COCKATOO

The State Government's WildNet database and Atlas of Living Australia were used to assess the presence of the species on or nearby the site. A review of the records indicate that 17 observations of the GBC were recorded within 3 km of the site. The closest known record, according to ALA, is from 2013 and located approximately 1 km from the site on a private residence in North MacLean (Figure 18). A more recent record, from 2021 is located approximately 8 km from the site at Upper Oxley Creek, Lyons.

Based on the Queensland Herbarium (2021) potential habitat modelling, the probable distribution of suitable GBC habitat includes areas located on site, except for areas mapped as Category X areas on the Vegetation Management Regulated Vegetation Management Map (version 7.01) (Department of Resources 2023). The modelled potential habitat is also located within large, connected patches to the west and southeast.

Potentially suitable habitat may be present throughout the site given the presence of open eucalypt forest with areas containing a subcanopy of *Allocasuarina* species. In some smaller patches, the vegetation was dominated by *Allocasuarina* species. The site can be described as eucalypt forest associated with RE 12.9-10.2, 12.9-10.7a and 12.9-10.19 (Refer

to Section 3.3 of the SBAR). The vegetation on site provides a large area of potential habitat for the GBC and is connected to bushland on the western[13] and southern boundary.

Based on the desktop assessment which indicates the presence of potential habitat and location of nearby sightings, it is likely that the species could occur on the site.

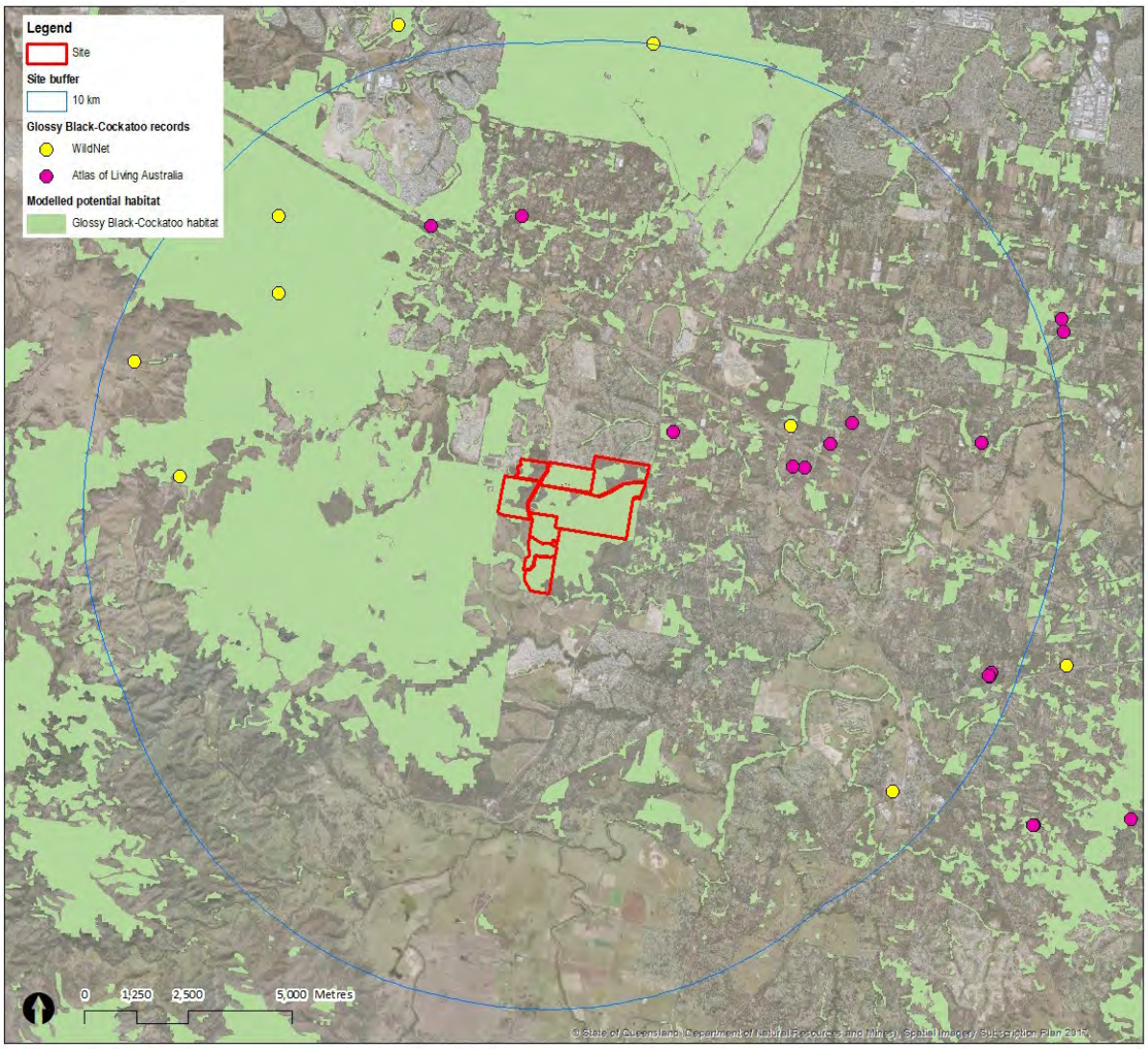


**FIGURE 18: LOCATION OF HISTORIC GBC SIGHTINGS AND POTENTIAL HABITAT MODELLING (QUEENSLAND HERBARIUM 2021, DEPARTMENT OF ENVIRONMENT AND SCIENCE 2023, NATIONAL RESEARCH INFRASTRUCTURE FOR AUSTRALIA 2023).**

## POWERFUL OWL

The State Government's WildNet database and Atlas of Living Australia were used to assess the presence of the species on or nearby the site. A review of the records indicate that seven (7) observations of the Powerful Owl were recorded within 3 km of the site. The closest known record, according to ALA, is from 2018 and located just over 1 km from

[13] Situated adjacent to the western boundary of the site is another property (Lot 11 on S31466; 448 ha) that is owned and operated by the applicant (New Beith Pty Ltd) as a native forest practice.

the site in New Beith (Figure 19). A more recent record, from 2023 is located just over 8 km from the site in Munruben. An ALA record from 2021 located approximately 3.5 km west of the site includes the approximate location of a nesting tree near Oxley Creek.

Based on the Queensland Herbarium (2021) potential habitat modelling, the probable distribution of suitable Powerful Owl habitat includes areas located on site, except for areas mapped as Category X areas on the Vegetation Management Regulated Vegetation Management Map (version 7.01) (Department of Resources 2023) (Appendix 1). The modelled potential habitat is also connected to other modelled habitat to the west and southeast.

Potentially suitable habitat may be present throughout the site given the presence of open eucalypt forest with areas containing a subcanopy of vegetation including *Acacia* and *Allocasuarina* species. The site can be described as eucalypt forest associated with RE 12.9-10.2, 12.9-10.7a and 12.9-10.19 (Refer to Section 3.3 of the SBAR). The vegetation on site provides a large area of potential habitat for the Powerful Owl and is connected to bushland on both the western[13] and southern lots.

Based on the desktop assessment and the presence of open eucalypt forest and watercourses, it is likely that the species could occur on the site.

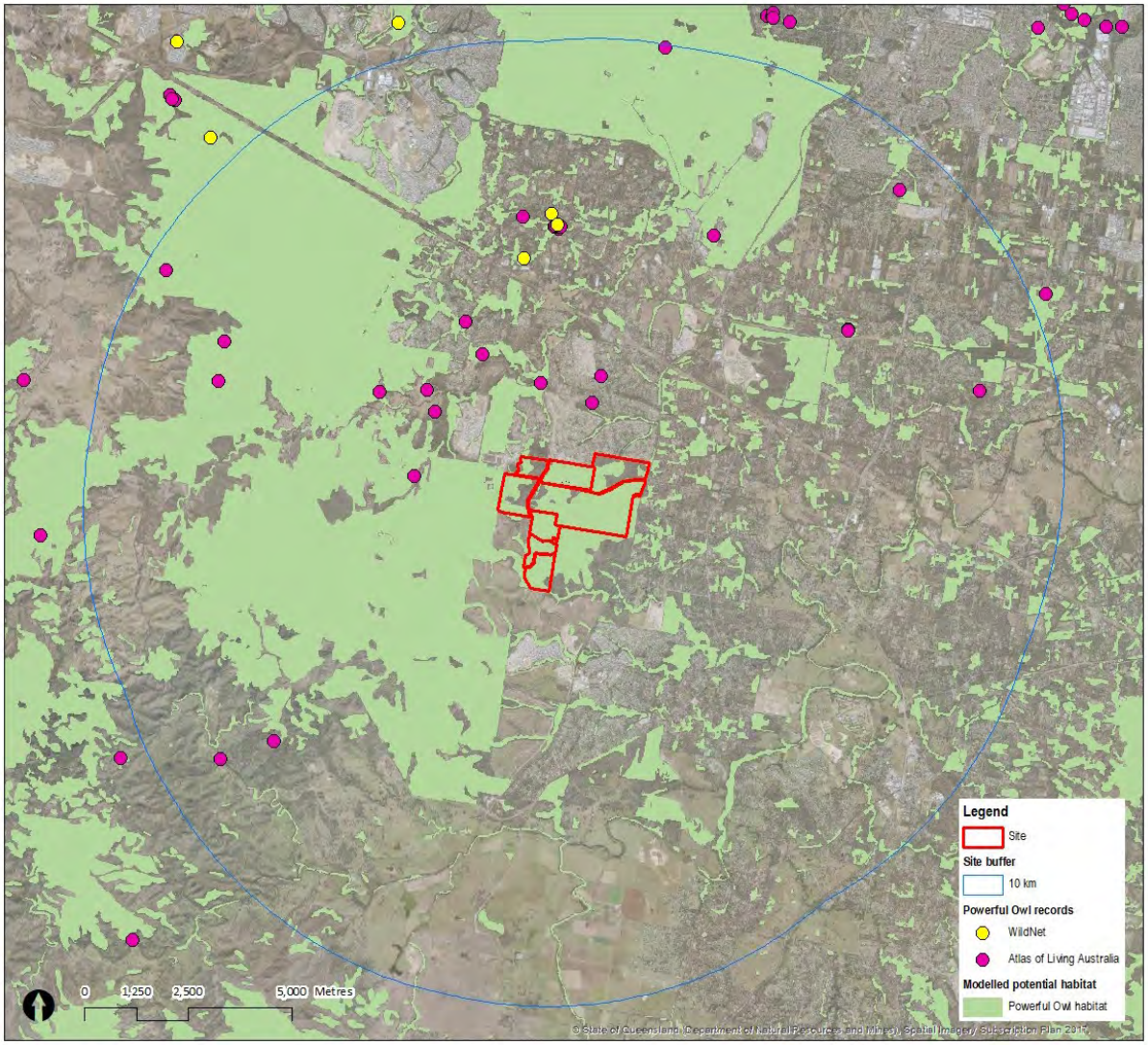


**FIGURE 19: LOCATION OF HISTORIC POWERFUL OWL SIGHTINGS AND POTENTIAL HABITAT MODELLING (QUEENSLAND HERBARIUM 2021, DEPARTMENT OF ENVIRONMENT AND SCIENCE 2023, NATIONAL RESEARCH INFRASTRUCTURE FOR AUSTRALIA 2023).**

## TUSKED FROG

The State Government's WildNet database and Atlas of Living Australia were used to assess the presence of the species on or nearby the site. A review of the records indicate that one (1) observation of the Tusked Frog was recorded in 2011 within 3 km of the site in Greenbank. A more recent ALA record, from 2021 is located approximately 4.5 km from the site in an urban area near Flagstone Creek, South MacLean.

Based on the Queensland Herbarium (2021) potential habitat modelling, the probable distribution of suitable Tusked Frog habitat is located in large, connected patches to the west and north of the site; however, is not located on or adjacent to the site. Given there are local records of the species, including a record near Flagstone Creek which intersects the site, the site may provide potentially suitable habitat for the Tusked Frog.

Potentially suitable habitat may be present throughout the site given the presence of open eucalypt forest and aquatic habitat (i.e., dams and creeks). The site can be described as

eucalypt forest associated with RE 12.9-10.2, 12.9-10.7a and 12.9-10.19 (Refer to Section 3.3 of the SBAR). The vegetation on site provides a large area of potential habitat for the Tusked Frog, is connected to bushland to the west and southeast, and contains two waterways including Abrade Creek and Flagstone Creek.

Based on the desktop assessment and the presence of open eucalypt forest and aquatic habitat, it is likely that the species could occur on the site.

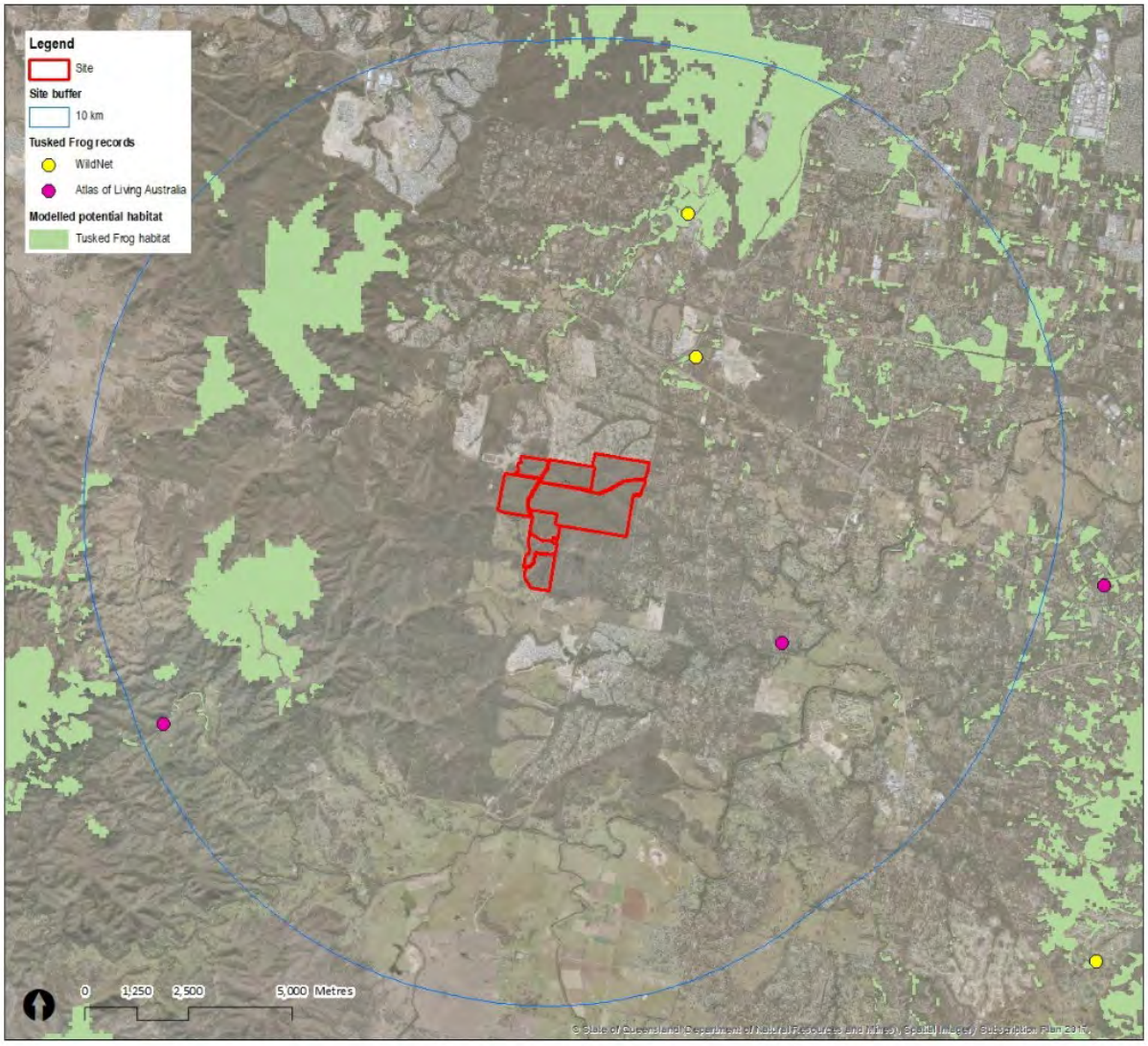


**FIGURE 20: LOCATION OF HISTORIC TUSKED FROG SIGHTINGS AND POTENTIAL HABITAT MODELLING (QUEENSLAND HERBARIUM 2021, DEPARTMENT OF ENVIRONMENT AND SCIENCE 2023, NATIONAL RESEARCH INFRASTRUCTURE FOR AUSTRALIA 2023).**

## KOALA

The State Government's WildNet database and Atlas of Living Australia were used to assess the presence of the species on or nearby the site. A review of the records indicate that Koala individuals are located within the site. The five (5) records located on site were recorded from 1989 to 2018. Four of these records are located along Abrade Creek. There are numerous records of the Koala within 10 km of the site, mostly in residential areas located to the east of the site.

Based on the Queensland Herbarium (2021) potential habitat modelling, the probable distribution of suitable Koala habitat is located on site, except for areas containing mapped Category X areas on the Vegetation Management Regulated Vegetation Management Map (version 7.01) (Department of Resources 2023) (Appendix 1). The vegetation on site is located within large, well-connected patches of modelled potential habitat.

Koala habitat is defined in the *Nature Conservation (Koala) Conservation Plan 2017* (Qld) as:

*(a) an area of vegetation in which koalas live and that includes a koala habitat tree[14]; or*
*(b) an area of vegetation that consists primarily of koala habitat trees and which is reasonably suitable for sustaining koalas; or*
*(c) a partially or completely cleared area used by koalas to cross from an area mentioned in paragraph (a) or (b) to another area mentioned in paragraph (a) or (b).*

As the site contains forested areas, which form part of a large contiguous landscape, including a range of eucalypt species, the site contains suitable habitat for the Koala. The site can be described as eucalypt forest associated with RE 12.9-10.2, 12.9-10.7a and 12.9-10.19 (Refer to Section 3.3 of the SBAR). The vegetation on site provides a large area of habitat for the Koala and is connected to bushland on both the western[13] and southern lots.

Results of the assessment indicate that the species has been confirmed on the site during targeted Koala survey (refer to SBAR; Section 4.4).

[14] *Koala habitat tree* is defined in the *Nature Conservation (Koala) Conservation Plan 2017* (Qld) as:
a) a tree of the *Corymbia*, *Melaleuca*, *Lophostemon* or *Eucalyptus* genera that is edible by koalas; or
b) a tree of a type typically used by koalas for shelter, including, for example a tree of the *Angophora* genus.

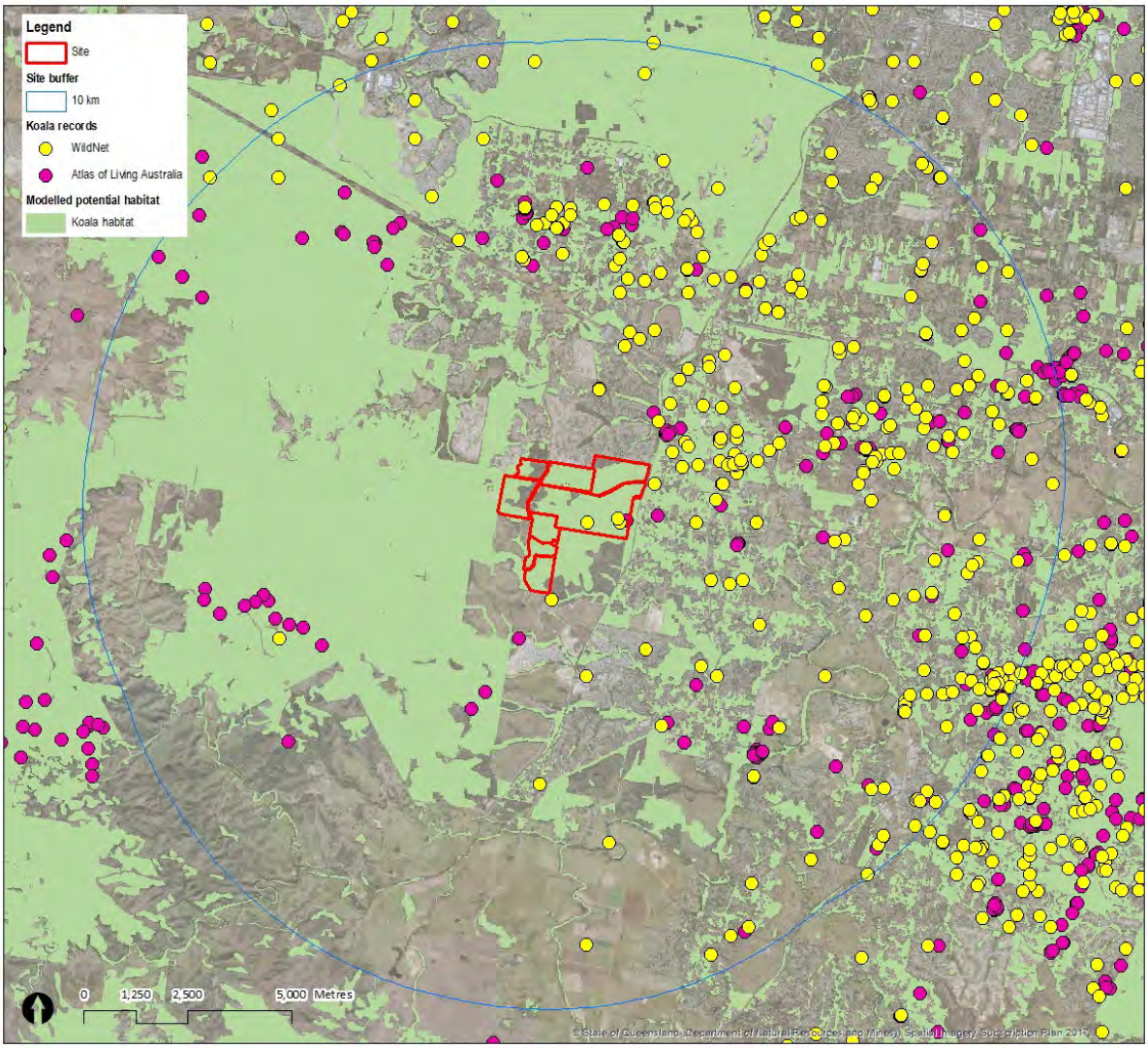


**FIGURE 21: LOCATION OF HISTORIC KOALA SIGHTINGS AND POTENTIAL HABITAT MODELLING (QUEENSLAND HERBARIUM 2021, DEPARTMENT OF ENVIRONMENT AND SCIENCE 2023, NATIONAL RESEARCH INFRASTRUCTURE FOR AUSTRALIA 2023).**

### 6.1.2 AIR PHOTO INTERPRETATION

Results of the assessment of aerial photography demonstrates:

- Historical timber harvesting is extensive across most of the site, with significant clearing occurring frequently on or before 2002, which is likely to have caused long-term habitat disturbances; and,
- Timber harvesting was most frequent or intense across Lot 1 on SP318791, Lot 58 on S312118 and Lot 8 on S312737 which predominantly contain trees less than 20 m in height (refer to Section 6.1.3) and are less likely to contain habitat trees with suitable hollows for the target species.

Refer to Figure 22, Figure 23, Figure 24 and Figure 25 for rectified digital aerial imagery of the site in 1944, 1971, 1982 and 2002 respectively. The LiDAR analysis outlined in the following section provides an analysis of more recent land use and disturbances.

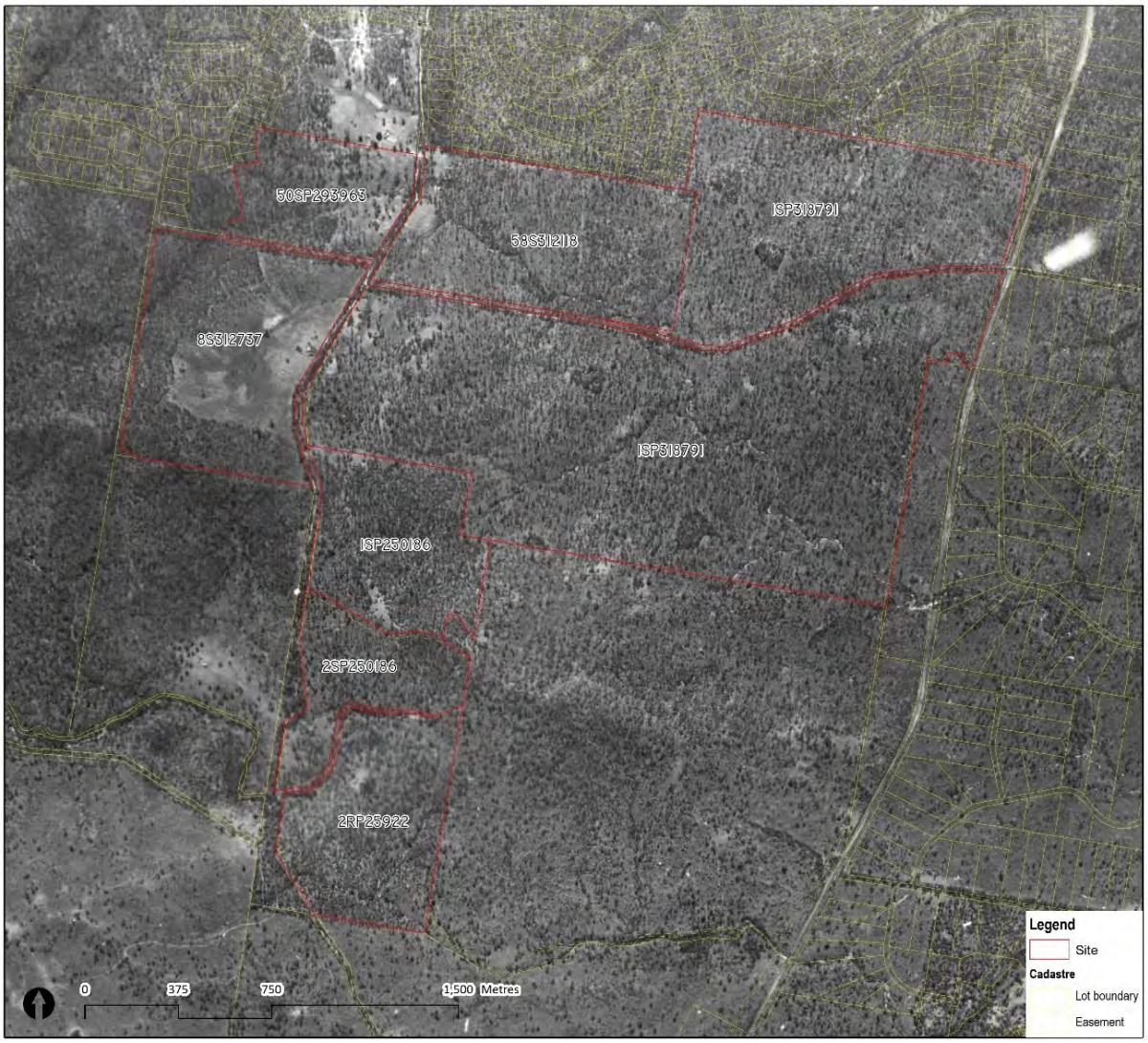


FIGURE 22: RECTIFIED DIGITAL IMAGE OF THE SITE, 1944 (STATE OF QUEENSLAND 2023).

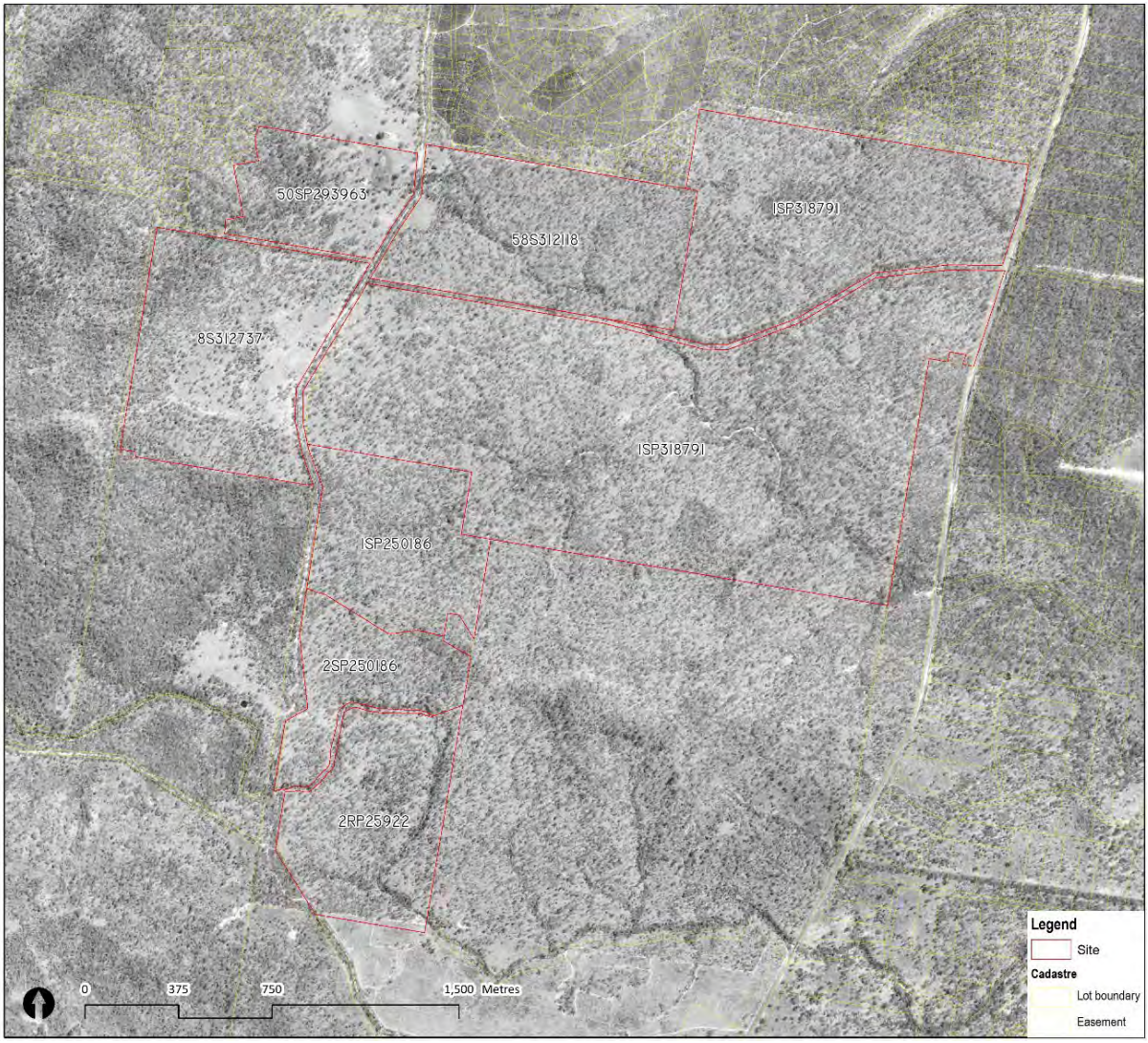


FIGURE 23: RECTIFIED DIGITAL IMAGE OF THE SITE, 1971 (STATE OF QUEENSLAND 2023).

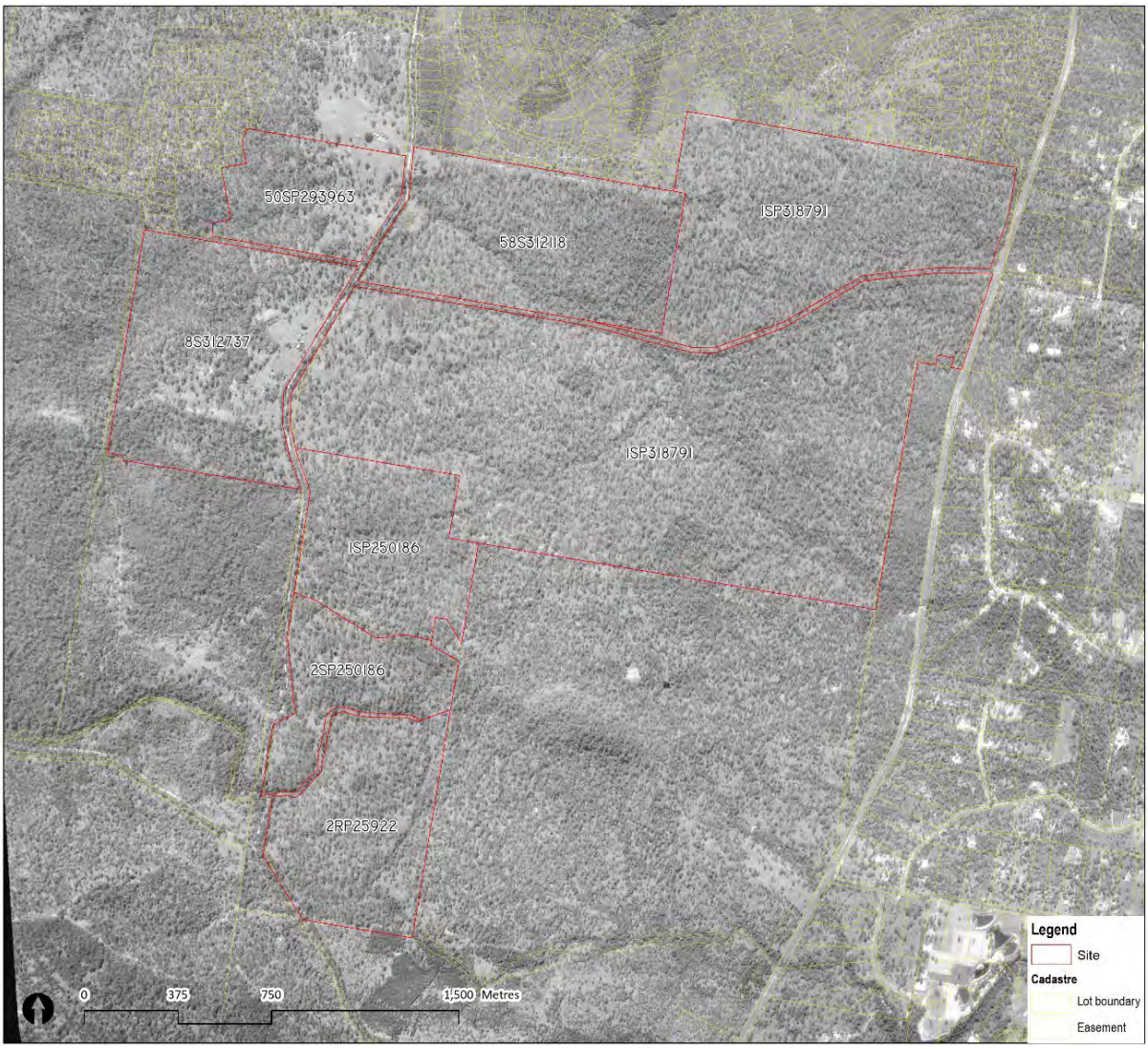


FIGURE 24: RECTIFIED DIGITAL IMAGE OF THE SITE, 1982 (STATE OF QUEENSLAND 2023).

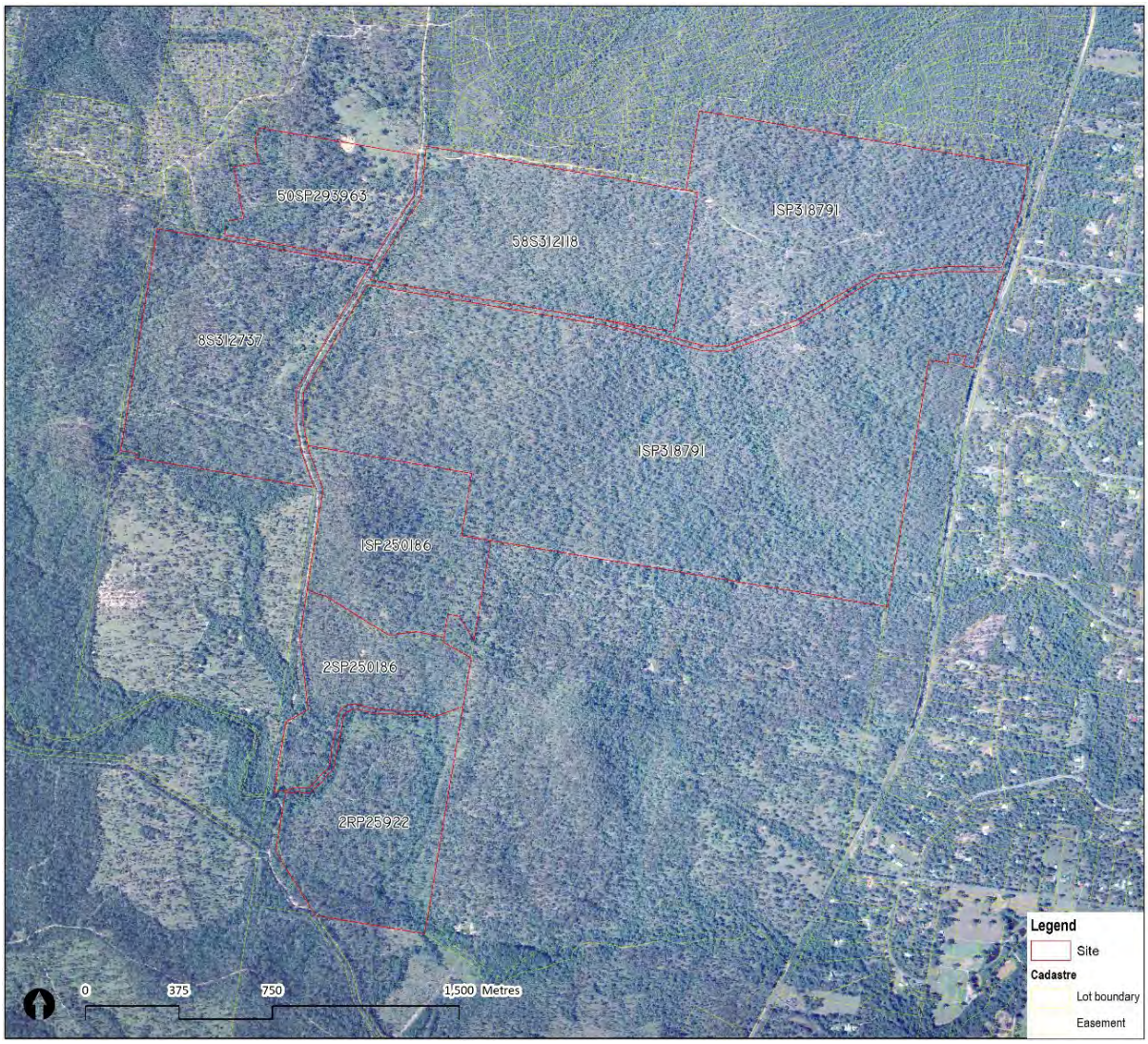


**FIGURE 25: RECTIFIED DIGITAL IMAGE OF THE SITE, 2002 (STATE OF QUEENSLAND 2023).**

### 6.1.3 LIDAR ANALYSIS

Results of the assessment of LiDAR data includes:

- The DTM provided high resolution information in regard to site topography, including the location of gullies and waterways, slope and aspects to inform the selection of biodiversity plot locations.
- Some regions of the site contain taller trees over 30m in height, suggesting these areas have been less affected by timber harvesting and may represent mature forest. These areas are more likely to contain habitat trees with suitable hollows and these locations were the focus of subsequent field investigations for tree hollows. These areas include:
  - Lots 2 SP250186 and 2 RP25922 located in the southern extent of the site,
  - Land near the eastern boundary of Lot 1 SP318791, and
  - The north west portion of Lot 8 S312737.
- LiDAR data indicates that the regions of the site logged more intensively correspond with flatter terrains.

- The majority of the site contains vegetation less than 15m in height, which is consistent with the observed subcanopy and shrub layer across the site that generally consisted of *Allocasuarina* sp. and/or *Acacia* sp. (refer to Section 2.1).

Refer to Figure 26 for a map of the DTM, and Figure 27 for a map of vegetation height. Refer to Figure 28 for a map of the biodiversity plots in relation to vegetation heights.

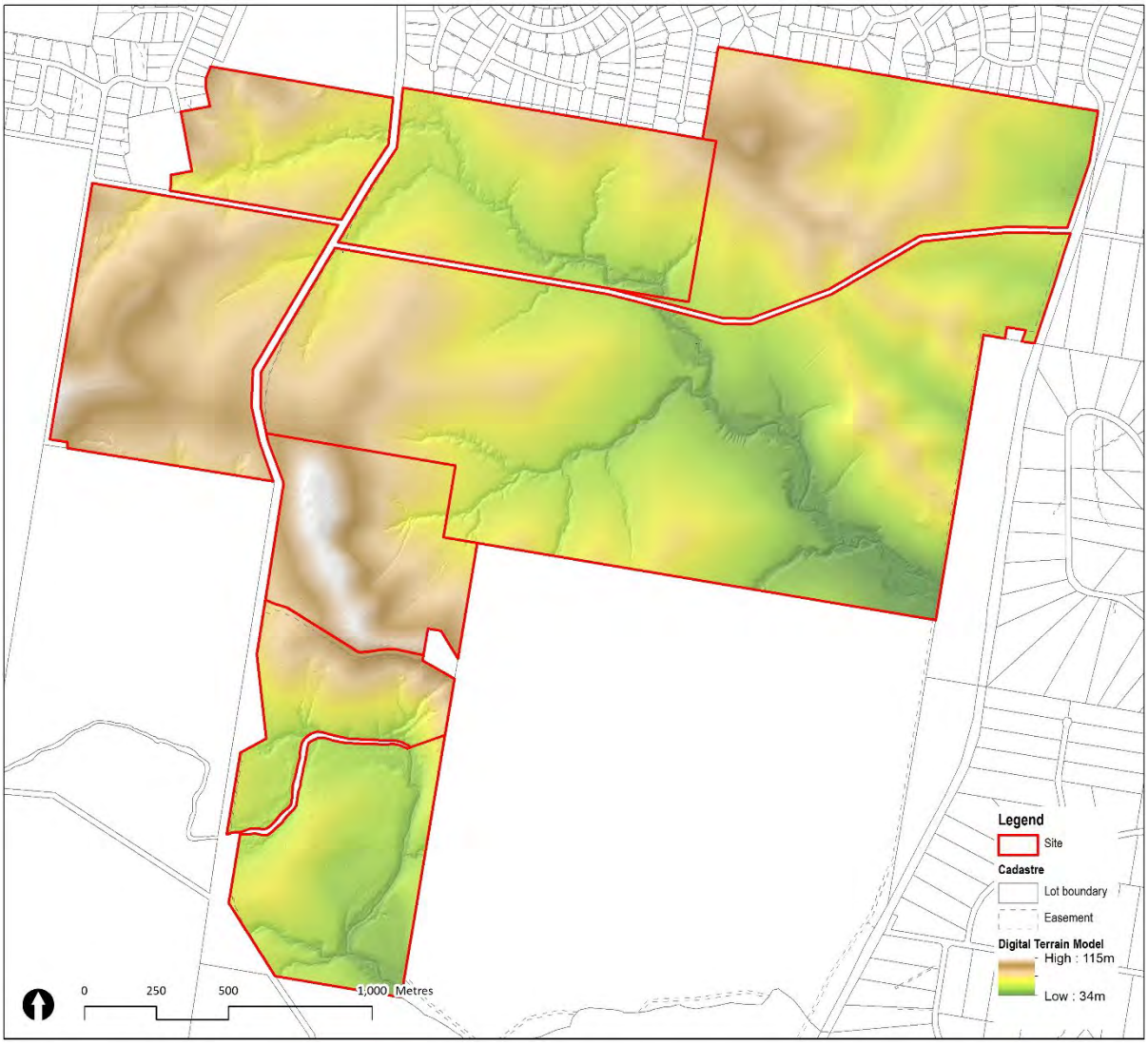


**FIGURE 26: DIGITAL TERRAIN MODEL (DEPARTMENT OF RESOURCES 2022).**

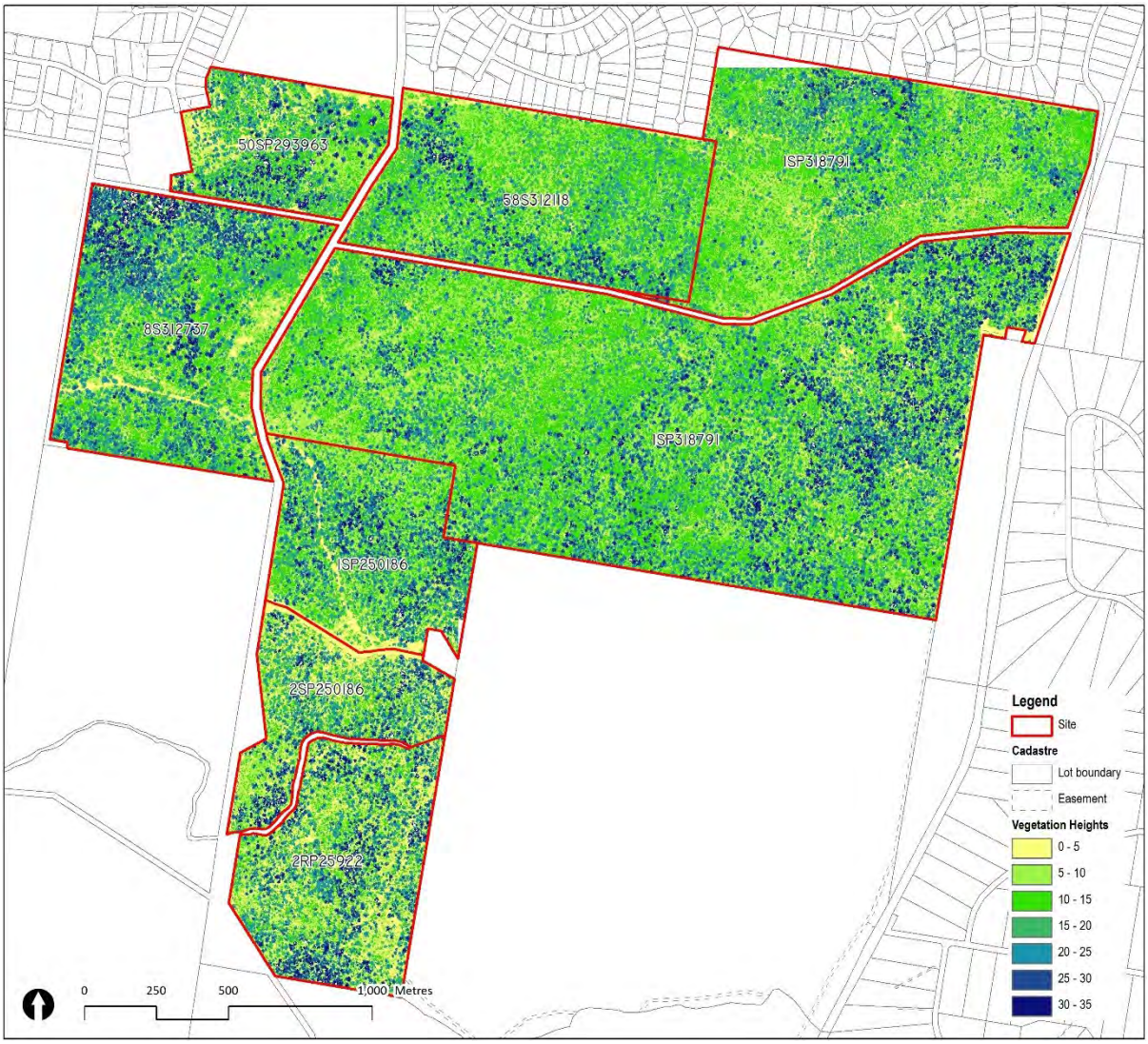


FIGURE 27: VEGETATION HEIGHTS (DEPARTMENT OF RESOURCES 2022).

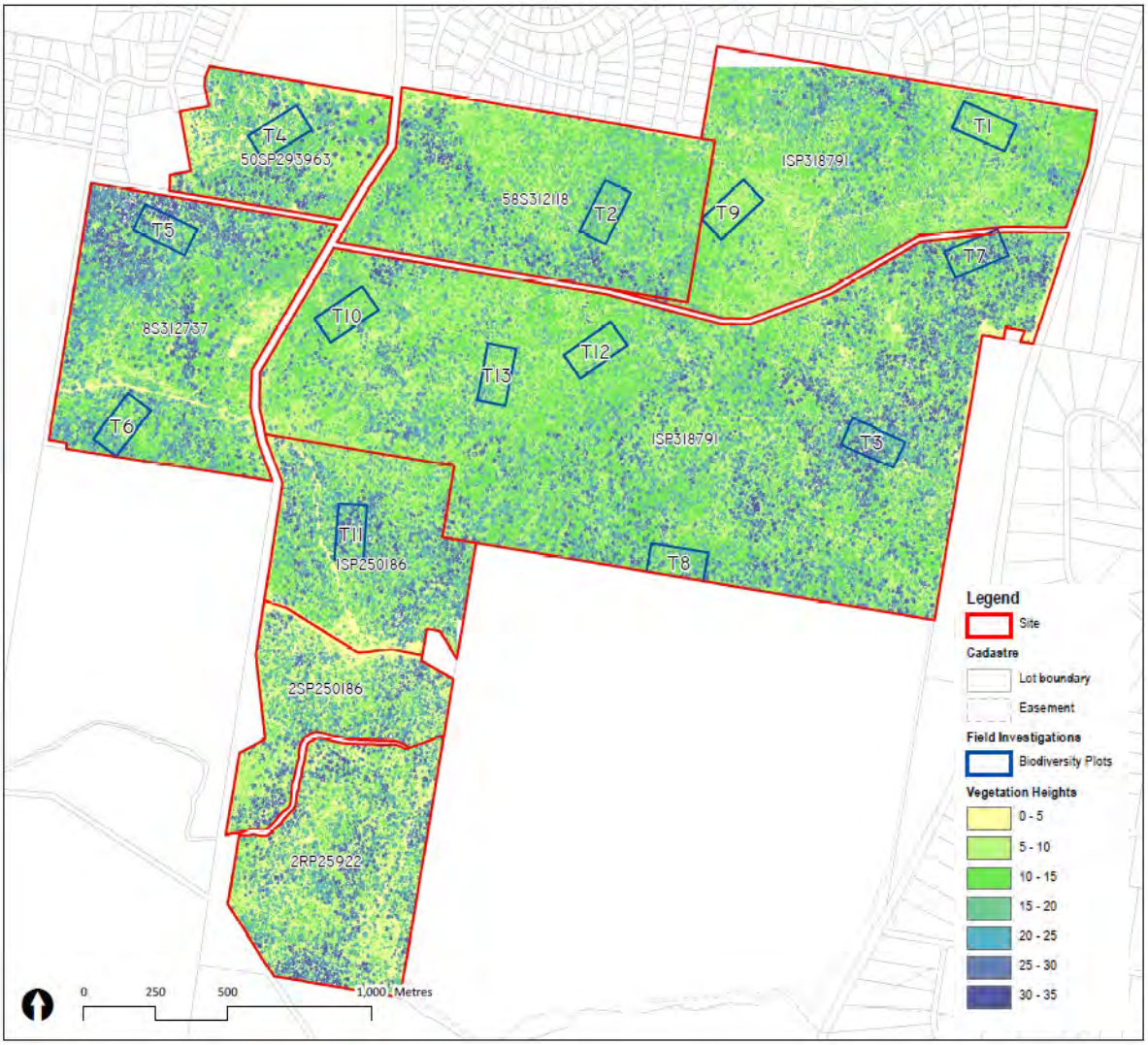


**FIGURE 28: VEGETATION HEIGHTS AND BIODIVERSITY PLOTS.**

## 6.2 FIELD ASSESSMENT

A total of 17 species (Table 4) of fauna were directly observed on site during the field assessments, including:

- Six (6) species of amphibians;
- Five (5) species of birds; and,
- Six (6) species of mammals.

**TABLE 4: DIRECT FAUNA OBSERVATIONS.**

| Scientific Name | Common Name | NC Act Status | Survey Methodology |
|---|---|---|---|
| **Amphibians** | | | |
| *Limnodynastes dumerilii* | Pobblebonk | LC | NS |
| *Litoria caerulea* | Australian Green Tree Frog | LC | NS |

| Scientific Name | Common Name | NC Act Status | Survey Methodology |
|---|---|---|---|
| *Litoria* sp. 1 | (tree frog) | - | NS |
| *Litoria* sp. 2 | (tree frog) | - | NS |
| *Platyplectrum ornatum* | Ornate Burrowing Frog | LC | NS |
| *Rhinella marina* | Cane Toad | Introduced | NS |
| **Birds** | | | |
| *Dacelo novaeguineae* | Laughing Kookaburra | LC | NS |
| *Philemon corniculatus* | Noisy Friarbird | LC | NS |
| *Podargus strigoides* | Tawny Frogmouth | LC | NS |
| *Calyptorhynchus banksii* | Red-tailed Black-Cockatoo | - | IN |
| *Malurus cyaneus* | Superb Fairy-wren | - | IN |
| **Mammals** | | | |
| *Petaurus* sp. | (Squirrel Glider / Sugar Glider) | - | NS |
| *Phascogale tapoatafa* | Brush-tailed Phascogale | LC | NS |
| *Pteropus* sp. | (flying-fox) | - | NS |
| *Trichosurus vulpecula* | Common Brushtail Possum | LC | NS |
| *Wallabia* sp. | (wallaby) | - | NS |
| *Macropus giganteus* | Eastern Grey Kangaroo | - | IN |

TABLE CODES:

- NC Act Status: Indicates the Queensland conservation status of each taxon under the Nature Conservation Act 1992, coded as Extinct (EX), Critically Endangered (CR), Endangered (E), Vulnerable (V), Near Threatened (NT), Least Concern (LC).
- Survey methodology: CP = call playback, NS = nocturnal spotlight searches, IN = incidental.

Although none of the target species were directly observed as part of these assessments[15], indirect evidence of the target species and potential habitat has also been assessed. The following sections outline the results of the direct and indirect field-based assessments, as well as the habitat assessment.

### 6.2.1 CALL PLAYBACK

No positive response was recorded for either of the target species: Powerful Owl or Tusked Frog.

[15] Noting that the Koala was directly observed in prior field investigation in the SBAR (Refer to Map 2. Field Survey Effort and Section 4.4: Fauna assessment).

### 6.2.2 SPOTLIGHTING

Although some native species were observed during spotlighting (Table 4), the nocturnal spotlight searches did not record either of the target species: Powerful Owl or Tusked Frog.

### 6.2.3 WILDLIFE DETECTION DOGS

The targeted survey found indirect evidence of Koala utilisation, including scats and/or pap[16] at 38 locations over the subset of the site surveyed. A total of 10 scat samples were collected which were suitable for molecular testing to obtain a reliable DNA profile.

The results of the laboratory analysis indicated the following:

- nine (9) of the samples provided genotype data, which were found to represent seven (7) unique individuals, four (4) males and two (2) females (sexing failed for one individual);
- all 10 individuals were positive for KoRV-A, while *Chlamydia pecorum* was detected in 29% (2/7) of individuals; and,
- pairwise relatedness between sampled individuals indicated that overall, individuals did not appear to be highly related and only one (1) pair of individuals had a mean relatedness estimate of 0.24, suggesting that the pair may be relatives, however, confidence associated with this estimate is low.

The pairwise relatedness results suggests that the individual Koalas profiled on site form part of and are connected to a larger population[17]. Based on the location of the site, it can be assumed that the Koalas on site form part of the SEQ West population cluster (OWAD, 2023); however, further genetic confirmation would be required to confirm which population they pair with.

Refer to the *Koala Survey Report – Tarnbrae* (Appendix 3) for further results details. Refer to Figure 16 for a map extract of the survey effort and koala scat locations.

### 6.2.4 ASSESSMENT OF FORAGING SIGNS

During targeted searches for evidence of GBC feeding, chewed she-oak cones (orts) were detected within a small patch (<1,500 sqm) of *Allocasuarina littoralis* located in the south west portion of the site (T6; refer to Figure 10). Within this patch, *Allocasuarina* was the dominant canopy species, with little to no shrub or understorey cover. Orts were detected under three potential *Allocasuarina littoralis* feed trees, approximately 10 m tall. In

[16] Joey Koalas are inoculated with microorganisms by feeding on specialised maternal faeces (pap) at about the time of first emergence from the pouch. This prepares the young Koala's digestive system for a dietary transition from maternal milk to tannin-rich eucalypt leaves.

[17] Despite the small sample size, if the site was isolated (i.e., not connected), the results would have more and higher relatedness scores.

addition, orts were opportunistically observed under one (1) *Allocasuarina littoralis* tree located along a walking track in the south east portion of the site. Targeted searches in areas surrounding this feed tree found no other evidence of orts.

GBC orts can be identified by chewing pattern, where they will often grasp a cone from the stem and chew from top to bottom, leaving behind crumbs and disc-shaped fragments of cone, (Glossy Black Conservancy 2022). When other bird species (for example, Rosellas) feed on she-oak cones they usually leave behind chewed cones that are shaped like apple cores (Glossy Black Conservancy 2022). In addition, GBCs often leave a large number of chewings under the tree, unlike other birds (Glossy Black Conservancy 2022).

The chewing style of the orts found on the site consisted of crumbs, partially chewed cones and fully chewed cones in variable chewing styles. The volume of orts discovered under the trees were generally low. Despite the variance in chewing pattern and the low amount of feeding, overall, the style of seed pod chewing is characteristic of the GBC due to the occurrence of disc shaped orts amongst other pods that were not completely chewed.

To support the inferences based on indirect evidence, descriptions and detailed photography of the evidence of the Orts were shared with multiple experienced GBC field researchers for independent peer review. All field researchers concluded that the evidence is characteristic of the GBC based on an independent peer review of the evidence. In addition, all concluded that the observed behaviour (low density of orts) is most likely due to tree sampling.

Refer to Figure 29 for the location of ort evidence. Refer to Figure 30 and Figure 31 for images of the orts.

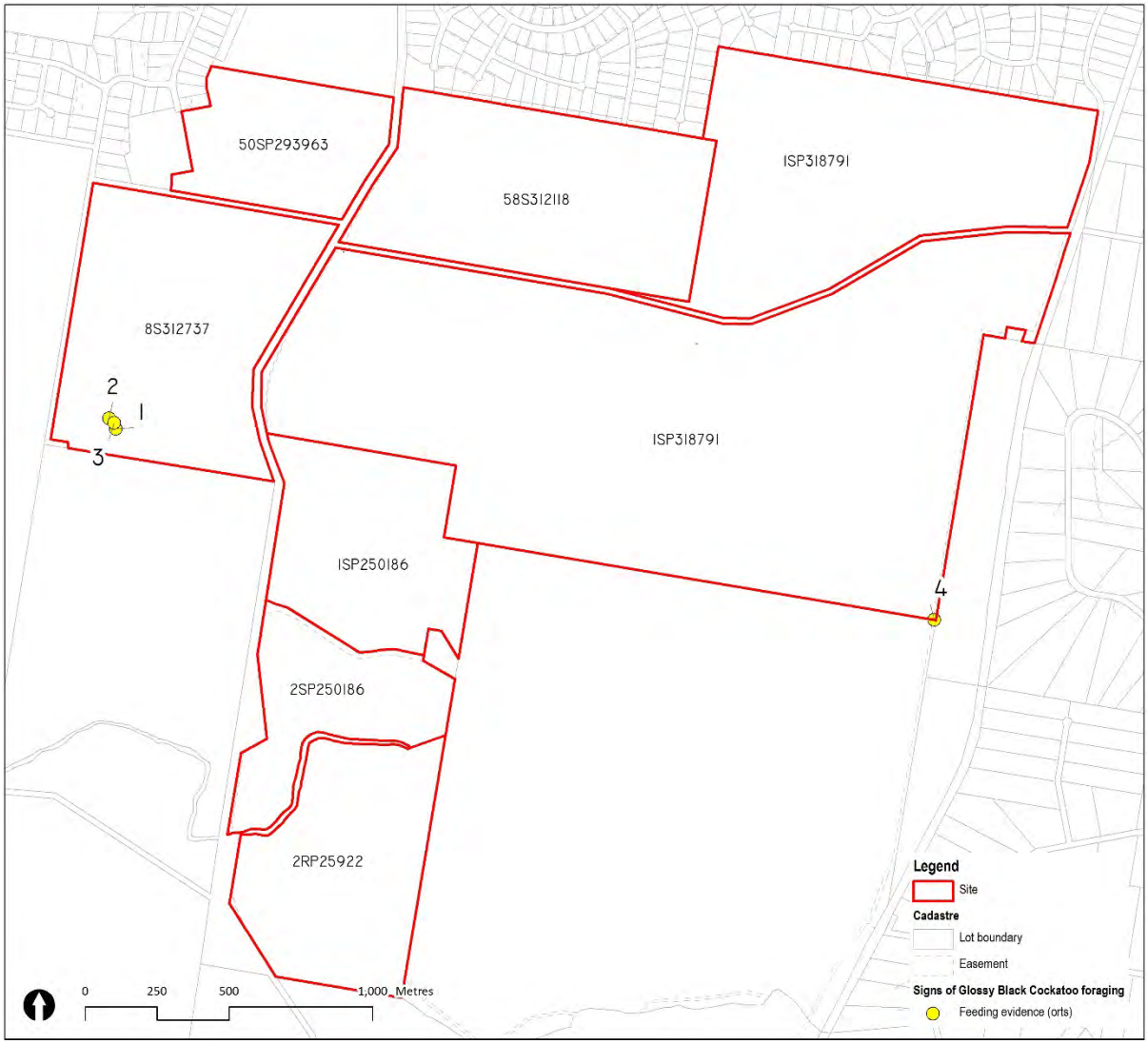


**FIGURE 29: SIGNS OF FORAGING (ORTS).**

FIGURE 30: ORTS IN-SITU.

FIGURE 31: DETAILED ORT PHOTOGRAPH.

### 6.2.5 EDNA BIODIVERSITY ASSESSMENT

The results of the laboratory analysis detected 22 vertebrate taxa, including three (3) introduced species, from the sample locations. The majority of taxa were identified at the species level (64% of all taxa). The inability to identify certain taxa at the species level is likely a result of inadequate genetic sequence data available in the reference sequence database for the region.

None of the target species (Glossy Black-Cockatoo, Powerful Owl, Tusked Frog or Koala) were specifically detected by the eDNA biodiversity assessment. Unidentified frog and/or toad species were detected (composing the order Anura) downstream of Abrade Creek and one of its drainage features, however, none of these samples match native species (above a 95% threshold).

Refer to the EnviroDNA report (Appendix 6) for full details of the eDNA assessment results.

### 6.2.6 HOLLOW SURVEY

Hollow survey found tree hollows of various sizes in 10 of the 13 biodiversity plots. The hollow assessment indicated the following general trends in hollow-bearing trees:

- Hollows were recorded in trees with a height range of 15 – 28 m, with the majority of hollows observed in trees standing between 20 – 25 m in height;
- Trees with hollows had a DBH measurement ranging from 23 – 90 cm, with most Hollows occurring in trees with a DBH between 41 – 60 cm;
- Hollow widths ranged from 5 – 40 cm, however, most hollows measured between 5 – 20 cm;
- Overall, nine (9) branch hollows, seven (7) chimney hollows and 17 side hollows were recorded; and,
- Most of the trees containing hollows were mature *Eucalyptus tereticornis*, *Corymbia citriodora* or dead trees.

Refer to Figure 32 for a breakdown of hollow tree characteristics.

The result of the assessment of linear relationships between average tree height and the density of hollows in biodiversity plots produced an *r* value of *0.7391*, i.e., as tree height across the site increases, the density of hollows also tends to increase. This supports the assumption that timber harvesting is likely to have reduced mature vegetation, containing large trees, and potential fauna habitat (Refer to Figure 27 for tree height data). Figure 33 shows a graph illustrating the relationship between mean tree height in biodiversity plots versus the number of hollows in a plot.

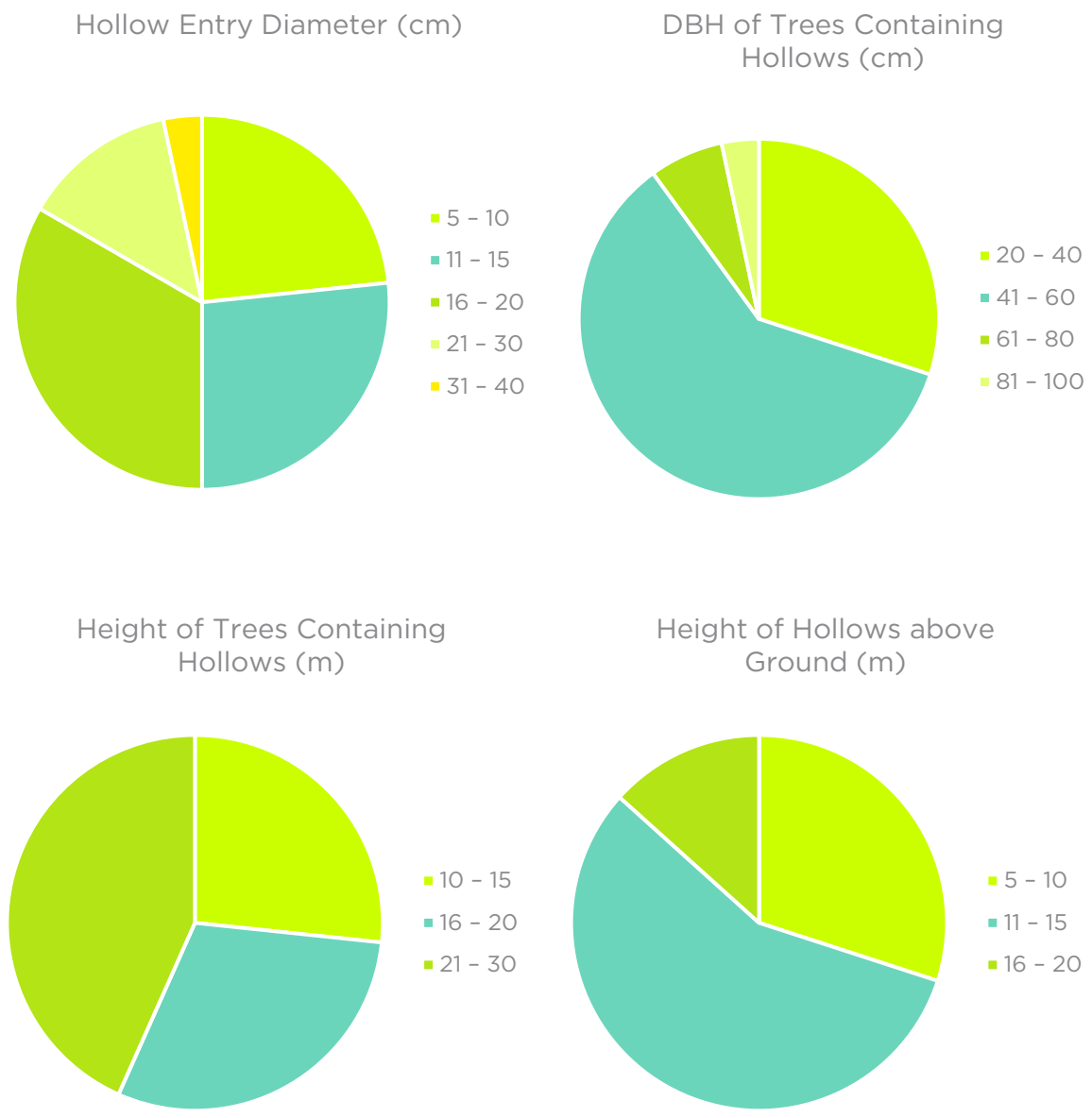


**FIGURE 32: HOLLOW CHARACTERISTICS.**

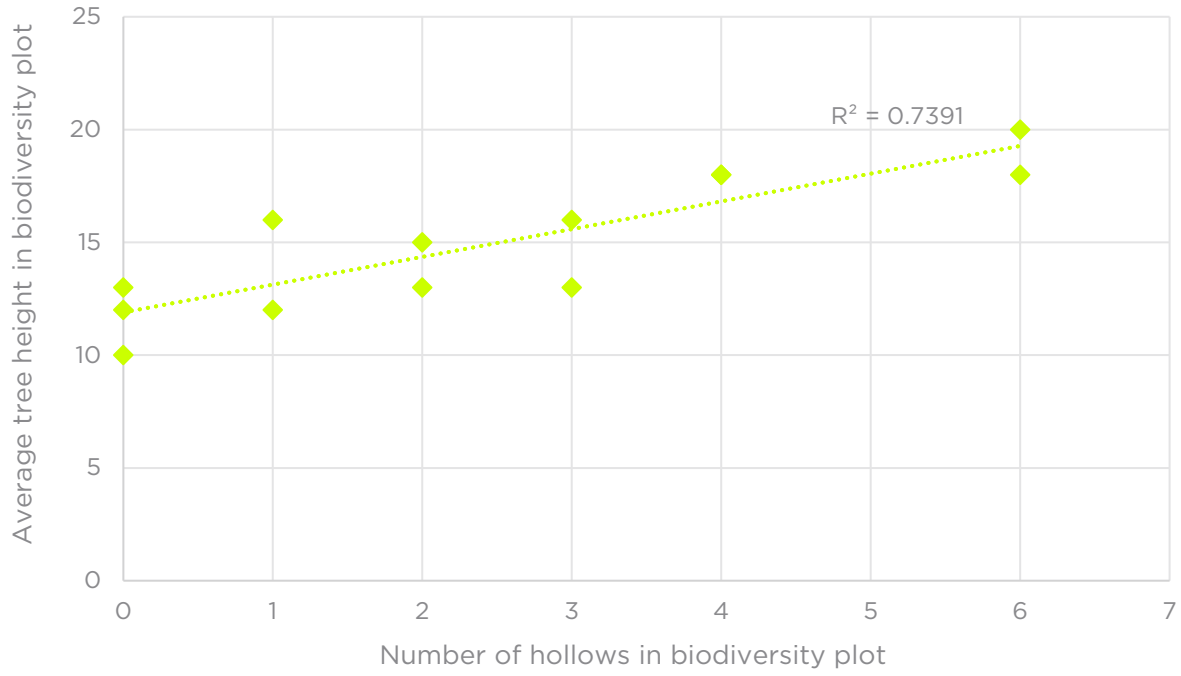


**FIGURE 33: AVERAGE TREE HEIGHT IN BIODIVERSITY PLOTS VS NUMBER OF HOLLOWS IN BIODIVERSITY PLOTS.**

## GLOSSY BLACK COCKATOO

The hollow survey did not record any hollows that met the minimum nesting criteria (chimney style hollows in trees with a minimum DBH of 60cm); however, side hollows were recorded in two trees with a DBH >60 cm. In addition, chimney style hollows with an entrance DBH >15 cm were recorded in an additional seven (7) trees with DBH <60cm. A total of 24 hollows that met the minimum requirements of 15 cm hollow diameter (Cameron 2006, Hourigan 2012, Birdlife Australia 2020) were recorded; however, none of these also met the DBH and style requirements outlined above. One-way analyses of variances (ANOVA) indicated that there were no significant differences between REs and hollow densities where potential GBC hollows were observed. Additionally, there were no significant differences between location types varying in topography, disturbance type, tree heights, and tree diameters. These characteristics suggest that all REs within the site provide equally suitable habitat for this species. Refer to Appendix 7 for hollow assessment data.

## POWERFUL OWL

There was only one record of a hollow suitable for the Powerful Owl, considering a >35 cm hollow diameter is required for nesting (NSW Scientific Committee 2008, Mott n.d.). No other potential hollows for this species were observed on the site. It was observed to be near the riparian zone of a waterway, which is a known breeding and roosting preference of the species. This particular hollow was observed on a wide tree (diameter of 64 cm) outside of the timber harvesting area, suggesting that potential Powerful Owl hollows will be more prevalent in larger trees not impacted by timber harvesting. Due to the size of

the hollow and its location near preferred habitat in a riparian corridor, the hollow could be considered potential nesting habitat for the Powerful Owl; however, no evidence of current use of the hollow was observed as part of the assessment. No statistical analyses were undertaken for this species as a singular sample would not return a robust patterning reference. Refer to Appendix 7 for hollow assessment data.

#### PREY HOLLOWS

All hollows were considered potential prey hollows. No significant differences in hollow densities were recorded between REs, suggesting that all areas of the site are of equal suitability for prey hollows. Field investigation data was integrated into an extrapolation model to determine approximated frequencies of hollows on site. When applying observed data to the entirety of the site, it is estimated that approximately 900 hollows will exist at all ranges of hollow diameters. RE 12.9-10.2/12.9-10.7a, the largest RE on site (224 ha), is projected to house approximately 450 hollows. Although determined as not statistically significant, it has one of the highest hollow density outputs (2 hollows per hectare) when compared to other REs. Refer to Appendix 7 for hollow assessment data.

### 6.2.7 INCIDENTAL OBSERVATIONS

Although fauna were opportunistically observed (Table 4) that had not been recorded as part of the targeted surveys, none of these were the target species.

A number of key fauna habitat features were also identified on the subject site. Identified key habitat features included:

- Hollow-bearing trees[18];
- Stags;
- Various scats, including a range of Macropod scats[19]; and,
- Course woody debris and other ground habitat suitable for ground-dwelling fauna.

[18] Refer to Section 5.2.6 for results of hollow survey and analysis.

[19] Refer to Section 5.2.3 for results of Koala scat assessment.

# 7 SUMMARY

The Addendum has been prepared by Litoria Consulting on behalf of New Beith Pty Ltd to address Items 14 - 18 in Economic Development Queensland's (EDQ)[20] Further Issues Letter (14 November 2023). The Further Issues Letter is associated with a Priority Development Area (PDA) assessable development application for the Tarnbrae Greater Flagstone Residential Development (EDQ Reference: DEV2023/1413), referred to in this report as Tarnbrae.

This Addendum to the Significant Biodiversity Assessment Report (Saunders-Havill Group, Issue C, 2022) has been prepared by Litoria Consulting on behalf of New Beith Pty Limited for land described as New Beith Road, New Beith (Lot 2 on RP25922, Lot 58 on S312118, Lot 8 on S312737, Lots 1 & 2 on SP250186, Lot 50 on SP293963 and Lot 1 on SP318791). The Addendum has been prepared to support the PDA assessable development application for the 'Tarnbrae Greater Flagstone Residential Development' located within the Greater Flagstone PDA and specifically addresses Items 14 – 18 in EDQ's Further Issues Letter (14 November 2023).

The purpose of the Addendum was to:

- Review State-approved guidance material and literature for the Glossy Black-Cockatoo (eastern) (*Calyptorhynchus lathami lathami*), Powerful Owl (*Ninox strenua*), Tusked Frog (*Adelotus brevis*) and Koala (*Phascolarctos cinereus*); and,
- Survey for the presence or otherwise of the aforementioned species within the site; and,
- Provide the results of the survey/s in order to respond to the EDQ Further Issues Letter.

The results of the targeted species assessments are summarised in the following subsections.

## 7.1 GLOSSY BLACK-COCKATOO

Field investigation results suggest that the GBC is likely to occupy the site from time to time. Indirect evidence suggests the site includes potentially suitable habitat:

- Low intensity feeding activity on four (4) *Allocasuarina littoralis* trees;
- A few chimney style hollows were encountered with an entry diameter above 15cm (Refer to Section 6.2.6 for results of hollow survey and analysis); and,

[20] Department of State Development, Infrastructure, Local Government and Planning.

- Limited hollows were found in trees with a DBH > 60cm, however, these hollows were not the preferred chimney style (Refer to Section 6.2.6 for results of hollow survey and analysis).

GBC feeding habits are driven primarily by tree and cone productivity/profitability, as such, they are selective (Cameron and Cunningham 2006, North, Lamont et al. 2020). In regard to the indirect evidence of GBC feeding, although there is likely to be multiple factors influencing habitat selection at a landscape level, low intensity feeding evidence may be due to 'sampling' of cones which can leave behind a low volume of orts, where GBC are less likely to return to feed on that specific tree soon thereafter. Sampling behaviour is also less likely to fully extract seeds and will provide variable ort shapes. Both independent peer reviewers of the GBC evidence concluded that the observed behaviour is most likely due to tree sampling.

In regard to the results of the hollow assessment, there is a limited density of preferable hollows for the GBC. The GBC's minimum nesting site includes hollows in dead or living trees with a DBH >60 cm, with hollows that are vertical or near-vertical spouts (Cameron 2006, Birdlife Australia 2020). The hollow survey did not record any hollows that met the minimum criteria; however, side hollows were recorded in two trees with a DBH >60 cm. In addition, chimney style hollows with an entrance DBH >15 cm were recorded in an additional seven (7) trees with DBH <60cm. Given that the species often nests in close proximity to other breeding pairs and hollow density correlates strongly with nesting presence in a landscape, it is unlikely that the site provides suitable breeding habitat due to the limited number of preferred hollows on the site. These findings are consistent with the desktop assessment, which indicated that few areas across the site contain mature vegetation that may provide potential nesting hollows for the species.

Overall, field investigations suggest that the GBC is likely to occupy the site from time to time and may use the habitat for feeding. The observed feeding behaviour (low density of orts) is most likely due to tree sampling. The site is not likely to be used as nesting habitat due to the low density of suitable hollows; however, the species has a foraging range of up to 10 km from nesting sites and, as such, may nest in mature vegetation nearby and utilise the site for feeding.

Environmental Open Space areas along creek corridors, shown on the Context Plan (Saunders-Havill Group, Drawing Ref: 8905 P Rev. L – SK 01, 06/02/2024), will provide potential habitat for the species within the proposed master-planned community, as *Allocasuarina* sp. was observed within riparian areas.

## 7.2 POWERFUL OWL

Field investigation results suggest that the site may to provide suitable habitat for the Powerful Owl, although no direct or indirect evidence of the species was found on the site. In summary:

- Spotlighting and incidental survey results from the addendum and SBAR indicate prey species occupy the site,

- Only a single hollow was encountered with a suitable diameter for Powerful Owl nesting, and
- Riparian corridors have been subject to less historic timber harvesting and so could possibly provide suitable habitat for the species due to the intersection of suitable habitat features (large trees and waterways).

The hollow assessment results indicate that there is a limited presence and low density of suitable hollows for the Powerful Owl within the survey area, particularly given the large size of the site, largely due to the lack of mature trees. In terms of Powerful Owl habitat, the hollow survey and incidental observations resulted in the record of only one potentially suitable hollow that is of a sufficient size for nesting (>35cm hollow width). The hollow was roughly 40 cm in diameter, 14 m from the ground and located in Transect 2, which is positioned north of Abrade creek. Transect 2 is located near the riparian zone, with the end of the transect is located roughly 80 m from the centreline of the creek. Due to the size of the hollow and its location near preferred habitat in a riparian corridor, the hollow could be considered potential nesting habitat for the Powerful Owl; however, no evidence of current use of the hollow was observed as part of the assessment. Environmental Open Space areas along creek corridors, shown on the Context Plan (Saunders-Havill Group, Drawing Ref: 8905 P Rev. L – SK 01, 06/02/2024), will provide potential roosting and/or breeding habitat for the species within the proposed master-planned community.

The results of the hollow assessment and opportunistic observations indicated that the site also contains some large stags that could act as perching sites for the Powerful Owl. Despite the low density of suitable hollows, it is conceivable that the Powerful Owl uses the site for hunting, given there are nearby records of nesting individuals. These findings are consistent with the desktop assessment, which indicated that few areas across the site contain mature vegetation that would provide potential nesting hollows for the species.

## 7.3 TUSKED FROG

Field investigation results suggest that the site may provide suitable habitat for the Tusked Frog, although no direct or indirect evidence of the species was found on the site.

In summary:

- Call playback returned no positive results; and,
- Results of the eDNA assessment did not detect the Tusked Frog.

Environmental Open Space areas along creek corridors, shown on the Context Plan (Saunders-Havill Group, Drawing Ref: 8905 P Rev. L – SK 01, 06/02/2024), will provide potential habitat for frog species, including the Tusked Frog, within the proposed master-planned community. The Environmental Open Space includes areas near water and open forest-woodlands away from water that meet the habitat preferences for both males and females respectively.

## 7.4 KOALA

In summary, field investigation results confirmed that the koala is present on the site, as per previous reporting. Although the species was not directly observed, indirect evidence of the species was found.

In summary:

- The vegetation is suitable habitat for the Koala;
- Indirect evidence (koala scat) was located on the site by detection dogs; and
- Results of the DNA profile assessment indicated that the individual Koalas did not appear highly related and all individuals were positive for disease.

Given the geographic location of the site and the pairwise relatedness laboratory analysis results, it can be assumed that the Koalas on site form part of the SEQ West population cluster (OWAD, 2023); however, further genetic confirmation would be required to confirm which population they pair with. The laboratory analysis also confirmed the presence of both KoRV-A and/or *Chlamydia pecorum* disease within the individuals tested.

Environmental Open Space areas along creek corridors, shown on the Context Plan (Saunders-Havill Group, Drawing Ref: 8905 P Rev. L – SK 01, 06/02/2024), will provide potential refuge habitat for the species within the proposed master-planned community.

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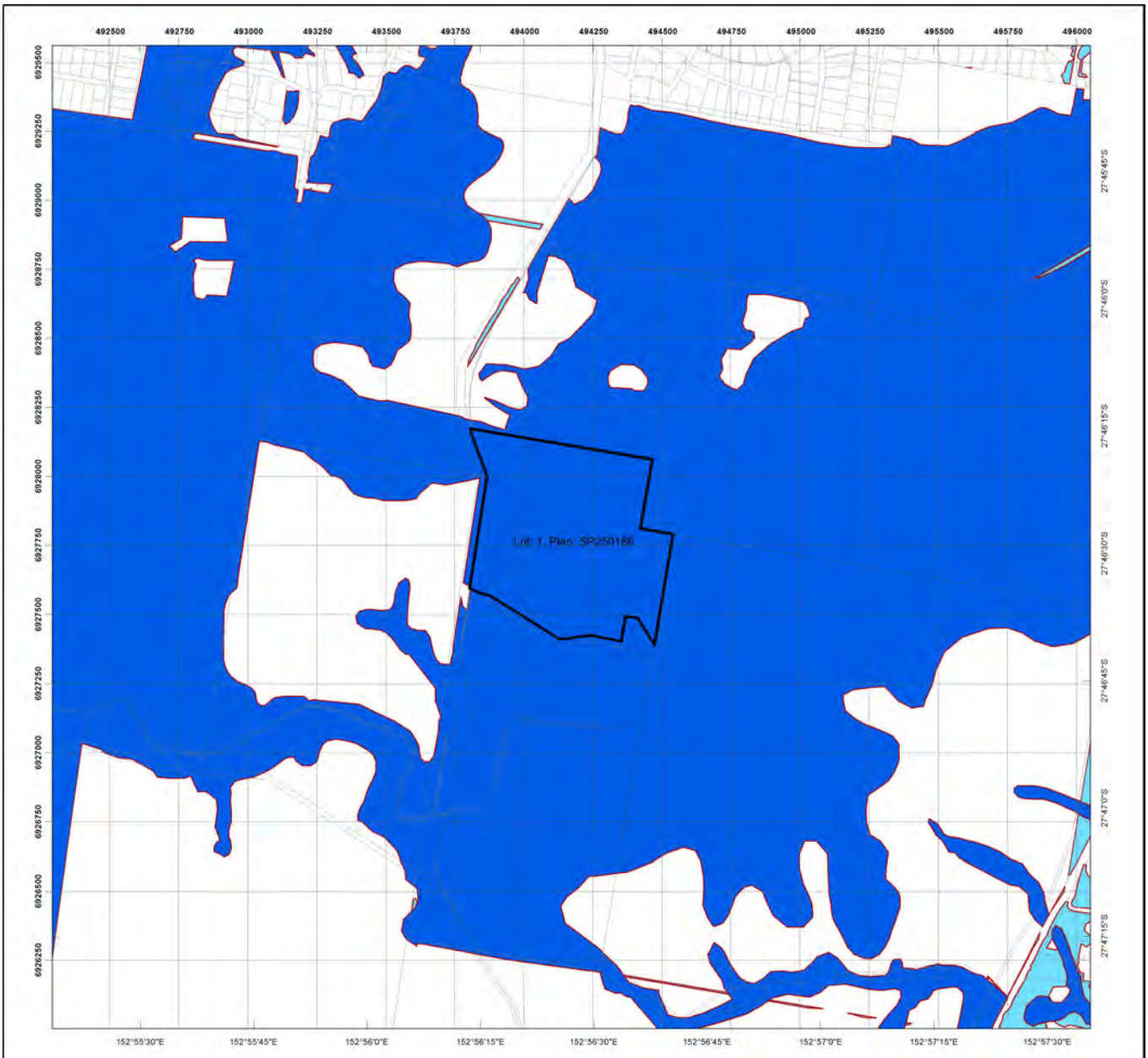
# APPENDIX 1: STATE MAPPING

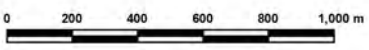



# Regulated Vegetation Management Map

## Legend

- Selected Lot and Plan
- Category A area (Vegetation offsets/compliance notices/VDecs)
- Category B area (Remnant vegetation)
- Category C area (High-value regrowth vegetation)
- Category R area (Reef regrowth watercourse vegetation)
- Category X area (Exempt clearing work on Freehold, Indigenous and Leasehold land)
- Water
- Other land parcel boundaries






This product is projected into:
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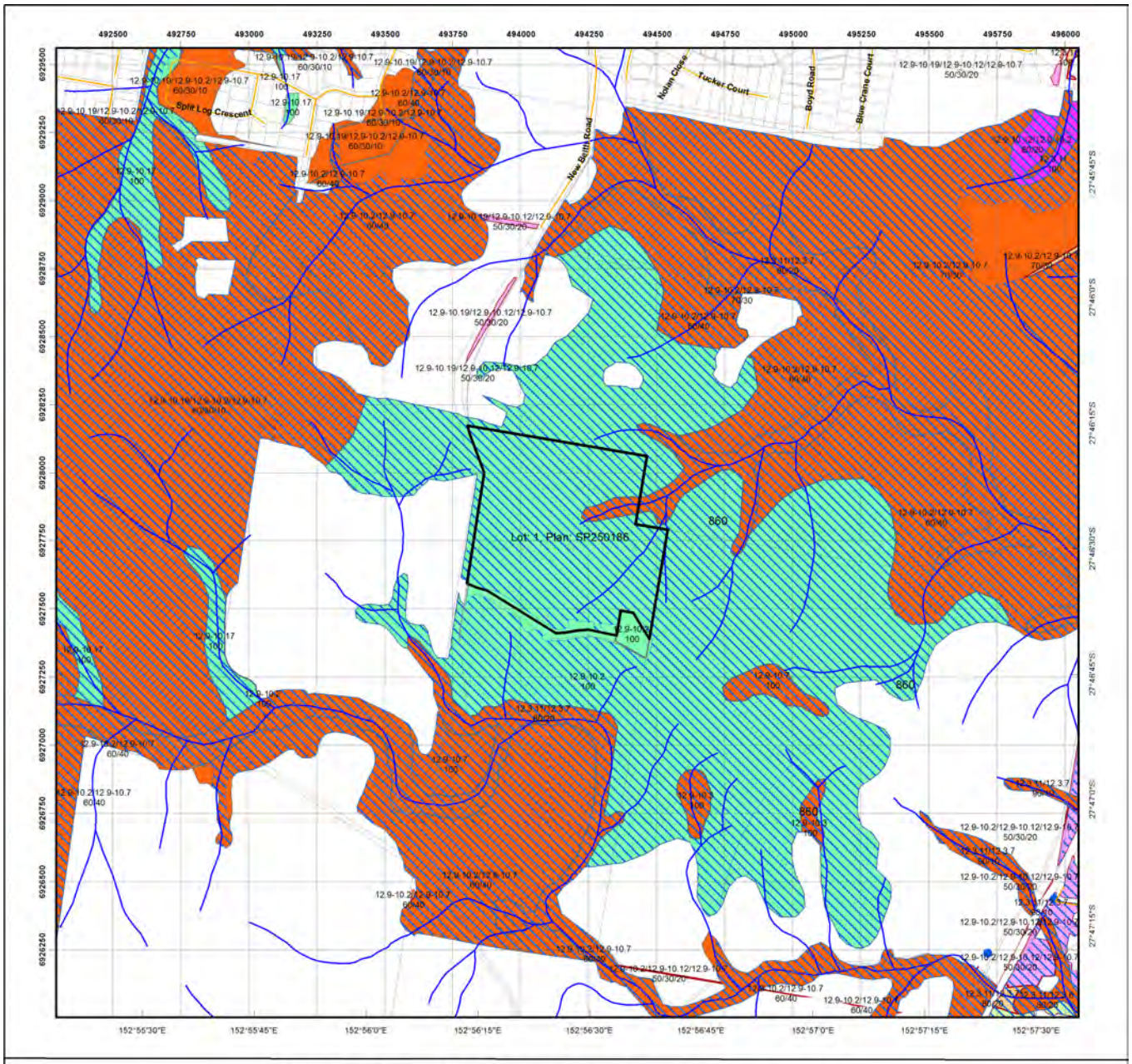
Additional information required for the assessment of vegetation values is provided in the accompanying "Vegetation Management Supporting map". For further information go to the web site: www.resources.qld.gov.au or contact the Department of Resources.

Digital data for the regulated vegetation management map is available from the Queensland Spatial Portal at http://www.information.qld.gov.au/

Land parcel boundaries are provided as locational aid only.

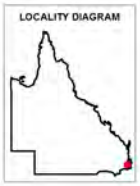
This map is updated on a monthly basis to ensure new PMAVs are included as they are approved.




# Vegetation Management Supporting Map

## Legend

- Selected Lot and Plan
- Category A or B area containing endangered regional ecosystems
- Category A or B area containing of concern regional ecosystems
- Category A or B area that is a least concern regional ecosystem
- Category C or R area containing endangered regional ecosystems
- Category C or R area containing of concern regional ecosystems
- Category C or R area that is a least concern regional ecosystem
- Category X area
- Water
- Wetland on the vegetation management wetlands map
- Essential habitat on the essential habitat map
- Essential habitat species record
- Watercourses and drainage features on the vegetation management watercourse and drainage features map (Stream order shown as black number against stream where available)
- Highway
- Connector
- Street/Local Road
- National Parks, State Forest and other reserves
- Other land parcel boundaries




N

0 140 280 420 560 700 m

This product is projected into:
GDA 1994 MGA Zone 56

Labels for Essential Habitat are centred on the area of enquiry.

Regional ecosystem linework has been compiled at a scale of 1:100 000, except in designated areas where a compilation scale of 1:50 000 is available. Linework should be used as a guide only. The positional accuracy of RE data mapped at a scale of 1:100 000 is +/- 100 metres.

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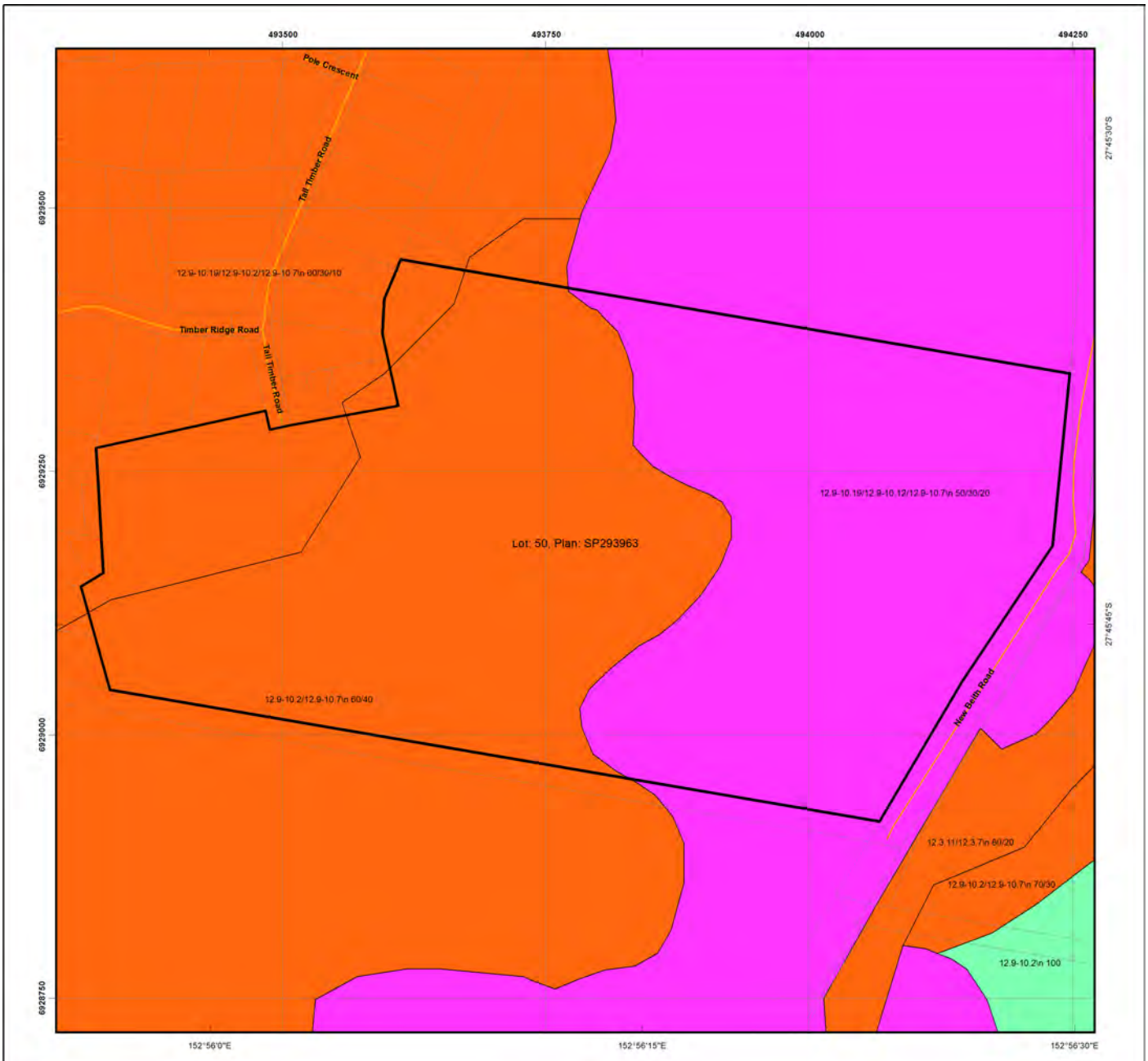
Additional information may be required for the purposes of land clearing or assessment of a regional ecosystem map or PMAV applications. For further information go to the web site: www.resources.qld.gov.au or contact the Department of Resources.

Digital data for the vegetation management watercourse and drainage feature map, vegetation management wetlands map, essential habitat map and the vegetation management remnant and regional ecosystem map are available from the Queensland Spatial Portal at http://www.information.qld.gov.au/

Land parcel boundaries are provided as locational aid only.




# Vegetation Management Pre-clear Regional Ecosystem Map

## Legend

- Selected Lot and Plan
- Highway
- Connector
- Street/Local Road
- Other land parcel boundaries
- Pre-clearing area containing Endangered RE
- Pre-clearing area containing Of Concern RE
- Pre-clearing area that is a Least Concern RE
- Water

LOCALITY DIAGRAM

N

0 30 60 90 120 150 m

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Pre-clearing regional ecosystem line-work reproduced at a scale greater than 1:100,000, except in designated areas, should be used as a guide only.

Digital data for the Pre-clearing regional ecosystem map is available from the Queensland Spatial Portal at http://www.information.qld.gov.au/

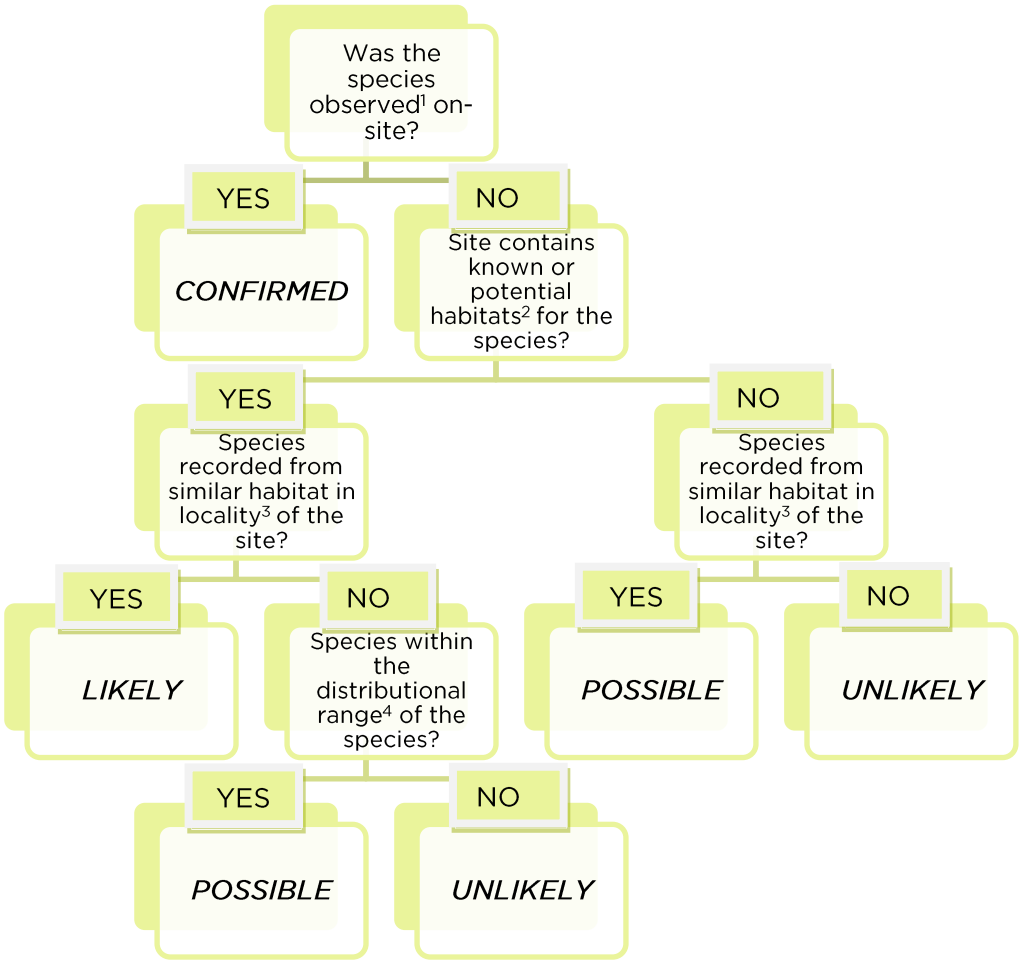
Land parcel boundaries shown are provided as a locational aid only.

# APPENDIX 2: HEURISTIC DECISION MODEL

# FAUNA AND FLORA HABITAT LIKELIHOOD ASSESSMENT – HEURISTIC APPROACH

The following represents a heuristic decision tree for use in habitat likelihood assessment to determine the likelihood of species occupying or utilising a subject site. While this heuristic tree was designed for use in the assessment of fauna habitat likelihood, there is nothing precluding its use for flora habitat likelihood assessment. The definitions underlying the likelihood assessment, predicating outcomes of the decision tree, are shown below, with $p(x)$ representing the probability (0% - 100%) that a given species (x) will be occupying or utilising the site:

- *Confirmed* – observed or recorded on the site[1] ($p(x) = 100\%$);
- *Likely* – site contains known or potential habitats for the species[2] and species recorded from similar habitats in locality of the site[3] ($p(x) > 50\%$);
- *Possible* – site contains known or potential habitats for the species[2]; however species not recorded from locality of the site[3], or vice versa ($p(x) \cong 50\%$);
- *Unlikely* – site does not contain known or potential habitats for the species[2] and/or species not recorded from locality of the site[3] ($p(x) < 50\%$).




[1] Based on systematic survey or incidental observation by Litoria Consulting ecologists, or based on anecdotal observations by credible source.
[2] According to expert knowledge by Litoria ecologists and published accounts of each species.
[3] Based on credible, local database searches (i.e., DEHP Wildlife Online), conservation advice documentation or site-specific consultant reports <2 years old.
[4] Based on inclusion of species flagged in EPBC PMST reports, yet are outside their known/accepted distributional range.

# APPENDIX 3: KOALA SURVEY REPORT - TARNBRAE

# KOALA SURVEY REPORT
# TARNBRAE

**Prepared by**
**OWAD Environment**

**For**
**Litoria Consulting**

## DOCUMENT CONTROL SHEET

OWAD project №: 230911

Client: Litoria Consulting

Report Title: Koala survey report – Tarnbrae

Report Author: Olivia Woosnam

Report Reviewer: Alex Dudkowski

Project Summary: This report presents the field results of a Koala field survey conducted on 11, 12 and 13 September 2023 on a site known as 'Tarnbrae' located in New Beith/Silverbark Ridge, Logan City Council Local Government Area, Queensland.

**Document preparation and distribution history**

| Report version | Date completed | Prepared by | Reviewed by | Sent to client on |
|---|---|---|---|---|
| Version 1 | 08/10/2023 | Olivia Woosnam | Alex Dudkowski | 08/10/2023 |
| Version 2 | 08/10/2023 | Olivia Woosnam | Alex Dudkowski | 13/10/2023 |
| | | | | |
| | | | | |



Signed on behalf of OWAD Environment

**Olivia Woosnam CEnvP, Director**

# KOALA SURVEY REPORT
# TARNBRAE

## Table of Contents



### FIGURES



### TABLES

## 1.0 INTRODUCTION

OWAD Environment (OWAD) was contracted by Litoria Consulting to conduct a rapid field assessment for Koala *Phascolarctos cinereus* presence/absence on a site located in New Beith/Silverbark Ridge, Logan City Council Local Government Area in Southeast Queensland. The site is known as 'Tarnbrae', and is approximately 602ha in size (see **Figure 1**).

The primary objective of the field assessment was to obtain a sense of whether there was any evidence of current or recent Koala presence on the site.

The survey was performed on 11, 12 and 13 September 2023 by Certified Environmental Practitioners[1] with the assistance of their professional field detection canines.

Note that two of the canines used on this survey are also certified for the detection of scat from three species of Quoll (Spotted-tail, Eastern and Northern Quolls) and two species of Underground Orchid. OWAD's detection dogs indicate on any of their targets they locate during the course of any survey.

[1] Certified Environmental Practitioner (CEnvP) Scheme from the Environmental Institute of Australia and New Zealand (EIANZ). https://www.cenvp.org/


0 10 20 40 Kilometers

N



Project No.: 230911
Created by: OW
On: 07/10/2023

## LEGEND

Site (602ha)

Local Government Area boundaries

## FIGURE 1
## SITE LOCATION

Koala survey report - Tarnbrae
for Litoria Consulting

OWAD ENVIRONMENT

# 2.0 FIELD SURVEY METHODS

## 2.1 SURVEY DESIGN

Three days of search effort were allocated for this survey. Convenience sampling was selected as an appropriate design for this site so as to maximise the survey effort achieved within those three days, and hence maximise the statistical chances of detecting evidence of Koala presence if the species were present on the site. Convenience sampling is a form of non-probability sampling whereby sample sites are selected based on their physical accessibility to the researchers. This means making use of e.g. existing 4WD tracks to access different parts of any given site, making use of wildlife tracks where available, if possible avoiding parts where the vegetation structure or condition makes it particularly slow/difficult for the survey team to progress, etc.

## 2.2 FIELD ASSESSMENT

### *2.2.1 Survey team, certifications and permits*

The field assessment was conducted by OWAD, including:

- Olivia Woosnam – Principal ecologist, EIANZ Certified Environmental Practitioner including CEnvP certification as Professional Field Detection Dog Handler; and professional training & Certification of Compliance from Steve Austin CCPDT[2].
- Alex Dudkowski – Field ecologist, EIANZ Certified Environmental Practitioner including CEnvP certification as Professional Field Detection Dog Handler; and professional training & Certification of Compliance from Steve Austin CCPDT.
- Wrangham Pink Knockout, Wrangham Mistral Bowscale and Wrangham Sweet Home Alabama – Purpose-bred professional field detection canines, bred by a specialist registered breeder and developed by CCPDT certified expert dog trainer Steve Austin. All three dogs have Koala scats or pap as target objects. Additionally, two of these dogs also have scats from three Quoll species (Spotted-tail, Eastern and Northern Quolls) and two species of Underground Orchid as target objects.

This field survey was conducted under OWAD's Queensland Government Department of Agriculture and Fisheries Animal Ethics Committee approval number CA2021/01/1446 for 'Targeted species surveys using professional detection dogs', and Scientific Use Registration number SUR000554.

### *2.2.2 Detection dog searches*

One detection dog is handled at a time. The dog is led out of the work vehicle on leash. Once ready to begin a search, the dog is taken off the leash and when prompted by the handler, begins scanning the volatile molecules in the environment in search of any potential target molecules while applying its trained search pattern to physically move through the landscape.

The dogs work independently and search non-discriminatorily following their trained search pattern. The handler redirects / recalls / or stops the dog at a distance using an Acme dog whistle,

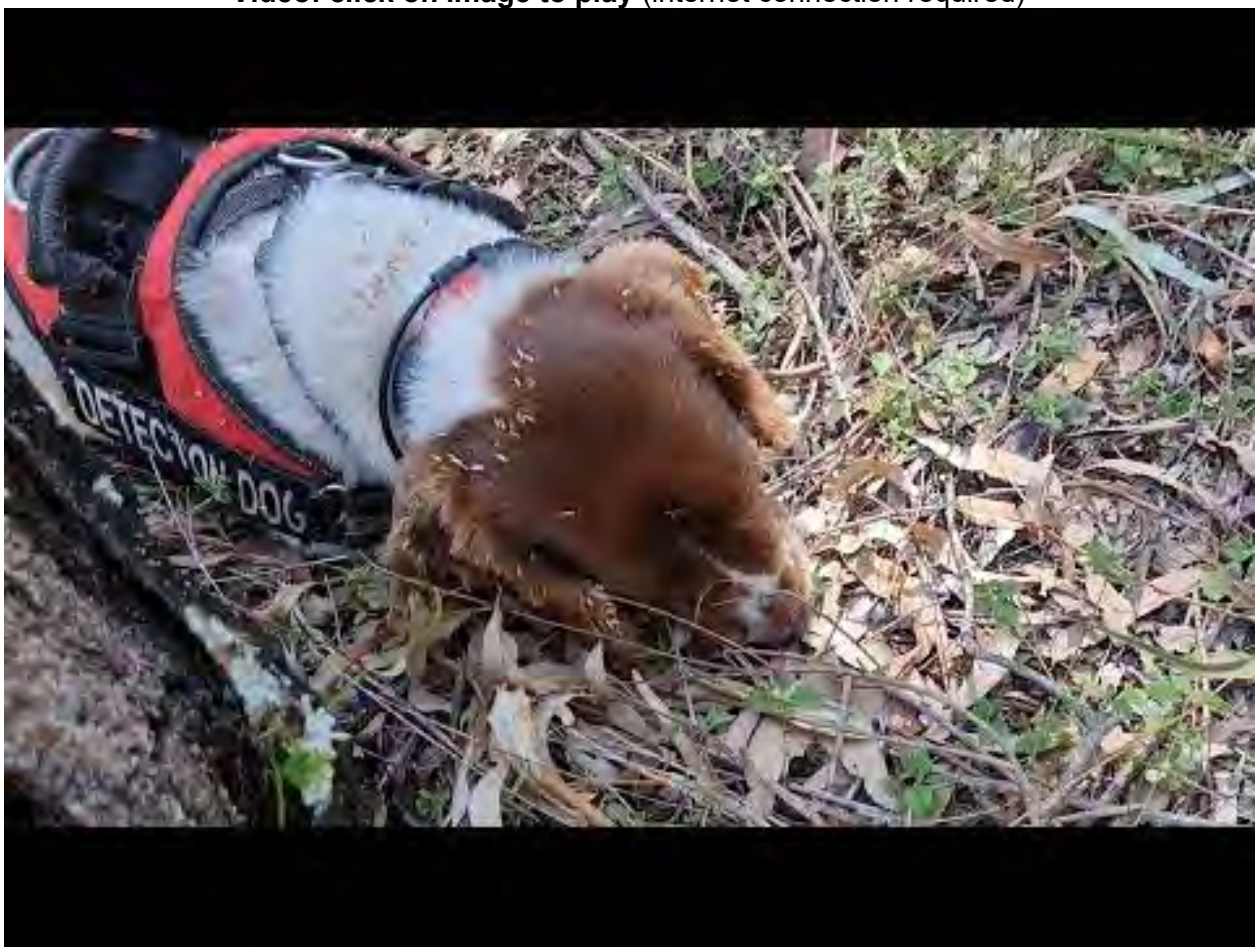
[2] Certification Council of Professional Dog Trainers

as required to keep the dog within the target land and/or for safety reasons (e.g. to prevent the dog from running into barbed wire). The handler keeps the dog in immediate sight at all times.

In order to minimise the risk of data loss in case of handheld GPS unit malfunction, all survey data is recorded with two handheld GPS units (models Garmin Alpha100 and Garmin eTrex 22X). The detection dog search tracks are recorded with Garmin T5 tracking collars worn by the dogs, which are paired with the Alpha 100 unit. These tracking collars record the dog's position at a rate of one waypoint every 2.5 seconds[3]. While working, the detection dog wear a red 'detection dog' jacket with reflective stripes.

When OWAD's detection dogs find a target object, they lie down with their nose on the object and hold the indication until the handler gives them a 'bridging cue'. If the handler needs further assistance from the dog to locate and retrieve a target object, the handler may ask the dog to 'show me'. The video below is an example of how OWAD works and communicates with their canines on projects.

**Video: click on image to play** (internet connection required)




[3] All dog search distances provided in this report are based on the Garmin T5 tracking collars' tracking rate of one waypoint every 2.5 seconds (currently the minimum setting). Hence, all measurements provided are underestimates (the dogs typically zig-zag and turn between two waypoints) and represent the **minimum** distance travelled by the dogs while actively searching for targets.

## 2.3 FIELD QUALITY ASSURANCE

### *2.3.1 Field Quality Assurance procedures*

In all studies undertaken by OWAD where the detection canines are deployed, field quality assurance (FQA) procedures are undertaken to ensure that the findings are representative of the true site conditions and are therefore valid for interpretation. OWAD's FQA procedures include the use of experienced ecology expert staff certified by the EIANZ as Certified Environmental Practitioners (including CEnvP certification as professional field detection dog handlers), the use purpose-bred professional field detection dogs raised/developed and trained by a CCPDT[4] expert, certificates of compliance obtained by the CCPDT trainer for each dog-handler combination for each target species, extensive field trials conducted over several consecutive full days for each new dog and each new target prior to the canine being deployed for project work on said target, the use of appropriate study designs and protocols, and the implementation of daily field quality control (FQC) searches on all applied studies.

FQC searches are performed each day in the field on all applied projects performed by OWAD. Either the detection dog finds a naturally occurring target within the first few minutes or hours of working each day, in which case there is no need for a third party to deposit a target sample for FQC purposes. Or, if no naturally occurring target is found within the first few minutes or hours of commencing work each day, then a third party (if available an accompanying staff external to OWAD; if not available then the OWAD field assistant) randomly deposits a target sample, ensuring the handler does not know when or where an FQC target sample has been placed. When a target sample is deposited for FQC purposes, the field assistant starts a chronometer (without the handler knowing) when the dog/handler team is within approximately 50 metres from the sample, and records the time it takes the dog/handler team to find a target (whether the FQC sample or naturally occurring target, whichever is found first).

An FQC search enables the assessment of the dog/handler team's ability to find a target in the specific conditions of a particular site at a particular time, within a *maximum time of 5 minutes*. This enables to ensure that there are no exceptional circumstances or factors that may be disabling the dog/handler team's ability to find targets (e.g. a scent that may be obscuring target odours for the dog; handler fatigue or distraction which may affect the handler's ability to correctly handle the dog, appropriately read the dog's behaviour and body language, unwantedly prompt the dog away from a target, etc.). Crucially, the handler is never informed in advance where or when target samples are deposited for FQC purposes. Not disclosing this information is crucial to ensuring there is no bias in how the handler handles the dog. At least one FQC search is performed on any given day of deployment in the field. However, the third party/or field assistant may elect to perform more than one FQC search on any given day. This additional unknown (i.e. the variation in the number of FQC searches that may be performed on any given day) is important to ensure that whichever OWAD staff is handling the dog/s, remains on high alert and focused at all times.

### *2.3.2 Field Quality Control search interpretation*

- Should the dog/handler team find a deposited FQC sample within 5 minutes, the FQC search is marked as successful, the time is recorded for record-keeping purposes and work continues. The coordinates of the FQC sample are recorded for QA purposes and presented to the client, but clearly labeled as 'FQC' on maps included in the report.

[4] Certification Council of Professional Dog Trainers

- Should the dog/handler team find a naturally occurring target within 5 minutes after an FQC search has started, the FQC search is marked as successful, the time is recorded for record-keeping purposes and work continues. The coordinates of the naturally occurring target found are included in the report and displayed on maps.
- Should the dog/handler team fail to find a target within 5 minutes after an FQC search has commenced (whether a sample deposited or a naturally occurring target), the field assistant would immediately stop the handler and disclose that an FQC search has failed. In the event that an FQC search were to fail, the survey team would cease work immediately to try and identify the reason for failure. Upon identification of the potential cause, a second controlled search would be immediately conducted to confirm correct identification and successful remediation of initial failure[5]. Should the second controlled search also fail[6], the study team would reassess the site conditions / the environmental conditions / the detection dog(s) / the handler(s) / the search protocol, etc. If the cause for failure cannot be quickly identified and remediated, the study team would liaise with the client. No further survey work would be conducted until the reason(s) for failure is or are identified and remediated.

## 2.4 KOALA GENETIC SAMPLING

Where Koala scats or pap that may be viable for molecular testing are found, these are collected as per the ISO 17025 compliant procedures for Koala genetic sampling developed by OWAD, which are designed to be compatible with the standard Wedrowicz *et al* method for molecular testing of DNA isolated from Koala scat first published in 2013[7].

## 2.5 FIELD DATA ENTRY

At completion of each survey day, the detection dog search tracks and all relevant coordinates are saved electronically. To eliminate any risk of field data loss, a copy of this data is saved daily in at least two physical devices and at least one virtual space.

[5] This instance has occurred once to date.
[6] This instance has never occurred to date.
[7] Wedrowicz F, Karsa M, Mosse J, Hogan FE (2013). Reliable genotyping of the koala (*Phascolarctos cinereus*) using DNA isolated from a single faecal pellet. Molecular Ecology Resources 13:634–641. https://doi.org/10.1111/1755-0998.12101.

# 3.0 SURVEY RESULTS

## 3.1 FINDINGS

The field survey was performed over three days on 11, 12 and 13 September 2023.

The detection dogs traveled a total of 41km while actively searching for targets.

Koala scats or pap were found at a total of 38 locations.

No evidence of Quoll presence was detected.

A total of 12 samples deemed to potentially be in sufficient condition for molecular testing were collected.

**Figure 2** shows the detection dog search tracks and all locations where Koala scats or pap were found, with the locations where DNA samples were collected depicted in pink.

Some photographs and video footage taken during this field survey are provided on **page 9**.

**Table 1** provides the sampling coordinates of the 12 samples collected during this survey. These samples were submitted to WildDNA for storage the day after completing the survey. These can be processed at any point. Those from which a sufficient amount and quality of target DNA can be isolated, can proceed to Koala DNA profiling & sexing to determine how many distinct individuals these originate from (and a wide range of further molecular tests and/or genotypic analyses).

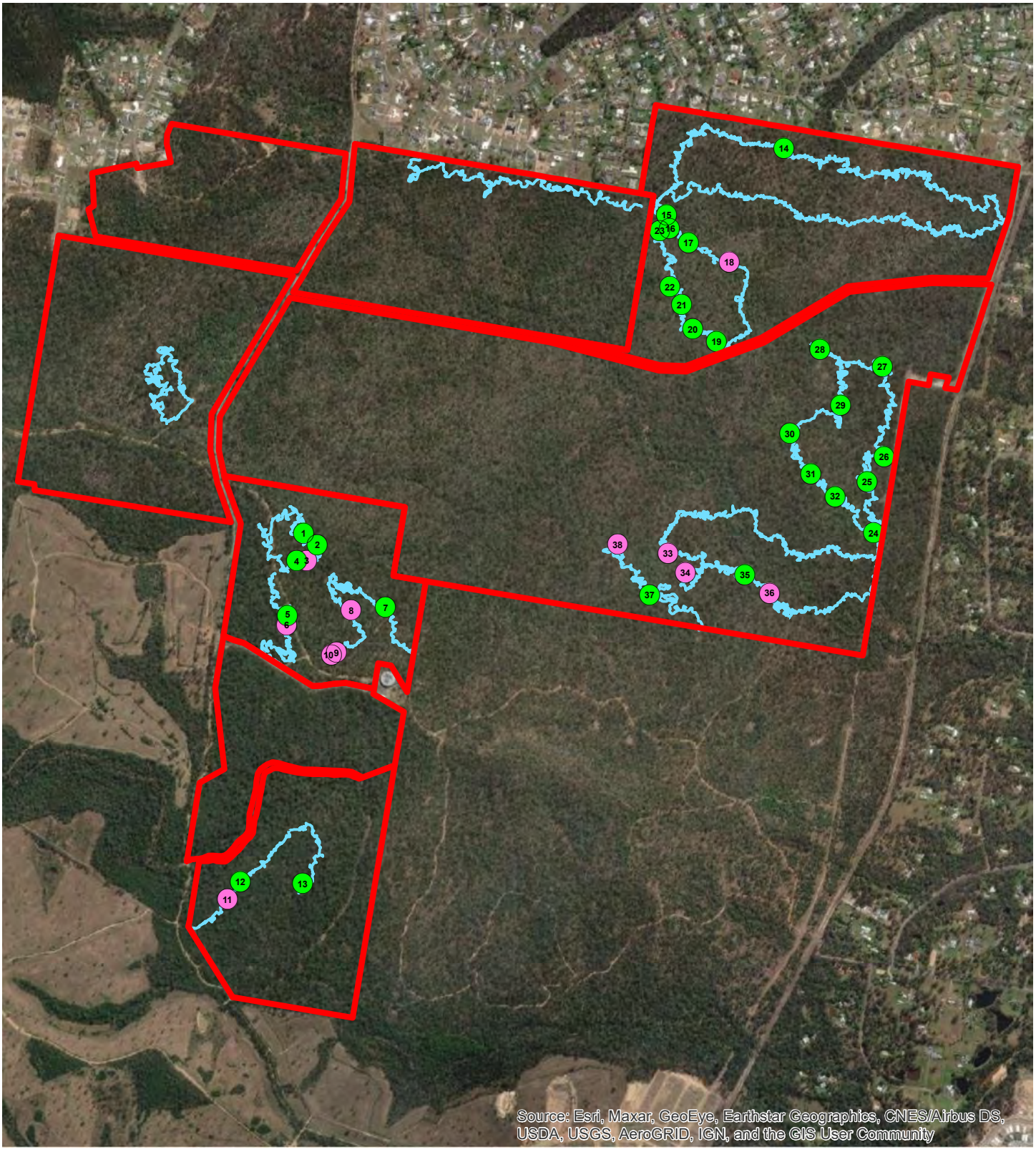
**Table 1: Sampling coordinates of Koala DNA samples collected**

| Waypoint number (ref Fig 2) | Unique sample code | Date collected | Sample condition score (1 to 3, 1 = best) | Sampling coordinates (UTM zone 56) | | Date submitted to WildDNA |
|---|---|---|---|---|---|---|
| | | | | Easting | Northing | |
| 3 | LOG82 | 11/09/2023 | 3 | 494107.285 | 6927868.404 | 14/09/2023 |
| 6 | LOG83 | 11/09/2023 | 3 | 494033.603 | 6927634.197 | |
| 8 | LOG84 | 11/09/2023 | 3 | 494269.743 | 6927688.256 | |
| 9 | LOG85 | 11/09/2023 | 3 | 494216.711 | 6927534.813 | |
| 10 | LOG86 | 11/09/2023 | 3 | 494197.996 | 6927525.056 | |
| 11 | LOG87 | 11/09/2023 | 2 | 493819.424 | 6926639.249 | |
| 18 | LOG88 | 12/09/2023 | 2 | 495647.763 | 6928951.071 | |
| 33 | LOG89 | 13/09/2023 | 2 | 495424.584 | 6927895.004 | |
| 34 | LOG90 | 13/09/2023 | 3 | 495488.948 | 6927825.685 | |
| 36 | LOG91 | 13/09/2023 | 3 | 495795.097 | 6927751.025 | |
| 36 | LOG92 | 13/09/2023 | 3 | 495795.1 | 6927751.02 | |
| 38 | LOG93 | 13/09/2023 | 2 | 495240.522 | 6927927.832 | |

**Sample condition score**

*On average*, samples have the following statistical chance of providing a reliable Koala DNA profile:

Score 1: 88% chance
Score 2: 72% chance
Score 3: 40% chance




0 0.5 1 2 Kilometers

N



Project No.: 230911
Created by: OW
On: 07/10/2023

## LEGEND

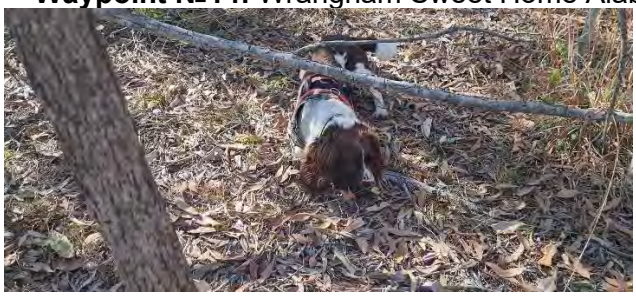
- Site (602ha)
- Koala scat found
- Koala scats found - sample collected
- Detection dog search tracks (total 41km)

## FIGURE 2
## FIELD SURVEY RESULTS

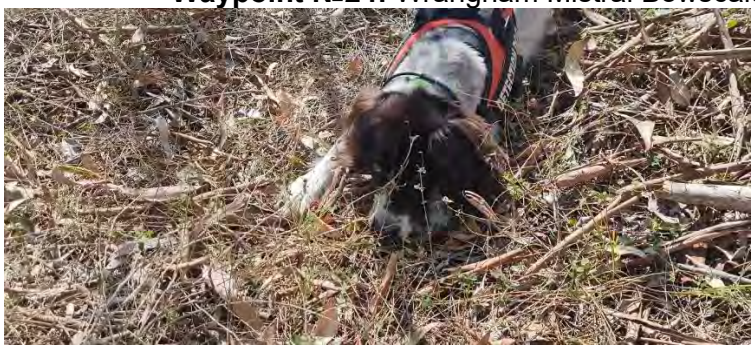
Koala survey report - Tarnbrae
for Litoria Consulting

OWAD ENVIRONMENT

**Waypoint №14:** Wrangham Sweet Home Alabama indicating on Koala scat under leaf litter




**Waypoint №24:** Wrangham Mistral Bowscale indicating on Koala scat




**Waypoint №38:** Wrangham Pink Knockout locating Koala DNA sample number LOG93
Click on image to play video (internet connection required)

### 3.2 OBSERVATIONS

At many of the locations where Koala scats were found, there was a range of scats present ranging in age from old (several months) to recent (<1 month), as well as scats that varied in shape/size/colour. Such variations tend to indicate these are produced by different individuals. At multiple locations, the survey team also observed what appeared to be consistent with pap, as well as large & small scats typically produced by mother & joey pairs. These are both very common observations during springtime, where many of the previous mating season's offspring are emerging from the pouches and mothers are still producing pap. The photo below is a typical example of mother & joey scats (the scats depicted were tested and confirmed by molecular results as originating from a mother and her male offspring).

**Typical example of mother & joey scats**

It is noted there was a significant rain event on the site on 04 September 2023, or one week prior to this field survey commencing. This means that no scat/pap samples could be collected that had been directly impacted by this rain event. As a direct result, the 12 samples that were collected are **necessarily 'fresh' material that was deposited after 04 September**. The condition of these samples was affected by the fact that despite being fresh to very fresh, this material had fallen on wet leaf litter and/or been exposed to other degrading factors typically associated with rain events (e.g. spike in microbacterial and/or insect predation).

### 3.3 INTERPRETATION

The findings and observations made during this field survey are consistent with ongoing and continued Koala presence on the site. Further information about the individuals sampled can be obtained if the DNA samples are processed, for those samples that can be successfully isolated and return reliable DNA profiles (and any other molecular results associated with each distinct individual).

### 3.4 PRE-EXISTING INFORMATION REGARDING SEQ POPULATION STRUCTURE

OWAD has already done extensive Koala DNA sampling across Southeast Queensland over the last 10 years (to date approximately 1,000 wild SEQ Koalas non-invasively genetically sampled). As of October 2023, three distinct Koala populations have been detected in SEQ. One population, currently known as the 'SEQ West' cluster, is suspected to be the original natural SEQ population

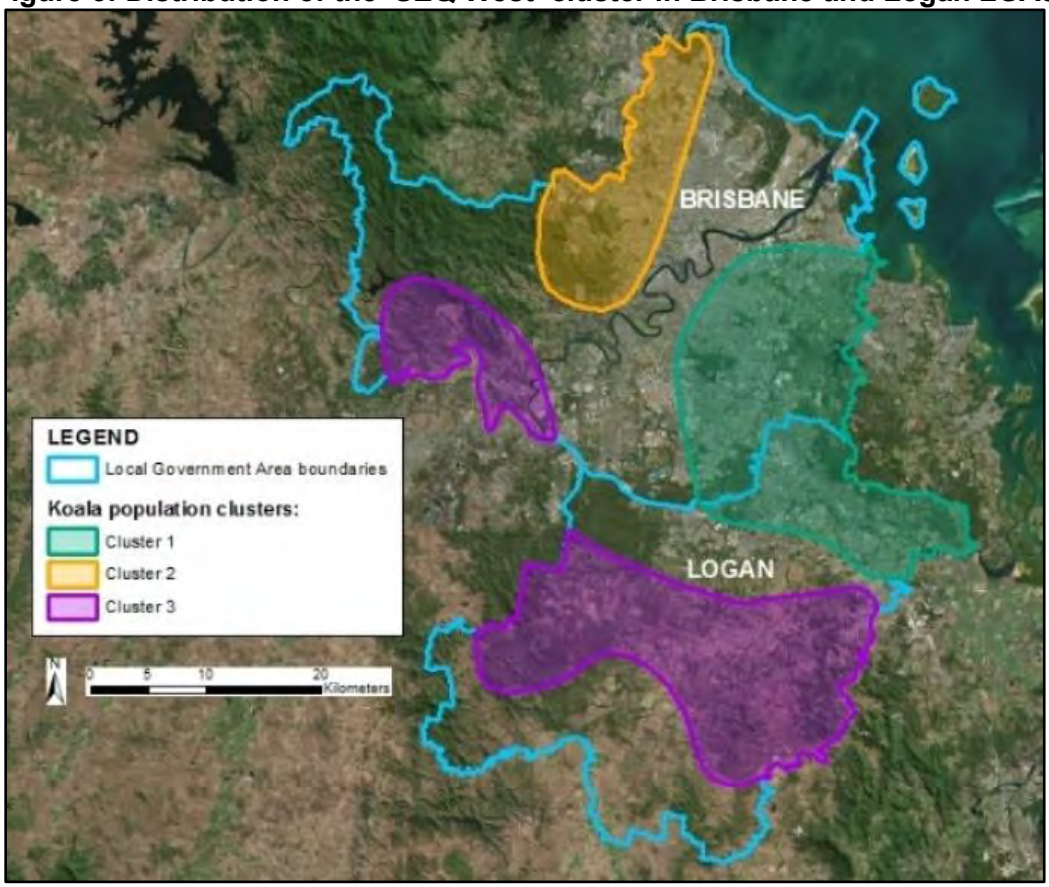
believed to have occurred homogenously across SEQ and beyond prior to European settlement. The other two clusters are suspected to have been 'split' and become genetically differentiated post European settlement due to habitat fragmentation.

*The SEQ West cluster is of particularly high conservation significance for the species* for a range of reasons, amongst others its very high genetic diversity (believed to be the highest known for the species at current) and its large geographic distribution remaining today.

The full geographic extent of where this SEQ West cluster still remains today is still under investigation, but it has already been confirmed / detected as currently surviving in multiple SEQ LGAs to date including Brisbane, Lockyer Valley, Ipswich and Scenic Rim Local Government Areas. This data is currently not published due to the complete absence of funding to analyse and publish the data on a regional scale across SEQ. However, a *partial map* was produced and made publicly available in 2018 thanks to Brisbane City Council funding, that shows the population structure across Brisbane and Logan LGAs only.

Given the geographic location of the subject site, it appears possible that the Koalas utilising the subject site may form part of the SEQ West population cluster ('Cluster 3' depicted in purple on **Figure 3** below). However, in the absence of genetic data this statement is strictly speculative. Scientifically ascertaining which SEQ population the Koalas from the site belong to, would require obtaining reliable DNA profiles from Koalas sampled from the subject site.

**Figure 3: Distribution of the 'SEQ West' cluster in Brisbane and Logan LGAs**




Map extracted from the OWAD 2018 Brisbane City Council Koala Population Study report
https://doi.org/10.13140/RG.2.2.35284.12164

## 4.0 STUDY LIMITATIONS

The results included in this report, and interpretation thereof, are strictly limited to the areas investigated as part of this study, at the time these were investigated. The results included in this report cannot be extrapolated to any other geographic area not investigated as part of this study, nor to any other time these areas were assessed.

The use of purpose-bred, expertly raised and developed professional field detection dogs, minimises the risk of not detecting a target if it is present. OWAD's professional dogs and their handlers are extensively trained and continuously coached by a professional expert who is certified by the CCPDT. The dogs are then further developed by their handlers once OWAD takes ownership of each new dog; and the handlers and the dogs obtain professional certification once fully operational for each specific target. The dogs are continuously reinforced and developed by their handlers throughout their working life. Before first deploying a detection dog in the field, OWAD thoroughly tests each dog. OWAD's standard procedure is that a dog is not deployed for project work until it consistently performs to 100% target detection rate *and* 100% target discrimination rate (i.e. never indicates on non-targets) first in controlled environments, and then in field trials performed over several consecutive days in the field. Moreover, OWAD has developed strict *internal* Field Quality Assurance/Quality Control procedures to ensure the correctness of field findings, as well as ongoing *external* Quality Assurance procedures (i.e., molecular testing of putative Koala scat/pap material to confirm species of origin, performed by a third-party laboratory) to scientifically measure and monitor the performance of their detection dogs. To date, the third-party laboratory has tested >5,000 individual pieces of material collected by OWAD indicated on by their detection dogs. To date, 100% of these have been confirmed via molecular testing as originating from Koala. OWAD is currently the only entity with a scientifically proven 100% correct Koala scat identification rate demonstrated by third-party molecular testing. OWAD currently relies on its own extensive experience as well as its own high standards to determine survey effort & survey design adequacy for each project, to provide clients with Koala presence/absence results with a high degree of confidence and deliver reliable data that enables adequately informed land use and planning decisions.

In the absence of reliable Koala DNA profiles obtained from scat samples collected within the subject site, any comment made in this report regarding which SEQ population the site's Koalas may form part of is strictly speculative and should not be treated or viewed as a verified scientific finding by any user of this report.

## 5.0 DISCLAIMER

This report can be used to inform the preparation of referral or statutory documents for assessment authorities at any level of government, or to provide further information for any such authority, regarding the Koala and the subject site.

OWAD declines all responsibility for the use of any result, finding or comment included in this report above and beyond the limitations stipulated in this report.

**Table 1** Summary of results for the 12 koala scat kits tested.

| **Logan region samples, LOG082 - LOG093** | | |
|---|---|---|
| Samples assessed for DNA quantity and quality: | | 12 |
| Count of samples that passed QC: | | 10 |
| Number of samples successfully genotyped: | | 9 |
| **Number of individuals detected:** | | **7** |
| | Males: | 4 |
| | Females: | 2 |
| | Unknown: | 1 |
| Individuals with KoRV-A detected: | | 100% (7/7) |
| Individuals with *C. pecorum* detected: | | 29% (2/7) |

*Samples LOG085 and LOG090 failed to pass quality screening. Sample LOG092 failed genotyping.

**Table 2** Results for genotyped samples indicating unique individuals along with the number of loci that were successfully typed, and the individuals inferred sex and infection (*C. pecorum* and KoRV-A) status.

| **Individual** | **Sample** | **Loci+** | **Sex** | ***C. pecorum*** | **KoRV-A** |
|---|---|---|---|---|---|
| 1 | LOG082 | 12 | Female | Not detected | Detected |
| 2 | LOG083 | 12 | Male | Detected | Detected |
| | LOG084 | 12 | Male | Detected | Detected |
| 3 | LOG086 | 7 | Fail | Detected | Detected |
| 4 | LOG087 | 12 | Male | Not detected | Detected |
| 5 | LOG088 | 12 | Female | Not detected | Detected |
| 6 | LOG089 | 12 | Male | Not detected | Detected |
| | LOG093 | 12 | Male | Not detected | Detected |
| 7 | LOG091 | 11 | Male | Not detected | Detected |
| NA | LOG092 | 1 | Fail | NA | NA |

**Individual**: Number indicating unique individuals (based on genotype data). Samples with the same number were deposited by the same individual.

**Loci+**: The number of microsatellite loci that were successfully scored for each sample out of a total of twelve.

**Sex**: the sex of the individual from which the sample tested originated.

***C. pecorum***: Whether *Chalmydia pecorum* was detected in the sample or not.

**KoRV-A**: Whether KoRV-A was detected in the sample or not. KoRV-A is present in all northern koalas.

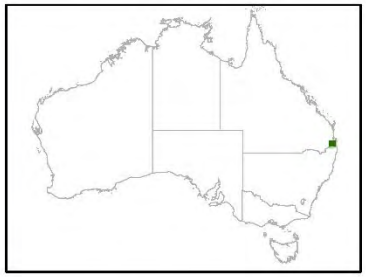

**Locations of koala scats sampled in the Logan region (LOG082 - LOG093)**

Samples that failed analysis are shown by light grey points. Samples successfully analysed are indicated by purple triangles (females), orange squares (males) or yellow diamonds (unknown sex).

CP indicates samples where *C. pecorum* was detected.

(*1) sample locations for Ind 2 (LOG083, LOG084)

(*2) sample locations for Ind 6 (LOG089, LOG093)



**Sex**

- Female
- Male
- Unknown

N

0 0.5 1

Kilometres

**Table 3** Relatedness matrix showing estimated relatedness values found between all individuals sampled along with the 95% confidence intervals for the estimate in parentheses. Pairs with a mean relatedness estimate over 0.25 are shown in bold and highlighted green.

Relatedness estimates can provide an indication of how closely a pair of individuals is related with values over 0.50 implying a first-degree relationship (parent-offspring or full siblings) and values between 0.25 and 0.50 suggesting second-degree relationships (half siblings, avuncular or grandparent-grand offspring).

| | **LOG082_F** | **LOG083_M** | **LOG086_X** | **LOG087_M** | **LOG088_F** | **LOG093_M** |
|---|---|---|---|---|---|---|
| **LOG083_M** | 0.00 (0.00 - 0.18) | | | | | |
| **LOG086_X** | 0.00 (0.00 - 0.09) | 0.00 (0.00 - 0.00) | | | | |
| **LOG087_M** | 0.00 (0.00 - 0.00) | 0.00 (0.00 - 0.00) | 0.00 (0.00 - 0.48) | | | |
| **LOG088_F** | 0.24 (0.02 - 0.50) | 0.00 (0.00 - 0.07) | 0.00 (0.00 - 0.00) | 0.00 (0.00 - 0.25) | | |
| **LOG093_M** | 0.00 (0.00 - 0.05) | 0.00 (0.00 - 0.00) | 0.00 (0.00 - 0.50) | 0.00 (0.00 - 0.07) | 0.00 (0.00 - 0.04) | |
| **LOG091_M** | 0.00 (0.00 - 0.19) | 0.00 (0.00 - 0.00) | 0.00 (0.00 - 0.17) | 0.08 (0.00 - 0.55) | 0.00 (0.00 - 0.00) | 0.00 (0.00 - 0.14) |

# APPENDIX 4: SAMPLE SIZE CALCULATION




# Sample Size Calculator



**Please Note: This calculator should be used for simple random samples only**

**Determine Sample Size**

Confidence Level: 95%

Population Size: 603

Proportion: 0.07

Confidence Interval: 0.1

Upper 0.17000

Lower 0.00000

Standard Error 0.05102

Relative Standard Error 72.89

Sample Size: 25

**How do I use it?**

1. Select the Confidence Level you want to work at.
2. If you are sampling from a finite population (one that isn't very large), enter the Population Size.
3. If you already know the estimate Proportion, or want to check the Relative Standard Error of an existing estimate, fill in the Proportion. If left blank it will be assumed to be 0.5.
4. You must fill in one of the Confidence Interval, Standard Error, Relative Standard Error or Sample Size. Make sure the bullet point corresponding to the one you wish to specify is selected.
5. Press **Calculate** to perform the calculation, or **Clear** to start again.

Sample Size Calculator Help

Sample Size Calculator Definitions

Sample Size Calculator Examples

Sample Size Calculator Stratification Examples

Calculate Clear

This page last updated 4 April 2023
Archived content. See ABS Website for latest information and statistics

# APPENDIX 5: RAINFALL DATA

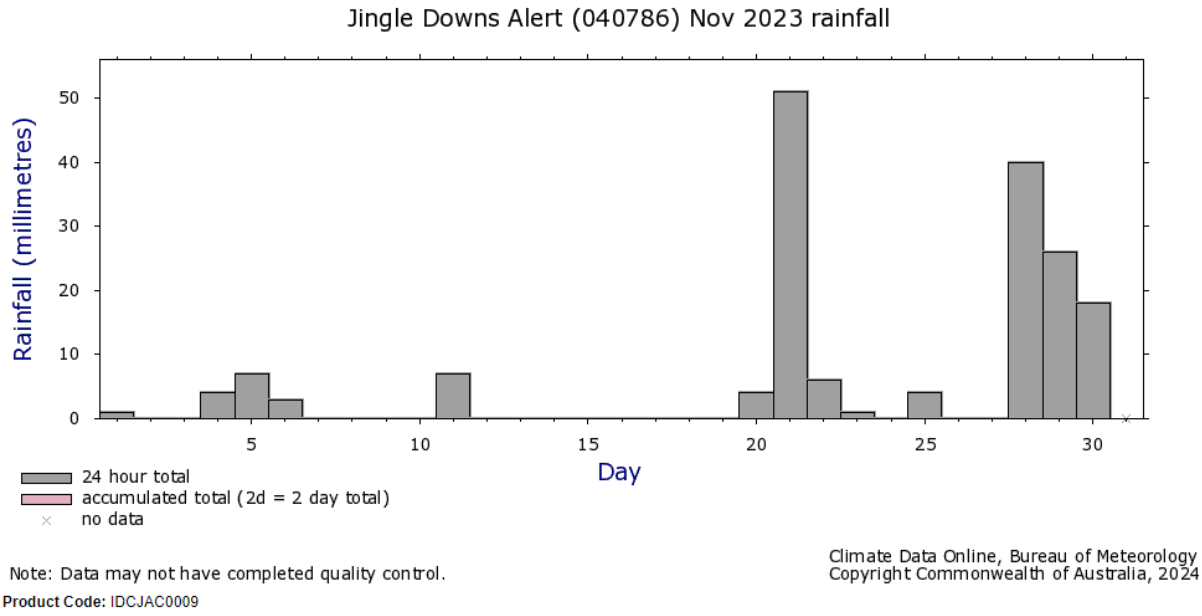



**FIGURE 34: NOVEMBER 2023 RAINFALL PER DAY (BUREAU OF METEOROLOGY 2023).**

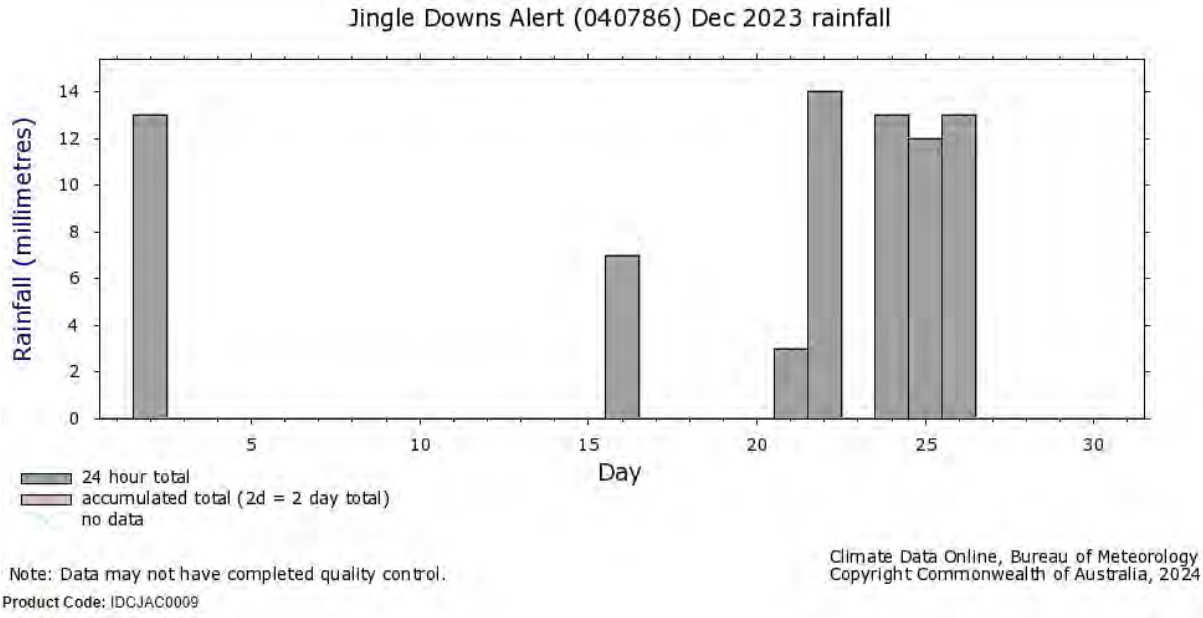



**FIGURE 35: DECEMBER 2023 RAINFALL PER DAY(BUREAU OF METEOROLOGY 2023).**

# APPENDIX 6: VERTEBRATE BIODIVERSITY SURVEYS IN SOUTHEAST QUEENSLAND USING ENVIRONMENTAL DNA

# Vertebrate biodiversity surveys in Queensland using environmental DNA

| Tuesday, 20 February 2024 | |
|---|---|
| Project number: | ED_2402CR3 |
| Client: | Litoria Consulting |
| Prepared for: | Freya Jassim |
| Lab analysis by: | Dr Rachael Impey |
| Report prepared by: | Emma Walker, Reid Tingley |
| Report approved by: | Sarah Hale |
| Assay(s): | *Vertebrate 12S* |
| Filter used: | 1.2µm EnviroDNA manual syringe disc filter |

## Highlights

- At each of the 6 sites, 3 water samples were collected.
- 64% of vertebrate taxa were resolved at the species level.
- Across all sites, 22 vertebrate taxa were detected.
- Vertebrate taxon richness at the site level ranged from 2 to 8.
- *Ranoidea gracilenta* (Dainty green tree frog) was the most commonly detected vertebrate taxon.
- >5000 reads were obtained for 100% of metabarcoding samples.

# Background

Environmental DNA (eDNA) methods are being used routinely to monitor aquatic animals including fish, amphibians and mammals across waterways, estuaries and wetlands throughout Australian catchments. Here we use a vertebrate eDNA metabarcoding assay to screen 18 eDNA samples collected from 6 sites in southeast Queensland to provide an assessment of vertebrate species present.

# Methods

## Sampling

During November and December 2023, 18 water samples were collected from 6 sites (sample locations shown in Figure 1 and details provided in spreadsheet ED_2402CR3_Litoria_Vert_Data). At each site, 3 replicate samples were collected by passing up to 820 mL of water (mean = 227 mL) through a 1.2 μm disc filter. Filtration was undertaken on-site to reduce DNA degradation during transport of water samples. A preservative was added to the filters after filtering to minimise DNA degradation. Filters were stored out of sunlight and at ambient temperature before being transported to the laboratory for processing.

## Analysis - Metabarcoding

DNA was extracted from filters using a commercially available DNA extraction kit (Qiagen PowerSoil Kit) that minimizes compounds that can inhibit PCR reactions in environmental samples. Library construction involved two rounds of PCR, whereby the first round employed gene-specific primers to amplify the target region and the second round incorporated sequencing adapters and unique barcodes for each sample-amplicon combination included in the library. Negative controls were included during library construction. Negative controls consisted of the extraction negative as well as PCR negatives, in which nuclease-free water was used in place of DNA during both rounds of PCR. Sequencing was carried out on an Illumina sequencing platform.

Following quality control filtering to remove primer sequences, truncated reads, and low-frequency reads, DNA sequences were clustered into Operational Taxonomic Units (OTUs) on the basis of sequence similarity. Taxonomic assignment was performed with VSEARCH software (Rognes et al. 2016), whereby each OTU cluster was assigned a species identity using a threshold of 95% by comparing against a reference sequence database. Where a species could not be assigned (i.e., reference database was deficient and/or taxa were poorly-characterised), taxonomic assignments were manually vetted by first obtaining a list of possible species through BLASTN searches against the public repository Genbank (www.ncbi.nlm.nih.gov), followed by elimination of species on the basis of their geographic distributions, using information from the Atlas of Living Australia. In cases where an OTU could not be adequately resolved to a single species (e.g., due to shared haplotypes), either a list of multiple species is included, or the OTU is assigned to the lowest taxonomic rank without further classification.

# Results

A total of 18 samples were analysed from 6 sites using a 1.2 µm manual disc filter. Raw data on per-sample detections can be found in an accompanying spreadsheet (ED_2402CR3_Litoria_Vert _Data.xlsx). The spreadsheet provides the taxa detected in each sample, as well as the number of sequence reads for each taxon. Reads should not be directly interpreted as taxa abundance. While some studies have shown a positive correlation between read numbers and abundance, reads can also be influenced by a number of other variables. Reads may be used to help assign a level of confidence in species detection along with the number of replicates in which the species was detected.

Overall, 22 vertebrate taxa were detected, including 3 introduced species. Eleven frog, 1 fish, 1 reptile, 6 bird, and 3 mammal taxa were detected. The number of vertebrate taxa at each site (across all replicate samples) ranged from 2 to 8 (Figure 1). The number of native species per site varied from 1 to 5.

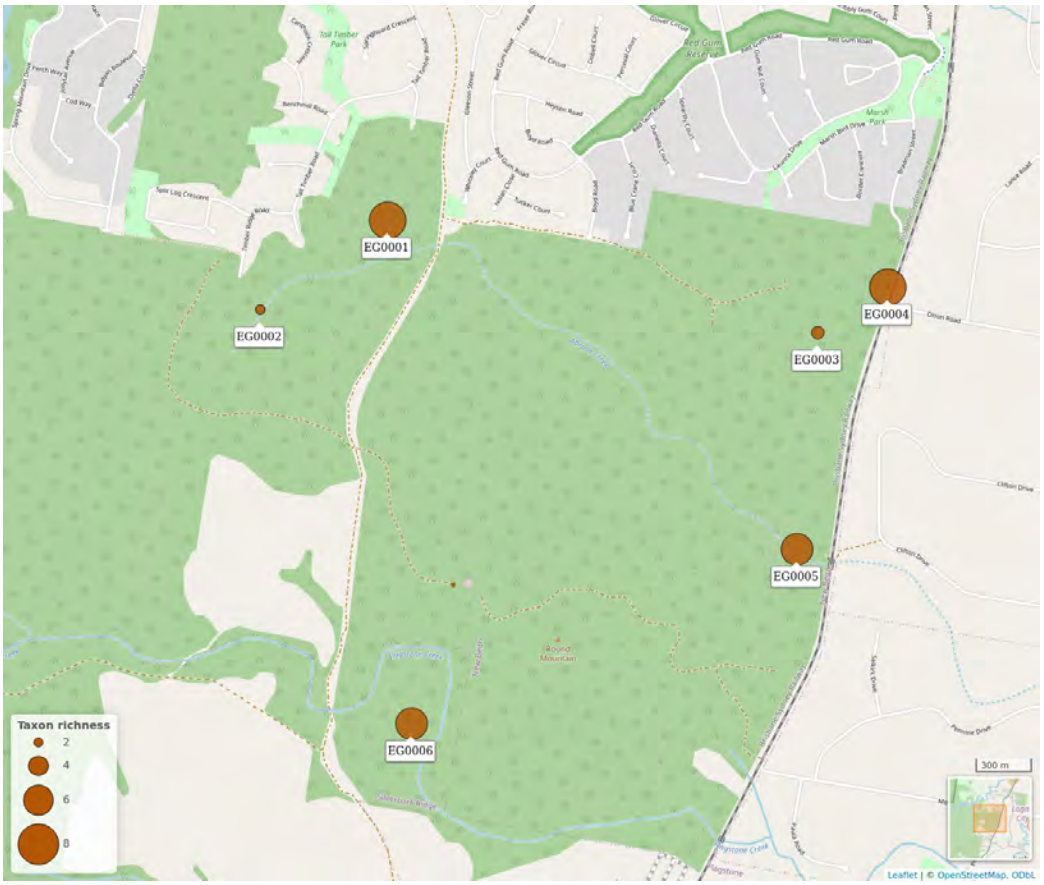



Figure 1. Vertebrate species richness at the 6 sampled sites. Marker size is proportional to detected species richness. Note that mapped richness only includes taxa resolved at the species level.

Most taxa were resolved at the species level (64% of all taxa). The fact that some taxa could not be resolved at the species level is likely due to inadequate genetic sequence data available in the reference library for the region. Further reference sequences for species that are not currently captured in the reference database are needed to fully evaluate the potential for the 12S region to resolve these taxa to a species or genus level. Unresolved taxa can also arise due to limitations with the target region (e.g., 12S) and metabarcoding assays in general, whereby only a very small subset of an organism's entire genome is interrogated for the purpose of species identification. Consequently, there is not always enough genetic variation in that short marker sequence to definitively assign it to a species.

A summary of the frequency of occurrence of each vertebrate species across all samples and sites is provided in Table 1.

Table 1. Number of detections and number of occupied sites for each vertebrate taxon.

| Family | Scientific name | Common name | N samples detected | N sites detected |
|---|---|---|---|---|
| Birds | *Alectura lathami* | Australian brush turkey | 2 | 1 |
| | *Anatidae* | Family of waterbirds that includes ducks, geese and swans | 3 | 2 |
| | *Chenonetta jubata* | Australian wood duck | 3 | 1 |
| | *Dacelo novaeguineae* | Laughing kookaburrra | 1 | 1 |
| | *Eopsaltria australis* | Eastern yellow robin | 1 | 1 |
| | *Passeriformes* | Order of passerine birds | 2 | 1 |
| Fishes & eels | *Hypseleotris* | Genus of carp gudgeons | 3 | 1 |
| Frogs | *Anura* | Order that includes frogs and toads | 4 | 2 |
| | *Cyclorana* | Genus of water-holding frogs | 2 | 1 |
| | *Hylidae* | Family of tree frogs | 5 | 2 |
| | *Limnodynastes* | Genus of ground dwelling frogs | 10 | 4 |
| | *Limnodynastes dumerilii* | Eastern banjo frog | 2 | 1 |
| | *Litoria* | Genus of australasian treefrogs | 3 | 1 |
| | *Litoria rubella* | Desert tree frog | 3 | 1 |
| | *Mixophyes fasciolatus* | Great barred frog | 1 | 1 |
| | *Ranoidea caerulea* | Australian green tree frog | 5 | 2 |
| | *Ranoidea gracilenta* | Dainty green tree frog | 12 | 5 |
| | *Rhinella marina* | Cane toad | 6 | 3 |
| Mammals | *Notamacropus rufogriseus* | Red-necked wallaby | 1 | 1 |
| | *Rattus rattus* | Black rat | 1 | 1 |
| | *Sus scrofa* | Pig | 1 | 1 |
| Reptiles | *Myuchelys latisternum* | Saw-shelled turtle | 1 | 1 |

Figure 2 below shows similar data to those presented in the table above. Rather than focusing on the number of detections, however, this figure shows the percentage of reads assigned to each taxon.

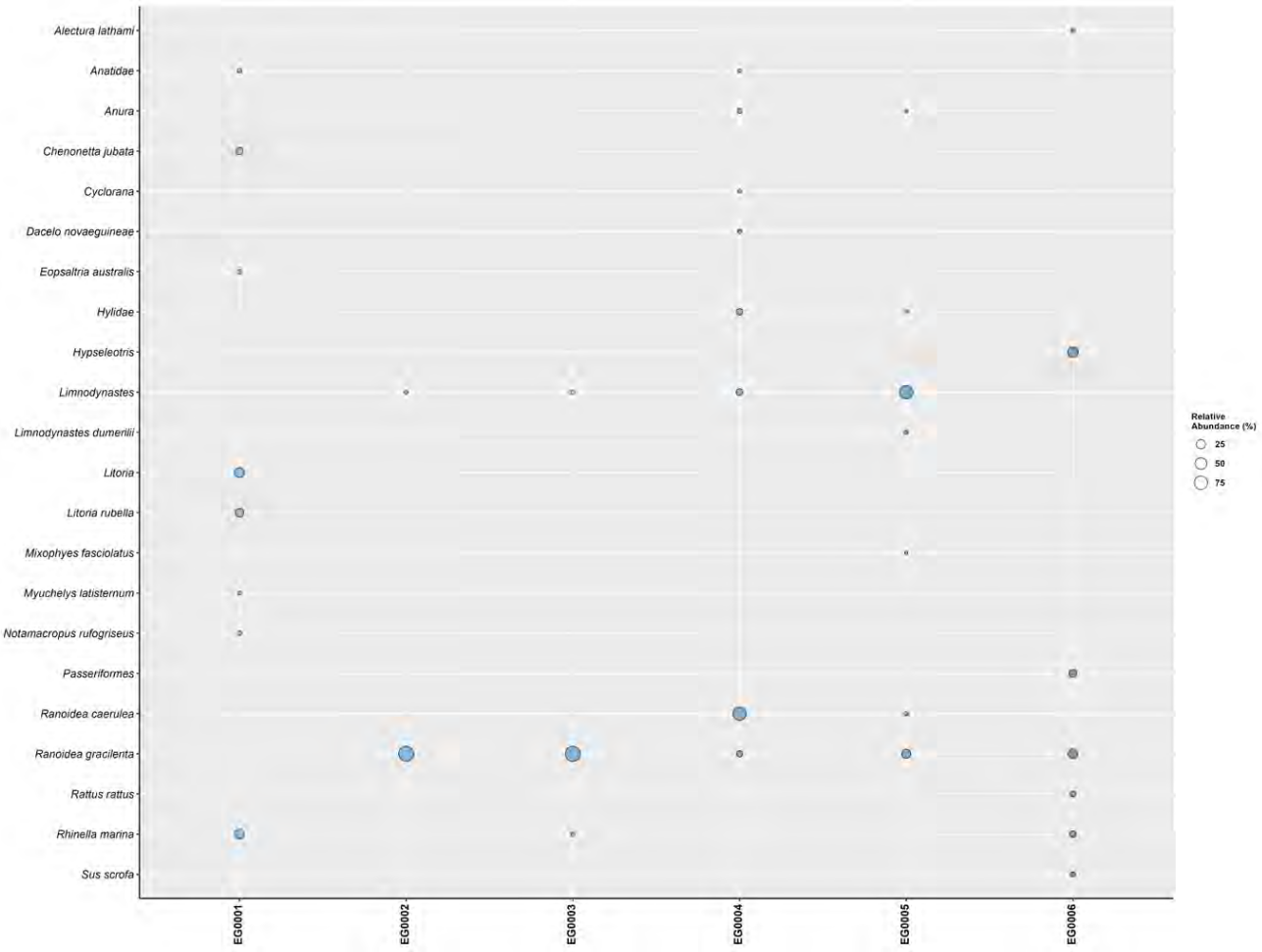



Figure 2. Percentage of reads assigned to each vertebrate taxon.

## Quality control and assurance

- Amplification success was confirmed by gel electrophoresis.
- The following controls were used:
    - 2 extraction controls
    - 3 mock communities
- The total number of reads was 568,411.
- The median number of reads per sample was 32,081 (range = 6,632– 46,825).
- Out of 18 samples analysed, 0 samples had fewer than 5,000 non-human reads.
- All mock community positive controls produced reads of expected species, with no contamination from other species.
- Numbers of reads in negative controls were below the acceptable threshold.

# References

Rognes T, Flouri T, Nichols B, Quince C, Mahé F. VSEARCH: a versatile open source tool for metagenomics. PeerJ. 2016 Oct 18;4:e2584. doi: 10.7717/peerj.2584. PMID: 27781170; PMCID: PMC5075697

# APPENDIX 7: HOLLOW ASSESSMENT STATISTICAL ANALYSIS

Anova: Single Factor
**REs & Total Hollow Frequency**

SUMMARY

| *Groups* | *Count* | *Sum* | *Average* | *Variance* |
|---|---|---|---|---|
| 12.9-10.2 | 3 | 8 | 2.666666667 | 2.333333333 |
| 12.9-10.2/12.9-10.7 | 2 | 8 | 4 | 8 |
| 12.9-10.2/12.9-10.7a | 3 | 12 | 4 | 1 |
| 12.9-10.19a/12.9-10.2/12.9-10.7 | 1 | 2 | 2 | #DIV/0! |
| Non-remnant | 1 | 3 | 3 | #DIV/0! |

ANOVA

| *Source of Variation* | *SS* | *df* | *MS* | *F* | *P-value* | *F crit* |
|---|---|---|---|---|---|---|
| Between Groups | 5.433333333 | 4 | 1.358333333 | 0.463068182 | [illegible] | 5.192167773 |
| Within Groups | 14.66666667 | 5 | 2.933333333 | | | |
| Total | 20.1 | 9 | | | | |

Anova: Single Factor
**REs & Hollow Diameters**

SUMMARY

| *Groups* | *Count* | *Sum* | *Average* | *Variance* |
|---|---|---|---|---|
| Non-rem | 3 | 40 | 13.33333333 | 33.33333333 |
| 12.9-10.2/12.9-10.7a | 12 | 223 | 18.58333333 | 94.99242424 |
| 12.9-10.2/12.9-10.7 | 8 | 145 | 18.125 | 20.98214286 |
| 12.9-10.2 | 8 | 120 | 15 | 28.57142857 |
| 12.9-10.19a/12.9-10.2/12.9-10.7 | 2 | 30 | 15 | 0 |

ANOVA

| *Source of Variation* | *SS* | *df* | *MS* | *F* | *P-value* | *F crit* |
|---|---|---|---|---|---|---|
| Between Groups | 120.2689394 | 4 | 30.06723485 | 0.577241431 | [illegible] | 2.714075804 |
| Within Groups | 1458.458333 | 28 | 52.08779762 | | | |
| Total | 1578.727273 | 32 | | | | |

Anova: Single Factor
**Tree Heights & Hollow Diameters**

SUMMARY

| *Groups* | *Count* | *Sum* | *Average* | *Variance* |
|---|---|---|---|---|
| 10-12 | 4 | 52 | 13 | 6 |
| 13-16 | 6 | 110 | 18.33333333 | 146.6666667 |
| 17-18 | 3 | 38 | 12.66666667 | 16.33333333 |
| 19-21 | 7 | 115 | 16.42857143 | 30.95238095 |
| 22-25 | 13 | 245 | 18.84615385 | 33.97435897 |

ANOVA

| *Source of Variation* | *SS* | *df* | *MS* | *F* | *P-value* | *F crit* |
|---|---|---|---|---|---|---|
| Between Groups | 177.5631036 | 4 | 44.39077589 | 0.902378231 | [illegible] | 2.714075804 |
| Within Groups | 1377.406593 | 28 | 49.19309262 | | | |
| Total | 1554.969697 | 32 | | | | |

Anova: Single Factor
**Tree DBH & Hollow Diameters**

SUMMARY

| *Groups* | *Count* | *Sum* | *Average* | *Variance* |
|---|---|---|---|---|
| 20-23 | 3 | 35 | 11.66666667 | 58.33333333 |
| 24-35 | 3 | 33 | 11 | 13 |
| 36-45 | 17 | 315 | 18.52941176 | 46.13970588 |
| 46-64 | 7 | 120 | 17.14285714 | 65.47619048 |
| 64-90 | 3 | 55 | 18.33333333 | 33.33333333 |

ANOVA

| *Source of Variation* | *SS* | *df* | *MS* | *F* | *P-value* | *F crit* |
|---|---|---|---|---|---|---|
| Between Groups | 238.3015024 | 4 | 59.5753756 | 1.24446318 | [illegible] | 2.714075804 |
| Within Groups | 1340.42577 | 28 | 47.87234894 | | | |
| Total | 1578.727273 | 32 | | | | |