December | 18

ECOLOGICAL CONSTRAINTS ASSESSMENT
Rezoning of Lot 2 DP 601094 and Lot 4 DP825704, Mumford Street, Port Macquarie

Prepared For: **East Coast Screw Piers Pty Ltd**
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User Notice

This report is presented on an objective basis to fulfill the stated legislative obligations, consideration and requirements in order to satisfy the client's instructions to undertake the appropriate studies and assessments. It is not directly intended to advocate the proponent's ambitions or interests, but is to provide information required in the determination of development consent by the decision-making authority for the subject proposal.

To the best of our knowledge, the proposal described in this assessment accurately represents the proponent's intentions when the report was completed and submitted. However, it is recognised and all users must acknowledge that conditions of approval at time of consent, post development application modification of the proposal's design, and the influence of unanticipated future events may modify the outcomes described in this document. Completion of this report has depended on information and documents such as surveys, plans, etc provided by the proponent. While checks were made to ensure such information was current at the time, this consultant did not independently verify the accuracy or completeness of these information sources.

The ecological information contained within this report has been gathered from field survey, literature review and assessment based on recognised scientific principles, techniques and recommendations, in a proper and scientific manner to ensure thoroughness and representativeness. The opinions expressed and conclusions drawn from this report are intended to be objective, based on the survey results and this consultant's knowledge, supported with justification from collated scientific information, references/citations or specialist advice.

Furthermore, it is clarified that all information and conclusions presented in this report apply to the subject land at the time of the assessment, and the subject proposal *only*.

This report recognises the fact, and intended users must acknowledge also, that all ecological assessments are subject to limitations such as:

- Information deficits (eg lack of scientific research into some species and availability of information)
- Influences on fauna detectability eg season in which survey is undertaken
- Influences on species occurrence eg stage of lifecycle, migratory, etc
- Time, resource and financial constraints.

All users should take into account the above information when making decisions on the basis of the findings and conclusions of this report.

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EXECUTIVE SUMMARY

This firm has been requested to undertake an ecological constraints assessment of Lot 2 DP601094 and Lot 4 DP825704, Mumford St, Port Macquarie. The subject land is intending to be rezoned under the Port Macquarie-Hastings Council (PMHC) Local Environmental Plan (LEP) 2011).

Constraints have been identified via a field survey, database review, assessment under State Environmental Planning Policy 44 – *Koala Habitat Protection*; preliminary review of potential planning pathways under the *Biodiversity Conservation Act 2016*; and an overview assessment under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*.

The proposal is to expand the existing developments on site via amending the existing E2 boundaries to increase the available development footprints, establishing an E3 zone, and changing the R1 zoning on Lot 2 to IN2 Light Industrial.

The site is located in the northwest urban precinct of Port Macquarie, and falls under the 1:100 ARI. It is currently occupied by a school on Lot 4 and former church now a workshop/parking area on Lot 2 associated with the adjacent car dealership and workshop to the north. The site has been substantially filled in the past with table drains established around the boundaries, and clearing of most of the original vegetation.

Most of the site is dominated by lawns, a few remnant native trees and planted native and exotic trees and shrubs. The remainder supports a swamp forest dominated by Broad-leaved Paperbark with a lesser abundance of Swamp Mahogany. No threatened plants were detected, but parts of the swamp forest appear to fall on alluvial soils, and hence qualify as the EEC – *Swamp Sclerophyll Forest on Coastal Floodplains*.

Some habitat values on site are limited due to the disturbance history e.g. lack of hollows on site, and connectivity is limited by existing urban growth and previous clearing. Lot 2 was subject to a full fauna survey in 2005 and hence limited survey was undertaken for this assessment. The Koala and Squirrel Glider were recorded in 2005, complimenting records in adjoining habitat, as well as several bats. A number of other mostly mobile species were also considered potential occurrences, generally using the site as a small part of their lifecycle requirements.

The site in total contains Potential Koala Habitat, and there is sufficient evidence to meet the SEPP 44 criteria to qualify as Core Koala Habitat. A Koala Plan of Management is thus required with a future DA, unless a Comprehensive Koala Plan of Management is adopted by PMHC prior to lodgment of any Development Application.

The site also has vegetation mapped as Coastal Wetland under the Coastal SEPP. The proposal seeks to undertake development within a Coastal Wetland proximity zone, however it is considered unlikely to significantly impact the attributes of this wetland.

A concept development layout for Lot 2 and Lot 4 was reviewed in terms of likely planning pathways under the new *Biodiversity Conservation Act 2016*, and the Commonwealth *Environment Protection Biodiversity Conservation Act 1999*. Referral to the Commonwealth Department of the Environment and Energy was not considered likely to be required for the latter. Potential pathways under the BC Act will depend on the final extent of vegetation clearing on Lot 2, while the development concept on Lot 4 may only need a Five Part Test assessment unless an Asset Protection Zone is required in land mapped as Sensitive Biodiversity Value Land in the northwest.

1 INTRODUCTION

This firm has been requested to undertake an ecological constraints assessment of Lot 2 DP601094 and Lot 4 DP825704, Mumford St, Port Macquarie. The subject land is intending to be rezoned under the Port Macquarie-Hastings Council (PMHC) Local Environmental Plan (LEP) 2011.

Constraints have been identified via a field survey, database review, assessment under State Environmental Planning Policy 44 – *Koala Habitat Protection*; preliminary review of potential planning pathways under the *Biodiversity Conservation Act 2016*; and an overview assessment under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*. Comment has also been provided on Part 2 Division 1 (11) of the Coastal SEPP and relevant provisions of the PMHC Development Control Plan (DCP) 2013.

2 BACKGROUND INFORMATION

2.1 Project Description

The proposal is to seek amendment of the current zoning boundaries of the subject land from under the PMHC LEP 2011 to allow expansion of the current developments.

The proposed development on Lot 2 (which is 2.185ha in area) is to convert the existing church to a dedicated automobile workshop, as an extension of the adjacent business premises to the north. This will eventually see two extra buildings plus extensive carparking established. The concept proposes to remove part of the patch of swamp forest along the western side of the site and the northeast tip in the east for a bioretention basin, filling above the flood level, and establishment of extra carparking and additional buildings.

On Lot 4 (approximately 4.044 ha), the existing school is proposed to be expanded via a number of new buildings and carparking to support the expansion. To enable this, the existing R1 zone will be changed to IN2 Light Industrial and an E3 zone will include the stormwater management works, etc. The remaining habitat will be protected in the E2 zone.

Figure 2 shows the concept, stormwater infrastructure and indicative area of vegetation to be cleared.

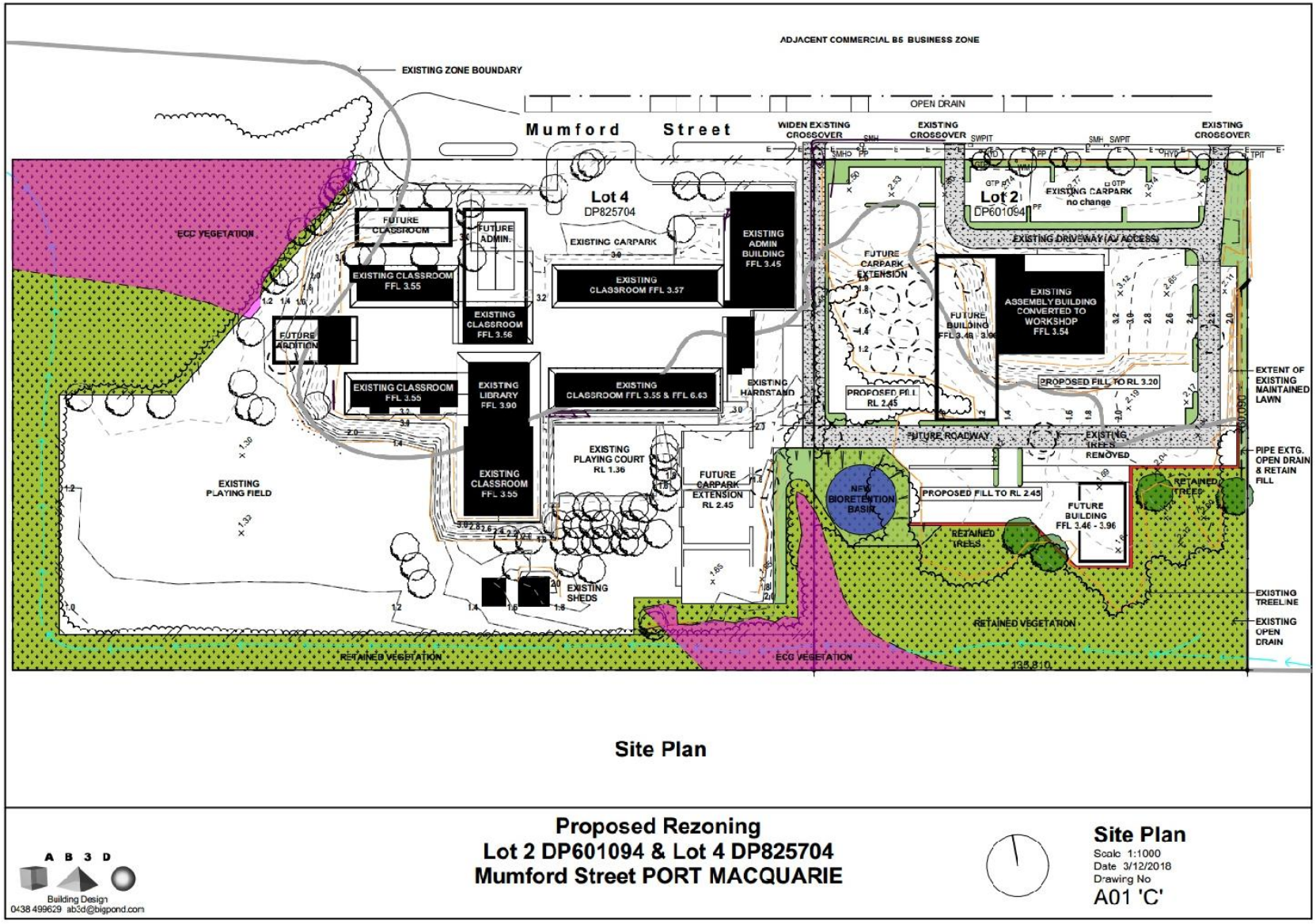
2.2 Location of the Study Site and Key Definitions

See **Figure 1** for location of the study site.

The **study site** is Lot 2 and Lot 4. The **study area** is nominated as the land within 100m of the site. The **locality** is nominated as the land within a 10km radius of the site.

Figure 1: Location of the study site

Figure 2: Development concept plan



2.2.1 Topography

Aside from the wetland in the northwest, a large proportion of the site's topography has been modified as a result of the previous development (e.g. introduction of fill material to establish a building pad, etc).

The site is located on low lying land, with a present elevation ranging from 3.2m AHD (Australian Height Datum) in the central north (around the existing building on Lot 2) to around 1m ADH in the southwest. The site is flood prone and below the 1:100 ARI as shown in Figure 4.

A permanent forested wetland dominates the northwest corner. A possibly sub-tidal channel runs through this wetland, existing off site to the west.

Runoff on site drains predominantly to the south/southwest to existing open drains (which appear to near permanently contain water) on the southern boundaries of both lots, and eastern and western side of both lots (these appear to be predominantly dry on Lot 2 and the eastern side of Lot 4). It appears that during construction of the drains, the excavated materials were deposited onto the adjacent areas.

Limited drainage is directed northwest to the wetland here, but it receives stormwater from the caravan park to the north and from Mumford St.

A depression (probably artificial) occurs in the southwest of Lot 2, creating a small area of freshwater wetland. Post rain, surface water may be present in small depressions in the southwest portion of the swamp forest on Lot 2; throughout the entire wetlands on Lot 4; and in depression in the gardens and lawns adjacent to the swamp forest and wetland.

2.2.2 Geomorphology and Soils

Refer to the map in Figures 1 and 3.

The site has been subject to some importation of fill and other disturbances of the surface under the current building footprint, but Quaternary soil landscape mapping at the 1:25 000 scale shows the study area is characterised by a complex intergrade over geological time of fluvial/estuarine and aeolian geomorphological processes (Hashimoto and Troedson 2007), with a confluence of fluvial and marine geomorphological processes on the boundary of Lot 4 and 2.

This is in-line with mapping by Cohen (2005) of the northern Hastings to Macleay which shows that a large estuarine lagoon dominated the coastal plains in the Holocene due to a sand barrier forming around former islands (now headlands) from South West Rocks to Port Macquarie. This large lagoon provided a low energy environment ideal for settling of fine materials, with gradual filling by the rivers with alluvial sediment from the upper catchments eventually overlaying much of this lagoon via infill by rivers and forming a deltaic plain. The remainder is mapped as disturbed, reflecting commercial and residential development.

The 1:25 000 near surface mapping (Hashimoto and Troedson 2007) shows a Pleistocene coastal backbarrier flat (Qpbf) dominates the site's southwest and northern fringe, with a more recent Holocene estuarine plain (a fluvial delta front) of fluvial provenance (Qhemd) crossing Lot 4's northwest corner, to merge on Lot 2 with a Holocene estuarine plain (Qhef, a tidal-delta flat of marine provenance). The merge zone of these geomorphological processes may see complex mix of alluvial (fluvial sand to mud) and estuarine (marine sand) soils, depending on the order of magnitude of the former and geological time (Cohen 2005).

On-site soil profile sampling (see Appendix 3 for logs and map of sample locations) of the Qhef soil landscape recorded shell pieces throughout the consistently sandy soil profile in the southern end of Lot 2 on the tidal delta flat, confirming a dominant estuarine not alluvial deposition (Hackett 2017). Almost white sand occurs along the table drain along the rear boundary of Lot 2 as shown in **Photo 1**, with black sandy in spoil pile adjacent on which the swamp forest has regenerated on.

Photo 1: White sand at rear of Lot 2 along drain

Soil profile testing on the Qhemd soil landscape forming a band over Lot 4 and crossing the southwest corner of Lot 2 however recorded no shells or consistent sand (Hackett 2017). Underneath a layer of imported fill about 0.5m deep from a local residual soil landscape (e.g. Thrumster as per Atkinson 1999), is a silty clay grading to clayey sands and eventually a sandy clay loam. This suggests a potentially complex history of geomorphological processes, but could possibly also be considered layering indicating of alluvial processes, in line with the fluvial provenance assigned to this soil landscape. It is considered that this soil landscape is predominantly alluvial in origin in line with the Precautionary Principle.

2.3 Site and Local Landuse and Disturbance History

The subject land and surrounding area is likely to have been cleared sometime over the last century for agricultural purposes (primarily pastoralism).

Drains to the south are likely to have been established 2-3 decades ago (as suggested by tree age on the spoil) possibly originally to enhance pastoralism via lowering the watertable and reducing the hydroperiod after flooding or use of the land after filling.

The school was established in the early 1990s and the Church appears to have been established at the same time. Development to the north has largely been present for well over 30 years, as has the tennis courts and residential areas to the east. Land to the south and west has largely remained unchanged for at least 20 years, with residential development further south largely occurring from the early 1990s (pers. obs.).

Fire appears to have been long excluded from all vegetation on the site and study area. The existing lawns and gardens are the only vegetation maintained. A former walkway used for school education occurs in the northwest wetland, but has not been used for some time.

Weeds and ornamental species (both exotic and non-endemic) occur throughout the site in the understorey, shrub and groundcover vegetation. In the swamp forest, there are extensive patches of Lantana in the shrub layer. Other weeds present include Cassia (**Senna pendula*), Tobacco Bush (**Solanum mauritianum*) and Large-Leaved Privet (**Ligustrum lucidum*) in the understorey/shrub layer; and Rhodes Grass (**Chloris gayana*), Pigeon Grass (**Setaria sphacelata*) and Whisky Grass (**Andropogon virginicus*) in the groundcover. The odd garden escapee is also present (e.g. Umbrella Tree).

2.4 Coastal SEPP

Prior to introduction of the Coastal SEPP, SEPP 14 Coastal Wetlands mapped swamp forest, saltmarsh and mangroves to the northwest of the site as SEPP 14 #508. This former wetland also comprises the swamp forest in the northwest corner of the site, but the SEPP 14 mapping erroneously fell over part of the existing school (including buildings and cleared playgrounds. Such errors are generally a relic of the mapping methodology used for the SEPP (Adams et al 1985).

The updated Coastal SEPP mapping appears to have corrected this error, and now maps swamp forest on the western and southwestern boundaries of Lot 4 as wetland under the Coastal SEPP (see **Figure 4**). Most of Lot 4 and the southwest of Lot 2 is also in the Proximity Area for Coastal Wetlands. Consideration of the requirements for the latter is provided in **section 7.5**.

As part of the rezoning and zone boundary adjustment process, the formal boundary of the Coastal SEPP is to be verified by site survey.

Figure 3: 1:25 000 Quaternary soil landscapes

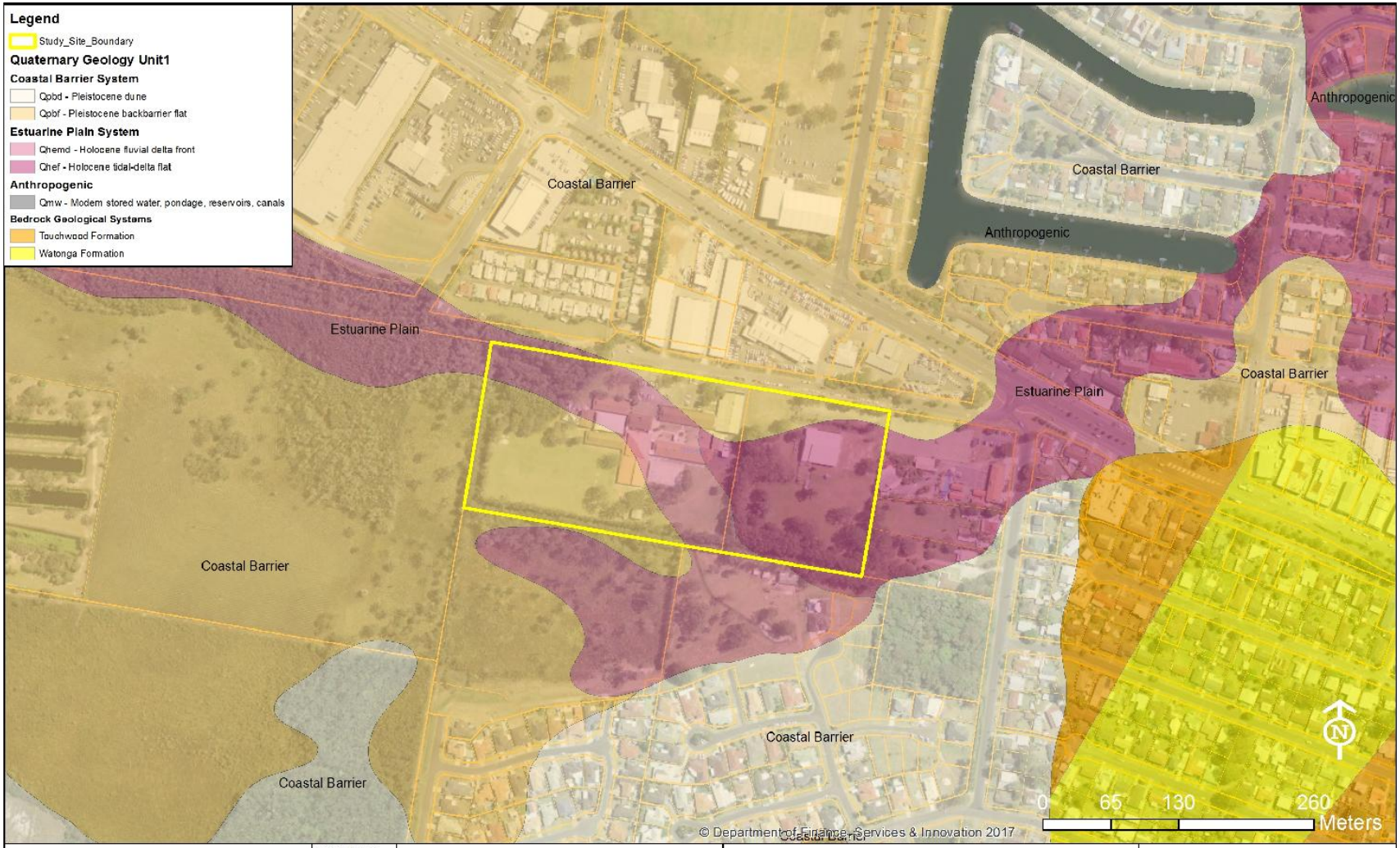


Figure 4: Coastal SEPP wetland mapping and 1:100 ARI in study area

3 FLORA

3.1 Known Threatened Flora Records

No threatened flora species were detected on site. The following threatened flora species have been recorded within 10km of the site (OEH 2018a).

Table 1: Threatened flora species recorded in the locality

Species	Common Name	Legal Status
Acronychia littoralis	Scented Acronychia	E-BCA, EEPBCA
Allocasuarina defungens	Dwarf Heath She-oak	E-BCA, E-EPBCA
Asperula asthenes	Trailing Woodruff	V-BCA, V-EPBCA
Dendrobium melaleucaphilum	Spider orchid	E-BCA
Chamaesyce psammogeton	Sand Spurge	V-BCA
Maundia triglochinoides	-	V-BCA
Melaleuca biconvexa	Biconvex Paperbark	V-BCA, V-EPBCA
Oberonia titania	Red-flowered King of the Fairies	V-BCA
Senna acclinis	Rainforest Cassia	E-BCA
Sophora tomentosa	Silverbush	V-BCA

The Narrow-leaved Black Peppermint (*Eucalyptus nicholii*) is also recorded in the locality, but these are only landscape plantings outside the species native range, hence are not considered further.

3.2 Survey Methods

The flora survey routinely consists of two components:

- Identification, description and mapping of the major vegetation communities and any Endangered Ecological Community listed under the *Biodiversity Conservation Act 2016* (TSC Act), and *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).
- Searches for, identification of, and (if found) mapping of any threatened species and their habitat.

3.2.1 Vegetation Mapping and Identification

The survey was undertaken in November 2017. As the study site is relatively small, has full access to all areas, and limited diversity in vegetation types, survey was undertaken via a random meander undertaken throughout all extent vegetation stands to identify associations

and structure, as well as and compile a species list, with limited use of aerial photo interpretation. Any opportunistic sightings of plant species while performing other survey methods on the study site were also recorded.

The advantages of this method are:

- Provides the most amount of information for given input.
- Provides a means to sample vegetation boundaries.
- Provides a means for assessing floristic diversity and possible presence of threatened species (Forest Fauna Surveys *et al* 1997).

3.2.2 Vegetation Classification and Species Identification

3.2.2.1 General

The vegetation communities were described from data collected by the random meander transects over the study area. Classification was based the OEH Plant Community Type (PCT) system.

Species identification was made with the assistance of PlantNET, GTCC (2007), Bale (1993), Beadle (1982), Harden (1990, 91, 92, 93, 2000), Williams and Harden (1984), Williams and Harden (1980), Williams and Harden (unknown), Robinson (1994), and Brooker and Kleinig (1999). Plant species were identified to species or subspecies level and nomenclature conforms to that currently recognized by the Royal Botanic Gardens and follows Harden and PlantNET for changes since Harden (1990-1992, 2000).

Identification of possible Threatened Ecological Communities (TECs) was based on the data collected by the survey and review of the relevant listings on the Office of Environment and Heritage (OEH) website (OEH 2018b).

3.2.2.2 PCT Identification

The PCTs were identified as follows utilizing the Bionet Vegetation Classification tool as follows in line with the Biodiversity Assessment Methodology (BAM):

(a) PCT1724 'Paperbark Swamp Forest'

- Search criteria IBRA Region: NSW North Coast (NCC)
- Search criteria Community Species (Upper stratum): *Melaleuca quinquenervia, Eucalyptus robusta*
- Search criteria Community Species (Mid stratum): *Glochidion ferdinandi, Archontophoenix cunninghamiana*
- Search criteria Community Species (Ground stratum): *Gahnia clarkei, Blechnum indicum, Christella dentata*
- Resulted in 391 PCT records generated with PCT1724 scoring 6 matches, PCT1230 5 matches and PCT 1717 5 matches.
- The community profile reports were reviewed for the top six matching PCT's in detail, and on the basis of best matching floristics for all stratum (with priority to the upper stratum), diagnostic species and community descriptions: PCT_ID1724 was determined to be the best match.

(b) PCT1724- 'Freshwater Wetland (derived)'

- Search criteria IBRA Region: NSW North Coast (NCC)
- Search criteria Community Species (Mid stratum): *Melaleuca quinquenervia*
- Search criteria Community Species (Ground stratum): *Enhydra woolsii, Persicaria strigosa, Blechnum indicum, Baumea juncea, Centella asiatica, Philydrum lanuginosum*
- Resulted in 383 PCT records generated with PCT 783 scoring 4 matches, PCT 781 3 matches and PCT 1724 3 matches.
- The community profile reports were reviewed for the top six matching PCTs, and on the basis of best matching floristics for all stratum, diagnostic species, community descriptions and occurrence within IBRA subregion NCC (PCT 783 and PCT 781 are not described for the NCC): PCT_ID1724 was determined to be the best match.

3.2.2.3 PMHC Vegetation Communities

Two vegetation communities are mapped for the site as per PMHC vegetation mapping. These communities are;

- PMVC 61 Broad-leaved Paperbark Swamp Woodland/Forest – Mapped on Lot 4 (School sub-site) block.
- PMVC 62 Broad-leaved Paperbark - Mixed Eucalypt Swamp Forest Complex – Predominantly mapped on Lot 2 (former Coastside Church sub-site).

3.2.3 Threatened Flora Species Searches and Occurrence Assessment

3.2.3.1 Searches

Searches for threatened flora recorded in the Local Government Area (LGA) and/or in regionally similar habitats to that on the site were carried out over the entire area of the study site during specific targeted searches. A total of 3 dedicated hours were spent on searches for threatened flora on the site during the survey.

3.2.3.2 Potential Occurrence Assessment:

Potential occurrence assessment of threatened flora species is provided in Appendix 1. This section assesses all threatened species (TSC Act 1995 and EPBC Act 1999) known to occur within range of the area for their potential to occur on the site based on the following factors:

- Presence/absence of suitable habitat.
- Condition and disturbance history of habitat.
- Local and regional records (eg. OEH 2018a).
- Location of site within known distribution of the species.

3.3 Site Vegetation Communities

As shown in **Figure 5**, the vegetation on the subject land is comprised of regrowth paperbark swamp forest (including a derived small wetland area) and lawns/miscellaneous vegetation. These vary predominantly due to disturbance regimes and history.

A species list is provided in Appendix 3. Photos follow the tables.

3.3.1 PCT 1724 Paperbark Swamp Forest

PCT 1724	Broad-leaved Paperbark - Swamp Oak - Saw Sedge swamp forest on coastal lowlands of the Central Coast and Lower North Coast
Location	Dominates the site in the northwest, and forms variable width bands of vegetation along the western boundary, the eastern boundary and the (internal) boundary between Lot 4 and Lot 2.
Description	(a) Canopy: *Structure and Species*: This stratum has a dense cover with Broad-leaved Melaleuca (*Melaleuca quinquenervia*) occurring as the dominant species. Swamp Mahogany (*Eucalyptus robusta*) occurs frequently while Swamp Oak (*Casuarina glauca*) occurs less commonly (mostly in the northern extent of the northwest patch). Cheese Tree (*Glochidion ferdinandi*) occurs commonly in the understorey while Hickory Wattle (*Acacia implexa*), Snow-in-Summer (*Melaleuca linariifolia*), Willow Bottlebrush (*Callistemon salignus*) and Bangalow Palm (*Archontophoenix cunninghamiana)* occasionally occur. The exotic species, Camphor laurel (*Cinnamomum camphora*) occurs occasionally also and is common in patches. Canopy/understorey height ranges predominantly between 6 and 20m. Trunk DBH (diameter at breast height) generally ranges between 10 and 50cm. (b) Shrub Layer: *Structure and Species*: Varies from negligible to well-developed depending upon light availability, disturbance and floristics. Ranges between 0.5 to 5m high. Cheese Tree (*Glochidion ferdinandi*) is the dominant species in patches. Swamp Hibiscus (*Hibiscus diversifolius*), Coffee Bush (*Breynia oblongifolia*) and the exotics Lantana (*Lantana camara*) Easter Cassia (*Senna pendula var. glabrata*) occur occasionally. Elsewhere young canopy/understorey species are generally dominant. A variety of other species including Sweet Pittosporum (*Pittosporum undulatum*) uncommonly occur. (c) Ground Layer: *Structure and Species:* Varies with light availability, soil moisture content and disturbance from negligible to moderately dense. Height generally ranges from 0.2-0.7m. Consists of a mix of species including Saw Sedge *(Gahnia clarkei*), *Ottochloa gracillima,* Swamp Water Fern *(Blechnum indicum), Christella dentata,* Twig rush *(Baumea juncea),* Drooping Sedge (*Carex longebrachiata), Centella asiatica,* False Bracken *(Calochlaena dubia)* and Kurnell Curse *(Hydrocotyle bonariensis).* On the edges Bladey Grass*, (Imperata cylindrica),* Rhodes Grass *(Chloris gayana),* Pigeon Grass *(Setaria sphacelata)* and Whisky Grass *(Andropogon virginicus)* also occasionally occur. (e) Lianas, scramblers, epiphytes, mistletoe etc.: Climbers generally occur throughout, though diversity is limited. Monkey Rope (*Parsonsia straminea*) is the most commonly occurring vine, while Mile-a-Minute (*Ipomoea cairica*) occurs frequently. Other vines such as Snake Vine (*Stephania japonica*), Native Raspberry (*Rubus moluccanas*) and Cockspur Thorn (*Maclura cochinchinensis*) uncommonly occur.
Comments	This community primarily consists of regrowth vegetation, with the eldest being the clump between Lot 2 and 4 and a handful of Swamp Mahogany on the fringes of the swamp forest in the southern end of Lot 2. Floristic diversity is medium-low, which is to be expected given the site and general area's disturbance history. The patches in the northwest and to a lesser extent, the patch in the southwestern corner on Lot 2 (Coastside sub-site) show a higher and developing diversity but have high levels of weed infestation due to edge effects associated with the adjacent stormwater drains i.e. deposition of propagules and nutrients. The dumping of garden waste, fill soil and mulch on some of the edges of this community has led to some garden escapees and other exotic weeds establishing.

	This community in the southeastern quadrant of Lot 2 exhibits an elevated disturbance history evident in the presence of fill soil, higher weed density, lower native diversity and a simplified structure. This community is a likely match for PMVC_61 Broad-leaved Paperbark Swamp Woodland/Forest which is mapped on part of the site.

3.3.2 PCT 1724 Freshwater Wetland (derived)

PCT_ID1724	Broad-leaved Paperbark - Swamp Oak - Saw Sedge swamp forest on coastal lowlands of the Central Coast and Lower North Coast
Location	This community occurs in a small area in the southwest of Lot 2, Coastside sub-site. It is mostly surrounded by swamp forest.
Description	(a) Canopy: Absent. (b) Understorey/shrub layer: *Structure and Species*: Scarce containing only a couple of stunted Broad-Leaved Melaleucas around 1m high depending on slashing regime. (c) Ground Layer: *Structure and Species*: Generally not well developed. Consist of a mix of native grasses and forbs Varies generally between 10 and 50cm high but occurs mostly in the 10-25cm height range. Generally is moderately dense.
Comments	This community appears likely to have been established by originally borrowing material for nearby filling due to its unusual shape. The high watertable and regular slashing is considered likely to have prevented any substantial shrub layer and excluded a canopy/understorey stratum from re-establishing post disturbance. This community is a likely match for PMVC_61 Broad-leaved Paperbark Swamp Woodland/Forest which is mapped elsewhere on the site.

3.3.3 Lawns/Miscellaneous Vegetation (non-PCT)

PCT	Cleared land (non-PCT)
Location	This general association occurs over the remainder of the site encompassing lawns, gardens and miscellaneous vegetation.
Description	(a) Canopy/understorey: *Structure and species*: Open, consisting mostly of scattered individual or small groups of trees. It is dominated by a mix of exotic, non-endemic and local ornamental species with mostly planted (few remnant) Swamp Mahogany and Broad-Leaved Melaleuca being most prevalent. Other species present include Forest Red Gum (*Eucalyptus tereticornis*), Small-fruited Grey Gum (*Eucalyptus propinqua*), an ornamental Palm, Swamp Oak and a Blackbutt (*Eucalyptus pilularis*). A number of non-indigenous eucalypts occur on the northern side of the school. Trunk DBH is 10-60cm. (b) Shrub-layer: *Structure and species*: Generally a sparse stratum, occurring between 0.5 and 5m. It is predominantly restricted to the carpark gardens and garden beds around buildings Mostly consists of a mix of ornamental species including Orange Jessamine (**Murraya paniculata)*, **Hibiscus sp.*, wattle (*Acacia sp.*,), Heath Banksia (*Banksia*

	ericifolia), an ornamental palm and a tea tree (*Leptospermum sp*.). Camphor laurel, Native Tobacco, Cassia and Cheese Tree were also present in the south. (c) Groundcover: *Structure*: As the grounds are maintained, the majority of this stratum is <10cm tall. Some un-mowed areas in the south (primarily on the edge of the swamp forest) are up to around 75cm high. *Species*: Carpet Grass is the dominant species throughout most of this association. Rhodes Grass and Whisky Grass are common in the un-mowed areas. Other frequently occurring weed species (at least in some areas) include Broad-leaf Paspalum, Kurnell Curse, Cudweed (**Gnaphalium americanum*), Fireweed (**Senecio madagascariensis*) and Catsear (**Hypochaeris radiata*). **(d) Scramblers:** Only Monkey Rope was noted in this community.
Comments	This vegetation association is overall very open with the total number of trees being relatively low for its area. The two notable patches of trees, mostly Koala Food Tree species are in a belt south of the school in the vicinity of the rear shed and a smaller patch west of the school adjoining the swamp forest remnant in the northwest corner. Most of these were planted in the 1990s during early stages of the school's establishment.

Figure 5: Site PCTs and non-PCT vegetation

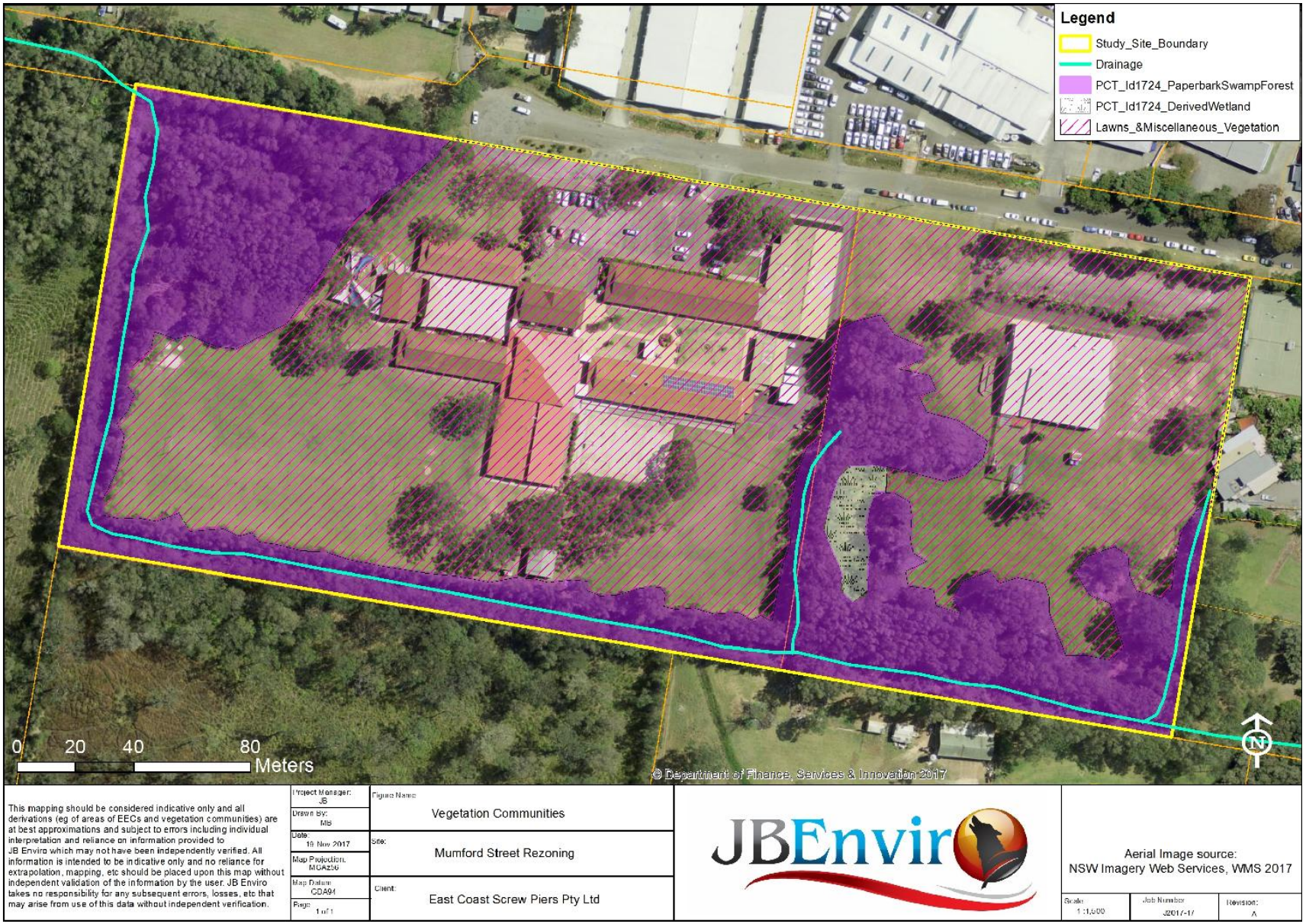


Photo 2: Swamp forest along southern boundary of Lot 2

Photo 3: Clump of swamp forest in mid-west corner of Lot 2

Photo 4: Derived wetland in southwest corner of Lot 2

Photo 5: Planted Swamp Mahogany on Lot 4 viewing towards regrowth in southeast

3.4 Threatened Ecological Communities

3.4.1 BC Act 2016

3.4.1.1 Darkheart 2005

Darkheart (2005) previously identified the paperbark swamp forest and derived freshwater wetland as the EEC *Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions"* on the basis of the following:

- Paperbark swamp forest and wetland match the floristics and structural description listed in the Final Determination (NSWSC 2004d).
- Site met the elevation and local government area (LGA) criteria
- Location below the 1:100 ARI.
- Mapping at the 1:100 000 scale (Atkinson 1999) suggested suitable soils.

3.4.1.2 PMHC EEC Mapping

Biolink (2013) undertook LGA wide mapping of vegetation communities and identified EECs based on this mapping. This was refined by Darkheart (2014) with correlation to the 1:25 000 Quaternary soil landscape mapping.

Coastal Floodplain EECs were primarily by Darkheart (2014) via correlating vegetation associations identified by Biolink (2013) with alluvial soil landscapes in line with both the Final Determination and key Land and Environment Court (LEC) precedents (*Gales Holdings Pty Limited v Tweed Shire Council [2008] NSWLEC 209, Motorplex (Australia) Pty Limited v Port Stephens Council [2007] NSWLEC 74*).

However, the Final Determinations for the Coastal Floodplain EECs however lack clarity in interpreting occurrences of qualifying vegetation communities on estuarine soil landscapes which fall below the 1:100 ARI.

Aside from being a merge zone of alluvial and aeolian geomorphological processes with associated influences on fill patterns (e.g. marine fill, central basin fill and bay head delta/fluvial fill), geomorphological processes which define estuarine soil landscapes are heavily influenced by other processes such as tides (Cohen 2005).

Darkheart (2014) adopted the Precautionary Principle in lieu of *in situ* soils data, and used the criteria of fluvial provenance as defined by Troedson and Hashimoto (2008) as indicative of alluvial geomorphology (as marine is associated with aeolian and true estuarine geomorphology) in line with NSW Land and Environment Court precedents (e.g. *Gales Holdings Pty Limited v Tweed Shire Council [2008] NSWLEC 209*) for the purposes of defining EECs using Biolink's (2013a) vegetation community mapping for PMHC.

For this reason, the PMHC EEC mapping shows *Swamp Sclerophyll Forest on Coastal Floodplains* EEC located on the site as shown in **Figure 6**.

The mapping was also caveated with the advice that the 1:25 000 mapping is based on modelling based on limited landscape sampling, elevation, topography, expert interpretation, etc, and hence site-based soil profile examinations may be required to verify the presence of alluvial soils in marginal or complex geomorphological situations, such as the study area.

3.4.1.3 Updated Evaluation

To verify the geomorphological origins of the original soils where potential EEC habitat is affected by future development proposals, geotechnical investigations were undertaken by Hackett laboratories (2017) and reviewed by Regional Geotech Solutiuons (2018) which are provided in Appendix 3.

As detailed in section 2.2.2, soil profile examination of the Qhef soil landscape which dominates the southern end of Lot 2 is clearly of estuarine geomorphology. This evidences an estuarine environment not alluvial, hence it appears that a 'coastal floodplain' is not present in this area as alluvial geomorphological processes do not appear to dominate the soil profile, especially the zone which supports the ecosystem (*Gales Holdings Pty Limited v Tweed Shire Council [2008] NSWLEC 209,* EPA 2016). Consequently, the supported vegetation appears to be disqualified as an EEC.

Cores taken on the Qhemd soil landscape which is mapped as being of fluvial provenance appear to have been confirmed as having an alluvial geomorphology as it lacked the typical sand and shell indicators of dominant estuarine processes, with a more complex layering of contrasting textures noted under a layer of fill. The Precautionary Principle is applied, and it is presumed that the swamp forest on this soil landscape unit is predominantly alluvial in geomorphology, and hence qualifies as the EEC – *Swamp Sclerophyll Forest on Coastal Floodplains*. The updated EEC map for the site is shown in **Figure 7**.

3.4.2 EPBC Act 1999

The site vegetation is not a Threatened Ecological Community listed under the *Environment Protection and Biodiversity Conservation Act 1999* as the site vegetation does not match the specified habitat or floristic criteria.

The recently nominated EEC - *Coastal Swamp Oak (Casuarina glauca) Forest of South-east Queensland and New South Wales* does not match the site vegetation as Swamp Oak is a lesser associate.

3.5 Threatened Flora

3.5.1 Result of Threatened Flora Survey

Despite targeted searches, no threatened plants were recorded on the study site.

3.5.2 Potential Occurrence Assessment

Searches of relevant literature and databases (OEH BioNet 2017a) found records of 8 threatened flora species in the locality. Potential habitat (see Appendix 1) occurs for *Maundia triglochinoides* and Trailing Woodruff, but targeted survey failed to detect either plant.

The vegetation on site shows at times intensive disturbances including complete clearing to compaction, as well as at times intensive weed invasion (via pastoralism). Given this and failure to detect any threatened species, none are considered likely potential occurrences.

Figure 6: Current PMHC EEC mapping

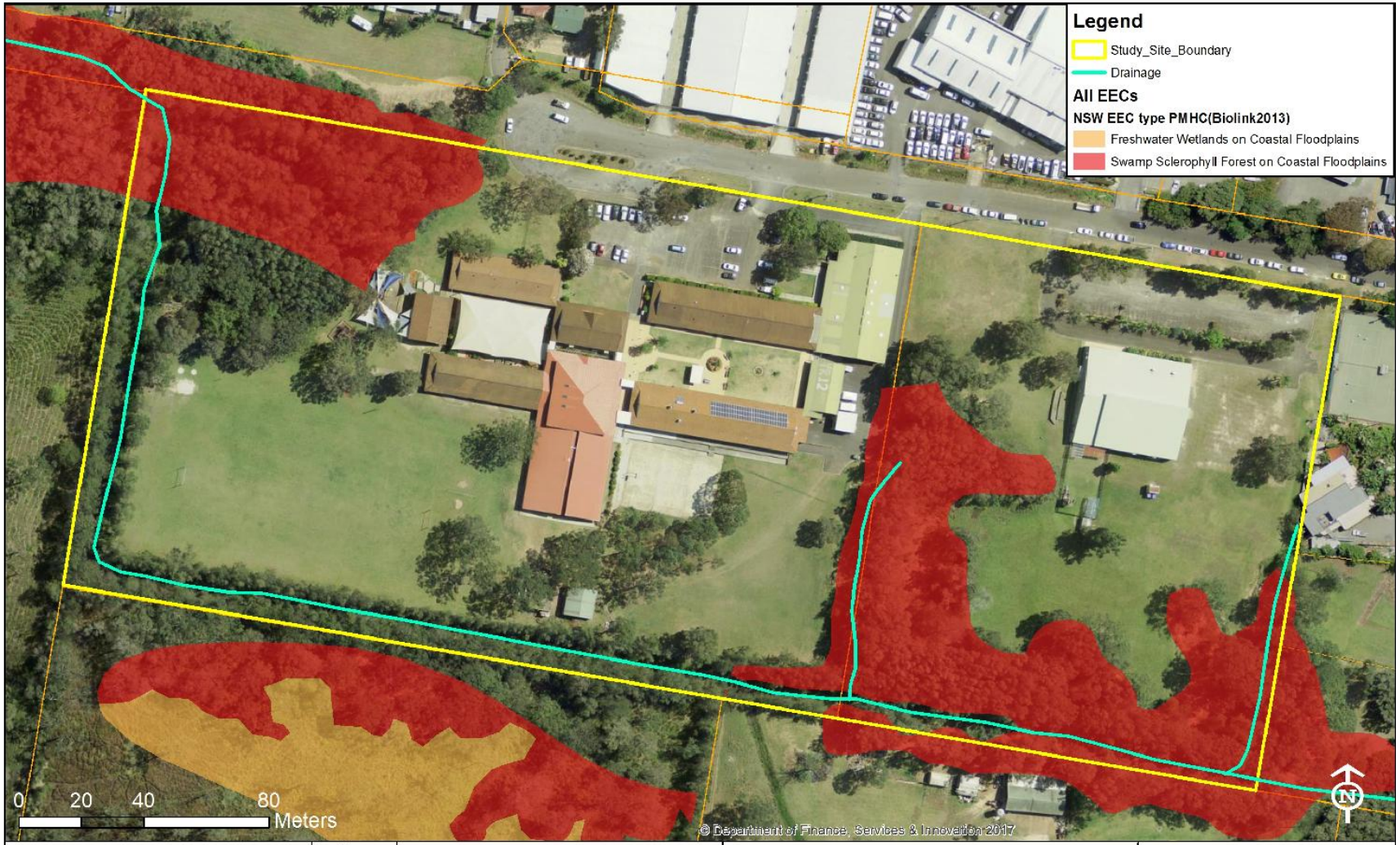
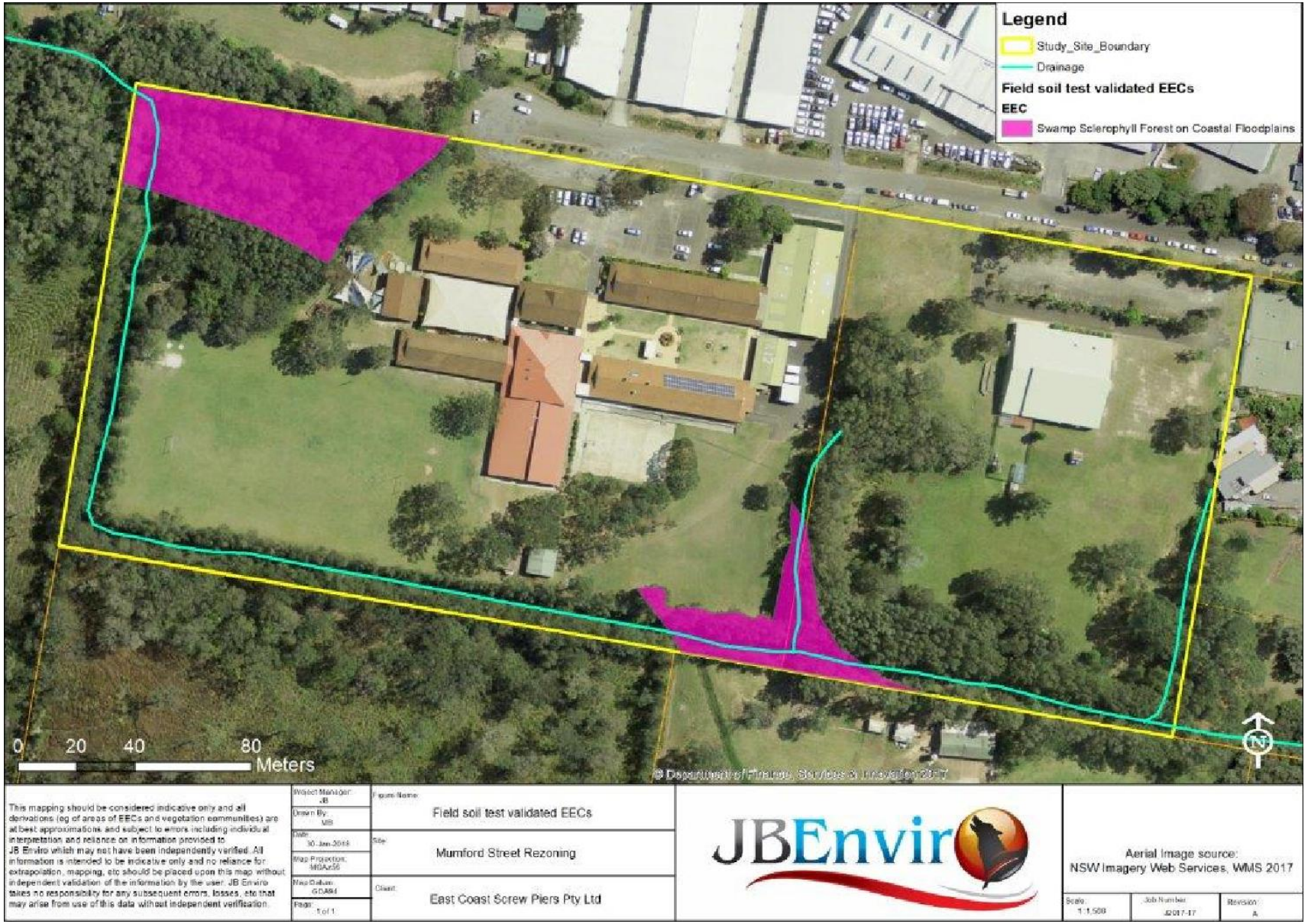


Figure 7: EECs based on site soil tests



4 FAUNA

4.1 Survey Methods

4.1.1 2005 Survey

Lot 2 was originally surveyed in 2005 (Darkheart 2005) via the following methods:

- 80 Elliot A trap nights
- 40 Elliot B trap nights
- 5hrs spotlighting and torch searches
- 6.5hrs Anabat call detection for microchiropteran bats.
- 3hrs of call playback for frogs, forest owls, Masked Owl, Powerful Owl, Barking Owl, Koala, Yellow-bellied Glider, Squirrel Glider, Wallum Froglet, Green-thighed Frog.
- 4 hours searching for scats, scratches, sap incisions, etc.

4.1.2 Updated Survey

Given the intensity of the previous survey and its results which remain valid; no significant change to site or study area habitats that may have altered conditions beneficially; and adjacent studies to the west which provided relevant data (Darkheart 2005a, Biolink 2012): additional survey was limited to:

- Updated habitat evaluation including targeted survey for hollow-bearing trees.
- A Spot Assessment Technique (SAT) in the clump of Swamp Mahogany in the rear of the school on Lot 4, as well as a search under all trees on the school site during Koala Food Tree (KFT) marking.
- Targeted survey for Koala via a three diurnal surveys over three consecutive weeks (1 day per search) over the site. All trees on site and the fringes of the SEPP 14 wetland were inspected for Koalas.
- Opportunistic observations of fauna during the survey.

4.1.2.1 Habitat Evaluation

The site was inspected to determine the available potential habitats, and the support value of these habitats for threatened species. Habitats were defined according to parameters such as:

- Structural and floristic characteristics of the vegetation, such as species mix, understorey type and development, maturity, groundcover density, etc.
- Degree and extent of disturbance, eg fire, logging, weed invasion, modification to structure and diversity, key threatening processes, etc.
- Soil type and suitability, eg for digging and burrowing.
- Presence of water in any form, eg dams, creeks, drainage lines, soaks.
- Size and abundance of hollows and fallen timber
- Availability of shelter, eg rocks, logs, hollows, undergrowth.

- Wildlife corridors, refuges and proximate habitat types.
- Presence of mistletoe, nectar, gum, seed and sap sources.
- Presence of preferred browse or sap species

Following assessment of the habitat and other survey work, threatened species recorded in the locality and in the region in similar habitats were evaluated for their potential to occur on the site. This is presented in Appendix 1.

4.1.2.2 Spot Assessment Technique

A single SAT was undertaken in the clump of trees at the rear of the school, as this was the only location where scats were found. The methodology was in line with Phillips and Callaghan (2011).

4.1.2.3 Targeted Koala Survey

This consisted of three separate days over three weeks of inspecting the site for Koalas in trees. A single ecologist traversed the site, targeting Koala Food Trees but also inspecting all other trees for Koalas. Aside from the interior of the swamp forest in the northwest corner, this saw 100% coverage of the site.

4.1.2.4 Direct Observation and Secondary Evidence

Physical habitat searches were undertaken for 8 hours. This involved lifting up of timber and debris, inspection of dense vegetation and leaf litter for frogs and reptiles, binocular inspection of potential hollows, observation of likely basking sites and searches for scats, tracks and scratches. This time was also devoted to searching under preferred/potential forage species for Koala scats, opportunistically for owl regurgitation pellets, etc.

Birds were generally surveyed by detecting calls and searching by binoculars at dawn and dusk (when call chorus and peak activity occurs); while walking around the entire site; and opportunistically during other activities.

Species identification was assisted by Simpson and Day (1996), Wilson and Knowles (1992), Strahan (1992), Briggs (1996), Robinson (1996), and Schode and Tideman 1990).

4.1.3 Survey Limitations

All surveys are limited in their ability to fully document all species of flora and fauna likely or actually occurring on a site. Surveys such as these are merely “snapshots” in time, and can only be expected to provide an indicative not absolutely comprehensive representation of a site’s species assemblage. To counter this limitation, this survey has employed methods recommended in literature and known from personal experience to best detect the target species or assess their potential to occur.

4.1.3.1 Flora

The study site was intensively traversed by foot during specific flora surveys and during other survey activities. This survey was undertaken in spring is suitable for detection of all locally occurring threatened plant species. The 2005 survey was undertaken in winter.

Regardless, any short-term survey will only provide a list of plants detected during a brief interval of time (DEC 2004). The total species list of an area is usually much greater than

can be detected in such a short time and it can be influenced by factors such as: size of the property, fire history, time since disturbance, flowering season (particularly orchids), and presence of reproductive material (DEC 2004). As the focus was on detection of threatened species, a comprehensive inventory of all species present was not obtained.

4.1.3.2 Fauna

Fauna detectability is limited by seasonal, behavioural or lifecycle of each species, and even habitat variations (eg flowering periods), which can vary within a year, between years, decades, etc. Habitat evaluation is used to counter this limitation by assessing the potential occurrence of threatened species based on potentially suitable habitat in the study area and local records.

Darkheart (2005) undertook an intensive survey to confidently confirm threatened species with small home ranges were absent, and although over 10 years have passed since the original survey, there has been no significant change in habitat quality or connectivity on site or in adjoining habitat south and west.

To counter standard survey limitations, habitat evaluation was used as well as a brief fauna survey. Habitat evaluation conservatively assesses the potential occurrence of threatened species based on potentially suitable habitat in the study area and local records, and provides a prediction of the likelihood of a particular threatened species occurring in the study area.

4.2 Corridors and Habitat Links

See Figure 8 showing the following.

4.2.1 Regional Corridors

Regional corridors are typically >500m wide and provide a link between major and/or significant areas of habitat in the region. Ideally they are of sufficient size to provide habitat in their own right and at least twice the width of the average home range area of fauna species identified as likely to use the corridor (OEH 2014c, Scotts 2002).

The site falls within the Limeburners-Lake Innes Regional Corridor, which extends north across the northwest side of the urban precincts of Port Macquarie and the Hastings River to Limeburners Creek Nature Reserve, south to Lake Innes Nature Reserve. Within a kilometer radius of the site, this regional corridor has the major limitations of the Hastings River and urban areas of Port Macquarie. Only the most mobile of species (ie. birds, bats, some insects) are likely to undertake landscape movements via this modelled corridor.

4.2.2 Sub-Regional Corridors

Sub-regional corridors connect larger landscaped features and are of sufficient width to allow movement and dispersal (generally >300m), but may not provide substantial species habitat (OEH 2014c, Scotts 2002).

The site is not identified as forming part of any sub-regional corridors. The nearest is just over a kilometer southwest (Lake Innes – Cowarra), extending via fragmented but large tracks of vegetation west to Cowarra State Forest. The Pacific Highway is the major barrier to fauna in this corridor, severely limiting terrestrial and arboreal fauna.

4.2.3 Local Corridors and Habitat Links

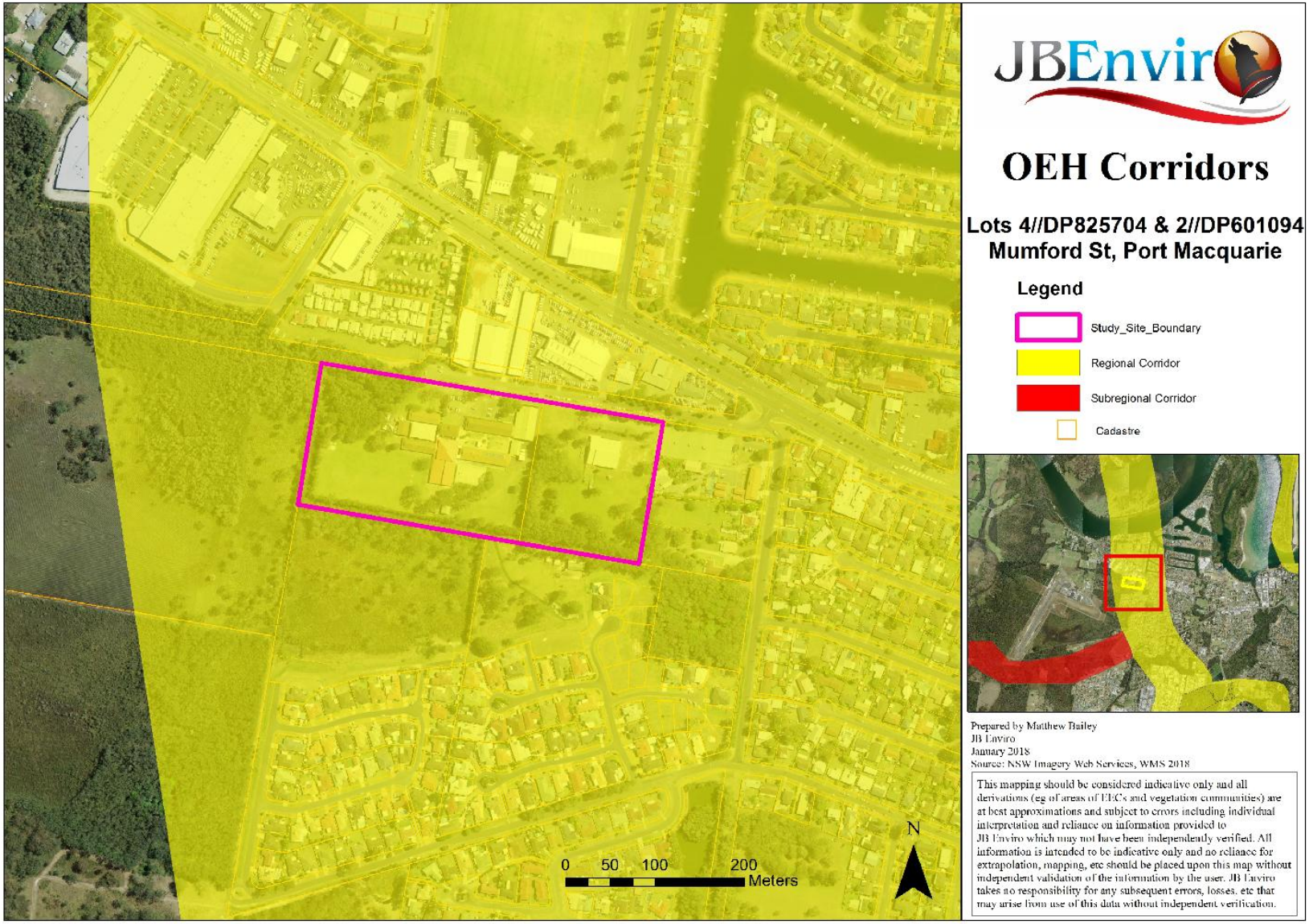
Local corridors provide connections between remnant patches of habitat and landscape features. Due to their relatively small area and width (they may be <50m) these corridors are subject to edge effects (OEH 2017c, Scotts 2002). Habitat links are evaluated in this report as links from habitat on-site directly to similar habitat on adjacent land. These would be used by fauna, which depend solely or at least partially on the site for all of their lifecycle requirements, and/or dispersal (Gibbons and Lindenmayer 2002).

Local corridors provide connections between remnant patches of habitat and landscape features. Due to their relatively small area and width (they may be <50m) these corridors are subject to edge effects (DEC 2004b).

The site adjoins a relatively sizeable tract of native vegetation mostly dominated by swamp forest to heathland to the west and south around the eastern side of the Port Macquarie airport. This area has been subject to major studies (Darkheart 2005a, Biolink 2012), indicating it supports Core Koala Habitat, Squirrel Glider, Wallum Froglet and probably *Allocasuarina defungens*. This vegetation has linkage to a similar and larger tract of forest west of the airport, which eventually links to Lake Innes Nature Reserve. It is thus a very significant local corridor.

The remnant vegetation on the site's southern side and northwest links to the habitat east of the airport and to remnant vegetation to the south, and thus has habitat linkage and local corridor values. Linkage however deteriorates rapidly to the north due to long established commercial and residential development, and similarly to the east into only urban woodland with limited value for any but tolerant species. The site is thus not a key interlink in a local corridor for species intolerant of urban woodland habitats, but would readily support the Koala which can use as little as 1 tree/ha (Wilkes and Snowden 1998).

Figure 8: OEH Regional Corridors



4.3 Survey Results

4.3.1 Fauna Habitat Description and Evaluation

Table 2: Habitat evaluation summary

Habitat attribute	On-site values	Significance
Aquatic/wetland habitat	Present in three forms: • Northwest wetland: Consists of a sub-tidal channel (possibly artificial) with tannin stained water, and at times flooded sedgeland in wetter years. • Artificial drains: Occur on all but northern boundaries. Southern and eastern drains appear to hold tannin stained water at all times in deeper sections (lot of sedimentation in some areas), with eastern boundary drains ephemeral. All are linked to urban stormwater outlets hence subject to pollutants, high nutrients and scouring flows. • Derived wetland: In southwest corner of Lot 2, this ephemeral wetland only holds water deeper than 5cm for short periods after rainfall or in wetter years. A depression dominated by paperbarks occurs just north of it, with similar tendencies.	All habitats unsuitable for Jabiru and threatened ducks and the Magpie Goose due to dense forest. Some generic potential for bitterns in northwest forest, but more remote and extensive habitat occurs extensively in the locality. Marginal potential for Wallum Froglet in dense swamp forest in northwest despite records on adjoining land to west as appears to prefer more open, sedge-dominated habitats with solar access. Stormwater inputs also likely to impact pH and water quality, further limited potential to occur.
Marine/estuarine habitats eg estuarine, rocky foreshores, open beaches, open ocean.	Absent	N/A
Caves, cliffs, overhangs, etc	Absent	N/A
Logs and stumps	Logs are scant and what is present is of smaller size offering poor refugia.	None large enough for Quoll dens. Limited generic refugia for prey species.
Groundcover/shrub layer/undergrowth	Maintained over most of site. Only well developed as a narrow band along the southern boundary and less so the eastern boundaries, where its mostly weed dominated. Some dense sedgeland on edges of SEPP 14 area.	No particular threatened species considered likely to occur. Potential habitat for exotic rodents which may add to prey base.

Habitat attribute	On-site values	Significance
Leaf Litter	Leaf litter was generally shallow and moist, and limited to the swamp forest only.	No potential for any significant fauna.
Wattles, Melaleucas, Callistemons and Banksias (shrub layer)	No Banksias, but other species common. These offer a nectar and insect attractant.	Source of prey attractant in form of insects and honeyeaters, to offering habitat for Squirrel Glider and Grey-headed Flying Fox.
Yangochiropteran bat habitats	In general, the site forms part of a wider modified landscape which contains a mosaic of remnant forest, pasture, modified patches of forest and scattered trees. The site offers a small area of suitable structure for bat species capable of foraging along the forest/grassland interface, and across medium sized remnants. Potential roosts occur very limited as no hollow-bearing trees and limited accumulation of decorticating bark in paperbarks.	Little and Eastern Bent-Wing Bats, East-Coast Freetail Bat, Greater Broad-Nosed Bat considered low to highly likely to use site as minute to minor portion of their wider local range.
Fruiting species	Limited to some Bangalow Palm and Cheese Trees. Bangalow Palm is a preferred food species of frugivorous birds and bats.	Not preferred vegetation type for potential foraging habitat for Wompoo Fruit-Dove, Rose-Crowned Fruit-Dove and Barred Cuckoo Shrike. Some low value as potential forage habitat for Grey-headed Flying Fox.
Flowering canopy trees.	Swamp Mahogany flowers in autumn to winter, with Broad-leaved Paperbark flowering from late January to mid-winter. These species are important to nectar dependent species, some of which range interstate.	Species present preferred by Squirrel Glider, Grey Headed Flying Fox, Yellow-Bellied Glider, Little Lorikeet, Swift Parrot (low abundance) plus passerine birds which offer potential prey to diurnal raptors.
Sap sources	Forest Red Gum and Grey Gum are a potential preferred sap sources for the Yellow-Bellied Glider and Squirrel Glider (Lindenmayer 2002, NPWS 1999, Smith et al 1995, NPWS 2002c, Gibbons 2002). These are however limited to single trees.	Extremely limited potential sap source range for gliders, with no sap incisions noted.
Allocasuarinas	Absent	These oaks generally provide nesting material for birds, and useful quantities of leaf litter, but their greatest value is to the Glossy Black Cockatoo, whose diet in this region is primarily based on Black She-oak and Forest Oak (NPWS 1999, OEH 2018b, Clout 1989, Birds Australia 2017, pers. obs.). The site does not offer any potential value to this bird.

Habitat attribute	On-site values	Significance
Tree hollows	Absent	Major constraint on hollow-obligate fauna.
Prey species	Known presence of Squirrel Gliders, rabbits, House Mouse, Swamp Rat, Ringtail Possum and a low abundance Brown Antechinus. Passerine birds in low diversity and abundance – dominance by medium sized woodland species.	Small terrestrial and passerine prey species may support mostly common diurnal raptors and snakes. Low chance for rare visitation by local pair of forest owls which are known to use peri-urban habitats. Likely to form part of range for locally recorded threatened raptors such as the Square-tailed Kite and Little Eagle, with site only forming minute part of a large area of potential foraging habitat within these species very large foraging range.

4.3.2 Observed fauna

The 2005 survey recorded the following threatened species on site:

- Squirrel Glider: V-BCA
- Koala: V-BCA, V-EPBCA
- Grey-headed Flying Fox: V-BCA
- Little and Eastern Bent-wing Bats (Confident and probable/possible call identification): V-BCA
- East-coast Freetail Bat (probable/possible call identification): V-BCA
- Eastern Cave Bat (default possible call identification): V-BCA

These results are discussed further in section 4.3.4. All fauna recorded to date on site are listed in the following table:

Table 3: Fauna detected on site to date

Group	Common Name	Scientific Name
Birds	Straw-necked Ibis	*Threskiornis spinicollis*
	Australian White Ibis	*Threskiornis molucca*
	Australian Wood Duck	*Chenonetta jubata*
	Rainbow Lorikeet	*Trichoglossus haematodus*
	Black-faced Cuckoo-shrike	*Coracina novaehollandiae*
	Laughing Kookaburra	*Dacelo novaeguineae*

Group	Common Name	Scientific Name
	Grey Fantail	*Rhipidura fuliginosa*
	Crested Pigeon	*Ocyphaps lophotes*
	Bar-Shouldered Dove	*Geopelia humeralis*
	Australian Raven	*Corvus coronoides*
	Magpie	*Gymnorhina tibicen*
	Magpie Lark	*Grallina cyanoleuca*
	Lewins Honeyeater	*Meliphaga lewinii*
	Galah	*Cacatua roseicapilla*
	Scaly-breasted Lorikeet	*Trichoglossus chlorolepidotus*
	Tawny Frogmouth	*Podargus strigoides*
	White-browed Scrubwren	*Sericornis frontalis*
	Noisy Friarbird	*Philemon corniculatus*
	Red Wattlebird	*Anthochaera carunculata*
	Eastern Whipbird	*Psophodes olivaceus*
	Grey Butcherbird	*Cracticus torquatus*
Mammals	Common Ringtail Possum	*Pseudocheirus peregrinus*
	Squirrel Glider	*Petaurus norfolcensis*
	Brown Antechinus	*Antechinus stuartii*
	Koala	*Phascolarctos cinereus*
	Eastern Grey Kangaroo	*Macropus giganteus*
	Swamp Wallaby	*Wallabia bicolor*
	Swamp Rat	*Rattus lutreolus*
	Bandicoot	-
	Grey-headed Flying-fox	*Pteropus poliocephalus*
	House Mouse	**Mus musculus*
	European Rabbit	**Oryctolagus cuniculus*
	Deer*	-
	Little Bent-wing Bat	*Miniopterus australis*
	Common Bent-wing Bat	*M. schreibersii*[1]

Group	Common Name	Scientific Name
	Large Forest Bat	*Vespadelus darlingtoni*
	Eastern Forest Bat	*Vespadelus pumilus*
	Eastern Cave Bat	*Vespadelus troughtoni*[1]
	Little Forest Bat	*Vespadelus vulturnus*[1]
	Chocolate Wattled Bat	*C. morio*[1]
	Gould's Wattled Bat	*C. gouldii*[1]
	A Freetail Bat	*Mormopterus spp.*
	East Coast Freetail Bat	*Mormopterus norfolkensis*[1]
	White-striped Mastiff Bat	*Tadarida australis*
	A Broad-nosed Bat	*Scoteanax sp.* [1]
	Eastern Broad-nosed Bat	*Scoteanax orion*[1]
Reptiles	Garden Sun-skink	*Lampropholis delicata*
Frogs	Common Eastern Froglet	*Crinia signifera*
	Striped Marsh Frog	*Limnodynastes peronii*
	Dwarf Tree Frog	*Litoria fallax*
	-	*Litoria dentata*

*feral species
[1]probable/possible call identification only

4.3.3 Koala Survey

No Koala were found on the study site despite targeted searches by the survey for this updated report. Scats were only found under two trees in the planted patch behind the school on Lot 4, resulting in a low activity level (see section 5.2.3).

4.3.4 Discussion of Fauna Survey Results

4.3.4.1 Success of Methodology

The 2005 survey results illustrate the importance of using a range of survey techniques to maximise the potential of recording target threatened species. For example Squirrel Gliders are readily detected via spotlighting, however were only detected by survey on site via Elliot B trapping.

Overall, the fauna assemblage (including the threatened species) detected is generally typical of the habitats sampled and are very similar to results on adjacent land with similar habitats (Biolink 2012, Darkheart 2005a).

Most of the species recorded were habitat generalist, capable of inhabiting areas with extensive disturbance histories. Some species groups were poorly represented eg reptiles, etc. This is possibly due to either a lack of suitable habitat, season, life cycle stage (eg migratory period, torpor, etc) or non-contact with the consultants (eg raptors). During peak flowering periods the diversity and abundance of fauna on site (particularly birds) is likely to increase substantially.

4.3.4.2 Recorded threatened species

Four threatened species were confirmed to occur in the study site by this survey: the Little Bent-Wing Bat, Koala, Grey-Headed Flying Fox and Squirrel Glider. The Eastern Freetail Bat and Common Bent-Wing Bat were "possible/probable" recordings, while the Eastern Cave Bat was a tentative "possible" detection.

(a) Koala

The Koala was reasonably expected to occur prior to the 2005 survey given local records, which includes Core Koala Habitat 500m to the west of the site (Darkheart 2005a, Biolink 2012); and the common presence of Swamp Mahogany. The Koala was recorded in 2005 as follows:

- A female Koala and joey were detected on the 1st, 5th and 6th of September via spotlighting and/or opportunistic sightings.
- An adult male Koala was detected via call playback on the 7th of September.

The consultant also made an anecdotal sighting of a Koala in a non-endemic eucalypt at the front of the school in 2011.

This survey recorded no Koalas and few scats in contrast to the previous assessment. This may simply indicate the limited range of survey techniques used for this survey and the limitations of 'snap shot' surveys (DEC 2004).

As discussed in section 5.2, the site is considered to be form part of the nearby Core Koala Habitat to the west and southwest identified by previous studies (Biolink 2012, Darkheart 2005a).

(b) Grey Headed Flying Fox:

Grey Headed Flying Foxes were readily observed flying over the site during the 2005 survey. This species ranges over a vast area following the fruiting/flowering pattern of preferred forage species. The species is dependent on year-round flows of nectar, pollen and fruit, and facilitates a few specific roosts for key lifecycle functions.

The site has potential to seasonally support a small number of Grey Headed Flying Foxes as a small part of their wider foraging range. The site thus potentially forms part of a much larger range used for opportunistic foraging, but is not known or considered to be key or temporary roosting habitat.

(c) Squirrel Glider:

The 2005 survey recorded a single female Squirrel Glider on two occasions via Elliot B trapping in the southwestern and western portions of the swamp forest on Lot 2.

While the site does not contain this species cited preferred habitat, this recording was not unexpected given recordings of this species in close proximity to the west of the site (Darkheart 2005f, 2004q) in floristically similar habitat which are linked to the site. Furthermore such records are not unprecedented with animals recorded in similar marginal habitat in other areas of Port Macquarie (Darkheart 2005d, 2005g), Sancrox (Darkheart 2005c, 2005h), and near Kempsey (Berrigan 1999a, 2003f, Darkheart 2004a, 2004b, 2004r). The co-occurrence of Sugar and Squirrel Gliders is also not unusual (Quin 1995), with the species observed in similar situations by this consultant (Berrigan 1999a, 2003f, Darkheart 2005c, 2005h, 2004a, 2004b, 2004r).

It is difficult to know the exact dynamics and nature of the group/s using the site without the implementation of a long term study eg. to determine movements according to availability of food. However given the recordings of this species on and to the west of the site; the lack of trees hollow on site and limited and marginal state of the vegetation present; the gliding distance (up to 50m (Lindenmayer 2002) and the cited home range sizes of this species, core habitat for the group/s using the site is likely to be concentrated in the forest along the southern boundary and northwest corner which adjoins known habitat to the west near Boundary Street; and extend into adjacent areas of woodlands and swamp forest to the south and west.

As the Squirrel Glider has been recorded foraging (and possibly even denning) in scattered parklands/partial woodlands consisting of isolated trees (Darkheart 2005d), the swamp forest and adjacent scattered trees in the gardens and lawns on site may provide potential foraging sources. Overall the site is considered to form part of the local Squirrel Glider group/s foraging range.

(d) Little and Eastern Bent-wing Bats:

These species are known to share roosting and nursery habitats. Both species roost in caves, mines, buildings etc generally located close to or within dense vegetation, although recent research has detected the Little Bent-Wing Bat roosting in banana bunches during winter (Hulm 1994) and tree hollows (Schultz 1996). Both species are limited by the availability of nursery caves. The Macleay valley has the southernmost population of Little-Bent Wing Bats, which seem to depend on a larger nursery colony of Common Bent-Wing Bats to provide environmental conditions (Dwyer 1991). These nursery and maternity caves are protected in Willi Willi National Park and Yessabah Nature Reserve.

The Little Bent-Wing Bat reportedly forages above and beneath the canopy of tropical rainforest, warm temperate rainforest, riparian forest and dry sclerophyll forest, and in clearings adjacent to forest (Dwyer 1991). The Common Bent-Wing Bat forages above and beneath the canopy, and also along tracks within tropical rainforest, warm temperate rainforest, riparian forest and dry sclerophyll forest, and in clearings or ecotones adjacent to forest (Dwyer 1991). It is even found foraging in urban-modified habitats (Hoye 1995).

The consultant has often recorded both species in rural, semi-rural areas, regrowth forest and rural-residential areas; most commonly foraging on the edge of vegetation or along tracks under the canopy (eg Darkheart 2004u, 2004t, 2004p, Berrigan 1998f, 1998c), and in even small urban remnants (eg Darkheart 2004l).

The “confident” detection of the Little Bent-Wing and “probable/possible” detection of the Eastern Bent-Wing on site, given the potential habitat and local records (OEH 2017) was not unexpected. The site thus forms part of the vast area of foraging habitat of the population centred on the maternity caves in the upper Macleay (Dwyer 1968, 1966).

(e) East-coast Freetail Bat:

Specific habitat requirements of the Eastern Freetail Bat are poorly known. The species has been recorded in habitats ranging from rainforest to dry sclerophyll and woodland, with most recorded in the latter (State Forests 1995, Allison 1991, Darkheart 2004d, 2004p). The species roosts in small colonies in tree hollows and under loose bark and under house eaves, in roofs and metal caps on telegraph poles. A colony was recorded roosting in roof in Hat Head village (Macleay Argus 1998). This species most probably forages above forest or woodland canopy, and in clearings adjacent to forest. Most records are of single individuals, and the species is likely to occur at low densities over its range.

Due to the "probable/possible" detection of this species during the survey, local records (Bionet 2017, Darkheart 2004d, 2004p, etc) and the presence of structurally suitable habitat on site, this species is considered a likely occurrence on site. The site is thus considered to form a small part of the local population's opportunistic foraging range.

(f) Eastern Cave Bat:

A particularly rare and poorly known bat, with populations in the southern part of its range appearing to be localised (Parnaby 2000). It is a cave dwelling bat roosting in small (5) to large (500) groups in sandstone overhangs, caves, boulder piles, mines, tunnels and sometimes buildings. It tends to roost in well lit portions of caves in avons, domes, cracks and crevices. Typically, it inhabits warm temperate to tropical mixed woodland and wet sclerophyll forest on the coast and dividing range, but extends into drier forest on western slopes and inland areas (Churchill 2009, Parnaby 2000). It hunts below the canopy down to about 2m above the ground for insects such as mosquitoes, flies and moths (Smith et al 1995).

The nearest known caves are crevices at Jolly Nose Hill to the south (near Bonny Hills) and Broken Bago State Forest and Bago Bluff National Park to the west. Marginally structurally suitable foraging habitat occurs on the site however more optimum and extensive potential foraging habitat occurs between the site and the potential roosts. The species is considered a default "possible" occurrence as its call cannot be separated from the common Vespadelus species (which are likely to occur on site).

Overall it is considered a very low to unlikely chance of occurrence on the site due to the limited habitat potential and lack of local records.

4.4 Potential Occurrence Assessment

Database searches were made of BioNet (OEH 2018a) and the EPBC Act Protected Matters tool (DotEE 2018a). These combined with a literature review of previous ecological studies provided a list of known locally recorded threatened fauna. In addition, a number of regionally recorded species are considered potential occurrences in the locality. In total, these species were evaluated for potential to occur in Appendix 1. Potentially occurring migratory species listed under the EPBC Act 1999 were also assessed.

4.4.1 Potential Occurring Threatened Species

Habitat for the majority of the above listed species does not occur on near the site (see previous references and Appendix 1 for justification).

Due to potential habitat on and/or adjacent to the site, the following are considered at least low potential occurrences on or very near (within 100m) the site and thus require formal statutory assessment (see section 9 and 10):

Table 4: Threatened species potentially occurring in the study area

Species	Legal Status	Occurrence type and likelihood
Square-tailed Kite	V-BCA	Fair. Minute portion of large foraging territory. Generic nest potential.
Little Eagle	V-BCA	Low to fair. Not preferred habitat hence at most minute portion of large area of potential foraging territory, with generic potential nesting trees.
Little Lorikeet	V-BCA	Low at best forming small portion of foraging and breeding habitat within adjacent forest, falling within a wider foraging range. No potential nest sites.
Masked Owl Powerful Owl Barking Owl	V-BCA	Low chance of occurrence foraging using site as outermost fringe of larger territory. No potential to nest on site.
Greater Broad-nosed Bat	V-BCA	Fair chance of using site and study area as minute portion of large foraging territory with extensive potential habitat beyond study area. No potential roost sites.

5 SEPP 44 KOALA HABITAT ASSESSMENT

5.1 Potential Koala Habitat

5.1.1 Introduction

The identification of an area of land as SEPP 44 Potential Koala Habitat is determined by the presence of Primary Preferred Koala Browse tree species. These species are listed under Schedule 2 of SEPP 44: Koala Habitat Protection.

Potential Koala Habitat is defined as areas where the tree species listed under Schedule 2 constitute at least 15% of the total number of trees in the upper or lower strata of the tree component. SEPP 44 Primary preferred food species occurring in the Hastings Valley are: Tallowwood (*Eucalyptus microcorys*), Scribbly Gum (*E. signata*), Swamp Mahogany and Forest Red Gum.

An area of land to which the policy applies to must be at least 1ha (and may include adjoining land in the same ownership). According to a Land and Environment Court ruling (*St Ives Bus Services Ltd V. Ku-Ring-Gai Council* 15/11/95), it may also refer to a minimum of 1ha of habitat within a larger property containing sufficient Schedule 2 species to qualify as Potential Koala Habitat.

5.1.2 Assessment

Schedule 2 species on site comprise Swamp Mahogany and a single Forest Red Gum.

Figure 9 shows the approximate location of these trees on site (subject to GPS error). A one hectare polygon including >20 KFTs behind the school on Lot 4 readily meets the SEPP 44 definition of Potential Koala Habitat.

5.2 Core Koala Habitat

5.2.1 Introduction

Under SEPP 44, Core Koala Habitat is defined as "an area of land with a resident population of Koalas, as evidenced by attributes such as breeding females (that is, females with young) and recent sightings of and historical records of a Koala population" (Source: State Environment Planning Policy No. 44 - Koala Habitat Protection).

The definition "an area of land" is interpreted as the land to which the development application applies (if it exceeds 1ha in area, together with any land in the same ownership).

5.2.2 Literature and Database Review

5.2.2.1 Bionet 2017

Bionet (2018) records 6020 Koala records in the locality. The closest (1km radius) are shown in **Figure 10**.

5.2.2.2 Biolink 2013b

Biolink (2013b) undertook a broad-scoping study of Koalas and their habitat within the coastal Local Government Area. This major study had the primary aims of:

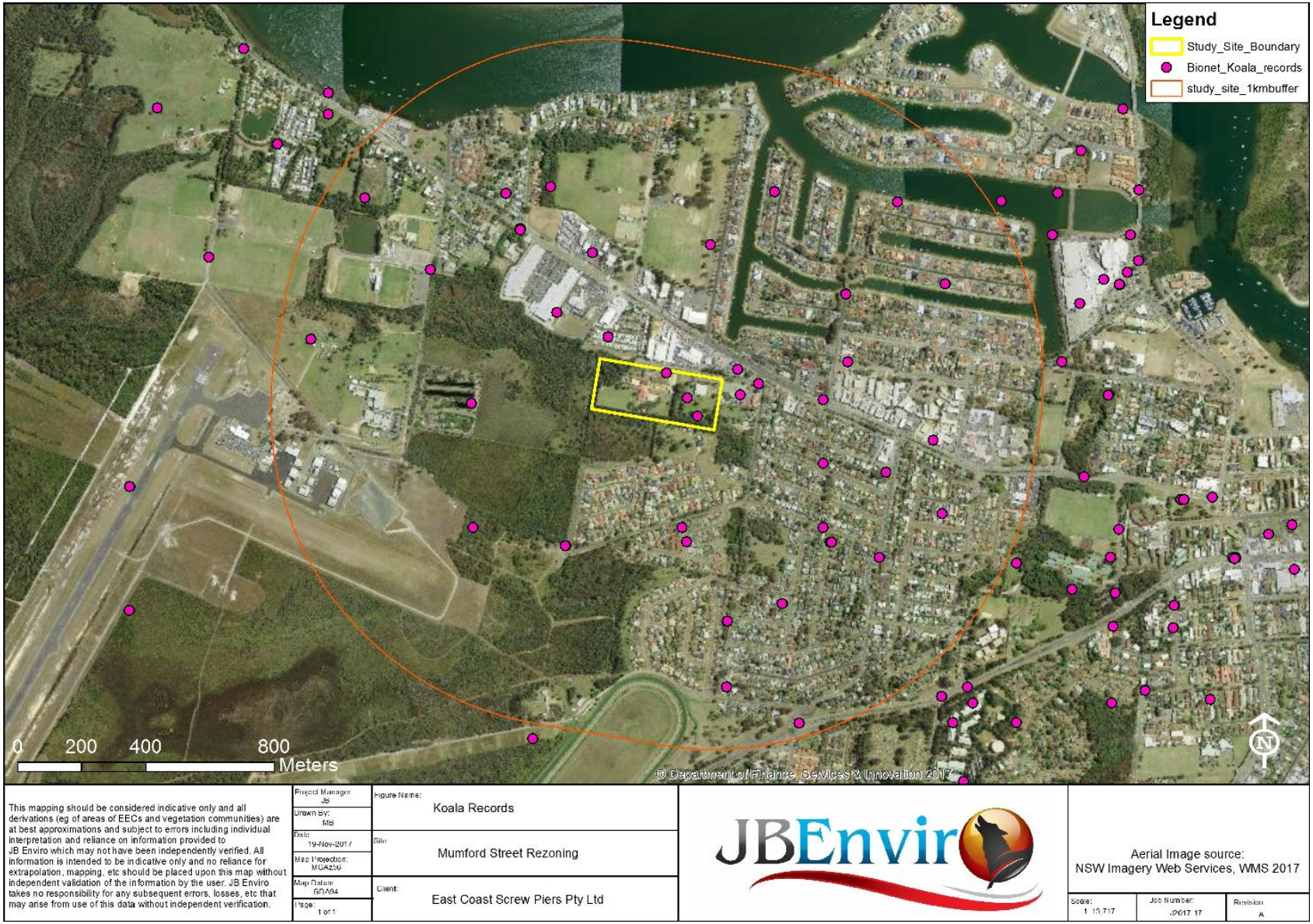
a) survey and analysis of current (and past) koala distribution and population size;
b) identification of preferred koala food trees;
c) delineation of vegetation communities and other areas considered to be important for Koalas;
d) assessment of key threats to Koalas and their habitat.

The study included a large-scale regularized grid-based Spot Assessment Technique (RGSAT) to identify Koala habitat.

Relevant to the site, the study identified a cell of high Koala activity to the southwest in habitat east of the airport (indicating Core Koala Habitat). Biolink only map the swamp forest vegetation site, with the west and southwest habitat mapped as non-Koala habitat, and the swamp forest on Lot 2 mapped as Secondary Class A. This mapping underestimates the habitat quality of the swamp forest to the west and south, where Swamp Mahogany is locally common.

Figure 9: Location of KFTs on site

Figure 10: Site and local Koala records



5.2.2.3 Biolink 2012

Biolink undertook an ecological survey and assessment of the Port Macquarie airport precinct. The study site extended over 162ha, extending east, west and south of the airport.

The study identified swamp forest to the east of the airport was a significant area of Core Koala Habitat.

5.2.2.4 Darkheart (2005a)

Darkheart (2005a) assessed Lot 2 DP 442098 to the west, which is 13 ha in extent. The site contains Swamp Mahogany along the southern margins of the larger swamp forest remnant, and a small patch in the central south.

Three Koala sightings (two in one night) as well as medium to high activity levels indicated this site was Core Koala Habitat. Given proximity to high quality habitat to the south (also a long term release area for rehabilitated Koalas from the Koala Hospital), this was reasonably expected.

5.2.3 Site Evidence

As detailed in section 5.2, during the 2005 survey of Lot 2, a female Koala with a joey was recorded on site, a male responded to call playback nearby, and 35 trees were found to have scats.

A diurnal survey was undertaken on Lot 4 and Lot 2 for this survey, with a Spot Assessment Technique (SAT) taken under the clump of mostly planted Swamp Mahogany behind the school (the swamp forest was constrained by dense groundcover and water for scat searches and SAT assessment) on Lot 4 (given sufficient evidence had been collected previously on Lot 2).

No Koalas were recorded and only low activity was recorded on Lot 4. While this result is in contrast to the 2005 survey, survey did not include spotlighting and call playback and hence this is acknowledged as a limitation.

5.2.4 Conclusion

SEPP 44 defines Core Koala Habitat as "*an area of land with a resident population of Koalas, as evidenced by attributes such as breeding females (that is, females with young) and recent sightings of and historical records of a Koala population*". The attributes are provided as examples of only some of characteristics a Core Koala Habitat may demonstrate, and thus to meet the definition of Core Koala Habitat, a site does not necessarily need to show all of these attributes, and may even show other evidence indicating the site is Core Koala Habitat.

In regards to the identified attributes though, the following is provided:

1) "*Breeding females (that is, females with young)"*. Breeding activity was recorded on Lot 2 in the form of a female with joey in 2005. Call playback also recorded a male to the west at the time.

2) "*Recent sightings and historical records of a Koala population*". While no Koalas and limited evidence was recorded for this recent survey, scats and scratches were found, indicating a continuing association of the Koala with the site. This combined with the

previous site observations, Bionet records (OEH 2018a) and directly adjoining Core Koala Habitat within a locality well known to support a large Koala population indicate a Koala population is present.

Note that the term "population" is not defined by SEPP 44, and it does not distinguish between a site that contains *all* of a population, or *part* of it. Hence, it is not necessary for an area to contain the entire local population to qualify as Core Habitat.

In view of the above information, it was concluded that the site is Core Koala Habitat, and hence a Koala Plan of Management is required.

6 AMELIORATIVE MEASURES

The following measures are expected to be implemented in future development, many under the Koala Plan of Management which will be required to accompany a future Development Application/s.

6.1 Offset Bush Regeneration

The loss of swamp forest on Lot 2 and reduction of the buffer to the EEC in the southern end of the site is to be offset via bush regeneration of the residual which is infested with lantana and Winter Senna; and planting out of the current pasture infill areas on Lot 2 with swamp forest species to widen the band of vegetation in the south.

This will be undertaken under a Vegetation Management Plan (VMP) as part of a future DA.

6.2 Koala Food Trees Offsets

The concept plan indicates one tree potentially removed on Lot 4 for a building extension, and one on the mid-west boundary on Lot 2. All other trees are to be retained.

The KFTs removed for the proposal are to be replanted at a ratio of 1:5 in the southern end of Lot 2 where an existing gap occurs (currently occupied by weeds or pasture), and margins of the swamp forest to maintain proximity to existing habitat. This will reinforce this habitat link and the carrying capacity of this habitat. The offset plantings will be planted at a minimum of 5m x 5m spacings to allow maximum crown development.

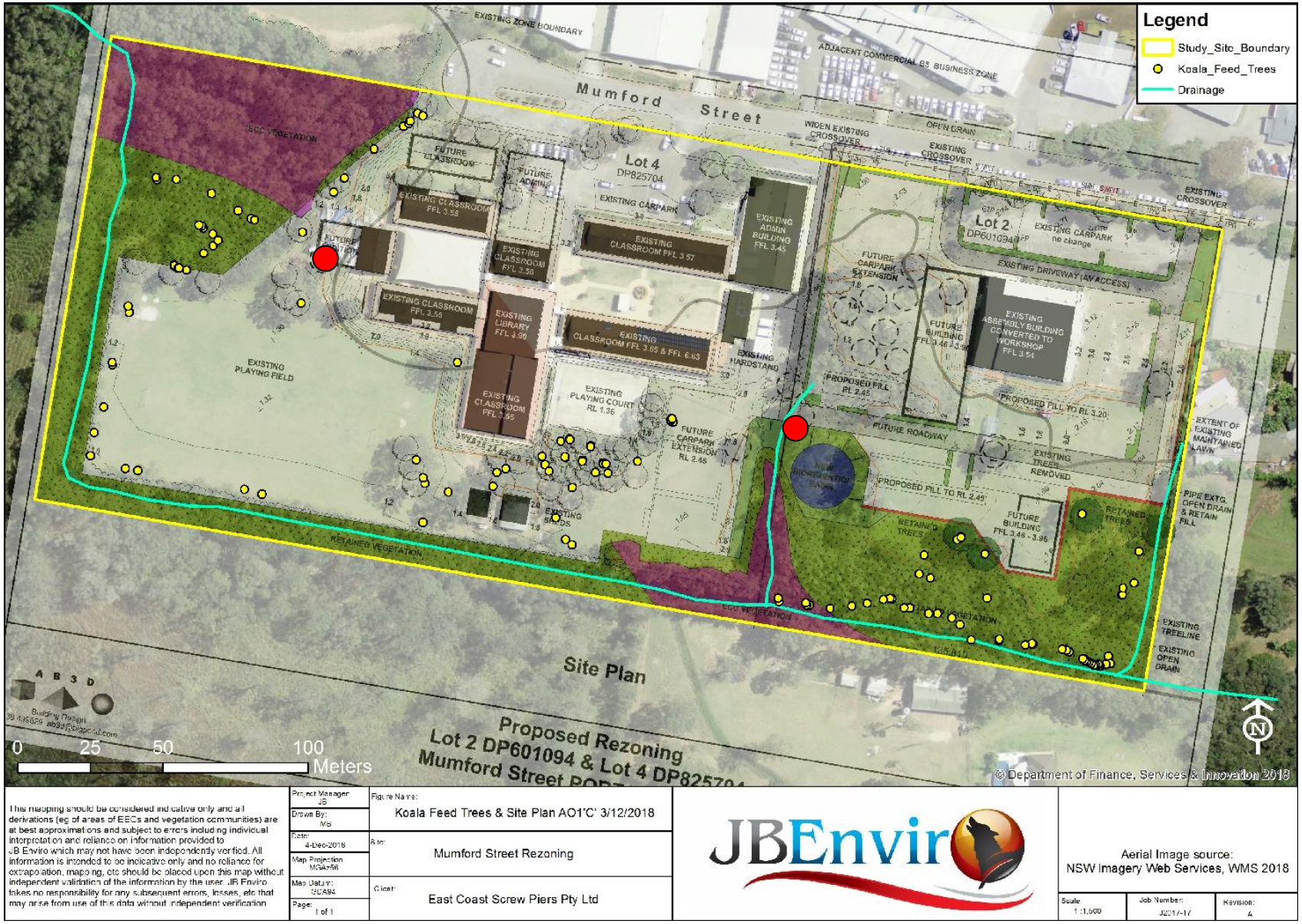
The plantings will be implemented under a Vegetation Management Plan (VMP) which will include removal of lantana and other transformer weeds from the remnant habitat.

6.3 Clearing Management

The KFTs and habitat to be retained are to be clearly flagged and temporarily fenced off to prevent accidental damage during clearing or minimise compaction under the drip line. Such fencing is to retain Koala access.

Site induction is to specify that no clearing is to occur beyond the designated area, and vehicles are only to be parked in the designated areas. Similarly, any construction materials are to be stored within designated areas to avoid any inadvertent encroachment or otherwise into adjacent forest.

Figure 11: Koala food trees to be removed (red circles) and development concept



6.4 Pre-Clearing Koala Survey

The following ameliorative measures should be carried out to minimise the risk of injury or stress to Koalas during clearing works on site.

1. The area of works is to be inspected for Koalas by an approved ecologist immediately prior to commencement of any vegetation removal involving machinery and/or tree-felling.

2. If a Koala is present in an area subject to vegetation removal/modification, it is preferred works are suspended until the Koala moves along on its own volition. If the Koala is located in a position that a 25m buffer may be established, works may proceed outside this buffer.

6.5 Erosion and Sediment Control

Council's standard sediment and erosion control measures will be required during construction to ensure on site and nearby watercourses are not impacted upon.

This includes the use of silt fences and hay bales to ensure downstream aquatic habitats are not impacted. Particular care should be taken when conducting earthworks near watercourses.

6.6 Donation of Koala Food Trees

The Port Macquarie Koala Hospital and the Billabong Wildlife Park both have a constant need for sections of rough-barked trees for 'gunyas' (wooden poles in enclosures which the Koala roosts) and Koala browse species.

Both organisations should be contacted for interest in collecting these materials (subject to WH&S considerations) during clearing.

6.7 Security Fencing and Koalas

Currently, the southern boundary is fenced with a chain mesh fence topped with barbed wire as shown in the following photo. This poses a barrier and entanglement risk to Koalas and Squirrel Gliders. Other KFTs occur on adjoining land to the south of this fence and arboreal fauna appear likely to be able to cross the fence via inter-connected canopy.

If replaced or upgraded, the new fencing must:

- Not be of a design or include materials that pose an entanglement risk.
- Include structures such as a timber A-frame to enable Koalas to circumvent the fencing and not isolate habitat.

6.8 Artificial Lighting

Lighting may potentially discourage particularly nocturnal native species from foraging near areas of development (e.g. Squirrel Gliders and Yellow-bellied Gliders), especially given light may travel significant distances and it can have a similar effect to a full moon on the hunting success of predators such as owls, or a behavioural avoidance impact by potential prey species (DEC 2004a, Andrews 1990, Grayson and Calver 2004). Wallabies, kangaroos, Tawny Frogmouth Owls, Kookaburras, Magpies and possums have been noted foraging under artificial lighting in residential areas eg. around Lake Innes, Port Macquarie and Kendall

(personal observations). Conversely Squirrel Gliders have been recorded foraging within urban woodland within a caravan park at Bonny Hills (Darkheart 2005b).

Artificial lighting may also be beneficial to Yangochiropteran bats by localised aggregation of insects, with these animals being observed foraging under streetlights, and even landing on lit footpaths in Horton St Port Macquarie to scamper for insects (personal observations). Conversely, studies have also shown that artificial lighting can modify bat assemblages i.e. some species avoiding lit areas (Hourigan et al 2009, Scanlon and Petit 2008).

Artificial lighting may be used for security, particularly on the future expansion of industrial enterprise on Lot 2. Lighting technology should utilise environmental designs that are not only energy efficient, but minimize spillage onto adjacent retained habitat.

No lighting should be directed towards habitat to avoid impacts on normal behaviour and habitat use in the adjacent habitat.

Photo 6: Existing boundary fence of Lot 2 posing a barrier to KFTs on adjoining land

7 STATUTORY OVERVIEW

The site has four major constraints under the legislative framework:

- Core Koala Habitat: A Koala Plan of Management will be required.
- PMHC LEP 2011 DCP 2013: Offset requirements for Koala Food Trees.
- BC Act 2016: Biodiversity credits may be required.
- Coastal SEPP: Needs to demonstrate compliance with Part 2 Division 1 (11).

7.1 Biodiversity Conservation Act 2016

7.1.1 Introduction

As of August 25th 2017, the *Threatened Species Conservation Act 1995* was superseded by the NSW *Biodiversity Conservation Act 2016* (BC Act) and the associated *Biodiversity Conservation Regulation 2017*.

For Development Applications (DAs) under Part 4 of the *Environmental Planning and Assessment Act* (EP&A) *1979*, there are now several triggers for an assessment under the Biodiversity Assessment Methodology (BAM) and hence the need to secure offset credits via the Biodiversity Offset Scheme (BOS). These are:

- Clearing of a prescribed area limit of native vegetation designated for the minimum lot size for the LEP zoning of the subject land.
- Clearing of land mapped as having Sensitive Biodiversity Values Land (SBVL).
- Determined as likely to have a significant after assessment under the Five Part Tests.

Figure 12 shows the Coastal SEPP 14 area is SBVL. The SBVL trigger for the BOS is however not activated if the proposed development is not a subdivision and the land is zoned R1-R4, RU5, B1-B8, or IN1-IN3 under the LEP, as per Clause 7.3(4) of the *Biodiversity Conservation Regulation 2017*. Regardless, the concept does not require clearing of SBVL.

If the area threshold is triggered however, the BOS will apply.

If the area threshold is not triggered, the DA will be assessed under the Five Part Tests. This is discussed further in section 7.1.3.

The Biodiversity Offset Scheme (BOS) may apply to future development of Lot 2 if the final design exceeds the area threshold for clearing of native vegetation. Native vegetation is defined under s. 60B of the *Local Land Services Amendment Act 2016* as follows (OEH 2017e):

1. For the purposes of this Part, native vegetation means any of the following types of plants native to New South Wales:
    a. trees (including any sapling or shrub or any scrub),
    b. understorey plants
    c. groundcover (being any type of herbaceous vegetation)
    d. plants occurring in a wetland.

Figure 12: Sensitive Biodiversity Value Lands in the study area

2. A plant is native to New South Wales if it was established in New South Wales before European settlement. The regulations may authorise conclusive presumptions to be made of the species of plants native to New South Wales by adopting any relevant classification in an official database of plants that is publicly accessible.

3. For the purposes of this Part, native vegetation extends to a plant that is dead or that is not native to New South Wales if:
    a. the plant is situated on land that is shown on the native vegetation regulatory map as category 2 – vulnerable regulated land, and
    b. it would be native vegetation for the purposes of this Part if it were native to New South Wales.

Hence disturbed areas such as a paddock with clusters of trees may still comprise native vegetation (and are assessed under the Streamlined Module of the BAM).

This is discussed further in section 7.1.2.

7.1.2 Biodiversity Offset Scheme

When the Biodiversity Offset Scheme (BOS) is triggered by one or more of the thresholds above, a development must be assessed under the Biodiversity Assessment Methodology (BAM). The BAM assessment will be detailed in Biodiversity Development Assessment Report (BDAR) which will detail the following:

1. Assessment of the biodiversity values (as defined in s1.5 of the BC Act) of the land the subject of the proposed DA, in accordance with the BAM,
2. Assessment of the impact of the proposed DA, proposed activity or proposed clearing on the biodiversity values of that land,
3. Measures the proponent proposes has or will take to avoid or minimise the impact,
4. Specifies the number and class of biodiversity credits that are required to be retired to offset the residual impacts on biodiversity values of actions to which the BOS applies.

The proponent will be required to retire the necessary biodiversity credits. Credits are divided into either Ecosystem Credits (where a number of species associated with that specific Plant Community Type (PCT) can be addressed under one type of credit) or Species Credits (species for which ecosystems are not adequate surrogates).

Species Credit (SC) species known to occur on site comprises the Squirrel Glider, with dual credit (Ecosystem Credits for foraging habitat, SC for breeding habitat) species including the Koala and Grey-headed Flying Fox. The BAM will also identify species with potential to occur (including those listed in Table 4). SC species nominated by the BAM as having potential to occur may be subject to targeted survey, or an expert report to discount their occurrence and hence negate the need for species credits. Otherwise, they must be assumed present and credits secured.

There are a number of ways credits requirements can be met, including:

- Retiring biodiversity credits through establishing your own Biodiversity Stewardship (offset) site.
- Purchasing credits on the open market.

- Funding biodiversity actions for individual species or communities (limited opportunities).
- Making a payment to the Biodiversity Conservation Trust (BCT) as prescribed by the Biodiversity Offsets Payment Calculator.

The DA consent will specify the offset requirements, and the credits must be retired before commencement of the activity.

7.1.3 Five Part Test

Future development on Lot 4 would fall under the 5 Part Tests, if a separate DA is lodged for this development, and the area thresholds and intrusion into SBVL are thus also avoided by any potential APZ requirements.

The 5 Part Tests are used to determine whether a proposed development is likely to have a significant effect on threatened species, Endangered Ecological Communities, Endangered Populations and Critical Habitat listed under schedules of the *Biodiversity Conservation Act 2016* known or considered reasonably likely to occur in the area influenced by a development proposal. Considerations must be given to the possible significant impacts a proposed development may have on threatened species, populations, ecological communities, and their habitats (DECC 2007).

The content of the 5 Parts are specified by Section 7.3 of the *Biodiversity Conservation Act 2016.*

In addition to the EEC and threatened species currently known to occur on site, the following species (see Appendix 1) would need to be subject to the 5 Part Tests as they are considered to have at least a low potential to use some habitat on the site or study area at some time (eg. now or if they were to potentially recover and expand):

The guidelines currently associated with the revised factors have provided definitions for key terms with the most significant being that of the "*local population*" and "*local occurrence*" as follows (OEH 2018e):

> **"Local population**: the population that occurs in the study area. The assessment of the local population may be extended to include individuals beyond the study area if it can be clearly demonstrated that contiguous or interconnecting parts of the population continue beyond the study area, according to the following definitions.
>
> - The *local population* of a threatened *plant* species comprises those individuals occurring in the study area or the cluster of individuals that extend into habitat adjoining and contiguous with the study area that could reasonably be expected to be cross-pollinating with those in the study area.
> - The *local population* of *resident fauna* species comprises those individuals known or likely to occur in the study area, as well as any individuals occurring in adjoining areas (contiguous or otherwise) that are known or likely to utilise habitats in the study area.
> - The *local population* of *migratory or nomadic fauna* species comprises those individuals that are likely to occur in the study area from time to time or return year to year"

The local population of the potentially and known occurring threatened species is thus defined as follows:

Table 5: Definition of Local Populations

Species	Legal Status	Local Population
Square-tailed Kite	V-BCA	Any individuals potentially using habitat within site/study area depending on prey abundance as part of larger range. Local population requires much more habitat that found within study area to meet lifecycle requirements.
Little Eagle	V-BCA	
Powerful Owl	V-BCA	Any individuals potentially using habitat within site/study area depending on prey abundance as part of larger range. Local population requires much more habitat that found within study area to meet lifecycle requirements.
Masked Owl	V-BCA	
Barking Owl	V-BCA	
Little Lorikeet	V-BCA	Any individuals potentially using habitat within the site/study area depending on flowering incidences. Local population requires much more habitat that found within study area to meet lifecycle requirements.
Squirrel Glider	V-BCA	Local population would be those animals which use denning habitat in the study area, using the site forest as part of their outlying foraging habitat. Local population range thus extends beyond the study area to meet lifecycle requirements.
Koala	V-BCA, E-EPBCA	Local aggregate which includes the site and adjoining habitats as part of the local Core Koala Habitat. Local population range thus extends beyond the study area to meet lifecycle requirements.
Grey-Headed Flying Fox	V-BCA, V-EPBCA	Any individuals potentially using habitat within the study area depending on lifecycle stage/seasonal range and flowering/fruiting incidence. Due to its ecology, local population requires much more habitat that found within study area to meet lifecycle requirements.
Little and Eastern Bent-wing Bats	V-BCA	Any individuals known/potentially using habitat within site/study area depending on lifecycle stage/seasonal range. Due to the ecology of these species, the local population requires much more habitat that found within study area to meet lifecycle requirements.
Eastern Cave Bat	V-BCA	
Greater Broad-nosed Bat	V-BCA	
East-coast Freetail Bat	V-BCA	

The local occurrence of the EECs as per the OEH (2018d) definition are that within the study area.

The 5 Part Test is as follows:

> (a) in the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,
>
> (b) in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,

(c) in relation to the habitat of a threatened species or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and

iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality,

(d) whether the proposed development or activity is likely to have an adverse effect on any declared area of Outstanding Biodiversity Value (either directly or indirectly),

(e) whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.

A formal assessment is not provided in this constraints assessment, but assuming no loss/modification of the swamp forest in the northwest corner of Lot 4, a preliminary overview of the development nominated on Lot 4 suggest it is unlikely to have a significant impact as:

- Vegetation removal is minimal – only common weeds and the northern tip of the swamp forest along the eastern boundary for a driveway and parking area.
- Connectivity around the site is retained.
- No new barrier will be created, and Koala ladders can be installed if security fencing poses a barrier to Koala access to habitat within the school grounds.
- Nest boxes can be installed to enhance the habitat value of the swamp forest for the Squirrel Glider.
- No area of Outstanding Biodiversity Value is impacted.

7.1.4 Serious and Irreversible Impacts

Serious or Irreversible Impacts (SaII) are a new criterion the consent authority under Part 4 DAs must consider. The consent authority must determine if the proposal's residual impacts after avoid or mitigation measures have been undertaken are serious and irreversible. SaII's are defined for a discrete list of EECs and threatened species (OEH 2018d).

Thresholds have been nominated for the following relevant species: Little and Eastern Bent-wing Bats, Eastern Cave Bat and Swift Parrot.

The SaII thresholds for the bats relate to cave roosting habitat which is not affected by the proposal.

Areas mapped as SC areas for the Swift Parrot are potential SaII and need to be assessed. Other areas with potential food tree species are likely to be EC areas, and are unlikely to have potential serious and irreversible impacts.

The locality has recently seen a significant number of Swift Parrot records (OEH 2018a, Siossian and Scully 2018), most likely in response to drought conditions in its core non-breeding foraging areas (Slossian and Scully 2018, Saunders *et al* 2016). Swamp Mahogany is a preferred forage species, but only 2 be removed and these would be offset with additional plantings due to SEPP 44 obligations. Hence it is very unlikely that a SaII threshold will be exceeded.

7.2 EPBC Act 1999 Overview

The provisions of the EPBCA require determination of whether the proposal has, will or is likely to have a significant impact on a "*matter of national environmental significance"*. These matters are listed and addressed as follows:

1. **World Heritage Properties**: The site/study area is not listed as a World Heritage area nor does the proposal affect any such area.

2. **Ramsar Wetlands of International Significance**: No Ramsar wetland occurs on or adjacent to the site, nor does the proposal affect a Ramsar Wetland.

3. **EPBC Act listed Threatened Species and Communities**: The Koala (Vulnerable) and the Grey-Headed Flying Fox (Vulnerable) are known occurrences in the study area. The Swift Parrot is considered a very low potential occurrence – incidental in the locality if suitable flowering conditions occurred. As detailed below, neither are considered at risk of a significant impact.

4. **Migratory Species Protected under International Agreements**: No migratory species is likely to be significantly affected by the proposal, as detailed below.

5. **Nuclear Actions**: The proposal is not a nuclear action.

6. **The Commonwealth Marine Environment (CME)**: Listed as relevant to the site though is not within the CME nor does it affect such.

7. **The Great Barrier Reef Marine Park:** The proposal does not affect the Great Barrier Reef Marine Park.

8. **National Heritage**: The site does not contain an item of National Heritage.

9. **A water resource, in relation to coal seam gas development and large coal mining development**: The proposal is not a mining development.

The proposal thus is not considered to require referral to the Department of Environment and Energy (DotEE) for approval under the EPBC Act.

7.3 Threatened Species

7.3.1 Threatened Flora and EECs

No EPBC Act listed flora species were found on the study site or considered likely potential occurrences, and are thus not considered further.

No EECs listed under the Act occur on site or in the study area, and hence are not considered further.

7.3.2 Threatened Fauna

7.3.2.1 Koala

Under the Act, proposed actions must be assessed under the Commonwealth Department of the Environment (2014) guidelines, and hence assessment is required. The assessment is three stages:

1. Qualification as Critical Koala Habitat assessment.
2. Impacts on Critical Koala Habitat.
3. Assessment of other threats.

The habitat on site has been assessed using the Koala habitat assessment tool from the EPBC Act Referral Guidelines (DotE 2014) to determine if the site contains habitat critical to the survival of the Koala. To qualify as critical habitat, it must score 5 or more. This is shown in the following table:

Table 6: Critical Koala Habitat assessment

Attribute	Score	Reason	
Koala occurrence	2	Desktop	Recorded within 1km of the site on Bionet Atlas
		On-ground	Identified Core Koala Habitat.
Vegetation structure and composition	1	Desktop	Biolink (2013b) vegetation mapping of forest on site as only Secondary Koala Habitat.
		On-ground	Site surveys confirmed preferred Koala food trees species qualify site as Potential Koala Habitat (but only in localised area).
Habitat connectivity	1	Site is not part of a contiguous landscape >500ha	
Key existing threats	1	Desktop	OEH Bionet has records of Koala road kill in local area.
		On-ground	No evidence of Koala road kill found during survey. No evidence of wild or domestic dogs on
Recovery value	2	The following factors indicate that it is important for achieving the interim recovery objectives for the Koala: • Evidence of Koala activity in the study area • Presence of food trees interlinked to significant areas of known Koala habitat. • Risk of dog attack and car strike is very low • Risk of high intensity fire is very low.	
Total	7	Site qualifies as critical habitat	

As per the Koala habitat assessment tool, the site qualifies as critical habitat. An assessment has been undertaken to determine if the proposal will adversely affect this habitat and/or interfere substantially with the recovery of the Koala and require referral to the Minister.

The following table derived from the Koala Referral Guidelines (DotE 2014) assesses whether the proposal is likely to adversely affect habitat critical to the survival of the Koala.

Table 7: Critical habitat assessment

Factor	Y/N	Reason
Does impact area contain habitat critical to the survival of the Koala	Y	Site scores 7 as per the Koala habitat assessment tool.
Do the areas proposed to be cleared contain known Koala food trees	Y	Habitat to be removed contains primary preferred KFTs. Other browse species (*Melaleuca quinquenervia*) will also be removed.
Are you proposing to clear<2ha of habitat containing known Koala food trees in an area with a habitat score of ≤5	N	Proposal will remove <1ha of habitat containing Koala food trees in an area that scores 7.
Are you proposing to clear >20ha of habitat containing known Koala food trees in an area with a habitat score of ≥8	N	Proposal will only remove/modify <1ha of habitat containing Koala food trees in an area that scores 7.
Outcome	Impact unlikely to be significant	

The Guidelines also require consideration of whether the proposed action may interfere with the recovery of the Koala, as follows:

Table 8: Impact on recovery assessment

Threat	Likely to increase Y/N	Reason
Increasing Koala fatalities in habitat critical to the survival of the Koala due to dog attacks to a level that is likely to result in multiple, ongoing mortalities.	N	Dogs not a current feature of the development, nor proposed for future development.
Increasing Koala fatalities in habitat critical to the survival of the Koala due to vehicle-strikes to a level that is likely to result in multiple, ongoing mortalities.	N	No change to existing speed limit on Mumford St, and on-site access will continue to be <10km/h
Facilitating the introduction or spread of disease or pathogens for example Chlamydia or *Phytophthora cinnamomi*, to habitat critical to the survival of the Koala, that are likely to significantly reduce the reproductive output of Koalas or reduce the carrying capacity of the habitat.	N	Unlikely. *Phytophthora cinnamomi* introduction is a low risk that can be mitigated if required by implementation of standard hygiene protocols. Potential loss of two trees to be offset with 10 replacements, and overwhelming majority retained, hence risk of stress-induced disease is minimal.

Threat	Likely to increase Y/N	Reason
Creating a barrier to movement to, between or within habitat critical to the survival of the koala that is likely to result in a long-term reduction in genetic fitness or access to habitat critical to the survival of the Koala.	N	Existing security fences provide a barrier to access. Where necessary, these will be reviewed for providing Koala ladders. If habitat in the south of Lot 2 is fenced off to provide security to the development, structures to be provided to ensure habitat will not be isolated.
Changing hydrology which degrades habitat critical to the survival of the Koala to the extent that the carrying capacity of the habitat is reduced in the long-term.	N	Filling is required, but specialist studies will confirm this will not impact the retained vegetation.
Outcome	Referral not required as impact unlikely to be significant as: • Measures generally at least meet the low criteria for mitigation.	

7.3.2.2 Grey-Headed Flying Fox (V)

For the purposes of discussion, the "*important population*" of Grey-Headed Flying Foxes is defined as that population of the species likely to depend on colonial roosts in the locality or within foraging range of the site.

The proposed activity may only see the loss/modification of <1ha of paperbark swamp forest, which forms a minute fraction of the locally available habitat for an important population; and is not roosting habitat. No other aspect of the proposed activity is considered to pose a significant threat to this species.

7.3.2.3 Swift Parrot (CE)

The proposal may see loss of up to 2 Swamp Mahogany, which is a species that if flowering when the bird is present during its non-breeding season, it may use for foraging (subject to competition with other nectarivores). These comprise a small fraction of trees on site, and on adjoining land to the south and west. These will be offset by replantings at a ratio of 1:5.

Given this, the proposal is not considered likely to pose any significant threat to the species and hence not require referral to DotEE.

7.3.3 Migratory Species

No EPBC Act listed migratory species was recorded on the site. However several species (eg Rainbow Bee-eater, White-throated Needletail, Fork-tailed Swift) are considered potential occurrences.

The proposed activity will have minimal impact on these species as the affected habitat only comprises only a minute fraction of the locally available habitat, and breeding does not occur on site.

7.4 DCP 2013

7.4.1 - KFTs

Under the new Port Macquarie-Hastings Council Local Environmental Plan (PMHC LEP) 2011, Council has prepared and implemented the PMHC Development Control Plan (DCP) 2013.

The DCP has relevant provisions for Koala food trees. Section 2.6.3.2 specifies that Koala food tree removal must be replaced at ratio of 1:2.

The current concept plan suggests potential loss of 2 KFTs which will need to be offset to meet compliance with the DCP, unless the offsets via the BC Act and/or SEPP 44 are deemed to address this obligation.

7.4.2 EEC Buffers

Section 2.3.3.4 of DCP 2013 specifies that a vegetated buffer 35m wide to Coastal Floodplain EECs.

Figure 13 shows the extent of the DCP buffer on site to the areas identified to be Coastal Floodplain EEC.

7.4.2.1 Lot 4

The buffer width to the EEC in the northwest of Lot 4 generally encompasses the edges of the existing school plus two nominal new buildings which occur in a maintained lawn and parkland setting. The erection of these buildings will have negligible if any impacts on the adjacent EEC, and establishing a vegetated buffer here would create bushfire issues for the existing school. Hence literal compliance with the DCP here is considered impractical.

The buffer zone in the southeast falls over an area currently maintained as lawn with plantings of Swamp Mahogany. The lawn area is proposed to be converted to a car park, with stormwater drainage directed to the adjacent retention basin on Lot 2.

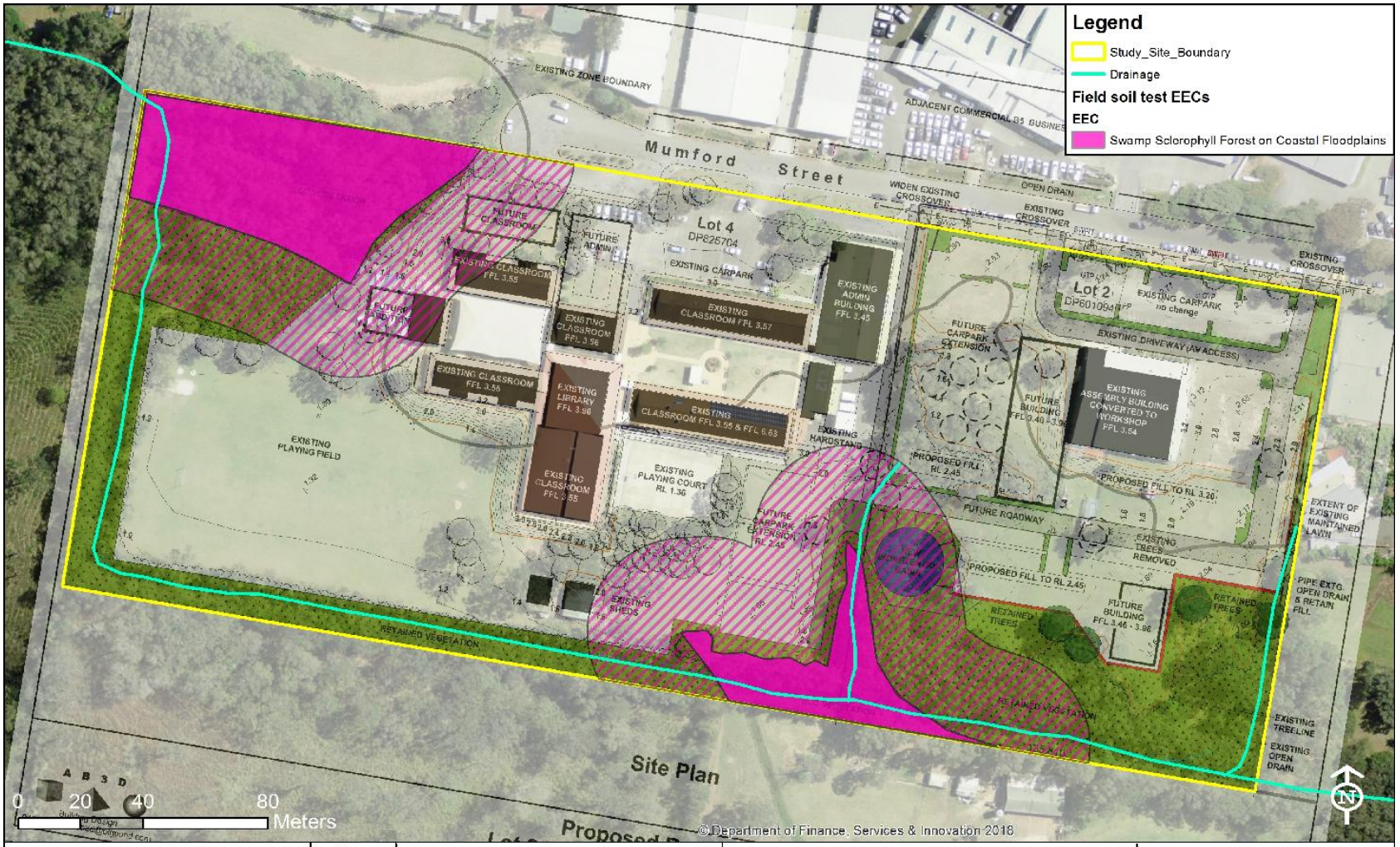
Again, literal compliance with the DCP is considered impractical due to the incurred bushfire issues to the existing school. The development also does not change current edges of the EEC and its current buffers.

7.4.2.2 Lot 2

The development concept on Lot 2 avoids the EEC, but intrudes into the buffer's north and northwest with a road and the stormwater detention basin on the northeast side.

This is however to be offset by bush regeneration to improve the condition of the EEC in the southern end of the site and widening of the remnant of swamp forest in the southern end. These combined actions are intended to maintain and enhance the ecological processes associated with the EEC and hence its viability in the long term, in line with the objectives of the SEPP.

Figure 13: DCP 2013 EEC buffer zones



7.5 Coastal SEPP

Part 2 Division 1 (11) requires the consent authority to be satisfied that development on land mapped as within proximity to coastal wetlands and littoral rainforest does not significantly impact on:

a) the biophysical, hydrological or ecological integrity of the adjacent coastal wetland or littoral rainforest, or

b) the quantity and quality of surface and ground water flows to and from the adjacent coastal wetland or littoral rainforest.

These are addressed as follows:

7.5.1 Lot 4

The proposal on Lot 4 has no impact on any of these attributes as:

- No clearing of any current buffering vegetation is required.
- No change to watertable required ie raising or lowering.
- No cutting below the watertable leading to changes in the adjacent wetland.
- No change to stormwater flows which will adversely impact recharge regimes.
- No adverse change to flooding regime which could lead to changes in drying/wetting regime, scouring, sedimentation or water depth which could lead to changes in the characteristics of the wetland.
- Stormwater is to be treated to the legislative standard to minimise water quality impacts on the wetland vegetation.

7.5.2 Lot 2

The proposal is similarly unlikely to have any significant impact on these attributes:

- No clearing of buffering vegetation directly adjacent to the wetland.
- No change to watertable required ie. raising or lowering.
- No cutting below the watertable leading to changes in the adjacent wetland.
- No change to offsite discharge of stormwater that is likely to lead to changes in drying/wetting regime in the adjacent wetland.
- Stormwater is to be treated to the legislative standard to minimise water quality impacts on the wetland vegetation.
- The proposed filling is not likely to lead to adverse flood behaviour patterns eg. significantly increased velocity leading to scouring or sedimentation (Advisian 2018) of the adjacent wetland.
- Increased width of intact vegetation identical to the Coastal Wetland in the buffer zone to improve ecological processes.

8 CONCLUSION

The subject land has a history of disturbance which has seen much of the original vegetation cleared, drainage infrastructure installed, and a substantial area filled to mitigate flooding.

The remnant and regrowth vegetation however has value for threatened fauna, most importantly for the Squirrel Glider and Koala, and parts of this vegetation qualify as the EEC – *Swamp Sclerophyll Vegetation on Coastal Floodplains*.

The final development concept will be subject to outcomes under the new BC Act 2016 which may require offsets for development of Lot 2 under the current concept. As the site also contains Core Koala Habitat, a Koala Plan of Management will also be required to accompany future Development Applications unless a Comprehensive Koala Plan of Management is adopted by PMHC in the interim.

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10 APPENDIX 1: TSCA – FIVE PART TEST ELIGIBILITY

10.1 POTENTIAL OCCURRENCE ASSESSMENT

10.1.1 FLORA

As mentioned previously, no threatened flora species were detected on site by the survey. Searches of relevant literature and databases (OEH 2018a) found records of the following threatened flora species in the locality. In the table below, these species are evaluated for their potential to occur on the site; significance of the proposal to this potential occurrence; and thus their eligibility/requirement for Five Part Test assessment.

Table 9: Eligibility for the Five Part Tests – Flora

Species	Legal Status	Records	Habitat Requirements	Likelihood Of Occurrence	Significance Of Impacts
Acronychia littoralis	E-BCA, E-EPBCA	4	An understorey tree found in littoral rainforest on sand.	No suitable habitat on site. Unlikely to occur	Modification of site of no significance as no habitat potential. No significant impact likely to occur. No Five Part Test required.
Dwarf Heath Casuarina *(Allocasuarina defungens)*	E-BCA, E-EPBCA	1	A straggly oak about 2m high with blue-green foliage found in heath on sand (sometimes clay and sandstone soils), and swamp sclerophyll forest margins.	No suitable habitat on site and not recorded on adjacent lands. Unlikely to occur	Modification of site of no significance as no habitat potential. No significant impact likely to occur. No Five Part Test required.
Trailing Woodruff *(Asperula asthenes)*	V-BCA, V-EPBCA	1	An herb found in damp sites along riverbanks and similar areas	Some generic potential habitat along drain to south and in swamp forest, but not found by survey. Not found by targeted survey of derived wetland on site. Unlikely to occur.	Modification of site of no significance as no significant habitat potential. No significant impact likely to occur. No Five Part Test required.

Species	Legal Status	Records	Habitat Requirements	Likelihood Of Occurrence	Significance Of Impacts
Chamaesyce psammogeton	V-BCA	2	An herb that grows on fore dunes and exposed sites on headlands.	Recorded in locality but no suitable habitat on site. Unlikely to occur.	Unlikely to occur thus no significant impact likely. Five Part Test not required.
Spider Orchid *(Dendrobium melaleucaphilum)*	E-BCA	2	An epiphyte on *Melaleuca styphelioides*, rainforest trees or rocks in coastal districts north from the Blue Mountains. It has square stems, similar to *D. tetragonum* and it flowers Jul.-Oct.	Generic potential habitat in swamp forest on site but not found despite being relatively conspicuous. Unlikely to occur as only old record.	Modification of site of no significance as only generic habitat potential and overwhelming majority retained. No significant impact likely to occur. No Five Part Test required.
Slender Marsdenia *(Marsdenia longiloba)*	E-BCA, V-EPBCA	1	A slender climber with clear, watery latex (sap). Occurs in rainforest and moist eucalypt forest adjoining rainforest, at no particular altitude, sometimes in areas with rock outcrops. Found at scattered sites from Barrington Tops to SE Queensland (NPWS 2000).	No suitable habitat on site. Unlikely to occur	Modification of site of no significance as no habitat potential. No significant impact likely to occur. No Five Part Test required.
Narrow-leaved Black Peppermint (*Eucalyptus nicholii*)	V-BCA, V-EPBCA	3	Small tree found on the New England Tablelands in dry grassy woodland on shallow, infertile soils derived from granite or metasedimentary rock.	Planted as an ornamental widely around Port Macquarie – not indigenous. Not recorded on site.	Non-indigenous and not present. No Five Part Test required.
Maundia triglochinoides	V-BCA	6	A paperbark shrub/small tree found in damp places, often near streams, on the coast and adjacent tablelands from Jervis Bay to Coffs Harbour.	Generic potential habitat in swamp forest on site but not found despite being relatively conspicuous. Unlikely to occur	Modification of site of no significance as no known habitat and at best very marginal potential habitat impacted. No significant impact likely to occur. No Five Part Test required.
Biconvex Paperbark *(Melaleuca biconvexa)*	V-BCA, V-EPBCA	33	A paperbark shrub/small tree found in damp places, often near streams, on the coast and adjacent tablelands from Jervis Bay to Port Macquarie. Appears to be associated with the Cairnscross soil landscape in Port Macquarie.	No suitable habitat on site - wrong parent material/soil. Unlikely to occur	Modification of site of no significance as no habitat potential. No significant impact likely to occur. No Five Part Test required.

Species	Legal Status	Records	Habitat Requirements	Likelihood Of Occurrence	Significance Of Impacts
Oberonia titania	V-BCA	1	An epiphytic orchid that grows in a tight clump in a variety of habitats from subtropical to littoral rainforest, *Melaleuca* swamps, and gorges within dry sclerophyll forest.	Only marginal generic habitat on site, and this conspicuous plant was not detected. Unlikely to be present as site is accessable to orchid collectors and only single local record in Sea Acres NR. Unlikely to occur	Modification of site of no significance as no habitat potential. No significant impact likely to occur. No Five Part Test required.
Senna acclinis	E-BCA	1	A shrub found in or on the edges of subtropical and dry rainforest. Variable geology and soils are favoured	No suitable habitat on site. Unlikely to occur	Modification of site of no significance as no habitat potential. No significant impact likely to occur. No Five Part Test required.
Sophora tomentosa	E-BCA	6	A coastal shrub that occurs on recent sands on frontal coastal dunes northwards from Port Stephens. Port Macquarie has the largest known population eg Shelley and Nobby's Beaches	No suitable habitat on site. Unlikely to occur	Modification of site of no significance as no habitat potential. No significant impact likely to occur. No Five Part Test required.

10.1.2 FAUNA

As previously noted in section 4.3, a significant number of threatened fauna have been recorded in the locality, and a number of others are considered potential occurrences by the consultant. In the table below, these species (excluding marine species due to obvious lack of habitat) are evaluated for their potential to occur on the site; significance of the proposal to this potential occurrence; and thus their eligibility/requirement for Five Part Test or MNES assessment.

Table 10: Eligibility for Five Part Test Assessment – Fauna

Name	Legal Status	Records	Habitat Requirements	Likelihood Of Occurrence	Significance Of Impacts
Powerful Owl (*Ninox strenua*)	V-BCA	11	Wet and dry sclerophyll forests. Nests in tree hollows. Requires high diversity and abundance of medium-sized arboreal prey. Very large territory (500-5000ha).	Habitat in the study area comprises a relatively small isolated remnant with poor prey potential with no suitable potential nesting hollows. Very limited prey potential – at most comprising marginal fringe of larger territory. Only low potential to occur as rare foraging foray utilising it as minute fraction of wider territory.	Proposal only affects a small area of marginal potential foraging habitat that has been previously subject to similar periodic disturbances. Significant impact unlikely as vast majority of habitat retained. **Five Part Test required** to demonstrate no significant impact risk.
Barking Owl (*Ninox connivens*)	V-BCA	1	Well-forested hills and flats, eucalypt savannah (especially), and riverine woodland in coastal and subcoastal areas. Prefers hunting in more open country for mammals (rabbits, rats, mice, small bats and small marsupials) and birds (small up to Frogmouths and Magpies). Large territories. Nest in hollows.	Single record in Fernbank Creek area. Very limited prey potential – at most comprising marginal fringe of larger territory. Only low potential to occur as rare foraging foray utilising it as minute fraction of wider territory.	Proposal only affects a small area of marginal potential foraging habitat that has been previously subject to similar periodic disturbances. Significant impact unlikely as vast majority of habitat retained. **Five Part Test required** to demonstrate no significant impact risk.

Name	Legal Status	Records	Habitat Requirements	Likelihood Of Occurrence	Significance Of Impacts
Masked Owl (*Tyto novaehollandiae*)	V-BCA	2	Eucalypt forest and woodlands with sparse understorey. Nests in tree hollows. Requires high diversity and abundance of prey 200-600g weight. Large territory.	Habitat in the study area comprises a relatively small isolated remnant with poor prey potential with no suitable potential nesting hollows. Very limited prey potential – at most comprising marginal fringe of larger territory. Only low potential to occur as rare foraging foray utilising it as minute fraction of wider territory.	Proposal only affects a small area of marginal potential foraging habitat that has been previously subject to similar periodic disturbances. Significant impact unlikely as vast majority of habitat retained. **Five Part Test required** to demonstrate no significant impact risk.
Grass Owl (*Tyto capensis*)	V-BCA	27	Eastern population occurs on coastal floodplains in a variety of wet & dry heath, tall grass, swamps and sedgeland which may have common structure rather than floristics. Records in Port Macquarie area are all near wet sedgelands. Breeds year round. Known to nest near or surrounded by water. Forage near nest site. (summary in Redpath 2002) Dependant on good numbers of rodent prey, with possible nomadic link (NSW NPWS 2000).	No suitable habitat on or adjacent to the site. Recorded in locality. Unlikely to occur.	No suitable habitat affected. No risk of significant impact. Five Part Test not required.
Little Eagle (*Hieraaetus morphnoides*)	V-BCA	1	Occupies habitats rich in prey within open eucalypt forest, woodland or open woodland, sheoak or acacia woodlands and riparian woodlands of interior NSW are also used (Marchant and Higgins 1993; Aumann 2001a). For nest sites it requires a tall living tree within a remnant patch, where pairs build a large stick nest in winter and lay in early spring. It eats birds, reptiles and mammals, occasionally adding large insects and carrion (Marchant and Higgins 1993; Aumann 2001b; Debus et al. 2007). It is distributed throughout the Australian mainland excepting the most densely forested parts of the Dividing Range escarpment (Marchant and Higgins 1993). It occurs as a single	Some very marginal potential foraging habitat present on site, however species was not recorded on site and not known in urban fringe. Considered very low to unlikely chance of occurrence on site– more likely to occur in hinterland of LGA.	Modification of habitat on site considered insignificant, given lack of local records and amount of similar habitat available locally. Five Part Test not required.

Name	Legal Status	Records	Habitat Requirements	Likelihood Of Occurrence	Significance Of Impacts
			population throughout NSW.		
Square-Tailed Kite (*Lophoictinia isura*)	V-BCA	19	Open forests and woodlands in coastal and subcoastal areas. Forages low over, or in, canopy for eggs, nestlings, passerines, small vertebrates and invertebrates. Large home range (>100km²). Observed foraging in residential areas of Port Macquarie. Large stick nest in high fork of living tree. Breeds July-December. Probably migrates to northern Australia in winter. (Debus 1998, NSW NPWS 2000).	Site provides potential foraging habitat. No nests found on or adjacent to the site and it was not detected by the survey. Recorded in locality. Fair chance of occurrence as part of a larger foraging range.	No critical or preferred habitat to be modified. Potential support for occurrence to be retained. Significant impact unlikely. However **Five Part Test undertaken** as fair chance of occurrence.
Spotted Harrier (*Circus assimilis*)	V-BCA	12	Occurs in grassy open woodland including acacia and mallee remnants, inland riparian woodland, grassland and shrub steppe (e.g. chenopods) (Marchant and Higgins 1993; Aumann 2001a). It is found mostly commonly in native grassland, but also occurs in agricultural land, foraging over open habitats including edges of inland wetlands. The species builds a stick nest in a tree and lays eggs in spring (or sometimes autumn), with young remaining in the nest for several months. Diet includes terrestrial mammals, birds and reptiles, occasionally large insects and rarely carrion (Marchant and Higgins 1993; Aumann 2001b). Many of the remaining key prey species (e.g. terrestrial grassland birds such as quail, button-quail, pipits, larks and songlarks) require ground cover and are sensitive to habitat degradation from grazing (Marchant and Higgins 1993).	Some very marginal potential foraging habitat present on site, however species was not recorded on site and not known in urban fringe. Considered very low to unlikely chance of occurrence on site– more likely to occur in hinterland of LGA.	Modification of habitat on site considered insignificant, given lack of local records and amount of similar habitat available locally. Five Part Test not required.

Name	Legal Status	Records	Habitat Requirements	Likelihood Of Occurrence	Significance Of Impacts
Little Lorikeet (*Glossopsitta pusilla*)	V-BCA	8	Gregarious, usually foraging in small flocks, often with other species of lorikeet feeding primarily on nectar and pollen in the tree canopy, particularly on profusely-flowering eucalypts, but also on a variety of other species including, melaleucas and mistletoes. Mostly occurs in dry, open eucalypt forests and woodlands. They have been recorded from both old-growth and logged forests in the eastern part of their range, and in remnant woodland patches and roadside vegetation on the western slopes. In south-east Queensland (Smyth *et al*. 2002), were more likely to occupy forest sites with relatively short to intermediate logging rotations (15–23 years) and sites that have had short intervals (2.5– 4 years) between fires.	Not recorded on site. The site contains only a relatively small area of generic potential foraging within a locality with a relatively vast area of such habitat. Considered a low chance of occurrence as part of a wider foraging range.	Loss of small of low value potential foraging habitat but no potential nesting hollows. Extensive amount of similar habitat available locally, hence proposal unlikely to significantly impact. **Five Part Test required** however due to potential to occur.
Regent Honeyeater (*Anthochaera phrygia*)	CE-BCA E-EPBCA	1	Nomadic. Inhabits temperate eucalypt woodlands and open forest, including forest edges, woodland remnants on farmland and urban areas. Also uses *Casuarina cunninghamiana* gallery forests. Requires reliable and ample nectar supplies to support semi-permanent (core breeding) habitat. Favoured nectar sources are *E. sideroxylon, E. albens, E. melliodora, E. leucoxylon, E. robusta, E. planchoniana*, and heavy infestations of mistletoe. Also take insects and orchard fruits. Breeds in pairs or small colonies in open woodland/forest and occasionally more disturbed woodland near housing and farmland, depending on food availability, from August-January. Breeding less likely to occur if nectar flows are low or unreliable, or heavy competition with more aggressive honeyeaters eg Noisy Miner, Red Wattlebirds and Noisy Friarbirds.	Mistletoe absent but Swamp Mahogany present. Single record in locality this species makes very rare visits to the LGA in non-breeding migratory visits. Unlikely to very low chance of occurrence.	No critical or preferred habitat to be modified. Significant impact unlikely. Five Part Test Not required. MNES assessment not required.

Name	Legal Status	Records	Habitat Requirements	Likelihood Of Occurrence	Significance Of Impacts
Eastern Ground Parrot (*Pezoporus wallicus wallicus*)	V-BCA	4	Found from coastal southeastern to eastern Australia, with a highly fragmented distribution. Terrestrial bird, most often found in heathland or sedgeland with dense cover and high density of preferred food plants. Found from coast to 300m ASL. Heathland usually high diversity of heath species with scattered shrubs of Banksia and She-oaks, grass trees with abundant sedges and grasses. Sometimes found in open Bansksia woodlands with heath understorey, closed fernland around shallow creeks or plains or sedges at swamp margins. Nests on ground. Appears to prefer a fire regime that promotes plant growth and hence seed production. Breeds in spring-early autumn depending on latitude (in summer in colder areas). Feeds on seeds, some green shoots, leaves, buds, flowers and fruits. Diurnal and mainly sedentary with young dispersing in autumn, with movements of 80-220km recorded. Estimated to range over 8-20ha depending on habitat condition (eg fire) and quality.	Recorded locally in Fernbank Creek swamp but not suitable habitat on sire or study area. Unlikely to occur.	Significant impact unlikely as unlikely to occur. Five Part Test not required.
Swift Parrot (*Lathamus discolour*)	CE-BCA E-EPBCA	29	Breeds in Tasmania and winters in Victoria with some dispersal northwards. Feeds mostly on pollen and nectar of winter flowering eucalypts, but also feeds on fruit, seeds, lerps and insect larvae (Schodde and Tideman 1990). Also favours profusely flowering banksias. Favoured species are *E. robusta*, *Corymbia gummifera*, *E. globulus, E. sideroxylon, E. leucoxylon, E. labens, E. ovata, C. maculata, Banksia serrata* and *B. integrifolia*	Swamp Mahogany present but given extent of such habitat to the south and around Port Macquarie airport; and more suitable habitats near Lake Cathie and in Limeburners Creek NR, the probability of this extremely rare species utilising habitat on site is very low.	No critical or preferred habitat to be modified. Significant impact unlikely. Five Part Test Not required. MNES assessment not required
Varied Sittella (*Daphoenositta chrysoptera*)	V-BCA	16	Sedentary and inhabits most of mainland Australia except the treeless deserts and open grasslands, with a nearly continuous distribution in NSW from	Not preferred vegetation types on site or study area. Low chance of visitation. Given dominance by	Proposal only affects a small area of marginal potential habitat. Significant impact unlikely as unlikely to occur.

Name	Legal Status	Records	Habitat Requirements	Likelihood Of Occurrence	Significance Of Impacts
			the coast to the far west (Higgins and Peter 2002; Barrett et al. 2003). It inhabits eucalypt forests and woodlands, especially rough-barked species and mature smooth-barked gums with dead branches, mallee and Acacia woodland. Feeds on arthropods gleaned from crevices in rough or decorticating bark, dead branches, standing dead trees, and from small branches and twigs in the tree canopy. It builds a cup-shaped nest of plant fibres and cobweb in an upright tree fork high in the living tree canopy, and often re-uses the same fork or tree in successive years.	medium sized woodland birds including Noisy Miner, is it unlikely to occur.	Five Part Test not required.
Dusky Woodswallow *(Artamus cyanopterus cyanopterus)*	V-BCA	3	Woodlands and dry open sclerophyll forest, usually eucalypts and mallee associations. Also have recordings in shrub and heathlands and various modified habitats, including regenerating forests. In western NSW, this species is primarily associated with River Red Gum/Black Box/Coolabah open forest/woodland and associated with larger river/creek systems. Widespread in NSW from coast to inland including the western slopes of the Great Dividing Range and farther west. Species have also been recorded in southern and southwestern Australia.	Not preferred vegetation types on site or study area. Low chance of visitation. Given dominance by medium sized woodland birds including Noisy Miner, is it unlikely to occur.	Proposal only affects a small area of marginal potential habitat. Significant impact unlikely as unlikely to occur. Five Part Test not required.

Name	Legal Status	Records	Habitat Requirements	Likelihood Of Occurrence	Significance Of Impacts
Scarlet Robin (*Petroica boodang*)	V-BCA	1	Small passerine bird usually found in open forests and woodlands from the coast to the inland slopes (Higgins and Peter 2002). Usually breeds in drier eucalypt forests and temperate woodlands, often on ridges and slopes, within an open understorey of shrubs and grasses and sometimes in open areas. Abundant logs and coarse woody debris are reported to be important structural habitat components. Migrates seasonally (Autumn and Winter) to more open habitats such as grassy open woodland or paddocks with scattered trees. Forages from low perches, feeding on invertebrates taken from the ground, tree trunks, logs and other coarse woody debris. Builds an open cup nest of plant fibres and cobwebs, sited in the fork of tree (often a dead branch in a live tree, or in a dead tree or shrub) which is usually more than 2 m above the ground (Higgins and Peter 2002; Debus 2006a,b, NSWSC 2009).	No preferred habitat. Only 1 local record. Unlikely to occur.	No critical or preferred habitat to be modified. Significant impact unlikely. Five Part Test Not required. MNES assessment not required
Bush Stone Curlew (*Burchinus grallaris*)	E-BCA	2	Nocturnal, sedentary and territorial (when breeding) species generally inhabiting open grassy woodlands with few or no shrubs. Abundant leaf litter and fallen debris such as tree branches required for foraging and roosting. Nests in more open areas with very little groundcover (even recorded on mown lawns and golf courses). Coastally, often associated with Swamp Oak groves, saltmarsh, mangroves, *Melaleuca quinquenervia* woodlands and even golf courses, etc. May travel as far as 3km from roost site to foraging grounds.	Some broadly generic potential habitat perhaps in lawns and swamp forest but no proximate records and not detected on urban fringe of Port Macquarie despite numerous surveys. Unlikely to occur.	No critical or preferred habitat to be modified. Significant impact unlikely. Five Part Test Not required. MNES assessment not required

Name	Legal Status	Records	Habitat Requirements	Likelihood Of Occurrence	Significance Of Impacts
Barred Cuckoo Shrike (*Coracina lineata*)	V-BCA	26	Gregarious rainforest/moist forest (especially creek gullies) species feeding mainly on fruit on tall rainforest trees and shrubs, and insects; generally moving with fruiting patterns	No suitable habitat on or adjacent to the site. Recorded in locality. Unlikely to occur.	No suitable habitat affected. No risk of significant impact. Five Part Test not required.
Wompoo Fruit Dove (*Ptilinopus magnificus*)	V-BCA	2	Sub-tropical, littoral, warm temperate and dry rainforest, and wet sclerophyll with rainforest understorey. Feeds on fruit. Known to feed on Camphor Laurel and Lantana.	No suitable habitat on or adjacent to the site. Recorded in locality. Unlikely to occur.	No suitable habitat affected. No risk of significant impact. Five Part Test not required.
Rose-Crowned Fruit Dove (*P. regina*)	V-BCA	2	Inhabits dense rainforest or vegetation containing fruit bearing trees, feeding on fruit. Migratory with fruiting patterns.	No suitable habitat on or adjacent to the site. Recorded in locality. Unlikely to occur.	No suitable habitat affected. No risk of significant impact. Five Part Test not required.
Glossy Black Cockatoo (*Calyptorhynchus lathami*)	V-BCA	21	Dry sclerophyll forest and woodland containing Allocasuarina and Casuarina, and large tree hollows. Preferred regional forage species are A. littoralis and A. torulosa. Requires sufficient extent of forage within home range to support breeding. Breeds Mar-Aug, takes 90 days to hatch and fledge (Lindsey 1992).	No potential food or nest trees. Unlikely to occur.	No loss of known foraging habitat or potential nest sites, hence no risk of significant impact. Five Part Test not required.
Osprey (*Pandion cristatus*)	V-BCA	37	Fish (mostly Mullet) and carrion eater. Forages along coastal rivers, lakes, beaches, creeks and inlets. Tall, dead tree for staging or feeding roost. Nests on exposed tree within 2km of water, but rarely adjacent, and with access to Paperbark or Swamp Oak for nest material. Breeds April-Sept. (Clancy, 1991)	No foraging, roosting or nesting habitat on or adjacent to site. Recorded in locality but not during survey. Unlikely to occur (possibly only flying over).	No suitable habitat affected. No risk of significant impact. Five Part Test not required.

Name	Legal Status	Records	Habitat Requirements	Likelihood Of Occurrence	Significance Of Impacts
White-bellied Sea Eagle *(Haliaeetus leucogaster)*	V-BCA	40	Freshwater swamps, rivers, lakes, reservoirs, billabongs, saltmarsh and sewage ponds and coastal waters. Terrestrial habitats include coastal dunes, tidal flats, grassland, heathland, woodland, forest and urban areas. Distributed along the coastline of mainland Australia and Tasmania, extending inland along some of the larger waterways, especially in eastern Australia.	No foraging, roosting or nesting habitat on or adjacent to site. Recorded in locality but not during survey. Unlikely to occur (possibly only flying over).	No suitable habitat affected. No risk of significant impact. Five Part Test not required.
Black-Necked Stork/Jabiru (*Ephippiorhynchus asiaticus*)	E-BCA	24	Wetlands, mudflats, mangroves, floodplains, irrigated fields, farm dams. Forages in shallow water for small vertebrates. Shuns cover, prefers extensive open shallows. Nests in a tree, often above water in a secluded swamp. Eggs laid Aug-Nov in NSW. Adults resident, juveniles dispersive (DEC 2005a, Lindsey 1992).	No foraging, roosting or nesting habitat on or adjacent to site (avoids forest). Recorded in locality but not during survey. Unlikely to occur (possibly only flying over).	No suitable habitat affected. No risk of significant impact. Five Part Test not required.
Brolga (*Grus rubicunda)*	V-BCA	2	Inhabits coastal and inland wetlands, shallow lakes, grassland, saltmarsh, farm and dry open land. Forages for large invertebrates, frogs, fish, seeds, green shoots and bulbs. Breeding occurs predominantly in tropical wetland and large inland swamps and irrigated grasslands at inland and central northern Australia (eg Queensland and Northern Territory), though has been recorded in the northwest and north-eastern corner of NSW and Victoria.	No foraging, roosting or nesting habitat on or adjacent to site. Recorded in locality but not during survey. Unlikely to occur (possibly only flying over).	No suitable habitat affected. No risk of significant impact. Five Part Test not required.

Name	Legal Status	Records	Habitat Requirements	Likelihood Of Occurrence	Significance Of Impacts
Freckled Duck (*Stictonetta naevosa*)	V-BCA	13	Usually in small groups. Nomadic, breeds in densely vegetated freshwater wetlands with thickets of small trees, usually in western NSW. After breeding, disperses to open fresh or saline water, often in eastern NSW. Breeds Sept-Dec or after flooding rain. Nests in tree, low over water. (Morecombe 2000)	No foraging, roosting or nesting habitat on or adjacent to site. Recorded in locality but not during survey. Unlikely to occur (possibly only flying over).	No suitable habitat affected. No risk of significant impact. Five Part Test not required.
Blue-Billed Duck (*Oxyura australis*)	V-BCA	1	Deep, densely vegetated freshwater wetlands. Rarely comes ashore. Nests in vegetation over water. Nocturnal. Mainly inland. (Lindsey 1992)	No foraging, roosting or nesting habitat on or adjacent to site. Recorded in locality but not during survey. Unlikely to occur (possibly only flying over).	No suitable habitat affected. No risk of significant impact. Five Part Test not required.
Magpie Goose *(Anseranas semipalmata)*	V-BCA	3	Mainly found in shallow wetlands (less than 1 m deep) with dense growth of rushes or sedges. Equally at home in aquatic or terrestrial habitats; often seen walking and grazing on land; feeds on grasses, bulbs and rhizomes. Activities are centred on wetlands, mainly those on floodplains of rivers and large shallow wetlands formed by run-off; breeding can occur in both summer and winter dominated rainfall areas and is strongly influenced by water level; most breeding now occurs in monsoonal areas; nests are formed in trees over deep water; breeding is unlikely in south-eastern NSW. Often seen in trios or flocks on shallow wetlands, dry ephemeral swamps, wet grasslands and floodplains; roosts in tall vegetation.	No foraging, roosting or nesting habitat on or adjacent to site. Recorded in locality but not during survey. Unlikely to occur (possibly only flying over).	No suitable habitat affected. No risk of significant impact. Five Part Test not required.

Name	Legal Status	Records	Habitat Requirements	Likelihood Of Occurrence	Significance Of Impacts
Black Bittern (*Dupetor flavicollis*)	V-BCA	3	Coastal waterways, estuaries, swamps with densely wooded edges, Swamp Oak, Mangroves. Secretive, partly nocturnal. Roosts in trees overhanging water or in dense reeds. Critical breeding habitat is mangrove belts (Lindsey 1992). Breeds Dec-Mar, nests in trees over water. (NSW NPWS 2000, DEC 2007b)	Marginal potential to roost in the swamp forest to mangroves remnant west of the site but unlikely on site as low value potential foraging habitat. Recorded in locality but not during survey. Unlikely to occur (possibly only flying over).	No suitable habitat affected. No risk of significant impact. Five Part Test not required.
Australasian Bittern (*Botaurus poiciloptilus*)	E-BCA E-EPBCA	2	Wetlands, preferably with dense sedges, rushes, reeds. Prefers freshwater, but also uses densely vegetated saltmarsh and flooded grasslands. Roosts on the ground, forages in shallow water from a platform of trampled vegetation, nests above water on similar platform. Single or groups to 12. Usually sedentary, but nomadic in response to flood, drought. (DEC 2007b)	Marginal potential to roost in the swamp forest to mangroves remnant west of the site but unlikely on site as low value potential foraging habitat. Recorded in locality but not during survey. Unlikely to occur (possibly only flying over).	No suitable habitat affected. No risk of significant impact. Five Part Test not required.
Blue-Billed Duck (*Oxyura australis*	V-BCA	1	Deep, densely vegetated freshwater wetlands. Rarely comes ashore. Nests in vegetation over water. Nocturnal. Mainly inland. (Lindsey 1992)	No foraging, roosting or nesting habitat on or adjacent to site. Recorded in locality but not during survey. Unlikely to occur (possibly only flying over).	No suitable habitat affected. No risk of significant impact. Five Part Test not required.

Name	Legal Status	Records	Habitat Requirements	Likelihood Of Occurrence	Significance Of Impacts
Spotted-tail Quoll (*Dasyurus maculatus*)	V-BCA E-EPBCA	16	Various forested habitats with preference for dense forests. Requires tree hollows, hollow logs or caves for nesting. Large home range (>500ha) and may move over several kilometres in a few days. Tends to follow drainage lines.	Not preferred forest type and site lacks suitable tree hollows and logs for shelter/denning. Predator species (eg foxes, feral cats, etc) are present in the general area. Not recorded on site, but recorded in the locality. Unlikely to very low chance of transient occurrence as part of wider foraging range.	No significant habitat affected potential for occasional occurrence retained, no significant impact likely. Five Part Test not required.
Brushtailed Phascogale (*Phascogale tapoatafa*)	V-BCA	2	Range of forest habitats but prefers drier sclerophyll forest with sparse ground cover. Forages on large rough-barked trees for small fauna, also utilises eucalypt nectar. Rests in tree hollows, stumps, bird nests. Requires tree hollows for nesting. (NSW NPWS, 2000) Breeds May-July. Occupies territory of 20-100ha.	Not preferred forest type and site lacks suitable tree hollows and logs for shelter/denning. Predator species (eg foxes, feral cats, etc) are present in the general area. Not recorded on site, but recorded in the locality. Unlikely occurrence.	No suitable habitat affected. No risk of significant impact. Five Part Test not required.
Common Planigale (*Planigale maculata*)	V-BCA	2	Wide variety of habitats. Preference for areas of dense groundcover due to heat/dehydration problems. May prefer ecotones of dry/wet habitats (Denny 1982). Preys on arthropods, small vertebrates, shelters in nest under/in fallen timber or rock (Strahan 1995). Home range about 0.5ha. Breeds Oct-Jan (NSW NPWS 2000).	Virtually all of site is too disturbed. Swamp forest to west may offer some potential more so in the study area but limited groundcover in site portion likely to preclude this species. Unlikely to occur.	No suitable habitat affected. No risk of significant impact. Five Part Test not required.

Name	Legal Status	Records	Habitat Requirements	Likelihood Of Occurrence	Significance Of Impacts
Eastern Chestnut Mouse (*Pseudomys gracilicaudatus*)	V-BCA	13	Appears to prefer heathland especially dense wet heath and swampy areas usually occupied by Swamp Rat (AMBS,1996). Also recorded from mid-elevation grasslands, open dry and wet sclerophyll woodland. In the Port Macquarie area, associated with heathland with dense shrub layer of *Banksia ericifolia*, *B. serratifolia, Xanthorrhoea* spp, *Dillwynia floribunda, Boronia spp*, *Leptospermum flavescens* and *Melaleuca nodosa*. Requires specific fire regime, greatest density 3-4 years after fire. Omnivorous, seeds, fungi, green stem, arthropods. Home range <0.5ha (NSW NPWS 2000).	No structurally suitable habitat on site. Site has been subject to an extensive disturbance history and predators (eg foxes, feral cats, etc) are known to occur in the general area. Recorded in the locality but unlikely to occur on site.	No suitable habitat affected. No risk of significant impact. Five Part Test not required.
Squirrel Glider (*Petaurus norfolcensis*)	V-BCA	25	Dry, open forest and woodland, and occasionally wet eucalypt and rainforest. Most common in floriferous sub-coastal and coastal forests with abundant winter flowering trees and shrubs (coastal populations apparently rely heavily on *Acacia* sap and flowering Banksias	Recorded on **site and in directly adjacent** habitat. Appears to be no den sites hence home range must be larger than site.	Loss of portion of known home range. **Five Part Test required**
Yellow-Bellied Glider (*Petaurus australis*)	V-BCA	1	Moist and dry mature eucalypt forest and woodland. Tree hollows, diversity of winter-flowering and suitable sap-feeding eucalypt species required. Large territory.	Not recorded on-site, but recorded in the locality. Swamp forest not preferred habitat and not connected to a mosaic of other forest types. Given above and the disturbance history of the site and general area, this species is considered an unlikely occurrence.	Unlikely to occur. No risk of significant impact. Five Part Test not required.

Name	Legal Status	Records	Habitat Requirements	Likelihood Of Occurrence	Significance Of Impacts
Greater Glider (*Petauroides volans*)	V-EPBCA	2	Restricted to eucalypt forests and woodlands of eastern Australia. Its diet is mostly eucalypt leaves and occasional flowers and is found in highest abundance in taller, montane, moist eucalypt forests, with relatively old trees and abundant hollows. The distribution may be patchy even in suitable habitat. Forests with a diversity of eucalypt species, due to seasonal variation, is its preferred tree species.	Not recorded on-site, but recorded in the locality. Swamp forest not preferred habitat and not connected to a mosaic of other forest types. Given above and the disturbance history of the site and general area, this species is considered an unlikely occurrence.	Unlikely to occur. No risk of significant impact. MNES assessment not required.
Koala (*Phascolarctos cinereus*)	V-BCA V-EPCA	6020	Areas where preferred food species occur in sufficient concentrations and diversity With suitable edaphic conditions and presence of other Koalas.	**Previously recorded via scats and observed**. Core Koala Habitat	**Five Part Test and MNES assessment required**
Grey-Headed Fruit-Bat/Flying Fox (*Pteropus poliocephalus*)	V-BCA V-EPBCA	83	Nomadic frugivore and nectarivore on rainforest, eucalypt, melaleuca and banksia. Recorded flying up to 45km from roost (generally max. of 20km). Roosts colonially with short term individual or small groups, mostly near watercourses. Spring or Summer roosts are maternity sites. Dependant on Winter flowering species eg *E. robusta* and *E. tereticornis.*	**Previously recorded**. Site contains some potential nectar and pollen and fruit sources, and is considered likely to form a small part of the species wider foraging range. No roosting habitat on/adjacent to the site.	Proposal will remove some potential foraging resources **Five Part Test required** as known to occur.
Greater Broad Nosed Bat (*Scoteanax rueppellii*)	V-BCA	12	Forages over range of habitats including rainforests and moist forests, but prefers ecotones between riparian forest, woodland and cleared land. Requires sparse understorey and will forage over water. Roosts in tree hollows. Feeds on larger insects, small vertebrates and perhaps other bats.	Site's vegetation is considered potentially suitable as foraging habitat. No potential roosting habitat. Not recorded during survey, though recorded in the locality. Considered a fair potential occurrence at some stage.	Fair chance of occurrence. **Five Part Test required.**

Name	Legal Status	Records	Habitat Requirements	Likelihood Of Occurrence	Significance Of Impacts
East-Coast Freetail Bat (*Micronomus norfolkensis*)	V-BCA	13	Specific habitat requirements of this species are poorly known. Has been recorded in habitats ranging from rainforest to dry sclerophyll and woodland, with most recorded in the latter (State Forests 1994). Roosts in small colonies under tree hollows and under loose bark; has been found under house eaves, in roofs and metal caps on telegraph poles. Recorded roosting in roof in Hat Head village. Probably forages above forest or woodland canopy, and in clearings adjacent to forest. Most records are of single individuals, and is likely to occur at low densities over its range.	**Recorded on site**. Site's vegetation is considered suitable as foraging habitat. No potential roosting habitat..	Proposal will remove some potential foraging resources **Five Part Test required** as known to occur.
Eastern Bent-wing Bat (*Miniopterus schreibersii oceanensis*)	V-BCA	18	Habitat generalist - forages above well-forested areas. Roosts in old buildings, caves, mines etc. Dependent on nursery caves and communal roosts.	**Recorded on site**. Site's vegetation is considered potentially suitable as foraging habitat. Tree hollows and trees with crevices/notches may provide marginal temporary non-breeding roosting opportunities, though such substrate is limited. Not recorded during survey, though recorded in the locality. Considered a fair potential occurrence at some stage.	Proposal will remove some potential foraging resources **Five Part Test required** as known to occur.
Little Bent-wing Bat (*M. australis*)	V-BCA	32	As for Eastern Bent-wing Bat.	**Recorded on site**. As for Eastern Bent-wing Bat.	Proposal will remove some potential foraging resources **Five Part Test required** as known to occur.

Name	Legal Status	Records	Habitat Requirements	Likelihood Of Occurrence	Significance Of Impacts
Dwyer's Bat/Large Eared Pied Bat (*Chalinobus dwyeri*)	V-BCA	0	Found in moderately wooded habitats such as dry sclerophyll forest, tall open eucalypt forests, woodlands, sub-alpine woodlands, edge of rainforest and wet sclerophyll forest. Roosts in caves, mines and abandoned bottle-shaped mud nests of Fairy Martins. In caves and mines, tend to roost in twilight sections near entrance. Insectivorous but habits poorly known. Fly relatively slowly, direct and maneuverable, low to ground or 6-10m above ground.	General foraging preferences of this poorly known species suggests locality potentially generically structurally suitable foraging habitat. No cave, mines, etc on or near site for roosting. Not recorded within 10km radius of site (or LGA, and very few regional records). Likelihood to occur on site considered unlikely.	Loss of extremely marginal structurally suitable potential habitat. Considered unlikely chance of occurrence. Five Part Test not taken as no risk of significant impact.
Eastern False Pipistrelle (*Falsistrellus tasmaniensis*)	V-BCA	3	Occupies sclerophyll forest from the Great Dividing Range to the coast, typically wet tall forest at high elevations and is more common in northern NSW. It may migrate to coastal areas in Winter. Roosts typically in tree hollows, but also in caves, buildings. Roosts as single sex colonies of 3-36 bats. Forages in and below tree canopy on moths, beetles, bugs, flies & ants, up to 12km from roost site. Breeds in Summer (Churchill 2009, Smith *et al* 1995). Recently recorded at Thrumster west of Port Macquarie.	Site's vegetation is considered marginally potentially suitable as foraging habitat. No potential roosting habitat. Not recorded during the survey. Recorded in the locality, though records at low elevations are scant. Overall considered a very low potential occurrence.	Very low chance to occur and this potential will be retained post-development, hence no risk of significant impact. Five Part Test not required.
Hoary Bat (*Chalinolobus nigrogriseus*)	V-BCA	1	Occurs in a range of habitats, such as monsoon forest, tall open forest, open woodland, vine thickets, coastal scrub, sand dunes, grasslands, floodplains, watercourses and dams. Roosts in eucalypt tree hollows, as well as rock crevices. Breeding colonies have been recorded in roofs of buildings. Preferred prey is beetles and moths, but also spiders, mantids, crickets, grasshoppers, cicadas, bugs, diving beetles, flies and ants (thus may land and forage). Previously not recorded south of Kempsey	Not preferred habitat type and only 1 record at southern limit of its range. No potential roosts. Considered unlikely to potentially occur.	Considered unlikely chance of occurrence. Five Part Test not taken as no risk of significant impact.

Name	Legal Status	Records	Habitat Requirements	Likelihood Of Occurrence	Significance Of Impacts
Yellow-Bellied Sheathtail Bat (*Saccolaimus flaviventris*)	V-BCA	4	Ecology poorly known. Found in almost all habitats, particularly wet and dry sclerophyll forests and woodlands below 500m altitude, and also open woodland, Acacia shrubland, mallee, grasslands and desert. Roosts mainly in tree hollows, but also under bark, under roof eaves and in other artificial structures. Fast flying species, believed to forage above the canopy or closer to the ground in open areas. Insectivorous. May be Summer migrant.	Forest on site offers potential foraging habitat. Potential roosts in hollow-bearing trees. Recorded in locality, but not by survey on site. Low to fair chance of occasional occurrence.	Fair chance to occur and this potential will be retained post-development, hence no risk of significant impact. **Five Part Test required** as fair potential to occur**.**
Eastern Cave Bat (*Vespadelus troughtoni*)	V-BCA	6	Rare and poorly known bat. Cave dwelling bat roosting in small (5) to large (500) groups in sandstone overhang caves, boulder piles, mines, tunnels and sometimes buildings. Tend to roost in well lit portions of caves in avons, domes, cracks and crevices. Inhabits tropical mixed woodland and wet sclerophyll forest on the coast and dividing range, but extend into drier forest on western slopes and inland areas.	**Tentative call identification**. Site and general area may be marginally structurally suitable as foraging habitat. The nearest known caves are at Broken Bago State Forest/Bago Bluff National Park and Jolly Nose Hill. Considered at best a precautionary marginal "*possible*" recording during the survey though its call cannot be separated from the common *Vespadelus* species (which are likely to occur). Overall considered a very low to marginally fair occurrence.	Considered very low chance of occurrence however **Five Part Test required** as '*possible*' recording on site.
Southern Myotis (*Myotis macropus*)	V-BCA	7	Tunnel, cave, bridges, old buildings, tree hollow and dense foliage roosting bat which prefers riparian habitat over 500m long with nearby roosting habitat. Key habitats are streams, rivers, creeks, lagoons, lakes and other water bodies. Feeds on aquatic insects and small fish. Has recently been observed foraging in small bodies of water.	Some marginal potential along drain and in swamp forest but considered two dense and low prey values. No hollows or other structures for roosts. Recorded in locality but not on site. Unlikely chance of occurrence as not likely foraging habitat.	Unlikely to occur and this potential will be retained post-development, hence no risk of significant impact. Five Part Test not required.

Name	Legal Status	Records	Habitat Requirements	Likelihood Of Occurrence	Significance Of Impacts
Green and Golden Bell Frog (*Litoria aurea*)	E-BCA V-EPBCA	3	Found in permanent swamps and ponds. Prefers water bodies which are: still; shallow; unshaded; ephemeral; unpolluted; generally isolated; and free of native fish species or Plague Minnow (*Gambusia holbrooki)* and little macro-algae. Requires emergent vegetation, grass tussocks or rocks for shelter. May use disturbed sites opportunistically. Eats insects and other frogs. Spring-autumn breeder. (	No suitable breeding or refugia habitat on site Recorded in locality but unlikely to occur on site.	No impact likely as no potential or known habitat affected. Five Part Test not required.
Wallum Froglet (*Crinia tinnula)*	V-BCA	55	Predominantly confined to acidic paperbark swamps of coastal areas. Also found in wet heathland and Melaleuca sedgelands. Recorded breeding in flooded pasture adjacent to paperbark swamps.	No recorded on site, but suitable habitat on adjacent land to south-west and known habitat to west. Swamp forest on site generally too dense for this species.	No potential or known habitat directly affected, but risk of indirect impacts on known habitat in study area. **Five Part Test required.**
Laced Fritillary (*Argyreus hyperbius* spp. *inconstans*)	CE-EPBCA, E-BCA	2	Open, coastal grassy sedgelands, wetlands and swamps with *Viola betonicifolia* (the egg laying substrate and larval food species). Occasionally occurs in (swampy) disturbed areas (eg drainage ditches of sugarcane farms) where *Viola betonicifolia* is abundant, and may occur in other watercourse plant communities where *Viola betonicifolia* is present.	No suitable larvae habitat as *V. betongifolia* absent. Unlikely to occur.	No impact likely as no potential or known habitat affected. Five Part Test not required.
Coastal Petal-Tail Dragonfly (*Petalura litorea*)	E-BCA	3	Restricted to coastal and near coastal lowlands between Coffs Harbour and Ballina, where it is found in permanent swamps and bogs with some free water and open vegetation. Adults emerge from late October and are short-lived, surviving for one summer after emergence. Adults spend most of their time settled on low vegetation on or adjacent to the swamp, hunting for flying insects over the swamp and along its margins (OEH 2018b).	Not preferred habitat on site or adjacent – not found in dense swamp forest. Unlikely to occur.	No impact likely as no potential or known habitat affected. Five Part Test not required.

APPENDIX 2: SITE FLORA SPECIES LIST

Frequency:
D Dominant, at least in some areas
C Common
O Occasional
L Localised
U Uncommon
R Rare on site, few specimens

Association:
S PCT ID1724 Paperbark Swamp Forest
W PCT ID1724 Wetland
LM Lawns & Miscellaneous Vegetation

*denotes an introduced species

COMMON NAME	SCIENTIFIC NAME	FREQUENCY	ASSOCIATION
Canopy Trees			
Swamp Oak	*Casuarina glauca*	C	S
Small-fruited Grey Gum	*Eucalyptus propinqua*	R	LM
Swamp Mahogany	*Eucalyptus robusta*	C	S, LM
Forest Red Gum	*Eucalyptus tereticornis*	R	LM
Broad-Leaved Paperbark	*Melaleuca quinquenervia*	D	S, LM
Understorey Trees			
Hickory Wattle	*Acacia implexa*	O	S
Red Ash	*Alphitonia excelsa*	R	S
Bangalow Palm	*Archontophoenix cunninghamiana*	O, Common in places	S
Willow Bottlebrush	*Callistemon salignus*	O	S
Camphor laurel	*Cinnamomum camphora**	O, Common in places	S, LM
Tuckeroo	*Cupaniopsis anacardioides*	U	S, LM
Blueberry Ash	*Elaeocarpus reticulatus*	R	S
Common Coral Tree	*Erythrina × sykesii**	RL	S
Sandpaper Fig	*Ficus coronata*	R	S

COMMON NAME	SCIENTIFIC NAME	FREQUENCY	ASSOCIATION
Strangling Fig	*Ficus watkinsiana*	R	S
Cheese Tree	*Glochidion ferdinandi*	C	S, LM
Narrow-Leaved Paperbark	*Melaleuca linariifolia*	O	S
Broad-Leaved Paperbark	*Melaleuca quinquenervia*	D	S, W, LM
Shrubs			
Sydney Golden Wattle	*Acacia longifolia*	U	S
Ornamental Wattle	*Acacia sp.*	U	LM
Heath Banksia	*Banksia ericifolia*	R	LM
Coffee Bush	*Breynia oblongifolia*	O	S
Ornamental Callistemon	*Callistemon sp.*	U	LM
Green Cestrum	*Cestrum parqui**	U	S, LM
Cheese Tree	*Glochidion ferdinandi*	D	S
Swamp Hibiscus	*Hibiscus diversifolius*	C	S, W, LM
Lantana	*Lantana camara**	O	S
Ornamental Tea-tree	*Leptospermum sp.*	U	LM
Small-leaved Privet	*Ligustrum sinense**	R	S
Orange Jessamine	*Murraya paniculata**	U	S, LM
Brush Muttonwood	*Myrsine howitteana*	R	S
Mickey Mouse Plant	*Ochna serrulata**	U	S
Orange Thorn	*Pittosporum multiflorum*	U	S
Common Pittosporum	*Pittosporum undulatum*	U	S
Elderberry Panax	*Polyscias sambucifolia*	R	S
Easter Cassia	*Senna pendula var. glabrata**	O	S, LM
Wild Tobacco	*Solanum mauritianum**	U	S, LM
Cocos Palm	*Syagrus romanzoffiana**	U	S
Scentless Rosewood	*Synoum glandulosum*	U	S
Awabuki Sweet Viburnum	*Viburnum odoratissimum var. awabuki**	U	S

COMMON NAME	SCIENTIFIC NAME	FREQUENCY	ASSOCIATION
Ferns & Fern Allies			
Swamp Water Fern	*Blechnum indicum*	C	S, W
False Bracken	*Calochlaena dubia*	O	S
Binung	*Christella dentata*	C	S, W
Harsh Ground Fern	*Hypolepis muelleri*	O	S
Bracken Fern	*Pteridium esculentum*	U	S
Grasses			
Whisky Grass	**Andropogon virginicus*	O	LM, S
Carpet Grass	*Axonopus affinus**	D	LM, S
Rhodes Grass	**Chloris gayana*	O	LM, S
Wiry Panic	*Entolasia marginata*	O	S
Browns Lovegrass	*Eragrostis brownii*	U	S
Bladey Grass	*Imperata cylindrica*	C	S, LM
Weeping Grass	*Microlaena stipoides*	O	S, LM
Forest Grass	*Ottochloa gracillima*	O	S, LM
Paspalum*	**Paspalum dilatatum*	O	S
Broad-leaf Paspalum*	**Paspalum mandiocanum*	O	S
South African Pigeon Grass	*Setaria sphacelata**	O	S, LM
Buffalo Grass	*Stenotaphrum secundatum**	C	W
Sedges, Rushes,			
Bare Twig Rush	*Baumea juncea*	O	W,S
Tall Sedge	*Carex appressa*	U	W,S
Drooping Sedge	*Carex longebrachiata*	O	W,S
	*Cyperus eragrostis**	U	W,S
	Cyperus haspan	U	W, S
Saw Sedge	*Gahnia clarkei*	C	S
	Juncus mollis	U	W, S
	Juncus prismatocarpus	O	W, S

COMMON NAME	SCIENTIFIC NAME	FREQUENCY	ASSOCIATION
Spiny-Headed Matrush	*Lomandra longifolia*	O	S
Bog bulrush	*Schoenoplectus mucronatus*	O	W, S
Groundcovers			
Blue Billy Goat Weed*	*Ageratum houstonianum**	O	W, S, LM
Cunjevoi	*Alocasia brisbanensis*	U	S
Farmers Friend	*Bidens pilosa*	O	S, LM
Canna Lily*	*Canna indica**	O	LM
Pennywort	*Centella asiatica*	C	W, S
Taro*	*Colocasia esculenta**	U	S
Scurvy Weed	*Commelina cyanea*	O	W,S,LM
Fleabane*	*Conyza sp.**	O	W, S, LM
Blue Dampiera	*Dampiera stricta*	U	S
Purple Flax-Lily	*Dianella caerulea*	O	S, LM
Kidney Weed	*Dichondra repens*	O	S, LM
Purple Cudweed	*Gamochaeta purpurea*	O	LM
White Root	*Pratia purpurascens*	O	S, LM
Asparagus Fern*	*Protasparagus aethiopicus**	U	S
Kurnell Curse*	*Hydrocotyle bonariensis**	C	S, W, LM
Pennywort	*Hydrocotyle peduncularis*	U	S, LM
Catsear*	*Hypochaeris radicata**	O	LM
Lamb's Tongue*	*Plantago lanceolata**	O	LM
River Buttercup	*Ranunculus inundatus*	O	S, W, LM
*Fireweed	**Senecio madagascariensis*	U	LM
*Paddys Lucerne	**Sida rhombifolia*	U	S, LM
*Purple Top	**Verbena bonariensis*	O	S, W, LM
Ivy-leaved Violet	*Viola hederacea*	C	S, LM
Lianas, Scramblers and Twiners			
Devils Twine	*Cassytha glabella*	U	S

COMMON NAME	SCIENTIFIC NAME	FREQUENCY	ASSOCIATION
Whip Vine	*Flagellaria indica*	R	S
Scrambling Lily	*Geitonoplesium cymosum*	U	S
Coastal Morning Glory*	*Ipomoea cairica* *	C	S
Honeysuckle*	*Lonicera japonica**	U	S
Cockspur Thorn	*Maclura cochinchinensis*	O	S
Monkey Rope	*Parsonsia straminea*	D	S, LM
Native Sarsaparilla	*Smilax glyciphylla*	U	S
Snake vine	*Stephania japonica*	O	S
Aquatic Plants			
	Enhydra woolsii	D	S, W
Native Gipsywort	*Lycopus australis*	O	S, W
Water Lily	*Nymphaea sp.**	U	S
Spotted Knotweed	*Persicaria strigosa*	C	S, W
Frogmouth	*Philydrum lanuginosum*	O	S, W
Arrowhead*	*Sagittaria graminea ssp. Platyphylla**	C	S
Cumbungi	*Typha orientalis*	O	S

APPENDIX 3: SOIL PROFILE SAMPLE DATA